



# **An Investigation into the Improvement of Graduate Attributes within the Egyptian University Sector**

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## **Abstract**

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Graduate attributes have been used in Europe since the early 1980s. They were highlighted by the Dearing report in 1997 as a fundamental learning outcome of university education in the light of the concerns raised by UK employers who claimed that many graduates lacked the necessary attributes for employment, causing what is known as the skills gap. Many authors agreed that graduate attributes are at the nexus of a number of complexities that affect teaching and learning in taught courses. These could be conceptual, pedagogical, epistemological, structural or cultural. However, many of their studies overlooked the role of context in the implementation of graduate attributes in taught courses which explains why the skills gap still exists.

In Egypt earlier this century, the government recognised the importance of reforming its higher education sector to meet the challenges of the new era. One of these challenges was Egyptian employers' dissatisfaction with graduate attributes which were described as not meeting employment demands. To address such a problem, the Egyptian government, through a reform strategy, initiated a number of projects which among other things aimed to improve graduates' readiness for the labour market and thus reduce the skills gap. Yet, with all the initiatives achieved to date the problem still persists.

This research has sought to study the skills gap problem in depth but within the scope of computer engineering undergraduate studies. It aims to understand the contextual factors affecting the effective implementation of graduate attributes in taught courses in Egyptian universities. To do this, a number of questions were posed, using semi-structured interviews, to a purposive sample of academics and graduates belonging to two different computer

engineering undergraduate programmes; one private and the other public. To ensure the validity of the data, more information was collected from Egyptian employers as well as the documents that represent the different educational policies and practices implemented in both private and public programmes of study. Through thematic data analysis and by applying complexity theory as a conceptual framework, the research arrived at its contribution to knowledge; namely, identification of the different contextual factors that affected Egyptian academics' performance when teaching and learning graduate attributes in computer engineering undergraduate courses. These factors: were academics' recruitment; promotion and progression procedures; department/faculty culture which has an orientation towards disciplinary knowledge; lack of scholarship of learning and teaching; performance appraisal; the pay scale; fringe benefits and remuneration; no incentive to conduct industry based research; collaborative projects or industry secondments; and the fact that industrial practitioners are prohibited to teach in academia.

In the light of these key findings, the main conclusion from this research is that it is possible, given the appropriate contextual conditions, that academics' teaching and learning of graduate attributes in undergraduate degree courses could be improved. This research has shown through its results that a concept such as graduate attributes is at the nexus of a number of complexities that affect their teaching in taught courses. Yet, these complexities are not only conceptual, pedagogical, epistemological and cultural but also contextual. The research also advises higher education authorities and practitioners, through a policy document, on how to improve Egyptian higher education reform outcomes and hence graduates' readiness for the labour market.

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## **Declaration**

I hereby declare that this thesis and the work reported is entirely my own. Information derived from a document or source (book, article, report, thesis, website, etc.) has been acknowledged and cited in the text and references are given in the list of references.

## Acronyms

<b>AGR</b>	Association of Graduate Recruiters
<b>ABET</b>	Accreditation Board for Engineering and Technology
<b>BERA</b>	British Educational Research Association
<b>CBI</b>	Confederation of British Industry
<b>COGA</b>	Conceptions of Generic Attributes
<b>CIQAP</b>	Continuous Improvement and Qualifying for Accreditation Project
<b>CO</b>	Coordination Office
<b>DEE</b>	Department for Education and Employment
<b>DEST</b>	Department of Education, Science and Training
<b>DFBSP</b>	Development of Faculties of Basic Sciences Project
<b>EGAC</b>	Egyptian Accreditation Council
<b>ENCC</b>	Egyptian National Competitiveness Council
<b>ESC</b>	Engineering Sector Committee
<b>ESRC</b>	Economic and Social Research Council
<b>ETCP</b>	Egyptian Technical Colleges Project
<b>ETEP</b>	Engineering and Technical Education Project
<b>FOEP</b>	Faculty of Education Project
<b>FRE</b>	Framework for Research Ethics
<b>GDP</b>	Gross Domestic Product
<b>GTA</b>	Graduate Teaching Assistant
<b>HEA</b>	Higher Education Academy
<b>HEEP</b>	Higher Education Enhancement Projects
<b>HEEPF</b>	Higher Education Enhancement Project Fund
<b>HERS</b>	Higher Education Reform Strategy
<b>HTI</b>	Higher Technical Institutes
<b>IBCT</b>	International Board of Certified trainers
<b>IBRD</b>	International Bank for Reconstruction and Development
<b>ICT</b>	Information Communication Technology
<b>ICTP</b>	Information and Communication Technology Project
<b>IDSC</b>	Information and Decision Support Centre
<b>IET</b>	Institution of Engineering and Technology
<b>IGCSE</b>	International General Certificate for Secondary Education
<b>JICA</b>	Japanese International Cooperation Agency
<b>LIAP</b>	Labs International Accreditation Project
<b>MENPP</b>	Monitoring and Evaluation of New Programs Project

<b>MOF</b>	Ministry of Finance
<b>MOHE</b>	Ministry of Higher Education
<b>NAQAAE</b>	National Authority for Quality Assurance and Accreditation of Education
<b>NARS</b>	National Academic Reference Standard
<b>NCFLD</b>	National Centre for Faculty and Leadership Development
<b>OECD</b>	Organization for Economic Co-operation and Development
<b>PBL</b>	Problem based Learning
<b>PMU</b>	Project Management Unit
<b>QAAP</b>	Quality Assurance and Accreditation Project
<b>QAAP2</b>	Quality Assurance and Accreditation Project 2
<b>QAA-UK</b>	Quality Assurance Agency-United Kingdom
<b>RAEng</b>	Royal Academy for Engineering
<b>SCU</b>	Supreme Council of Universities
<b>SFQAAP</b>	Sustainability Follow Up of Quality Assurance and Accreditation Project- Second Phase
<b>SOTL</b>	Scholarship of Teaching and Learning
<b>SPU</b>	Strategic Planning Unit
<b>UK-SPEC</b>	UK-Specifications
<b>UNESCO</b>	United Nations Educational, Scientific and Cultural Organization
<b>WIL</b>	Work Integrated Learning

# Chapter One: Introduction

## 1.1 Foreword

The motivation for this study has emerged from the researcher's professional experience in the design and delivery of training courses, as well as from the design and audit of management systems. It has also emerged from the researcher's interest in the Egyptian university sector, to which she belonged as an academic since 1998. The nature of her work together with her previous experience as a computer engineer enabled the researcher to trace a common concern which was brought to light through various discussions and meetings with Egyptian academics, senior managers, graduates and engineers. This concern was related to graduate attributes, which Egyptian employers said did not meet the needs of labour demands resulting in what is known as a skills gap.

The focus of this thesis is on understanding the skills gap within the Egyptian university sector. It aims to provide guidelines on how to improve the contextual factors that affect the implementation of graduate attributes in computer engineering undergraduate courses. The thesis includes a policy document that suggests to higher education authorities in Egypt how the teaching and learning of graduate attributes in undergraduate university courses could be improved. The purpose of this chapter is to introduce the Egyptian higher education sector pre and post the second and third Egyptian revolutions which occurred in 2011 and 2013, respectively. It describes the focus of the research, the research aims and objectives, the research methodology, contribution to research and an outline of the thesis structure.

## 1.2 Introduction

At its various levels, education forms a basic asset in the development and enhancement of nations. It provides the necessary knowledge and attributes to develop human resources, fight poverty and maintain countries' global

competitiveness (UNESCO 2004; OECD 2010; Korany 2011). As the Egyptian government is well aware of the importance of basic and higher education for its societal and economic development, it took upon itself the responsibility of ensuring appropriate education for all Egyptians after the first revolution in 1952 (Korany 2011). Since then, education, which was previously only accessible to the elite due to high tuition fees, has been declared almost free and therefore possible for all Egyptians (UNESCO 2004; Korany 2011). Bridging the societal gap between the poor and the rich was one of the revolution's main aims, and by declaring education almost free of tuition fees, the Egyptian government achieved one of those aims (Korany 2011).

To date Egypt has two separate but equivalent education systems: the secular system and Al-Azhar system. Both systems offer public and private education, however Al-Azhar places more emphasis on religious studies (UNESCO 2004). The secular system is divided into three levels: basic, secondary and higher education. Basic education consists of nine years of compulsory education covering primary and preparatory stages; secondary education consists of three years of general education or five years of vocational education; and higher education consists of four or more years of study depending on the degree attained (SPU 2010).

To progress through the three levels, students should pass their final examinations at the end of every year which rely mainly on rote learning and memorisation (UNESCO 2007; OECD 2010). Failure to achieve certain examination scores at the end of the preparatory stage shifts the students from general secondary education to vocational education. To enter university, students should pass the general secondary exam (the Thanaweya Amma) or its equivalent (e.g. IGCSE or American Diploma). However, vocational education students who wish to continue their higher studies can only do that through Higher Technical Institutes (HTI) (SPU 2010).

In Egypt as elsewhere, higher education paves the way for a better life and the possibility of breaking through class barriers (Golia 2008). It is considered the main platform for disseminating sciences, knowledge and attributes in order to prepare a

skilled, innovative and a productive labour force for employment (UNESCO 2007; Bond et al. 2013). Throughout history, Egypt's higher education sector has been known as one of the largest educational sectors in the Arab World, the expertise of which many countries in the region rely upon to develop their educational systems (UNESCO 2007; Korany 2011; Bond et al. 2013). This sector accounts for about 10% of the state budget (MOF 2013), which is almost equal to the budgets allocated to higher education in some neighbouring countries (e.g. Jordan) (UNESCO 2004). Despite an increase of 10% in this figure from 2010 (MOF 2013), the budget has been criticised by many Egyptian members of parliament who suggest that it should be further increased if Egypt aims to improve the quality of its higher education (OECD 2010).

The university sector in Egypt has expanded from three public universities in 1953 to twenty four public universities, eighteen private universities, and one hundred and fifty institutes and technical colleges to date (IDSC 2014; THE 2014). In comparison to public universities, private universities are characterised by: their lower ratio of students to academics, high tuition fees, unique specialisations, and their educational and administrative structures (UNESCO 2004). Private universities are not state funded and their financial resources come from tuition fees, founders' support and fund raising (OECD 2010). Students who apply to private universities either have not achieved the admission score to a public university, or have, but are looking for a better educational service (Golia 2008). To be admitted to a private university, students go through the university's admission process and do not have to apply through the Coordination Office (CO) of public universities. The CO is the unit responsible for managing the admission process to public universities, which is based on students' secondary test scores, places them in a programme of study (SCU 2010). Private universities decide their admission scores according to the approval of the Supreme Council of Universities (SCU); however, there are particular limitations on students' admission to medical and engineering faculties to ensure social equality across the country's different classes (SCU 2010).

The university sector in Egypt, which is the area under exploration in this study, has always been of a complex structure. Not only is it characterised by its historical background but also by the numerous activities important for managing university education. It serves 3.1 million students. Only one million students (32%) are enrolled in eighteen private universities and the remainder (68%) are in the twenty four public universities (IDSC 2014). The higher education sector is supervised by the Ministry of Higher Education (MOHE) through a number of councils, committees and units. One of these councils is the Supreme Council of Universities (SCU) which was established to set up and manage higher education executive policies as well as internal regulations for both public and private universities in accordance with a law which was enacted in 1972 (MOHE 2007; SCU 2006, 2010). Members of the Supreme Council are university presidents, vice-presidents and experts on higher education (SCU 2010). Universities in Egypt are geographically distributed across the country. They consist of a number of faculties which offer five year or six year degree courses (e.g. engineering, dentistry, pharmacology and medicine) and four year degree courses (e.g. law and commerce).

Engineering faculties, which are the scope of this research, are among the faculties that offer five year Bachelor of Science degrees. They are characterised by their small population size in comparison to other faculties such as commerce, law or education where student numbers in one lecture hall can be as many as two thousand (SCU 2010). Engineering education remains of national and strategic importance for Egypt's economic growth, and in particular, the computer engineering discipline (Bond et al. 2013). This is because computer engineers remain the nuclei of success for the Information Communication Technology (ICT) sector, which the Egyptian government has taken initiatives to invest in since 2000, in order to build a modern innovative-based economy (UNESCO 2007; Bond et al. 2013). Engineering education is strictly regulated by the Engineering Sector Committee (ESC) managed by the SCU. Through a number of experts the committee sets policies and benchmarks for



engineering education and approves all programmes of study either for private or public universities every five years (SCU 2010; Gomaa et al. 2011). Programme approval is carried out when a status report is submitted by educational programmes through their faculties to the Supreme Council of Universities. The report details the curriculum structure, course content, course credit hours, results of past examinations, lab structure and equipment in use, available books and course references, and lists the faculty members, their qualifications and professional development. The ESC does not impose a fixed format however the required criteria for programme approval should be addressed as appropriate (SCU 2010).

Within the university sector, at the faculty and programme level, academics such as teaching assistants, assistant professors, associate professors or professors, are the core agents in the teaching and learning process. Policies and procedures pertaining to the academic experience are implemented by educational programmes through academics with reference to the requirements of the law governing Egyptian universities (SCU 2006), the Supreme Council of Universities (SCU 2010), the National Authority for Quality Assurance and Accreditation of Education (NAQAAE) and academic programmes internal regulations. Examples of these requirements are the identification and description of: programme aims and objectives, core courses, pre-requisites and learning outcomes, the grading system and graduation requirements.

In Egypt, early economic reform plans began in the late 1980s when the Egyptian government took the decision to improve the country's socio-economic goals (UNESCO 2004; SPU 2010; OECD 2010). The driver for improvement was Egypt's global competitiveness index which had been lagging in comparison to other countries in the region for a number of consecutive years (ENCC 2010). This index, which is an indication of countries' prosperity and productivity, urged the Egyptian government to set up a number of initiatives to improve its global competitiveness status (ENCC 2010; OECD 2010). These initiatives involved attracting foreign investments,

reforming taxation, promoting exports, improving private sector growth, and reforming the education sector. The decision to reform education was based on the Egyptian government's awareness that economic soundness could not be achieved without reforming its education sector, and in particular higher education (OECD 2010). Such awareness was based on a number of reports which criticised Egypt's higher education system as "ineffective" and not serving the "country's needs well" due to a number of problems that had accumulated across the years (OECD 2010, p.15). As the reports suggested, it was imperative to address these problems through higher education reform if Egypt sought to achieve its economic goals (SPU 2010; OECD 2010).

In addition to these criticisms were Egyptian employers' concerns about graduate qualities which they described as inadequate and lacking many important attributes or soft skills for employment (MENA 2009; ENCC 2010; OECD 2010). The cause of the difference between employers' expectations and what graduates actually delivered, also known as the skills gap (Martin et al. 2005), was that universities were not equipping their graduates with necessary attributes such as information technology and language skills, although they excelled in preparing them technically for employment (MENA 2009; SPU 2010; OECD 2010). The International Labour Conference (2008) stated that the skills gap has high social and economic costs which cause not only employers' dissatisfaction but also structural unemployment.

To improve the higher education sector, the Engineering and Technical Education Project (ETEP) was introduced in 1989. The aim of the project was to improve the quality and performance of public engineering faculties in order to develop engineering graduates' qualities for the labour market. The project involved a number of activities such as restructuring the labs and workshops of public engineering faculties (The World Bank 1989; HEEP 2010). As the World Bank noted in its report (The World Bank 1989), the engineering discipline was chosen in preference to others due to the deterioration of its labs and workshops. The project was funded by the World Bank in

collaboration with the Egyptian government and managed by the Project Management Unit (PMU). The rationale for the World Bank's involvement aligned with its mission in supporting developing countries technically and financially in areas like technical education, admission policy and linking education with the labour market (MOHE 2010).

Following a decade of satisfactory work (The World Bank 1999), the World Bank was encouraged as well as other sponsors, such as the Ford Foundation, Prince Talal Foundation and Japanese International Cooperation Agency (JICA), to fund further education reform projects in Egypt (HEEP 2009c; HEEP 2009d). Such initiatives, together with the Egyptian government's previous decision to reform the higher education sector to "improve the quality and relevance of higher education so that graduates have the knowledge and skills demanded by Egypt's developing and globalising economy" (HEEP 2009e, p.1) encouraged the immediate uptake of the reform projects. Consequently in 1999, the Minister of Higher Education appointed a committee, composed of governmental and private representatives, higher education experts and distinguished stakeholders in tertiary education (HEEP 2009d; HEEP 2010), to set a strategy to reform the higher education sector. The reform committee was divided into six sub-committees responsible for setting up the reform methodology and determining Higher Education Reform Strategies (HERS) and guiding principles (HEEP 2009d; HEEP 2010).

Upon completion, HERS was presented at the National conference for higher education in February 2000, under the patronage of the former Egyptian President Hosni Mubarak. The conference then led to a declaration of action endorsed by the President and his Prime Minister (HEEP 2009a). It could be argued that, despite the commitment shown by the Egyptian government to improve the quality of higher education, implementing HERS in such an authoritarian way (even with the application of the participatory approach) affects the people who have to cope with HERS plans and projects. This means that people involved in HEEP implementation may resist the

change needed to improve university education in Egypt because it was imposed by leadership rather than generated through internal commitment. As argued by Kohstall (2012), reform models implemented in developing countries such as Egypt are usually not accompanied by a greater freedom of movement for the people having to implement them and therefore fail to achieve their reform goals.

### **1.3 Higher Education Reform Strategy and Projects**

The strategy presented in 2000 consisted of a number of tracks which were the outcome of analysing the Egyptian higher education sector. The analysis was based on evaluating higher education strengths and problems (referred to as weaknesses in the strategy) encountered over time (HEEP 2009a). Among the strengths, as described in HERS (HEEP 2009a) were: the increasing demand for higher education services by the Egyptian society, the growing demand of the labour market for new disciplines, the high technology infrastructure which enables more sophisticated teaching and learning methods, the high potential for partnerships and agreements with international educational institutions, and qualified faculty members and graduates who were technically skilled. Among the weaknesses, as described in HERS (HEEP 2009a), were: lack of a general philosophy or future strategy for the higher education sector; absence of a vision and strategy for the role of higher education in developing human resources; outdated/slow improvements in curricula, teaching and learning methods; graduates who lack the necessary attributes for the labour market; the limitation of funding resources for higher education improvement and development by the Egyptian government; high student enrolment rates; inflation in the number of academics' due to their tendency to continue in the same university from which they graduated without shifting at any stage; absence of sophisticated mechanisms for reviewing and evaluating programmes of study; traditional assessment methods which are based on rote learning; poor educational resources in terms of libraries and information sources; old administrative and financial systems; the rigidity of university laws; and the lack of a system that enables faculty capacity development and appraisals. Although private universities may not face similar

problems or weaknesses, there is no evidence that they have succeeded in meeting the needs of the Egyptian society, including employment demands (UNESCO 2004; The World Bank 2012; Bond et al. 2013).

As argued by Taha and Abou Ismail (2002), UNESCO (2007), Abdallah et al. (2008), SPU (2010), and the OECD (2010), these problems have affected the universities' ability to produce graduates of all kinds equipped with the necessary attributes for employment, and this has had an impact upon their readiness for work. For example, traditional assessment methods which depend in some courses on rote learning have greatly encouraged students to learn by rote which is quite an "odd practice" in a discipline such as engineering which is largely based on "know how" UNESCO (2007, p.7). The SPU (2010) and OECD (2010) have suggested that rote memorisation over a number of years has hindered graduates from developing the personal and intellectual skills needed for the workplace. They further suggested that there was a need to change students' rote learning if universities aimed to produce engineering graduates capable of meeting employment demands. With respect to academics' absence from campus, it has been noted that low salaries have encouraged public academics to work part time on external consultations or in private universities rather than to focus on curriculum development and assisting students with learning difficulties (Taha and Abou Ismail, 2002; UNESCO 2007; Abdallah et al. 2008). Although the CBI (2009) and HEEP (2009a) have explained the importance of creating links with the labour market to improve curricula, academics have failed to make changes. Similarly, according to the regulations of the Supreme Council of Universities (SPU 2010), high student enrolments have encouraged high student to faculty ratios in lecture halls and tutorials, which constrains student to academic interaction inside the lecture hall (SPU 2010; Bond et al. 2013). According to the OECD (2010), there is an urgent need to introduce new admission procedures to universities to contain the high student numbers if universities aim to produce graduates fit for the labour market. As the OECD report suggested, high student enrolments over some years have not only created a surplus of graduates for employment but also graduates who lack many

important attributes. Thus many employers have become dissatisfied with graduate qualities (OECD 2010).

To improve these circumstances which are common across the entire university sector, twenty five Higher Education Enhancement Projects (HEEP) were developed and were divided into three phases: HEEP short term (2000-2002), HEEP2 medium term (2000-2007) and HEEP3 long term (2000-2017) (HEEP2 2009a; HEEP 2009d, 2010). The key development objective of HEEP (short term) was to:

Create the conditions fundamental to improving the quality and efficiency of the higher education system in Egypt through legislative reform, organizational restructuring, the creation of tools for quality assurance and the establishment of monitoring and evaluation systems (The World Bank 2009, p.2; HEEP 2009d, p.13).

The key development objective of HEEP2 (medium term) was to “achieve significant improvements in system quality and efficiency” (HEEP 2009e, p.1), and for HEEP3 (long term) the key development objective was to “achieve further rationalization of the system, particularly regarding financing structures and private sector involvement” (HEEP 2009e, p.1).

Based on these driving objectives, the twenty five projects were as follows: the Higher Education Enhancement Project Fund (HEEPF), the Information and Communication Technology Project (ICTP), the Egyptian Technical Colleges Project (ETCP), the Faculty of Education Project (FOEP), the National Centre for Faculty and Leadership Development (NCFLD), the Quality Assurance and Accreditation Project (QAAP), the Sustainability Follow Up of Quality Assurance and Accreditation Project-Second Phase (SFQAAP), the Quality Assurance and Accreditation Project 2 (QAAP2), the Continuous Improvement and Qualifying for Accreditation Project (CIQAP), the Labs International Accreditation Project (LIAP), the Development of Faculties of Basic Sciences Project (DFBSP), the Monitoring and Evaluation of New Programmes

Project (MENPP), development of programmes for gifted and talented students, development of international cooperation with universities outside Egypt, development of a centre to evaluate and follow up graduates upon employment, improvement of management structures, promotion of linkages between universities, business and industry, reforming higher education legislations, establishment of a new plan for higher education, development of graduate studies, improvement of library and learning resources, promotion of distance learning, development of new admission mechanisms to tertiary education, restructuring of scientific departments and improvement of scientific research excellence in higher education. It could be argued that this list of projects and their action plans, as indicated by HERS, is not a simple 'to do' list but an outline of the complexity of activities and processes required for improving university education in Egypt (HEEP 2009; OECD 2010).

Of the twenty five projects only the first ten have been implemented to date, and the remainder are in progress until 2017. It should be noted that despite the second and third Egyptian revolutions which occurred in 2011 and 2013, and the challenges the country faced which might have slowed down much of the sector's work including higher education projects, the HEEP time plan remains unchanged (HEEP 2014).

With respect to the outcomes of these projects, the implementation of ten reform projects has resulted in a number of important achievements across the university sector (SPU 2010), not least in engineering (Taha and Abou Ismail 2002; Abdallah et al. 2008; Gomaa et. al. 2011). For example, the funds put in place through HEEPF have allowed the ICTP to establish a unified network that links all universities with digital libraries and research centres. Funds have also allowed through the ETCP to reform the structure and management of many technical colleges and to improve the Faculty of Education through the FOEP. Also CIQAP implementation improved teaching halls, laboratories and equipment, developed academics' capacities to cope with large cohorts of students and introduced open courseware for e-learning.

Similarly, LIAP allowed the renovation of all university laboratories to conform to the standards set by the Egyptian Accreditation Council (EGAC).

Another important achievement of HERS was the development of NCFLD. The project, through extensive funding from HEEPF, developed administrative and academic staff capacities and knowledge through training in four main areas: teaching, scientific research, communication and leadership; as a number of courses in these areas were offered; for example: use of technology in teaching, students' evaluation and examination techniques, quality standards in teaching, international publishing of research, research team management, research ethics, communication skills, presentation skills, strategic planning, university management and time management.

Other successfully implemented projects were QAAP and QAAP2. QAAP established the National Authority for Quality Assurance and Accreditation of Education (NAQAAE) (NAQAAE 2014) with the purpose of spreading the culture of quality in educational institutions and society as well as developing national standards that keep pace with the international standards for the restructuring of educational institutions and improving the quality of their operations and outputs as a lead to earn the trust of the community (NAQAAE 2014). NAQAAE was established by a Presidential decree in 2007 (NAQAAE, 2012). The decree consisted of three parts: the first part stated the bylaws that constituted it, two of which were Law No. 82/2006 regarding the establishment of the National Authority for Quality Assurance and Accreditation of Education (NAQAAE) and the law governing Egyptian universities (SCU 2006); the second part described the appended rules of the executive regulation of Law No. 82/2006 on the establishment of NAQAAE and the third part was related to publishing the decree in the newspapers (NAQAAE, 2012). Law No. 82/2006 regarding the establishment of NAQAAE consisted of 21 articles with few definitions to the terms used within the document. The articles described how the authority aims to assure quality in higher education and the necessary measures for that through HERS



implementation, the rules and procedures set to issue, renew and suspend accreditation, the accreditation process and its fees, the authority board of directors and management procedures, and the authority resources, budget and funds. Throughout the law there was no specific reference to graduate attributes except in the definition of the education programme which the law defined as “the curricula, courses and activities which help students acquire knowledge, skills and values necessary to achieve an educational goal, or a specific field of specialisation for which the student is awarded a degree or certificate when its components and requirements are met” (NAQAAE 2012, p.1). Based on the decree, it is suggested that although it referred to the bylaws, policies and procedures for the establishment of NAQAAE, which are important for disseminating a culture of quality assurance and accreditation in Egyptian universities, they were not sufficient to promote the quality of teaching and learning of graduate attributes within the Egyptian university sector (OECD, 2010; Korany, 2011). Law No. 82 (NAQAAE, 2012) and the law governing Egyptian universities (SCU, 2006) in their suggested policies have not introduced newer or updated regulations necessary to improve universities’ effectiveness for the labour market or achieve education reform objectives (OECD 2010). With reference to OECD (2010) report outcomes, Egyptian education legislations were criticised for being outdated and not addressing higher education contemporary demands which had its implications for education management within the Egyptian university sector.

Following the Presidential decree in 2007, NAQAAE was established and released two main guidelines: the Quality Assurance and Accreditation Handbook for Higher Education in Egypt and the National Academic Reference Standard (NARS) (HEEP2 2009b; NAQAAE 2009a). Both guidelines were designed upon good practices from the UK (Quality Code), USA, Australia, Germany and France (HEEP2 2009b; NAQAAE 2009a). The handbook guides universities on the quality measures needed for institutional capacity and educational effectiveness. Examples of these are: strategic planning, organizational structure, leadership and governance, academic programmes/courses, teaching, learning and supporting facilities, teaching staff

qualifications and scientific research (HEEP 2009b). NARS, on the other hand, is a reference for institutions when developing, reviewing and evaluating their programmes and courses of study. The standard sets out the general expectations from a qualification/degree and are categorised into knowledge and understanding, intellectual skills, practical and professional skills, general and transferable skills (NAQAAE 2009a) (Appendix K). In the UK, NARS is implemented as UK-SPEC.

These different categorisations are similar to the ones listed in the Quality Assurance and Accreditation Handbook for Higher Education (HEEP2 2009b), however NARS for engineering provided more examples to clarify each category as in (Appendix K) (NAQAAE 2009a, p.4-6). Examples of knowledge and understanding attributes were: “concepts and theories of mathematics and sciences, appropriate to the discipline”, “methodologies of solving engineering problems, data collection and interpretation”, “quality assurance systems, codes of practice and standards, health and safety requirements and environmental issues”, whereas examples of intellectual skills were: “select appropriate mathematical and computer-based methods for modelling and analyzing problems”, “select appropriate solutions for engineering problems based on analytical thinking”, “select and appraise appropriate ICT tools for a variety of engineering problems”. Examples of practical and professional skills were: “apply knowledge of mathematics, science, information technology, design, business context and engineering practice integrally to solve engineering problems”, “practice the neatness and aesthetics in design and approach”, “apply numerical modelling methods to engineering problems”; whereas examples of general and transferable skills were “collaborate effectively within multidisciplinary team”, “work in stressful environment and within constraints”, “communicate effectively”, “lead and motivate individuals”, “effectively manage tasks, time, and resources”, “refer to relevant literature”. According to Barrie (2006), these lists are important for universities to understand the nature of the attributes to be embedded in taught courses, yet they were created by combining a number of learning outcomes without significant critical scrutiny of their nature (NAQAAE 2009a). Amongst the general and transferable skills

listed, for example, are “collaborate effectively” and “communicate effectively”, as if collaboration does not require communication and communication does not require collaboration. Also, some learning outcomes such as “practice the neatness and aesthetics in design and approach” and “apply numerical modelling methods to engineering problems” tend to reflect ambiguity in the words, terms and language used to explain NARS practical and professional skills (NAQAAE 2009a). According to Barrie (2006) and Jones (2013) this implies that there is confusion, lack of conceptual clarity and therefore uncertainty on the part of academics as to what these categories mean at the undergraduate level. It also implies that meanings and understandings of graduate attributes are different within and across educational programmes/faculties due to the different categories used to those attributes and therefore there is no single way of understanding the concept (HEEP2 2009b; NAQAAE 2009a). This means that academics do not speak the same language or share common understandings about graduate attributes which explains their limited implementation in undergraduate taught courses (OECD 2010; Korany 2011; Kohstall 2012).

In addition to these learning outcomes, NARS for engineering listed more learning outcomes that should be acquired by computer engineering graduates (as in Appendix L) (NAQAAE 2009a; p.27-28). Examples of knowledge and understanding attributes were “engineering principles in the fields of logic design, circuit analysis, machine and assembly languages”, “quality assessment of computer systems” and “related research and current advances in the field of computer software and hardware”; whereas examples of intellectual skills were “select the appropriate mathematical tools, computing methods, design techniques for modelling and analyzing computer systems”, “select, synthesize, and apply suitable IT tools to computer engineering problems” and “capability of integrating computer objects running on different system configurations”. Examples of practical and professional skills were “design and operate computer-based systems specifically designed for business applications”, “use appropriate specialized computer software, computational tools and design packages throughout the phases of the life cycle of system development” and

“conducting user support activities competently”. When comparing engineering learning outcomes (Appendix K) to computer engineering learning outcomes (Appendix L), there was variance in the terms used to describe graduate attributes. It is understood that engineering learning outcomes are generic to all engineering undergraduate programmes (Appendix K) and computer engineering learning outcomes are specific to computer engineering programmes, yet according to Barrie (2006, 2009), Green et al. (2009), and Barrie and Hughes (2010) such variance is often unclear to academics, which leaves the stated outcomes confusing, open to different interpretation and thus raises the potential for inconsistent implementation of graduate attributes in courses.

Also, through a thorough reading of NARS for engineering, there was no indication that Egyptian engineering employers participated in the design, review and approval of the standard (NAQAAE 2009b). Unlike UK-SPEC which was developed by people from industry and academia (UK-SPEC 2015), NARS stakeholders included in the work were “representatives from the Ministry of Higher Education, National Syndicates, the academic university staff members and the Private Sector” (NAQAAE 2009b, p.5). This means that NARS content overlooked Egyptian engineering employers’ opinions on the attributes most desired for the labour market, which suggests that NARS does not reflect an accurate content of engineering employment needs (NAQAAE 2009a). This explains why the skills gap between Egyptian universities and the labour market exists, and indicates that the skills gap was not caused by academics’ different understandings of graduate attributes alone but also by NARS engineering content.

With respect to the Quality Assurance and Accreditation Handbook, it is suggested that the words, terms and language used to describe knowledge and understanding, intellectual skills, professional and practical skills, as well as general and transferable skills lack conceptual clarity and are ambiguous (Taha and Abou Ismail 2002; HEEP2 2009b, p71-72; UNESCO 2007). For example knowledge and understanding were

described as “the main information to be gained and the concepts that should be understood from the course”, whereas intellectual skills were described as “the intellectual capabilities gained by the graduate after completing the programme, such as the ability to select from different choices, concluding and discussing, innovation, specifying problems and finding solutions, etc”. The professional and practical skills were described as “the capability to use academic material in professional applications, which should be gained by the student upon completing the programme, such as use of remote sensing maps, managing water resources, performing an engineering design and designing a computer programme”. General and transferable skills were described as “the different general or transferable skills that should be gained by the student upon completing the programme such as computing skills, communication skills, management skills, working in a group and problem solving”. According to Barrie (2006) and Jones (2013), such lack of conceptual clarity and language ambiguity in describing the different categories of courses learning outcomes, affects academics understanding of graduate attributes and therefore their implementation in taught courses. Although these different categories and classifications are essential to explain universities central achievements for the labour market particularly in the area of graduate attributes, it was noted that they were created by combining a number of words and terms without significant critical scrutiny of the nature of the words used to describe each term (HEEP2 2009b). This means that essential data for the creation of meaning was removed, which according to Barrie (2006, 2007) and Jones (2013) creates uncertainty, ambiguity, inconsistency and confusion among academics with regard to the understanding of graduate attributes and therefore their effective implementation in taught courses.

Although HERS through QAAP and NAQAAE as well as other projects aimed to “improve the quality and relevance of higher education so that graduates have the knowledge and skills demanded by Egypt’s developing and globalising economy” (HEEP 2009e, p.1), they fell short of causing a radical reform, which explains why the skills gap exists (OECD 2010; Korany 2011). According to Kohstall (2012), HERS

produced a number of recommendations to improve the quality of university education processes without setting up the necessary contextual conditions to ensure their effective implementation, and this clarifies HERS limited success as well as the skills gap. It could also be noted that HERS was designed based on an analysis of higher education weaknesses and strengths; however these were not sufficient to promote teaching and learning strategies because the necessary conditions for improving the quality and efficiency of the Egyptian higher education system were not created. This includes changing existing policies, systems and bylaws such as the law governing Egyptian universities (SCU 2006), which are all important in driving change in the Egyptian university sector, including the incorporation of graduate attributes into taught courses (Korany 2010).

#### **1.4 Implications of Reform Projects for the Skills Gap**

Following the implementation of HEEP, the first phase was assessed in 2002 by the World Bank and was evaluated as satisfactory (HEEP 2009b). This was due to the relevance of the objective to the improvement efficiency, the environment created which was conducive to quality and the Ministry of Higher Education's strong commitment towards higher education development (The World Bank 2009). Nevertheless, even with the results achieved by HEEP, it faced a number of constraints which affected the implementation of its projects. For example, the lack of effective human resources for HEEP implementation, opposition and resistance of some faculty members to change, inconsistent cash flows and the need for more changes with respect to current regulations and legislation (HEEP2 2009a).

In another evaluation commissioned by the Egyptian government in 2010, the OECD and the World Bank re-assessed the quality of higher education in Egypt to determine what improvements were necessary whilst HEEP was in force (OECD 2010). In its report the OECD pointed to the efforts Egypt had made to develop its higher education sector, yet suggested further directions for improvement (OECD 2010). These were to (i) improve graduates' readiness for the labour market as the OECD (2010) stated that to overcome the skills gap which is principally related to graduates' unpreparedness

for the labour market, faculties need to effectively implement attributes in taught courses as well as engage with professional bodies and employers to design and evaluate programmes of study; (ii) increase institutional flexibility and self-management capacity requiring that public universities offer more disciplined specialisations for the students; (iii) share costs more equitably by finding an approach for continuous funding since education in Egypt is almost free; (iv) introduce quality assurance as an institutional responsibility where public universities need to review the quality of their programmes, adopt performance based practices and professionally develop their academics and staff; and (v) strengthen university research capacity.

As the Egyptian government was aware of the importance of these directions for improving the effectiveness of the higher education sector, the outcomes of these evaluations were taken in consideration while reform was in progress. However, due to the 2011 and 2013 Egyptian revolutions, which slowed down the pace of work of HEEP, there are no reports to date that evaluate HEEP performance (HEEP 2014). Despite the many achievements, many reviews and literature report the persistence of the skills gap in Egypt (MENA 2009; SPU 2010; OECD 2010; ENCC 2010; Korany 2011; UNESCO 2012).

According to previous studies, the skills gap is not new and has been discussed in much of the literature. Research from the UK and Australia revealed that graduate attributes are important university outcomes, although they are a complex nature, indeed they sit at the heart of a number of complexities that affect their development in taught courses (Barrie 2004, 2006, 2007, 2009; Jones 2009, 2013; Hughes and Barrie 2010). These studies, which aimed to understand the factors affecting the implementation of graduate attributes in taught courses, have highlighted the initiatives taken as well as the factors affecting their teaching and learning. Some of these factors were pedagogical, epistemological or cultural. Yet, it is suggested that the studies overlooked the role of context in graduate attributes teaching and learning

and that this explains their limited implementation (Jones 2013). This topic will be discussed in more detail in the coming chapter which deals with the literature review.

### **1.5 Higher Education in Post-Revolution Egypt**

Although the higher education sector is part of the recent Egyptian revolution, reform projects continued as planned but with a slower pace. Nevertheless, there were a number of changes that occurred in the higher education sector post second and third revolutions. These were: establishing Zewail City for Science and Technology Park to build an advanced science and technology base in Egypt (Bond et al. 2013); expanding students' access to universities by changing seven university branches located in governorates other than Cairo and Alexandria into fully fledged universities; improving academics' salaries; and increasing education funds in the new constitution to form 4% of Egypt's GDP (Bond et al. 2013; Serageldin 2013).

Despite these positive changes, the university experience had become worse particularly after the second revolution in 2011 (Serageldin 2013). Problems such as lack of security on university campus, student pressure to force out any academic associated with the old regime, political arguments over power, thugs, and fights, all affected early plans concerning education and curricular development (Lindsay 2012; El-Awady 2013; Serageldin 2013). Nevertheless, higher education development and HERS implementation remains a strategic priority for the government even with the existing confusions about where the country is heading after thirty years of dictatorship (Bond et al. 2013). After the third Egyptian revolution on 30<sup>th</sup> June 2013 and the appointment of a President who is widely accepted by the Egyptians, citizens are more hopeful and confident that changes and improvements will occur in various of Egypt's sectors, including that of higher education (Serageldin 2013).

In response to revolutionary changes, the Egyptian Higher Education Minister has recently stated that the university sector will undergo further reform plans between 2015 and 2020 (THE 2014). Among the Minister's priorities is a desire to change the



law governing universities which dates back to 1972, seeking a way to fund and regulate universities without direct control by the government, and launching the Newton-Mosharafa Fund (with £2 million from each of the UK and Egyptian governments) to be spent on capacity-building and collaborative research over the next five years. The Minister stated that the latest memorandum of understanding between Egypt and the UK opens new collaboration and co-operation channels between both countries in terms of higher education, and student and academic exchanges. The Ministry's aim is to make Egypt a future education hub in the region. Yet, to be able to do so educational reform must achieve its objectives for universities, and to produce graduates who are capable of meeting the country's vision for development and prosperity. This research through its contribution to knowledge as well as its output, will indeed inform and guide higher education authorities in Egypt of the necessary conditions to successfully achieve the country's reform objectives. It is important to note that to identify these conditions it was necessary to look beyond current developments and practices by shifting from the use of the simplistic attempts to improve university education to multi-layered descriptions and analysis that document the complexity and nonlinearity of the processes involved.

### **1.6 Research Focus**

As previous discussions have indicated employers' dissatisfaction with graduate attributes, the aim of the research was to identify the contextual factors that have affected HERS project implementations to improve graduates' readiness for the labour market and thus reduce the skills gap. More specifically, these factors were investigated within the scope of computer engineering, by asking two main questions:

- 1- What are the contextual factors which affect the skills gap within the Egyptian computer engineering undergraduate discipline?
- 2- How can the skills gap be reduced to meet the demands of the Egyptian computer engineering labour market?

### **1.7 Aims and Objectives**

In order to answer these research questions, the objectives of this study are to:

- 1- Evaluate the current status of university education in Egypt, with particular focus on engineering undergraduate education.
- 2- Identify the contextual factors that affect the skills gap within the Egyptian computer engineering undergraduate discipline.
- 3- Analyse these factors to understand how to reduce the skills gap.
- 4- Provide guidelines through a policy document for higher education authorities in Egypt to reduce the skills gap.

### **1.8 The Proposed Policy Document**

By achieving the above objectives and in line with the research findings, the proposed output from this research was a policy document. The aim of the document is to provide guidelines to higher education authorities in Egypt on how to improve academics' performance with regard to the teaching and learning of graduate attributes in undergraduate bachelor degree courses. The proposed policy document is applicable to all disciplines (with some limitations) within the Egyptian university sector and is also informative to other educational systems particularly in the Arab World, but cannot be generalised. This is because what is considered contextual, for example, as a process or a system in Egypt, will be different in another geographic location. Equally, something that is possible in a regional or global environment may not be so in a specific area. This is not to say that ideas presented in the policy document could not be adapted for use in other educational contexts. If used in this way, they would need to take into consideration the local contextual parameters.

### **1.9 Research Methods**

To answer the research questions, semi-structured interviews were used to understand the different views, perceptions and experiences of eleven academics (five public and six private), nine graduates (four public and five private), and seven employers. The main common factor among all participants was their scope of work which was related to computer engineering or the IT sector. Documents were also used to support the outcomes of interviews. Data were analysed using thematic data analysis then theoretically analysed using complexity theory.

### **1.10 Research Contribution**

Throughout the reviews of the available literature particularly in the UK and Australia, it appeared that the contextual factors that affect the teaching and learning of graduate attributes had been overlooked. This research highlighted those factors in the Egyptian university sector. The outcome of the research (the thesis policy document) is believed to be critical; it can be used to advise universities in Egypt on how to effectively improve graduates' readiness for the labour market by improving the environment for teaching and learning of graduate attributes on undergraduate bachelor degrees.

### **1.11 Sources of Data Used within the Research Study**

The following data sources were used as part of the literature review in order to explore the research problem:

- Latest academic conference papers and peer reviewed journals.
- Latest reports, standards, specifications and policy documents that have been generated by the Ministry of Higher Education in Egypt (MOHE), the Ministry of Finance in Egypt (MOF), the National Authority for Quality Assurance and Accreditation of Education (NAQAAE), the Supreme Council of Universities (SCU), the Strategic Planning Unit (SPU), the British Council, the Egyptian National Competitiveness Council (ENCC), National Academic Reference Standards (NARS), the Quality Assurance Agency (QAA-UK), UK-specifications (UK-SPEC), Higher Education Academy (HEA) and Royal Academy for Engineering (RAEng).
- Up to date statistical information from the Information and Decision Support Centre (IDSC), the Confederation of British Industry (CBI) and Association of Graduate Recruiters (AGR).
- Latest reports and policy documents produced by agencies such as the World Bank or International Bank for Reconstruction and Development (IBRD), the Organization for Economic Co-operation and Development (OECD), the World

Economic Forum and United Nations Educational, Scientific and Cultural Organization (UNESCO).

### **1.12 Thesis Structure**

The chapters of this thesis are:

#### **Chapter One: Introduction**

The chapter introduces the research study focus, the research questions, aims and objectives, the research contribution and output.

#### **Chapter Two: Literature Review**

The chapter includes a review of literature which captures the relevant theories related to the research. The purpose of the chapter was to further develop the relevance of the research study, identify the gap in knowledge and provide the basis to define relevant research questions.

#### **Chapter Three: Research Methodology**

The chapter focuses on the research methods that will answer the research questions. It gives an overview of which research approaches were followed and why. It covers the sample used in the study and discusses how the research tools were chosen and why.

#### **Chapter Four: Research Results**

The chapter covers the results of analysing semi-structured interviews and documentation. It also includes the conclusions reached based on these analyses.

#### **Chapter Five: Research Output and Validation**

The chapter covers the structure of the policy document developed from the research and the outcomes of its validation by different experts in the Egyptian higher education sector.

## **Chapter Six: Research Contribution to Knowledge, Conclusions and Recommendations**

The chapter covers the research contribution to knowledge identifying what has been achieved in comparison to the research stated aims and objectives. At the end of the chapter, the research conclusions and recommendations are presented.

### **1.13 Summary**

In this introductory chapter, a brief overview has been given on university education in Egypt pre and post the second and third Egyptian revolutions which occurred in 2011 and 2013. The chapter identified key problems facing the university sector and how they were addressed by the Egyptian government through a reform plan established in 2000. The chapter highlighted that despite the reform initiative set in 2000 to reduce the skills gap, the situation remained unchanged. This chapter also presented the focus of the research, the research questions, aims and objectives, and the research contribution.

# Chapter Two: Literature Review

## 2.1 Foreword

In the previous chapter a description of the Egyptian higher education sector pre and post the second and third Egyptian revolutions (2011 and 2013) was given. The introduction pointed out the Egyptian government initiative, begun in 2000, to reform the higher education sector in order to improve graduates' readiness for the labour market and to address the skills gap. The chapter also noted that, despite reform initiatives, and for a number of reasons, the skills gap still exists. The introductory chapter described the motivation and the focus of the study and the questions which should be asked in order to achieve the research aims and objectives.

This chapter continues the discussion around the skills gap in the Egyptian university sector despite the implementation of HERS and HEEP since 2002. It also considers graduate attributes as a concept, the initiatives taken to develop, implement and improve them in courses, and the skills gap and factors that affect it, as identified from the international literature.

## 2.2 Introduction

There is a distinct gap between the Egyptian government initiative's and efforts to improve graduates' readiness for the labour market on one hand and the views of Egyptian employers on the other. Since 2002, the Ministry of Higher Education in Egypt has tried to implement a number of HEEP projects to improve graduates' learning outcomes, particularly graduate attributes, yet most employers remain unsatisfied. In a number of reports, reviews and public panels set up to discuss the effectiveness of university education for the labour market, Egyptian employers have expressed their concerns over university graduates, noting that they lack the necessary attributes for the labour market and thus contribute to a skills gap (UNESCO 2007; MENA 2009; SPU 2010; OECD 2010; UNESCO 2012). One

employer said that “although educational institutions in Egypt are trying to address labour market needs, still many fail to meet the requirements of the job market” (MENA 2010, p.3). Another suggested that there is a “lack of information for adjusting the curriculum to meet employers’ needs, and individuals do not have the necessary critical mass of skills” (UNESCO 2012, p.10). Most employers are agreed “that many graduates are unprepared for the Egyptian job market in terms of skills and competencies such as problem solving and leadership skills” (SPU, 2010, p.6).

The OECD (2010) in its review of Egyptian national policies described the Egyptian labour market as suffering from two main problems: first the oversupply of university graduates, particularly in the humanities and social sciences, and second university graduates who lack the necessary attributes for the labour market resulting in employer dissatisfaction. The Egyptian National Competitiveness Council (ENCC) also reported, Egyptian employers’ concerns with regard to graduate attributes, suggesting that “Egyptian businesses face fierce competition for a scarce supply of graduates with proper skills causing a skills gap” (ENCC, 210, p.1). The President of Alexandria University, in a public panel, concurred that the skills gap existing between Egyptian universities and the labour market required the attention of Egyptian universities to meet education reform goals (MENA 2009). She described Egypt’s Higher Education system needs to undergo “a big wave of educational reform” (MENA 2009, p.6) and stressed the need to embed graduate attributes in taught courses to meet the demands of the job market and thus reduce the skills gap. She also emphasised the necessity to establish ties between the labour market and Egyptian universities to address HERS goals. In the same wave, the OECD expressed the need for universities to bond with the labour market to improve graduate attributes for employment and thus reduce the skills gap. With respect to graduate attributes that should be fostered through taught courses, Said (2006) identified a number, namely: self learning and long life capacities, communication and teamwork skills, intellectual skills such as creative thinking and problem solving, and management skills.

From a comparison of views about graduates' unpreparedness for the labour market, and an insightful understanding of the policy documents, international reports and various other pieces of literature which discuss the importance of HERS and its aims to improve Egyptian universities outcomes to the labour market, Egypt has shown a strong commitment to achieve satisfactory results (The World Bank 2009; HEEP 2009b; OECD 2010). Yet, Egyptian universities are still criticised for not improving graduates' readiness for the labour market (Abdallah et al. 2008; OECD 2010; Kandeel 2011; Bond et al. 2013; Korany 2011; El Nashar 2012; UNESCO 2012). According to OECD (2010), this is a persistent problem in Egypt and efforts to solve it are still small in number. Various authors have blamed the universities, which tend to focus mainly on the technical aspects of the curriculum rather than on the attributes required by the labour market (UNESCO 2007; ENCC 2010; Gomaa et. al. 2011). However, the OECD (2010) and Korany (2011) suggested that although reform projects have targeted change, they fall short of causing radical reform or dramatic new departures as they merely focus on procedural change rather than demonstrating commitment towards reform sustainability. For example, although the National Agency for Quality Assurance and Accreditation of Education (NAQAAE) required academics to document their course learning outcomes, these remained only as part of procedural work rather than being implemented in classes (OECD 2010), or being part of the teaching philosophy (Korany 2011).

Wilkens (2011) and Kohstall (2012) argued that during the last decade Egypt and Morocco have experienced an example of distorted internationalisation. Kohstall (2012) stated that international reform models may not bring the change which is expected in countries with relatively low performance indexes, such as Egypt and Morocco and others in the Arab world, because they have been implemented by universities in an authoritarian way (despite the application of the participatory approach) without understanding or setting up the necessary contextual conditions needed for change. For example, universities are requested to compete among themselves without being granted self autonomy as well as to comply with quality



standards for accreditation without better payment. Kohstall (2012) also clarified that policy-makers in Egypt build their reform instruments by referring to the advanced countries without creating the necessary contextual conditions. He suggested that because reform models in the Arab World are not necessarily preceded by an assessment of the domestic situation or a critical examination of the context in which they operate, none of the solutions provided are home grown.

Such an opinion on the Egyptian university sector is indeed appropriate, as HERS was designed and developed based on Western experiences, especially in what relates to quality such as NAQAAE and NARS, without creating the necessary contextual conditions for successful implementation (HEEP2 2009b; Kohstall 2012). Similarly, and according to HEEP (2009d) and HEEP (2010), although HERS methodology and guiding principles are developed by a professional committee of academics in higher education based on the weaknesses and strengths encountered in the Egyptian higher education system, HERS projects remain grounded in European experiences and practices in education (e.g. quality code for QAA). Kandeel (2011) and Korany (2011) commented that in Egypt, despite the establishment of certain strategies, such as QAAP, QAAP2, NAQAAE, NCFLD and their achievements to date based on World Bank reports (OECD 2010), education still needs an update or an overhaul that does not focus on makeshift reformatory strategies but rather on changing the philosophy of education in Egypt.

With respect to NAQAAE, its developed Quality Assurance and Accreditation Handbook for Higher Education (HEEP2 2009b), NARS for engineering (Appendix K) and NARS for computer engineering programmes (Appendix L) (NAQAAE 2009a) provided guidance to academics on how to promote the teaching and learning of graduate attributes in taught courses in line with HERS strategic goals for education reform, however they were of limited success in promoting the teaching and learning of graduate attributes in taught courses (OECD 2010; Korany 2011). Those guidelines classified graduate attributes in terms of knowledge and understanding, intellectual

skills, professional and practical skills, and general and transferable skills; however the words, terms and language used to explain these different classifications were ambiguous and lacked conceptual clarity (Taha and Abou Ismail 2002; HEEP2 2009b, p71-72; UNESCO 2007). For example intellectual skills were described as “the intellectual capabilities gained by the graduate after completing the programme, such as the ability to select from different choices, concluding and discussing, innovation, specifying problems and finding solutions, etc.”, whereas the general and transferable skills were described as “the different general or transferable skills that should be gained by the student upon completing the programme such as computing skills, communication skills, management skills, working in a group and problem solving” (HEEP2 2009b, p71-72).

Also, the examples provided by NARS to identify engineering attributes to be embedded in taught courses were created by combining a number of learning outcomes without significant critical scrutiny of their nature (NAQAAE 2009a). For example, the general and transferable skills listed “collaborate effectively” and “communicate effectively” as if collaboration does not require communication and communication does not require collaboration. Also some learning outcomes such as “practice the neatness and aesthetics in design and approach” and “apply numerical modelling methods to engineering problems” tend to reflect ambiguity in the words, terms and language used to explain NARS practical and professional skills (NAQAAE 2009a). Furthermore NARS was designed without the participation of Egyptian engineering employers (NAQAAE 2009a). NARS stakeholders included in the work were “representatives from the Ministry of Higher Education, National Syndicates, the academic university staff members and the Private Sector” (NAQAAE 2009b, p.5). This means that NARS content overlooked Egyptian employers’ opinion on the attributes most desired for the labour market, which suggests that NARS does not reflect an accurate assessment of engineering employment needs (NAQAAE 2009a). With respect to HERS, it is suggested that it was designed based on an analysis of higher education weaknesses and strengths; however these were not sufficient to

affect change in the Egyptian university sector, particularly in the area of teaching and learning graduate attributes, because the necessary conditions for improving the quality and efficiency of the Egyptian higher education system were not set up. Although HERS aimed to achieve its reform goals by creating the necessary conditions through legislative reform (The World Bank 2009, p.2; HEEP 2009d), the policies and regulations governing the Egyptian university system remained unchanged (OECD 2010; Korany 2011; Kohstall 2012).

In the light of these readings and from an in-depth understanding of their content, it might be suggested that the Egyptian government has made serious attempts to reduce the skills gap through a number of higher education enhancement projects set up by HERS; however the skills gap continues to exist. From the review of Egyptian literature it is understood that the reform strategy has not produced the expected changes to address the skills gap for a number of reasons including: (i) HERS which was implemented without carrying out the necessary changes to the existing policies and procedures to ensure the effective implementation of HEEP in the area of graduate attributes (OECD 2010); (ii) the Quality Assurance and Accreditation Handbook which lacks conceptual clarity in the language used to describe the different classifications of graduate attributes (HEEP2 2009b); (iii) the different classifications of graduate attributes listed in the handbook and the interchangeable names used to describe the concept which creates confusion among academics (HEEP2 2009b); (iv) NARS for engineering which was designed and reviewed without feedback from Egyptian engineering employers on the attributes desired for employment (Appendices K & L) (NAQAAE 2009a); (v) the attributes listed in NARS which lack clarity (NAQAAE 2009a) and (vi) reform tools which are built from the reform instruments of the advanced countries and implemented in an authoritarian way without being preceded by a critical examination of the context in which they are applied (Kohstall 2012). All of these causes, taken together, tend to provide insights into the limited implementation of graduate attributes in taught courses and therefore the skills gap within the Egyptian university sector.

In order to gain a deeper, broader understanding of the topic, particularly of the factors affecting the teaching and learning of graduate attributes, the international literature was reviewed. The following section introduces graduate attributes as a concept, their definition, nature and factors affecting their successful implementation in higher education. This review was carried out in order to benefit from the experiences of countries that have had a head start in education development.

### **2.3 Introduction to Graduate Attributes**

The term graduate attributes has been established in Europe, Australia and the United States since the early 1980s (Yorke and Harvey 2005). For over a decade, they included a variety of terms such as soft skills, transferable skills, generic skills, competencies, qualities and employability skills in the industrial sector (Harpe et al. 2000; Precision Consultancy 2007; Jones 2009; Green et al. 2009; CBI 2009). The emphasis on graduate attributes has been particularly common in Australia (DEST 2006) and can range from simple technical skills to complex intellectual abilities and ethical values (Barrie 2006; Bridgstock 2009). In the UK, the term graduate attributes is used interchangeably with graduate skills (Green et al. 2009), where it was addressed in 1998 through the Skills Task Force as a result of the concerns raised by employers who claimed that many graduates lacked the necessary attributes for employment causing what was known as the skills gap (Yorke and Harvey 2005). Graduate attributes were highlighted by the Dearing report in 1997 as a fundamental learning outcome of university education (Dearing 1997; Yorke and Harvey 2005). In its recommendations for improving the UK higher education sector, the report urged universities to develop graduate attributes in programmes of study as they are a necessity for employment (Dearing 1997; Harpe et al. 2000; Yorke and Harvey 2005, CBI 2009). Accordingly, the Department for Education and Employment (DEE) developed strategies for embedding attributes in curricula to reduce the skills gap (Harpe et al. 2000; Yorke and Harvey 2005; CBI 2009).

Initially, there were some concerns over how to develop and assess graduate attributes on taught courses (Yorke and Harvey 2005; Green et al. 2009). The continuous debates on the topic split the learning and literacy experts into two groups: the 'generalists' and the 'specifists' (Yorke and Harvey 2005; Green et al. 2009; Jones 2009, 2013). The generalists believed that attributes are generic, therefore can be applied to any discipline and hence taught separately from curriculum content. The specifists, on the other hand, believed that attributes are not generic and hence cannot be taught separately from course content. In other words, they believed that graduate attributes are context specific. The specifists stated that certain attributes such as critical thinking or problem solving cannot be taught as a one-shot inoculation and therefore cannot be separated from their disciplinary content (Harpe et al. 2000; Jones 2009; Green et al. 2009). Despite these conflicts, the Department of Education, Science and Training (DEST) in Australia asserted that graduate attributes are an important learning outcome that universities need to foster in their programmes of study in order for graduates to accomplish any work task (DEST 2006). In line with such a statement many authors (HEC 1992; Bowden et al. 2000; Sumsion and Goodfellow 2004; Barrie 2004) suggested, through a number of definitions, that graduate attributes are personal values and skills that represent a central achievement of higher education and thus should be acquired by all graduates irrespective of their disciplines.

Barrie (2004, p.262), along with the Higher Education Council, (HEC 1992, p.20) defined graduate attributes as:

The skills, personal attributes and values which should be acquired by all graduates regardless of their discipline or field of study. In other words, they should represent the central achievements of higher education as a process.

Sumsion and Goodfellow (2004 p.332) also defined graduate attributes as:

Those skills, abilities and personal attributes that can be used within the wide range of working environments that graduates operate in throughout their lives.

From these definitions it is understood that graduate attributes are generic university outcomes that are not related to any field of study and so they are developed in courses regardless of the nature of the discipline and context in which they are taught. In comparison, Jones (2009, 2013) stated that graduate attributes are context specific; that is, they are strongly influenced by the disciplinary culture in which they are taught and thus the assumption that they are generic or transferable remains quite problematic:

Considering generic attributes as separate from disciplinary knowledge and hence in competition rather than integral to it is at the heart of the problem (Jones 2009; p.189).

Despite these contradictions, previous research continued to highlight a number of classifications for graduate attributes, yet there is no blueprint for their nature. As exemplar attributes, Dearing (1997) suggested communication skills, numeracy, the use of information technology and learning how to learn, whereas Harpe et al. (2000, p.233), suggested communication, problem solving, critical thinking, teamwork, interpersonal skills, technology and information literacy. The Department of Education, Science and Training (DEST) classified graduate attributes into six main groups (DEST 2006, p.8).

These were:

- Basic/fundamental skills: such as literacy, numeracy and using technology.
- People-related skills: communication, interpersonal skills, teamwork and customer service skills.
- Conceptual/thinking skills: collecting and organising information, problem-solving, planning and organizing, learning-to-learn skills, thinking innovatively and creatively and systems thinking.

- Personal skills: being responsible, resourceful and flexible, being able to manage one's own time and having self esteem.
- Business skills: innovation and enterprise skills.
- Community skills: civic or citizenship knowledge and skills.

In contrast, Nguyen et al. (2005 p.206) classified them into six but different sets.

These were:

- Basic competency skills: learning how to learn, reading, writing and computation.
- Communication skills: speaking and listening.
- Adaptability skills: problem-solving and creativity.
- Personal development skills: self-esteem, motivation and goal-setting, personal and career development.
- Group effectiveness skills: interpersonal, negotiation and teamwork.
- Influencing skills: understanding organizational culture and leadership.

These lists are used as a reference by most academics to gain insights into the attributes to be developed in courses; unless their universities create their own (Jones 2013). Barrie (2006) criticised these lists, stating that although they are insightful, they are created by compiling a number of attributes without significant critical scrutiny of the nature of the attributes represented. Accordingly, some attributes could be classified under different sets. For example, teamwork is classified under people related skills in DEST (2006), but in another setting is classified under group effectiveness skills (Nguyen et al. 2005). The implication of this, according to Barrie (2006, 2007) and Jones (2013), is a variation, inconsistency and duplication of categorisation which creates confusion in the understanding of graduate attributes. Barrie (2007) stated that despite such confusion, they remain part of an important language that universities need to use to state their learning outcomes. They are also an important language that employers use in order to identify graduates' qualifications needed for the workplace (CBI 2009).

## **2.4 Employers' Desired Attributes**

From a survey conducted by the Confederation of British Industry (CBI) to understand employers' demands from universities, 82% suggested "improving students' employability skills," agreeing that this should be a key focus for universities (CBI 2009, p7). Employers believed that attributes are most important for a job as they enable and drive graduates "to move self-sufficiently within the labour market to realise its potentials" (Mason et al. 2006, p.2). Employers in the CBI survey also prioritised students' work while studying in order to become more prepared for employment, as well as improving graduates' technical capabilities (CBI 2009).

With respect to attributes most appreciated for employment, employers in the UK, Australia and the United States valued graduates who have: the necessary higher level thinking, willingness and ability for continuous learning, innovation, adaptability, knowledge of the business, good teamwork skills, presentation and communications skills (Harpe et al. 2000; Hesketh 2000; Yorke and Harvey 2005; Mason et al. 2006; Harvey and Mason 2008; Andrews and Higson 2008; AGR 2009). In Russia, employers preferred the graduate who has orientation towards greater initiative and independence and the ability to work in teams (Avraamova and Verpakhovskaia 2007). In Japan, product manufacturers chose communication skills and sincerity as the most important qualities for work (Nguyen et al. 2005). In addition to these attributes, there are: work commitment, self awareness, understanding the society, computer literacy and information technology, leadership and supervision, research and analysis, problem solving, literacy and numeracy (Hesketh 2000; Mason et al. 2006; Precision Consultancy 2007; GCCA 2009; AGR 2009; Green et al. 2009; CBI 2009; OECD 2010). As for engineering employability skills, Nair et al. (2009) suggested lifelong learning, information technology, leadership skills, managerial skills, communication skills, teamwork, and expertise in management of projects, while RAEng (2010) suggested communication skills, negotiation skills, information technology, team working, language skills and planning and costing. Despite these



desired attributes, communication skills and teamwork remained the most valued by employers in all disciplines (Martin et al. 2005).

This wide array of necessary attributes suggests that there is no single defined or agreed set of graduate qualities required by employers either in the scope of the engineering discipline or in any other. As mentioned by Yorke and Harvey (2005), desired employability skills may vary from one employer to another depending on the nature, type and size of business. Large sized businesses for example, are well known for the large ratio of applications to vacancies and as a result they are highly selective about what they look for in graduates, unlike small and medium sized businesses that are forced to be flexible and ad hoc when recruiting graduates because of the small number of applications received.

### **2.5 Universities' Initiatives to Develop Attributes in Courses**

In the light of the policies set and funds allocated, universities in the UK and Australia were pressured by their governments to take the necessary initiatives to reduce the skills gap (Dearing 1997; Harpe et al. 2000; Hesketh 2000; Medlin et al. 2003; Harvey 2005; Yorke and Harvey 2005; Barrie 2006; Kember et al. 2007; Precision Consultancy 2007; CBI 2009; Barrie 2009; Green et al. 2009; Harpe and David 2012; Jones 2013). The aim was to ensure that universities equip their graduates with the appropriate attributes for work and life (Dearing 1997; Harpe et al. 2000; Hesketh 2000; Medlin et al. 2003; Harvey 2005; Yorke and Harvey 2005; Barrie 2006; Kember et al. 2007; Precision Consultancy 2007; CBI 2009; Barrie 2009; Green et al. 2009; AGR 2009; Harpe and David 2012; Jones 2013). Accordingly, universities set up a number of initiatives, for example, producing curriculum maps to show areas of graduate attributes and their development in taught courses using a range of tools such as: the Gibbs et al. Matrix (Sumsion and Goodfellow 2004; Barrie 2006; Harvey and Kamvounias 2008), the graduate qualities grid (Medlin et al. 2003) and the transferable skills template (Atlay and Harris 2000). Other examples were: (i) attempts to explicitly articulate and implement various combinations of graduate attributes and

career management skills using Bloom's Taxonomy in courses (Barrie 2004; Bridgstock 2009; CBI 2009; Precision Consultancy 2007; Harpe and David 2012); (ii) adopting student centred, content focused strategies such as Work Integrated Learning and Problem Based Learning to allow students to actively share, practise and obtain feedback on their qualities (Harpe et al. 2000; Hughes and Barrie 2010; Harpe and David 2012); (iii) improving academics' literacy in teaching and learning graduate attributes in courses (Harpe and David 2012); and finally (iv) engaging industry members, careers office staff and students in the design of the curriculum (Leckey and McGuigan 1997).

Despite these initiatives, employers' concerns with graduate attributes remained unchanged where they described educational programmes as "being too theoretical" to meet employment demands (AGR 2009; CBI 2009). A number of writers (Sumsion and Goodfellow 2004; Barrie 2006; Radloff et al. 2008; Green et al. 2009; RAEng 2010; Harpe and David 2012; SCST 2012; Jones 2013) suggested that, despite extensive funding, universities' approaches to integrating and teaching graduate attributes remained patchy and of limited success. These authors attributed the struggle they observed to a number of causes of the perceived gap between academics' awareness of the importance of graduate attributes for employment and their enactment in teaching practice (Jones 2009; Harpe and David 2012).

In order to understand these causes, the next section will present a review of key studies which were selected based on their relevance to this research. The studies explain in depth the factors that affected attribute development in courses in different countries such as the UK and Australia.

## **2.6 Understanding Obstacles to Reducing the Skills Gap**

Authors such as Harpe et al. (2000) pointed to a number of generic factors that affect the provision of quality educational services in Australia. These were: (i) the level of funding per student; (ii) academics not having a formal qualification for teaching; (iii)

the traditional reward system existing in universities which may work against good teaching and (iv) students who come underprepared for university study, particularly with regard to their writing skills. Harpe et al. (2000) through a qualitative survey conducted on twenty three majors of the Bachelor of Commerce Programme highlighted a range of other factors that affected academics' potential to foster and teach attributes on courses. These were a range of cultural and structural factors including: lack of collaboration among academics concerning how attributes could be taught, practised, improved and assessed; academics' resistance to change as change is usually imposed (top-down) by leadership rather than generated through internal commitment; no rewarding system to encourage academics to undertake work they think is not part of their disciplinary knowledge; time constraints; and academics' lack of experience into teaching attributes as part of the course.

Similarly, Sumsion and Goodfellow (2004), through a qualitative study conducted on an Early Childhood Programme to understand how its academics teach, practice and evaluate graduate attributes for six hundred students using the Gibbs et al. Matrix, were able to identify a number of structural and cultural factors that affected the effective deployment of graduate attributes in the matrix and thus their implementation in courses. These factors were: time constraints; lack of collegiate dialogue; lack of support from leadership to encourage work facilitation; trust; autonomy; transparency and resistance to change to teaching practices because attributes are not seen integral to the disciplinary content.

In another two key studies, Barrie (2004, 2006), who strongly believed that graduate attributes are generic outcomes of university education, revisited institutional claims of graduate attributes from a phenomenographic perspective. The outcome of his studies was a conceptual framework which showed different understandings of graduate attributes. Barrie's (2006) study was conducted on a purposive sample of fifteen Australian academics using semi-structured interviews. The study revealed that academics hold different understandings of the nature of graduate attributes as an

outcome of university education. Such variation according to Barrie (2004, 2006) had its implications for the ways in which academics understand, teach, learn and value the importance and relevance of graduate attributes in courses. Thus, the uneven, inconsistent, varying or patchy implementation of graduate attributes in courses is explained and justified (Barrie 2004, 2006). It is important to note that the variation in interpretation is not bounded to discipline, that is to say academics in the same discipline may hold very different understandings of graduate attributes. Similarly, academics from different disciplines may have a common understanding of graduate attributes.

From the outcome of his studies, Barrie was able to identify four different qualitative understandings that academics hold for graduate attributes (as described below). These logical, in-sequence conceptions were: precursory conception, complementary conception, translation conception and enabling conception. This 'Conceptions of Generic Attribute' (COGA) model has shown that attributes may range

from atomistic low-level technical and personal skills, to holistic interwoven abilities and aptitudes for learning. They also differ in terms of the relationship between these outcomes and discipline knowledge and the additive or transformative potential of such attributes (Barrie 2006, p.440).

Barrie (2004, 2006) described precursor abilities as foundation generic attributes such as: English language proficiency or basic numeracy. They are different from subject knowledge and learning, yet they are vital precursors to such learning. Most students on entry to university are expected to have these attributes, and for those who do not, the development of such attributes is best met by the provision of an additional remedial curriculum. In this conception, attributes are truly generic; that is, they are the same regardless of which academic discipline the student is entering. Complementary conceptions are second higher level outcomes that complement disciplinary knowledge. In this conception, graduate attributes are personal, functional skills which might be addressed by inclusion of an additional unit(s) of study in a course or an

additional series of workshops or lectures. Complementary conceptions are part of the usual course curriculum yet they do not interact with disciplinary knowledge.

Translation conceptions position graduate attributes as clusters of cognitive abilities and skills of application. In this conception, graduate attributes interact with and shape disciplinary knowledge, for example through the application of context-specific disciplinary knowledge to the field of work, and are in turn shaped by this disciplinary knowledge. Due to the relationship between knowledge and graduate attributes, these conceptions are differentiated by the disciplinary context. Rather than being generic, graduate attributes tend to meet the needs of a specific field of knowledge or discipline. Because of this close relation to disciplinary knowledge, these attributes are usually developed within the learning environment (the class) through the usual teaching processes of that content or through students' engagement in the course.

Enabling conceptions address graduate attributes not as parallel learning outcomes to disciplinary knowledge but as abilities that "sit at the very heart of discipline knowledge and learning" (Barrie 2006, p.266). Rather than being clusters of attributes, enablers are understood as woven networks of these clusters which give graduates a particular view of the world. In this conception, graduate attributes are integral to disciplinary knowledge, thus they form its skeleton. They might be learned in the context of disciplinary knowledge or from student engagement in the broader experience of participation in the university community. Enablers do outlast disciplinary knowledge and therefore transcend that from which they were originally acquired.

Barrie (2007) also designed another framework using phenomenography to identify and conceptualise how academics understand students' acquisition of graduate attributes. He argued that despite academics' clarification of the nature of intended learning outcomes in taught courses, it is not sufficient to effectively promote the development of generic attributes. Barrie (2007) conceptualised six different categories of academics' understanding of how students acquire generic attributes (as described below). These were: remedial, associated, teaching content, teaching

process, engagement and participatory. He also suggested that the variation in how academics conceive what graduate attributes are and how they are developed in courses affects their conceptions of how such attributes are to be developed by students. Such a finding, according to Barrie (2007, p.454), explains why previous efforts to address graduate attributes in curricula “have met with only patchy success”. With respect to the remedial conception, academics understand it to be the responsibility of earlier educational experiences and that a university’s only remaining remedial teaching role is to instruct the students who have not already acquired these skills. ‘Associated’ oriented academics understand the development of generic attributes to be part of the university teaching role. They believe that this role is fulfilled through the provision of an additional separate curriculum in association with the usual university curriculum. This is not a remedial curriculum but rather a curriculum for all students. ‘Teaching content’ oriented academics understand attributes development as an integral part of the teaching content of the discipline. On the other hand, other academics understand teaching content not in terms of taught content of the usual university course but to be achieved through the teaching process. Other academics do understand the development of graduate attributes not as part of what is taught or the way it is taught but rather in terms of the way the student engages in learning his/her university course. Other academics perceive attributes development to stem from the way the student participates in the broader learning experience of university life, as opposed to the way they learn on the course.

Based on the outcomes of his study, Barrie (2007) stated that new insights into the diversity of universities’ past efforts to address graduate attributes had been uncovered. For some academics they are central to the curriculum, for others they have no place, and such fundamental differences according to Barrie, explain why universities’ previous efforts have been met with only limited success.

Barrie (2009) and Hughes and Barrie (2010) focused on a national study of thirty six Australian universities and developed a framework that identifies the factors that affect

the development and assessment of attributes in curricula. The framework consisted of seven main factors. These were: conceptualisation, stakeholders, implementation strategy, curriculum approach, staff development, quality assurance and student centredness. With respect to:

- Conceptualisation: academics' understanding of graduate attributes remains central to how attributes are written, designed and assessed in curricula.
- Stakeholders: employers', professional associations', national quality assurance agencies' views as to which employability skills and competencies are to be embedded in curricula might limit the transformation aspirations that underpin the philosophy of graduate attributes.
- Implementation strategy: lack of coordination among academics as to how attributes can be taught, practised, improved and assessed proves ineffective for attributes implementation in courses.
- Curriculum approach: the nature of curriculum planning and pedagogy (e.g. Work Integrated Learning (WIL) or Problem based Learning (PBL)) affects the nature of attributes fostered in courses.
- Staff development: many academics are unaware of how to stay focused on conceptions of teaching and learning rather than teaching only.
- Quality assurance: lack of monitoring of the effective implementation of attributes in courses to ensure an effective learning outcome.
- Student centredness: students play a fundamental role in the success of learning outcomes so no matter how hard universities try to foster attributes in courses, it does not work unless they are perceived by students (Harpe et al. 2000; Crebert et al. 2004; Yorke and Harvey 2005).

Hughes and Barrie (2010) suggested that it was imperative for Australian universities to consider these factors if they aim to improve attribute assessment procedures in their institutions, since otherwise they are unlikely to achieve significant or sustained change. They stated that attributes assessment is inherently intertwined with other elements of the institutional system which may act as barriers or obstacles that hinder any efforts to change. These elements are a range of systemic factors over which

individuals have little or no influence which, until addressed by universities as a whole, will continue to limit the effectiveness of graduate attribute development and assessment.

In line with the study outcomes of Hughes and Barrie (2010) and Barrie (2004, 2006, 2007 and 2009), Green et al. (2009) stated that the problems with attributes implementation in courses ultimately stem from academics' lack of conceptual clarity about what is meant by terms such as "attributes," "skills" and the like. Green et al. (2009) suggested that the variety of terms used interchangeably to describe graduate outcomes explains this confusion. 'Generic', 'core', 'transferable', 'key', 'enabling', 'professional', 'skills', or 'capabilities' (to name just a few) are all nouns and adjectives used to describe anything non-technical in universities. In addition to those descriptions, certain disciplines such as humanities and management use 'critical thinking' often interchangeably with problem solving and decision making to describe a common attribute. Green et al. (2009) also suggested that high student numbers in classes and tight budgets for education lead to a decrease in small group teaching which eventually affects students' learning outcomes. Faculty casualisation is another factor that acts against attribute development in courses and especially tutorial teaching. Green et al. (2009) did not suggest that casual academics lack experience or commitment, yet casual employment creates an environment of high staff turnover, lack of institutional support and lack of ownership which eventually has an impact upon teaching quality.

Harpe and David (2012) also prepared a study that investigated the factors that are most likely to influence academics' decisions to adopt or ignore a university's graduate attributes agenda. The study was conducted using a questionnaire on a sample of 1,064 academics teaching or assessing undergraduate courses in certain disciplines (engineering, management, commerce, health, society and culture). The sample covered sixteen different universities in Australia. Through ANOVA results, Harpe and David (2012) suggested that academic willingness and confidence are the most



consistent predictors for successfully developing attributes in courses. Yet Harpe and David (2012) argued that these predictors are influenced by three main factors: gender, having a teaching qualification and a year of industry experience. Being a female academic encouraged willingness and confidence to teach certain attributes in courses such as: communication skills and teamwork. Having a teaching qualification also encouraged academics to teach certain attributes in courses such as: oral communication, ethical practice and independent learning, and having a year's industrial experience influenced their willingness and confidence to effectively assess certain attributes in curricula such as: oral communication, ethical practice, problem solving, and teamwork.

In this study, Harpe and David (2012) provided insights into the factors that are most likely to influence academics' decisions to adopt or ignore universities' graduate attributes agenda. For the Egyptian university sector, it is important to understand these factors, not only to improve the conditions for HEEP implementation, but also to recognise that the implementation of graduate attributes is influenced by a variety of factors that are bound to the context in which they are taught (Yorke and Harvey 2005; Green et al. 2009; Jones 2009; Jones 2013).

Jones (2009) introduced a study that aimed to understand why academics find attributes development in courses a difficult task, why they are not implicit in academics' teaching although they are valued as an important university outcome. Jones noted that while much of the existing research assumed that graduate attributes are universal or generic, with reference to the work of Harpe et al. (2000) they remain highly complex and strongly affected by the disciplinary culture or context in which they are taught. To investigate those cultural, contextual factors, Jones interviewed thirty seven academic staff from two large Australian universities from different subject areas (history, physics, economics, law and medicine). The indicated factors from the analysed interviews were (Jones 2009, p188):

- Epistemological: generic attributes are not considered to be part of disciplinary knowledge.
- Cultural: generic attributes are not seen as one of the central roles of the university teacher.
- Intrinsic: generic attributes are complex and difficult to define.
- Pedagogical: there is a lack of understanding regarding the nature of attributes, a lack of experience of, or confidence in, teaching these attributes.
- Structural: large classes, the teaching of generic attributes are not actively supported by departments, top-down implementation, lack of time, emphasis on research rather than teaching.

Jones (2009) stated that setting out such a typology of barriers to teaching generic attributes shows that they are highly complex and influenced by a range of contextual factors and because of this complexity they should be part of disciplinary knowledge.

In more recent research, Jones (2013) suggested that there has been considerable work in the area of improving attribute implementation in courses and yet there is still uncertainty, particularly in the area of embedding or integrating graduate attributes in the curriculum. Jones (2013) also suggested that some research regarded graduate attributes as generic and transferable skills and this is problematic as graduate attributes have a very situated nature and hence are influenced by their local context. Using activity theory, her study found that the conceptualisation and teaching of generic attributes and the variation of interpretation suggested by Barrie (2004, 2006) are influenced by the disciplinary context in which they are taught. Jones (2013) argued that in order to understand teaching and to successfully implement graduate attributes, it is necessary to understand the culture in which it occurs as well as the conflicting influences.

Applying activity theory, Jones (2013) discussed a range of cultural phenomena by considering the relation between the subject (the teacher or teaching community) and the object (teaching practice) taking into account the context. She identified a number

of factors which were related to community, division of labour, artefacts, rules and disturbances. With respect to community, she stated that department culture and rules play a role in the teaching of graduate attributes since at this level they are operationalised in the form of descriptors, course outlines and curriculum structures and hence they affect the way in which graduate attributes are conceptualised. As for division of labour, Jones (2013) meant the number of classes taught by each academic, class size, marking, delegation of teaching as well as organisational and administrative tasks and research. With regards to artefacts, these include lists of graduate attributes generated in whatever way. For example, they could be derived from the literature or from stakeholders such as employers or professional groups. Though these lists hold common themes and elements, they have a certain degree of inconsistency and influence over the content of a degree. Artefacts also include university aspirational attributes which are set usually for all graduates regardless of discipline and will be acquired upon completion of their degree. Learning and assessment tasks, with each subject or course outline which refer to graduate attributes either implicitly or explicitly are also artefacts. Furthermore- explanations of graduate attributes in the literature either practical or theoretical, policy documents produced on a number of levels, research, pedagogical traditions, existing curriculum textbooks, teaching materials and technology such as computer power point and the Internet are all artefacts.

Rules are closely related to artefacts and community as they often arise out of policy and practice. Examples of rules include what could be taught, how it is taught, the sequencing of subjects and methods of assessment. Many of these are out of academics' control but affected the ways in which attributes are understood. Rules also include teaching practices that can either hinder or foster the teaching of graduate attributes.

Disturbances are the inconsistencies and tensions that occur between and within systems. For example, the variant understanding of graduate attributes among

academics generates disturbance. Furthermore, the number of stakeholders with a range of lists and agendas constitutes disturbance. The tension between graduate attributes and teaching practices is also disturbance.

From a thorough reading of Jones' (2009, 2013) outcomes, the author believes that graduate attributes implementation in taught courses is affected by a number of factors. In comparison to Jones (2009) study, her later (2013) work identified a number of key context specific factors which were uncovered by applying activity theory. The conceptual framework enabled the author to critically assess the environment in which graduate attributes are taught in Australia, thus arriving at more context specific factors than her earlier study in 2009 would suggest. In relation to the Egyptian university sector, the findings of Jones' studies are invaluable because they assure the role of context in influencing the teaching and learning of graduate attributes and therefore inform this research that contextual improvements are fundamental to the effective implementation of graduate attributes as well as to all HERS projects.

From a review of all the specialist literature discussed in this chapter, it is apparent that there has been a development in studies about graduate attributes since 2000. As discussed in previous researches, a number of initiatives were undertaken by universities to promote the teaching and learning of graduate attributes in taught courses, yet they remained patchy and rather a battle for academics (Sumsion and Goodfellow 2004; Barrie 2006; Radloff et al. 2008; Green et al. 2009; RAEng 2010; Harpe and David 2012; SCST 2012; Jones 2013). Previous studies revealed that a concept such as graduate attributes is at the nexus of a number of complexities that affect its teaching and assessment in taught courses (Hughes and Barrie 2010; Jones 2009, 2013). Accordingly the idea of producing curriculum maps to show areas of graduate attributes and their development in taught courses using a number of tools such as the : Gibbs et al. Matrix, the graduate qualities grid and the transferable skills template is more complex than the earlier discussion of generic attributes in the

literature would suggest (Jones 2009). Also the attempts to explicitly articulate and implement graduate attributes using Bloom's Taxonomy in courses (Barrie 2004; Bridgstock 2009; CBI 2009; Precision Consultancy 2007; Harpe and David 2012), adopt student centred strategies such as Work Integrated Learning and Problem Based Learning to prepare students for employment (Harpe et al. 2000; Hughes and Barrie 2010; Harpe and David 2012), improve academics' literacy with regard to teaching and learning graduate attributes in courses (Harpe and David 2012) and engage industry members, careers office staff and students in the design of the curriculum (Leckey and McGuigan 1997) were all serious efforts to improve the implementation of graduate attributes in taught courses, yet they achieved limited success. This is because graduate attributes as a concept are influenced by the activity, discipline, culture or context in which they are developed and taught (Harpe et al. 2000; Barrie 2009; Green et al. 2009; Hughes and Barrie 2010; Harpe and David 2012; Jones 2009, 2013).

Previous research has highlighted a number of factors which authors have discussed as causes underpinning the ineffective implementation of graduate attributes in taught courses and therefore the skills gap. For example Harpe et al. (2000), Sumsion and Goodfellow (2004), and Jones (2009) identified a number of structural and cultural factors, including lack of support from leadership, lack of collegiate dialogue, time constraints and resistance to change. In comparison to the Egyptian university sector, academics' resistance to change was a common factor where the OECD (2010) reported it as one of the obstacles that affected the implementation of HEEP.

Also Barrie's (2004, 2006, 2007) studies reported a number of factors that provided insights into the possible reasons why the implementation of graduate attributes was patchy and of limited success. The first was the statements of graduate attributes which were a mixture of different level abilities and skills created by combining a number of attributes without significant critical scrutiny of the nature of the attributes represented. Accordingly, some attributes could be classified under more than one

heading. For example, teamwork is classified under both people related skills and also under the heading effectiveness skills (Nguyen et al. 2005). The implication of this, according to Barrie's studies, is a variation, inconsistency and duplication of categorisation which creates confusion in the understanding of graduate attributes. Second, were the ranges of approaches included in the existing graduate attributes curricula, which spanned doing nothing to using different add-ons to the curriculum strategies, or embedded approaches, to strategies where such attributes formed the very core of the curriculum (Barrie 2004, p.268). Such a range of understanding reflects fundamental differences in how academics conceptualise graduate attributes and how they ought to be taught and learned. Through his phenomenographic paradigm, Barrie (2004, 2006, 2007) argued that academics' different understandings of the nature of graduate attributes and how they are acquired by students were causes for the uneven implementation of graduate attributes in courses.

In the scope of this research, it is suggested that Barrie's (2004, 2006, 2007) views provided insights into why graduate attributes were of limited success in Egypt. For example, NARS different classifications and the interchangeable names used to describe students learning outcomes (i.e. knowledge and understanding, intellectual skills, practical and professional skills, general and transferable skills), the attributes listed in NARS which were created by combining a number of learning outcomes without significant critical scrutiny of their nature (NAQAAE 2009a) and the unclear ambiguous words, terms and language used to describe NARS different classifications and learning outcomes (Taha and Abou Ismail 2002; HEEP2 2009b; UNESCO 2007) were all factors affecting academics conceptualisation of graduate attributes and thus their implementation in taught courses.

More studies by Barrie (2009), Jones (2009), Hughes and Barrie (2010) and Harpe and David (2012) listed more factors that affected the teaching and learning of graduate attributes. The factors were: curriculum approach, staff development, stakeholders, quality assurance and student centredness. It is important to note that

these studies were useful for informing this research about how the teaching and learning of graduate attributes could be improved in Egyptian universities if these factors were considered in the teaching and learning environment. Stakeholders such as employers, for example, play an important part in acknowledging the attributes required for employment and therefore their views are an asset in the attributes fostered in taught courses. This explains the gap between the attributes listed in NARS and the ones expected by the labour market because Egyptian employers views were overlooked when developing NARS learning outcomes (NAQAAE 2009b). Also students' centredness is core to the success of the learning process, as no matter how academics choose to foster attributes in courses, the approach will not work unless said attributes are perceived by students (Harpe et al. 2000; Crebert et al. 2004; Yorke and Harvey 2005). In the Egyptian literature there is no indication that students' perception of graduate attributes is taken into consideration in the teaching and learning experience (SPU 2010; OECD 2010).

Despite all these important studies which have described the cultural, structural, pedagogical and conceptual factors that affect the implementation of graduate attributes, their outcomes have not been sufficient in the context of teaching strategies to effectively promote the development of generic attributes. From this viewpoint, it became pertinent to provide newer insights into the improvement of graduate attributes in taught courses by conceptualising the contextual factors that influence their teaching and learning. Rather than a renewed emphasis on the initiatives taken to date, there was a need for a more pragmatic framework or a new lens that appreciates the critical connection between context and the notion of graduate attributes. To date, policy has driven pedagogy without a critical examination of the context in which they are implemented, which explains the limited success of the implementation of graduate attributes (Jones 2009, 2013). It has therefore become imperative to recognise and address the contextual factors associated with or affecting the teaching of graduate attributes to effectively implement graduate attributes in curricula. In a recent study and by applying activity theory, Jones (2013) described the

role of context as it affects the teaching and learning of graduate attributes in Australia using a number of key localised contextual factors. Yet, there needs to be a shift from determining key specific factors existing in local contexts towards multi-layered descriptions and analyses (on the university, faculty and educational programme levels) that document the complexity, nonlinearity and critical connections of the processes involved (Sumsion and Goodfellow 2004); the research addresses this claim through the use of complexity theory.

Although the research of Jones (2013) identified the key factors affecting attributes implementation in taught courses from a highly situated, localised perspective by applying activity theory, this remained problematic. This was because graduate attributes as a concept are affected by other factors that sit in the wider context in which they are implemented. This research aims to investigate these factors and claims that graduate attributes are not only affected by key localised situated factors that exist in its teaching and learning context but also other factors existing in the wider context of university education. With respect to Jones as well as all previous researchers, this does not only include the educational programme, but also the faculty and university in which graduate attributes are implemented.

## **2.7 Outcome of Literature Review**

Through a number of key studies, the literature review has described why the implementation of graduate attributes had been of limited success and rather of a struggle for academics despite the initiatives put in place. The studies for Harpe et al. (2000), Sumsion and Goodfellow (2004), Barrie (2004, 2006, 2007, 2009), Green et al. (2009), Hughes and Barrie (2010) and Harpe and David (2012) informed this research about the different factors that affected the implementation of graduate attributes in taught courses. These factors are: structural cultural, conceptual, stakeholder related and have to do with implementation strategies, curriculum approaches, staff development, quality assurance, student centredness, high student numbers in classes, tight budgets for education, and faculty casualisation, amongst other things.



In agreement with Jones (2009, 2013), it is suggested that graduate attributes are influenced by the context in which they operate. Up until the start of this study and between 2009 and 2012, researchers have overlooked an understanding of the role of context in affecting the implementation of graduate attributes (Harpe et al. 2000; Sumsion and Goodfellow 2004; Barrie 2009; Green et al. 2009; Hughes and Barrie 2010; Harpe and David 2012; Jones 2009, 2013). Although previous studies pointed to the initiatives undertaken by universities to improve the teaching and learning of graduate attributes as well as the different factors affecting attribute implementation in taught courses, they were not sufficient in the context of teaching strategies to effectively promote the development of generic attributes. This argument is demonstrated by the limited implementation of graduate attributes to date. To ensure an effective implementation of graduate attributes, the wider context in which it resides must be critically examined to identify the contextual factors or complexities that affect the implementation of graduate attributes. This includes the educational programme, the faculty system and the university sector. Jones (2013) identified the key factors affecting attribute implementation in taught courses from a highly situated, localised perspective by applying activity theory attributes to a sample from two Australian universities offering different subjects (history, physics, economics, law and medicine), yet this did not go far enough as graduate attributes as a concept are not only affected by key localised factors but other factors that sit in the wider context in which they are implemented.

As the situation is similar to that of Egypt, which was criticised for the quality of its graduate attributes despite reform plans set for the period 2000 to 2017 to improve the higher education sector (OECD 2010; Korany 2011), insights can be gained from the literature about the causes of limited success. These allow us to identify the following issues: (i) HERS was implemented without carrying out the necessary changes to the existing policies and procedures to ensure the effective implementation of HEEP in the area of graduate attributes; (ii) the Quality Assurance and Accreditation Handbook lacks conceptual clarity regarding the different classifications of graduate attributes

and the language used to describe them (HEEP2 2009b); (iii) the different classifications of graduate attributes listed in the handbook and interchangeable names used to describe the concept creates confusion (HEEP2 2009b); (iv) NARS for engineering (Appendix K) was designed and reviewed without feedback from Egyptian engineering employers on the attributes desired for employment (NAQAAE 2009a); (iv) the attributes listed in NARS lack conceptual clarity (NAQAAE 2009a); and (v) reform tools are built from the reform instruments of advanced countries and implemented in an authoritarian way without being preceded by a critical examination of the context in which they are introduced (Kohstall 2012). According to Kohstall (2012) policy-makers in Egypt build their reform instruments based upon those of advanced countries without creating the necessary contextual conditions, therefore the solutions are not home grown.

With reference to HEEP2 (2009b) and Kohstall (2012) it is suggested that HERS (especially those strategies that relate to quality such as NAQAAE and NARS) was designed and developed based on Western experiences, without first having identified or set up the necessary contextual conditions for successful implementation and has thus not achieved its intended outcomes. Based on these arguments there was a need to investigate and explore the contextual conditions influencing the teaching and learning of graduate attributes in the Egyptian undergraduate sector. In order to do so, this research used complexity theory as a framework for analysis, as discussed in the next chapter.

In the light of this, it is clear that there exists a gap in knowledge with respect to the contextual factors affecting the successful implementation of graduate attributes in the Egyptian university sector. The scope of the study is Egypt's university sector, in particular the computer engineering discipline, so supported by complexity theory as a conceptual framework, all the factors were identified on the department, faculty and university levels. This method of thinking allowed for the creation of a larger cultural

understanding of the existing system through the descriptions generated by its units and sub-units.

Based on these understandings and in order to achieve the research objectives, it was important to answer two main questions:

- 1- What are the contextual factors which affect the skills gap within the Egyptian computer engineering undergraduate discipline?
- 2- How can the skills gap be reduced to meet the demands of the Egyptian computer engineering labour market?

## **2.8 Summary**

In this chapter, a gap in knowledge was derived from a survey of the literature that discussed the skills gap and the factors affecting it in Egypt and internationally. To address this gap in knowledge, this research seeks to apply complexity theory as a conceptual framework to understand the different contextual factors affecting the teaching and learning of graduate attributes in university undergraduate degree courses. The next chapter focuses on the methods followed to answer the research questions. It discusses the research approach, design, strategy, tools for data collection, sampling and framework for analysis.

# Chapter Three: Research Methodology

## 3.1 Introduction

The aim of this research was to investigate the contextual factors affecting the implementation of graduate attributes in computer engineering undergraduate courses in Egypt, and this chapter describes the methodology used to arrive at these findings. This includes the research design, research tools, sampling, piloting, data analysis and validation.

## 3.2 Research Design

In educational research, there are a number of approaches that could be applied in order to answer research questions (Collis and Hussey 2003; Creswell 2003; Gray 2004; Maxwell 2005; Neville 2005; Cohen et al. 2007; Walther et al. 2013). These are basic to applied approach and inductive to deductive approach. A review of these approaches suggested that this research was basic-inductive in nature. Unlike applied-deductive research which focuses on testing the applicability of research findings (Creswell 2003; Cohen et al. 2007), this research concentrated on the application of complexity theory as a conceptual framework to provide newer insights into the research problem. It is suggested that these new insights, meanings and understandings would not have been possible without the qualitative interpretation of research participants' experiences and views of the world.

At a philosophical level, research paradigms encompass the basic views about the world that manage the behaviour and thinking of researchers (Creswell 2003; Cohen et al. 2007). The two most common research paradigms are the positivist and the anti-positivist (Gray 2004; Maxwell 2005). A review of these paradigms suggested that this research is anti-positivist in nature. This is because the researcher, in the light of the research questions, viewed the world as subjectively and socially constructed and considered that actors form a part of that world (Gray 2004; Cohen et al. 2007). This

means that the knowledge created through this study has a subjective orientation guided by the experiences and perceptions of actors. The interpretive anti-positivist paradigm had also allowed a comprehensive examination of the research problem in order to understand it in depth, unlike the positivist paradigm which collects and analyses data from parts of a problem. The anti-positivist viewpoint made it possible for the researcher to examine the Egyptian university sector in order to understand the factors affecting attributes implementation in courses rather than studying parts of the sector (Gray 2004; Cohen et al. 2007). This is an advantage to the anti-positivist or the interpretivist approach because it is unlikely to miss any important aspect as it seeks to comprehend the entire phenomenon (Gray 2004). Interpretivism also assumes in its approach that phenomena may have multiple realities and therefore focuses on meanings rather than facts (Cohen et al. 2007). This allowed the researcher to investigate the different contextual factors that affect the teaching and learning of graduate attributes in computer engineering undergraduate courses through the views of a number of participants (e.g. academics, graduates and employers).

Furthermore, instead of looking for fundamental laws or reducing phenomena to the simplest possible elements (Cohen et al. 2007), the interpretive paradigm allowed this research to gain insights and understandings of the Egyptian higher education sector in its complex form through its multiple processes and activities across time. It therefore allowed for an understanding of why graduate attributes were not effectively implemented in undergraduate courses of study, why graduates were unprepared for the labour market, and thus why the skills gap exists. Such understandings are only made possible by a qualitative appreciation of the context in which the phenomenon exists.

Qualitative research has its origins in interpretive phenomenological assumptions while quantitative research has been linked to the positivist perspective. From this point of view, qualitative research concentrates on meanings that cannot be numerically measured or examined by amount, frequency or quantity (Cohen et al.

2007). It therefore aims at no quantification. In qualitative research, phenomena are studied in their natural settings and the researcher is an active part of that context (Cohen et al. 2007; Walther et al. 2013). Qualitative research involves analysing data collected using a variety of research methods such as interviews, focus groups, observations and historical archives. Because of the subjective nature of qualitative research, documentation and interviews (from multiple sources) were used in order to better understand the phenomena being studied (Cohen et al. 2007; Walther et al. 2013).

Qualitative research is often connected with inductive research designs (Cohen et al. 2007), which is the approach used in this research to advance new knowledge regarding the factors affecting the teaching and learning of graduate attributes in the Egyptian university sector. Through the qualitative paradigm and by applying complexity theory, the Egyptian university sector was described and assessed by a group of participants (academics, graduates and employers) to allow for the exploration of the causes underpinning the skills gap. Also, qualitative research does not necessarily require a large sample size and so this was chosen, rather than a quantitative study, as the more effective method. Numbers in the research were not the primary focus but it was important to include a broad range of participants (e.g. academics, graduates and employers) to focus on the meanings attributed to events as well as the texture and quality of experience (Cohen et al. 2007).

Such approaches to conducting the research supported the design of the study which was guided by previous studies and literature reviews that also explained the different research strategies, research tools, ethical considerations, sampling, pilot work, analysis and validation work needed to accomplish the investigation. These are discussed in detail in the coming sections.

### **3.3 Research Strategy**

There are a number of research strategies that can be followed in order to answer research questions. Strategies such as surveys, experiments and action models tend to be more appropriate when applying the positivist paradigm (Creswell 2003; Gray 2004; Cohen et al. 2007). Others such as ethnographic study and case study are more appropriate when applying the interpretive paradigm. A review of these studies suggested adopting surveys when mapping the field, using a large sample size or making general clarifications (Gray 2004; Cohen et al. 2007). It also suggested using experimentation or action models if interventions or experiments need to be evaluated. However, if an in depth study is required for a situation or group of people, then ethnographic research or a case study are most suitable (Yin 2003; Cohen et al. 2007).

As this study applied the anti-positivist interpretive paradigm, surveys and experiments were not appropriate because as described by Creswell (2003), Gray (2004) and Cohen et al. (2007), they are more appropriate for the objectivist positivist paradigm. Also, the study did not collaborate with professional practitioners therefore action research was not considered among the choices. These facts oriented the researcher at the beginning of the study towards two possible strategies: case study and ethnographic research. Ethnographic and case study research may both focus on culture and the study of given phenomena in depth (Court 2003; Gray 2004; Cohen 2007). However, ethnographic research is more of “an inward looking process” that seeks to uncover participants’ knowledge in their own culture or habitat. On the other hand a case study is “outward looking” where the researcher seeks to expand knowledge and understanding of participants’ behaviours rather than habitats (Court 2003, p.2). In general, case studies remain the preferred strategy when the investigator has little control over events, when ‘how’ or ‘why’ questions are being posed and when the focus is on studying a problem in its real-life context (Stake 1995; Yin 2003). As this study aims to create knowledge in relation to Egyptian academics’

practices in the Egyptian university sector, complexity theory was chosen as a conceptual framework, or framework for analysis, in comparison to these conventional approaches.

### **3.3.1 Framework for Analysis**

#### **3.3.1.1 Background**

Law and Urry (2003, p. 13) suggested that:

... method, in practice, whatever its theoretical stance, and whatever its particular research tools, tends to a kind of empiricist realism: the assumption that in any given context and given the purposes of the study, there is a single reality.

Law and Urry's (2003) empiricist realism demonstrates an assumption that in order to make sense of data it is essential "to create abstraction that transcends the complex particularity of the data in specific ways" (Haggis 2008, p160). Even though abstractions could be created in relation to the longitudinal history of each sub-unit within a specific case, data is analysed cross-sectionally, on the basis that comparison between different sub-cases will identify key themes or elements that will have a meaning that transcends or goes beyond each individual sub-history (Haggis 2008). For example, in the analysis of narratives, the individual is the smaller unit within a case, with the comparative analysis occurring in relation to what can be viewed to be shared across different narratives when these are seen in relation to each other (Haggis 2008). In approaches such as phenomenography (Marton et al. 2007) or grounded theory (Strauss and Corbin 1998), the smaller unit is not essentially the individual, but the overall intention is the same which is to look across different data patterns and find a pattern of similarity which appears to go beyond or transcend these smaller units. The creation of such themes which become categories for analysis of "things in common" (e.g. key factors, correlations) occurring in both qualitative and quantitative types of analysis is core to research in the social sciences (Llewelyn 2003; Haggis 2008, p.161).



In creating a pattern of similarity, the researcher aims to see through difference and variety to establish a sense of generative principles (Gomm and Hammersley 2001). This is to find a subtle form of deep structure (Haggis 2008). Whether or not such structure is seen in more realist terms, “the implication in both cases is that its identification will lead to the possibility of other manifestations of variety becoming, at least in theory, more predictable” (Haggis 2008, p.161). This method does undoubtedly identify meaningful patterns which do often relate to other, similar, conditions or situations; and which can be successful in assisting certain kinds of prediction and generalisation (Haggis 2008). Yet, it is important to note that prediction and generalisation are often limited when attempts are made to use them in relation to human and social phenomena (Gomm and Hammersley 2001). According to Hargreaves (1996), Tooley and Darby (1998) and Haggis 2008) attention has been drawn to these limitations is the recent criticism of educational research. For is “limitations in applying this method to social phenomena are also suggested by the theoretical shift in fields such as anthropology and sociology towards an interest in difference, particularity and local, contextual concerns. This shift accommodates sensitivity to areas which conventional approaches are forced to downplay such as time, process and connectivity” (Haggis 2008, p.161). It has been said that approaches based on current ontology are not able to deal well with the “multiple”, “distributed” and the “complex” (Lan and Urry 2003, p.10). These concerns have affected the development of educational theory up to a point, but their impacts do not usually extend to an examination of the ontological and epistemological assumptions that underpin educational research practices, especially in relation to methods of analysis (Haggis 2008). Complexity theory provides a way of thinking about these aspects from a view point closer to the theoretical orientation of social scientists, and seems to open up a different way of thinking about individuals, classes, groups, cultures and societies (Haggis 2008).

The theoretical shift in social sciences towards an interest in understanding “things in context” has highlighted the importance of investigating difference and particularity.

This is for significance to education research because it attempts to create “knowledge that can be used in relation to practices in specific contexts” (Haggis 2008, p.162). However people and practices, in specific contexts are difficult to investigate from the dominant ontological and epistemological position. Many current approaches, such as case study, make people in context the focus of their investigations, to capture the richness of individual experience and to comprehend how meaning functions and is made; however they face problems when writing up the results of these studies (Haggis 2008). Although it is possible to relate some aspect of the particular study to other, similar situations, researchers know that they cannot easily generalise from small samples. This leaves research results as “lessons to be drawn”, the “possibility of illuminating” or “the drawing of conclusions that might apply to other situations” (Haggis 2008, p.162). Although case study researchers are aware of this, this caveat itself shows how such research is strictly situated within a particular ontological and epistemological assumption which does not privilege any kind of generalisation. This does not mean that connections between results of the case study and other potential situations are not possible, they are, yet they remain interpretive, subtle and to some degree indefinite (Haggis 2008). They are not always convincing to those who fund educational research and in a way do not overcome the problem of how subtle forms of connection may be understood to relate to the kinds of patterns described by other, more quantitative forms of investigations such as surveys (Haggis 2008).

A different method of dealing with these problems is recommended by forms of analysis such as ‘analytic induction’ (Smelser and Bates 2001) and ‘thick description’ (Geertz 1973) both of which take as a starting point the individual case, rather than trying to stand back from a variety of different cases and decide what they have in common. These methods also differ from each other, both identify a “principle which will explain and hopefully [...] predict, aspects of the future” as well as different events of similar cases (Haggis 2008, p.162). Although these methods are bottom up (i.e. they start with individual, concrete cases) rather than top down (i.e. looking across a

range of elements or individuals within the case), the idea for phenomena can be featured in this manner is to attempt to define central mechanisms (Haggis 2008).

Comparative and cross-sectional analyses clearly identify important types of linkage and pattern. These methods of analysis explain what is open to description in terms of categories, variables, measurement or counting (Haggis 2008). There are other aspects of the data, however, which cannot be explained in relation to either of these elements (Haggis 2008). First, what is different between the ranges of transcripts becomes invisible because what is similar becomes a theme or category. Second, to create a theme, the focus of attention is bounded, named and removed from its complex web of context. Third, the focus on expressing key aspects of the data means that many aspects are disregarded. Fourth, it is difficult to conceptualise time and process which are two contextual imperatives. Fifth, these approaches are underpinned by a desire to infer causal processes, despite the fact that they can hardly be measured directly.

With respect to the first two items, local context and difference, Guba and Lincoln (1998, p.197) note that “context-stripping” removes other variables in the context of the study which could “greatly alter findings” if they were “allowed to exert their effect”. In qualitative data analysis studies, context-stripping eliminates not only the details of individual lives and histories, but also aspects of the data that could affect the creation of meaning (Ashworth and Lucas, 2000; Haggis 2008). The aggregated theme is created at the expense of acknowledging other less disciplined situational factors which could nonetheless be crucial in making what is being examined meaningful in interpretive terms. Haggis (2008) argues that the partial cause of some of the problems that can be experienced when attempting to apply a general principle to a particular case, in the sense that the specifics of the situation can appear to complicate such application. Part of the problem in such situations appears to be the way context is conceptualised in relation to the case boundaries, and the relationship of this conceptualisation to contexts of the individual sub-units within the case (Haggis

2008). If the researcher aims to interpret meanings in context then comparative analysis of the different interview transcripts from a particular context appears to make this achievable. The meanings that are represented by interview narratives, in one sense do not so much relate to the class or group which has been defined as the case, but they do relate to the local contexts inhabited by the different individuals who have been interviewed (Haggis 2008). In other words, it is apparent that it is these individual contexts that have created the meanings expressed in the narratives (Haggis 2008).

A pattern of similarity created through comparative analysis of different interview transcripts says more about the group which has been identified as the case than it does about the individuals within the group. In cases where individual contexts are not considered in the analysis, the theme is less likely to inform the researcher about the individual (“these adults are all motivated by career prospects” rather than “this university setting, in the context of current political and cultural agendas, encourages these adults to talk about learning in terms of career prospects”) (Haggis 2008, p.163). This kind of theme is usually presented as if it points to some kind of deep structure that might explain the range of individuals (Haggis 2008). Goodwin (2002) identified three themes of individual: pleasers, sceptics and searchers. These themes appear to merge certain elements of the different transcripts that have been analysed in this research, although all of these were generated from different contextual settings. Describing a particular group as a case allows patterns that go beyond individual uniqueness to be identified, but it does not allow assessment of the ways in which individuals are also unique (Haggis 2008). Each individual within a case could, from a different view point, be examined as a case in themselves, but current epistemologies do not provide a way of conceptualising either the unique individual or of exploring uniquely individual differences in a meaningful way (Haggis 2008).

The third issue is disregarding certain aspects of the data because it is necessary to identify key aspects of the phenomenon. Haggis (2008, p.165) argued that there

should be no principle of the “key factor” in the analysis of data; for what if all the factors were equally important or what if something unimportant was producing an important effect? Law and Urry (2003, p.7) argue that much of social life cannot be modelled because it is currently difficult to imagine and discuss a world in which a number of factors are interacting equally, rather think in relation to a defined forces. With respect to the fourth issue, difficulties conceptualising process and time, the removal of “spatial and temporal grounding” is an important casualty of the important eradication of contextual imperatives (Haggis 2008, p.104). Although interviews gather data at three or four points in time, “the range of conceptual resources available for the discussion of fluidity and change in relation to process and interaction is currently limited and this limitation is enhanced by cross-sectional methods of analysis” (Stehr and Grundmann 2001; Haggis 2008, p.104).

Complexity theory (Cilliers 1998), sometimes known as dynamic systems theory, or the theory of emergence (Haggis 2008), appears to provide a different way of conceptualising the aspects discussed so far. Complexity not only offers another theory, but a completely new departure for theory and also the conceptualisation of method. Cilliers (1998) differentiates between complex (having many parts, although not all of can be named and not all processes involved can be tracked or described) and complicated (having many parts, but each part can be explained). Haggis (2008) suggests that complexity could be conceptualised as consisting of a large number of smaller, overlapping types or organised open systems. Practices, cultures, grouping, individuals and institutions could all be seen as open systems which reflect different types of organisations (Cilliers 1998; Haggis 2008).

With respect to the methods used to understand open systems, comparative and cross-sectional types of analysis (whether in qualitative case studies or in large-scale surveys) discount the relationships which exist with the smaller units bounded by the case, in order to focus on the patterns which can be viewed when these smaller units are viewed in relation to each other (Haggis 2008). The interconnectedness of the elements within these types of units is too specific to be useful for the extraction a

general principle. In contrast, dynamic systems theories focus upon the relationships and interactions that occur within open systems (Haggis 2008). A dynamic system consists of a large number of components, processes or activities that are interacting dynamically at a local level (Cilliers 1998). These multiple interactions are non-linear and involve feedback loops which continually modify parts of the system and the system itself (Cilliers 1998). As the system is open, the interactions can affect the boundaries of the system itself, and have effects beyond each part in the system. Moreover, because the interactions are local, such effects are distributed, rather than originating from any central source (Osberg 2002; Johnson 2001). If there are enough number of these interactions, and if they occur over a sufficiently long period of time, specific forms of order or organisation periodically emerge from within the system (Johnson 2001).

Causality in complex systems is not A causes B but a state of deterministic emergence from non-linear interactions and thus is unexpected in relation to the principles governing the lower level domain (Osberg 2002). The outcome of these interactions cannot be predicted because it is impossible to know in advance what has interacted with what, or what will interact with what.

The simplified outline of complexity presented above gives an idea of how an ontology based on these thoughts can produce very different ways of conceptualising and analysing data in social research (Byrne 1997; Haggis 2008).

First, the interactions are various and multiple and it is the multiplicity of the interactions through time that produces effects. Causality thus cannot be reduced to a limited or single number of factors, "as the factors are all crucially implicated in relation to each other" (Haggis 2008, p.167). The histories of these multiple interactions cannot be tracked, which shift from a focus on cause to a focus on effects (Byrne, 2005).

Second, because of this multi-factor causality, elements that are removed, isolated or conceptually removed from the system of connected interactions in effect affect meaning in terms of understanding that system (Haggis 2008). The system itself has to be studied in terms of its interactions rather than identifying key elements in relation to smaller units within the system and comparing these to elements from other systems (Haggis 2008). As this kind of open dynamic system develops through time, it is constantly interacting with environmental factors or factors that exist beyond its boundaries (Haggis 2008), which immediately suggests a “thing” with “context” (Haggis 2008; p.167). Dynamic systems consist of interactions, which at any point in time constitute interactions that are part of the dynamic structures of other smaller or larger systems (Haggis 2008). These interactions are constantly reforming and combining in a unique way, yet are particular to that system. Based on that systems constituted of interactions, they cannot be reduced to objects or categories, so a way has to be found for conceptualising “event rather than structure” (Thomas 2002, p.430).

Third, irregularity and unpredictability have to be accepted as structural aspects of interactions being investigated because of causality based on untraceable histories of multiple interactions (Haggis 2008). These features cannot be ignored or evened out. Unpredictability and irregularity are part of the structuring dynamics of complex systems even if they have happened too fast or too simultaneously to be noticed, but this does not mean they are absent (Haggis 2008).

Fourth, complexity theory in comparison to other approaches offers an account of structure and also of coherence (Morrison 2008). “Structure here relates to processes of dynamic, de-centralised emergence which are being created as a result of local interactions” and which occur in relation to constraints that exist in and outside the system (Haggis 2008, p.168). In a dynamic system, constraints are as much internal as external and as Haggis (2008) suggested each dynamic system has a starting point in time that emerges as a result of a set of historical interactions through time. This

means that every dynamic system is unique, “even similar types of system will have emerged out of slightly different specific combinations of the numerous different interactions” which were possible in that place and at that time and will have specific histories which engage further specific interactions with specific combination of factors (Haggis 2008, p.168). Coherence is the existence of the system itself, in the sense of a shape and identity. Coherence makes it difficult to understand individuals when they are studied in relation to each other and is why generalising resultant individuals is difficult (Haggis 2008). In a cross-sectional analysis, what an individual does or says at a particular point in time is an emergence caused by an unseen history of interactions through time (Morrison 2008; Haggis 2008). When a system is observed from its outside, emergences may appear mystifying and messy, yet if it is observed from within, emergences are likely to be consistent with the history of interaction.

### **3.3.1.2 Investigating the Egyptian University Sector through the Complexity Lens**

Complexity theory challenges the nomothetic programme of universally applicable knowledge at its very heart – it asserts that knowledge must be contextual (Haggis 2008, p.169).

Based on a thorough understanding of complexity theory and its assertion that knowledge must be contextual, the specific factors affecting the teaching and learning of graduate attributes in computer engineering undergraduate degree courses were explored. A complexity ontology provided a way of thinking, understanding and investigating the Egyptian university sector as a unique complex, open and dynamic system of interactions, partially constituted however, by the interactions of other larger systems; systems of governance such as funding, policy and management. The Egyptian higher education sector consists of a large number of smaller systems including universities, faculties, educational programmes, councils, committees, administrative structures and stakeholders (e.g. academics, students, graduates and employers). Although a more conventional approach might try to understand the



operation of these systems interactions with respect to the idea of underpinning structures which cut across individual examples such as administration for example, a complexity framework suggests investigating the ways in which aspects of these larger system interactions function within a specific smaller case (how is this faculty administered compared to this one?). The first method appreciates the similarities encountered by comparison (leading to the ability to formulate a theme such as administration), while the complexity method is as likely to find difference as it is to find similarity. When it does find similarity patterns, these will relate to different aspects of the study focus.

Figure 1: Conventional, cross sectional abstraction and Dynamic systems abstraction (Haggis 2008; p.170)

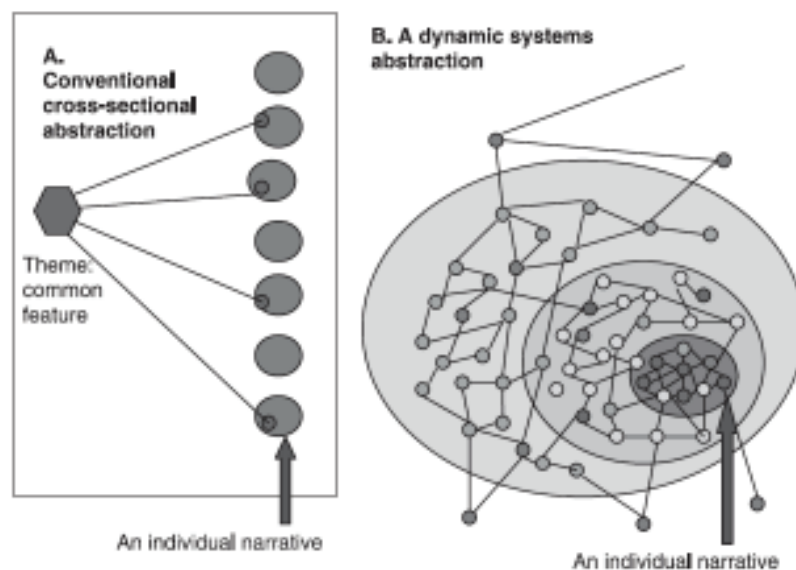


Figure 1A, the individual cases (oval shapes on the right hand side) which represent the different faculties, educational programmes or academics in the Egyptian university system are compared cross-sectionally, and a theme is identified in relation to features that the different cases have in common. Aspects of the data that are not found to be similar cannot be reported. In figure 1B, the individual case (the smallest oval is equivalent to the row of ovals in 1A) is analysed in terms of different systemic interactions. The oval shapes represent the different systems embedded within each other (the educational programme embedded in the faculty embedded in the university

system embedded in the higher education sector). The interactions are represented as smaller circles of different shades – each smaller circle represents a type of interaction, process or activity rather than a static theme. An individual narrative (the darkest oval) consists of the interaction that makes the individual or the person (awareness, consciousness, knowledge etc). The paler area within which this is embedded represents one of the contexts or systems within which the person operates.

With respect to the problems discussed above, the complexity approach was helpful in relation to the conceptualisation of the Egyptian university sector (the faculty system as the case), and the confusion that results from the merging of the context of the case with the contexts of the lives and histories of those being interviewed within the case. Thinking of individuals (academics, students, graduates, employers) and systems (educational programmes, faculty, university) as complex, open, dynamic systems allowed for the separation of these two types of context, even though one is embedded within the other they are embedded in each other. As the intention was to understand the factors affecting the teaching and learning of graduate attributes in the Egyptian faculty system (the case), interviews with individuals were quite limited. As the attempt was “to draw together.....a diverse and unrelated range of phenomena” (Hammersley and Atkinson 1995, p.211; Haggis 2008, p.169), there was a need to be positioned conceptually “outside” the smaller sub-units or sub-systems within the Egyptian faculty system (the case), “trying to understand something that is likely to be multi-factorial in relation to a comparison of only one type of element in the dynamic system (i.e. the individuals)” (Haggis 2008, p.170). In this research, the aim is to find out why the skills gap exists in Egypt, why Egyptian reform plans were of limited success despite the efforts and funds put in place. If the research had only interviewed academics, producing an account according to the views of academics, it could not have come to its conclusion, which is that there are a number of complex factors or complexities that affect the teaching and learning of graduate attributes in the Egyptian university sector. In order to understand how this complexity of factors

worked together, over time, to produce a certain effect or result, the researcher had to investigate higher education documentation, policies and procedures, units and councils bylaws and regulations, universities' educational processes, educational programme activities, faculties' internal operations, academics' work processes, political events in Egypt, academics' experiences, graduates' views, and employers' perceptions and desires of university education in Egypt. Rather than looking from the outside at a collection of descriptions produced by a group of separate individuals (academics, graduates and employers) (the view from above), the university sector in Egypt was looked at as if from the inside; conceptualised as a dynamically interacting system of multiple elements (the academic/faculty system in which academics were embedded). It is quite obvious that interview descriptions cannot say something about the multiple interactions of the dynamic university system in Egypt in which academics are embedded, although interviews might say something about how such interactions affected academics (Haggis 2008).

In order to deal with the wider contexts (both historical and present) of the academics bound by the faculty system (the case), conventional approaches in comparison to complexity theory would conceptualise the researcher as being outside the smaller sub-systems or sub-units within the case (Figure 1A). This would allow the researcher to see a "transcendent analytical category that will hopefully indicate some kind of connection which could link to underpinning causal processes" (Haggis 2008, p.172). In order to see inside, the researcher shifted to a position that investigated the Egyptian university sector including its units and sub-units which allowed the conceptualisation of each academic as a dynamically interacting system with a history through time (Figure 1B). History includes historical events such as academics' work processes, activities and practices. The shift from analysing sub-systems constituting the Egyptian university sector as if from outside sub-units, to thinking about both the sector and its sub-components as open systems made it possible to study specificity in relation to academics teaching and learning practices from a very different ontological position. Through complexity theory, each academic was seen as a point

within a number of different intertwined dynamic systems which also has its own history through time.

In the context of dynamic systems, a reconceptualised individual begins to produce different thinking and understanding of both individual and context (Haggis 2008), an analysis that evaluates histories and emergences in relation to the various contexts within which “a sense of self” (Haggis 2008, p.173) employs various abstractions and reduction. Cilliers (1998) suggested that a mistaken interpretation of complexity theory is that it can model the totality of things. Within the scope of this research, reduction and abstraction occurred in relation to the history and multiplicity of different academics, public and private, rather than by creating a transcendent theme that deliberately ignores these histories and multiplicities.

Despite complexity theory ontological assumptions, it has its limitations (Morrison 2008). First, in the context of this study, complexity theory remains a descriptive rather than a prescriptive theory. This means that it describes and explains the Egyptian university sector to help focus efforts on how to identify the contextual factors that affect the teaching and learning of graduate attributes in computer engineering undergraduate courses. It is a theory for the here and now, which means that while it may offer suggestions for practice, it gives no guarantees; it is a theory without responsibility, accountability or predictability. Certainty is elusive according to Morrison (2008). This means that even if the contextual factors that affect the implementation of graduate attributes in undergraduate degrees are identified, there is no guarantee that graduates’ readiness for the labour market will be improved. Second, complexity theory is “amoral” (Morrison 2008, p.26). This means that in the Egyptian university sector it describes and explains what is happening and what has happened. For example, it explains why the skills gap exists and what has happened that led to such a phenomenon according to its participants’ (e.g. academics, students, graduates and employers) views of the world, but it does not involve discussions of the desirable and

undesirable, good and bad or why participants held their particular views (Morrison 2008).

### **3.4 Research Tools**

There are several techniques which can be used to collect qualitative and quantitative data, namely: interviews, observations, questionnaires and focus groups. Yet, according to Creswell (2003), Gray (2004) and Cohen et al. (2007), the selection of any tool is highly dependent on the nature of the data required as well as the sample size. To select the most appropriate tool for this research, a review of data collection methods was carried out which revealed that: observations are most appropriate when researchers need to observe human behaviour(s) to understand a given phenomenon, interviews are most suitable when collecting direct in depth information from interviewees, documentation is most appropriate when collecting information from documents and focus groups are most useful when collecting direct information from a group of participants (Creswell 2003; Gray 2004; Cohen et al. 2007). In line with the literature, it was recognised that observations are not applicable to this study as the intention is to understand the research problem through the views, perceptions and experiences of its participants rather through observations.

There are three types of interview: structured, semi-structured and unstructured. In structured interviews identical questionnaires are developed using a set of pre-determined questions; semi-structured interviews are developed using a set of pre-determined questions which can be changed, reordered, or probed depending on the flow of the interview; and unstructured interviews are used when spontaneous, informal, in depth discussions about a particular topic are needed. To answer the questions of this research which were derived from the literature, semi-structured interviews with open ended questions were considered to be the most appropriate as the tool allowed the researcher to ask probing questions to gain new insights into the research problem in a direct way as well as to seek clarification from the interviewee through in depth detailed responses. The interview questions used are in Appendix G.

Documentary data was also a useful tool for collecting evidence related to universities, faculties and academics' work processes; it was important because it supported the outcomes of the semi-structured interviews. Examples of Egyptian reviewed documents were: the Egypt higher education reform plan (HEEP 2009a), the Quality Assurance and Accreditation Handbook for Higher Education in Egypt (HEEP 2009b), the law governing universities (SCU 2006), the Quality Assurance and Accreditation Project Handbook (HEEP2 2009b), the National Academic Standards (NAQAAE 2009a), NAQAAE quality forms, records from the faculty council meetings with CEO members from the industry, status reports which described in detail the nature of programmes, and courses and services offered to students to complete a bachelor's degree. Examples of international reviewed documents included: the Dearing report (Dearing 1997), the Quality Assurance Agency (QAA-UK) Quality Code, UK specifications (UK-SPEC), Bournemouth University unit specifications, and the Institution of Engineering and Technology (IET) handbook of learning outcomes.

A focus group was also used to collect data to validate the research findings. This method of data collection allows research evaluators to discuss the research findings in an interactive debatable way. Despite the strength of the focus group as a method of data collection and its ability to mobilise participants to comment on and to respond to one another's feedback, it was difficult to set up to collect primary research data. This was due to the difficulties presented by arranging and coordinating large scale meetings (more than six).

Questionnaires were not appropriate for this research as they are best used with large numbers of respondents and for quantitative research.

#### **3.4.1 Limitations of Interviews**

There are criticisms for interviews as data collection tools. According to Creswell (2003), Gray (2004) and Cohen et al. (2007), these are as follows: (i) interviewers' interviewing skills; (ii) the interviewer's position which may be subjectively orientated

while gathering and analysing collected data as s/he is the one who decides which questions to pose and which quotes to report; (iii) interviewees' readiness to answer questions as well as mood during the interview; (iv) the time and effort taken to conduct and moderate interviews. Interviews are time consuming in nature at all stages, from their design to their execution and finally to their analysis.

### **3.4.2 Overcoming the Limitations of Interviews**

Before conducting the main study interview, three pilot interviews were held in Egypt. Another was carried out with an academic working at Bournemouth University. All those pilots trained the researcher and developed her skills for conducting semi-structured interviews. To maintain the validity of the data throughout the interview process, the researcher adopted "bracketed" behaviour (Walther et al. 2013, p.645), which means that her views and opinions were withheld. The interviews' ethical considerations for the interview process will be discussed in detail later in this chapter. Also after the interviews were conducted, they were transcribed verbatim (except pilot interviews) and sent back to the respondents for validation to ensure maximum validity of data.

Regarding interviewees' readiness for, and mood, when answering questions, academics' interviews were carried out in their offices. Graduates' interviews were conducted in public places quiet and private. Employers' meetings were conducted in a conference room in their workplaces. The average time for an interview was 60-70 minutes.

## **3.5 Sampling**

### **3.5.1 Criteria for Selecting Samples**

In this study, a purposive sample with unequal gender representation was selected from amongst the academics and graduates of the Faculty of Engineering, Department of Computer Engineering, at two universities in Egypt, one private and the other public. The faculties are considered to be two of the oldest higher education institutions, offering five year computer engineering degree courses. They are well

recognised for the technical competencies of their academics and graduates (THE 2010; IDSC 2013). The identities of these universities are not disclosed for ethical reasons. The Faculty of Engineering in both universities offers the study of practical sciences based on experimentation and application. Examples of these sciences are: computer engineering, electronics and communication engineering, electrical and power control engineering, mechanical engineering, civil engineering, and architectural engineering. It is worth noting that 6 out of 24 (25%) of public engineering faculties and 9 out of 18 (50%) of private engineering faculties teach computer engineering undergraduate programmes.

The research sample was selected based on a number of criteria to ensure that participants share equally the experience of a particular situation, event or condition. With respect to academics, these criteria were: (i) nature of employment: the researcher aimed to avoid biased answers so full time academics working only in one faculty were chosen, because in comparison to part time academics, who may be working in other academic faculties, full time academics would be more experienced and focused on their work and hence their perceptions would provide real time, contextual and valid data; (ii) possession of a PhD degree: this was to ensure that selected academics had sufficient experience of course design, teaching and development; (iii) teachers of core courses: this was because core courses should embed the attributes which a student requires to complete a degree, so selecting academics who teach core courses would add to the richness of data collected since they have adequate experience with these courses.

The criteria set for selecting graduates were: (i) work experience of one year or more: this was important to ensure that graduates had experience and understanding of job related tasks in the area in which they operated; and (ii) having a computer engineering related job: in Egypt, computer engineers work in jobs related to help desks and technical support, software testing, software programming and



development, operations management, and network and database administration, so any graduate working in any of these sectors was appropriate.

Employers were chosen according to: (i) the nature of business: only those related to the computer engineering sector were selected and this included industries such as: banking, software solution providers, information technology services and software consultation houses; and (ii) years of business experience in the market: this was important to ensure their long experience with graduate employability; (iii) seniority in the workplace: as interviewing a senior level person would have an impact on the nature of the data collected since s/he would have a clear and experienced understanding of the causes underpinning the research problem.

### **3.5.2 Sample Size**

According to Arksey and Knight (1999), a purposive sample of eight people is often sufficient for generalising interview findings unless new data is emerging. The interview sample included eleven academics (five public and six private) and nine graduates (four public and five private). The total number of academics who worked in the public faculty and to whom the criteria in (3.5.1) applied was ten, while in the private faculty there were nine. This means that 50% of the public academics were interviewed in comparison to 66% from the private faculty. These academics held various academic titles including professor, associate professor and assistant professor. The samples included the heads of departments. With respect to graduates, the total number who graduated from the private faculty and to whom the criteria in (3.5.1) applied was sixty, while the graduates of the public faculty, were eighty in number. These statistics for academics and graduates were available on the university websites at the time the data were collected in 2011 and confirmed by department heads and alumni offices. The entire academic and graduate samples were e-mailed, however only eleven (58%) and nine (6%) in total replied respectively. Similarly, ten employers were contacted and only seven (70%) replied. The ten employers were not the total number of employers servicing the computer engineering

sector, but they were the ones most known for their long historical experiences in the field of work in Egypt.

### **3.6 Interviewing Techniques**

The interviews aimed to explore the contextual factors affecting the teaching and learning of graduate attributes in courses and thus the skills gap within the Egyptian computer engineering discipline. To do so, semi-structured interviews were used to collect face to face information from a number of academics, graduates and employers. This information was essential to establish a real picture of the problem in its current state in Egypt. As the data collected came from different participants, this permitted comparisons among the different views and perceptions.

There was a range of possible techniques for managing the interviews (Appendix F). The researcher chose to interview the participants, faculty by faculty in a sequential way; that is one academic followed by one graduate followed by one employer. Although the process was time consuming to set up, it encouraged an in depth, progressive understanding of the Egyptian computer engineering undergraduate discipline. The researcher interviewed the participants from the public faculty followed by those from the private faculty because the first offers to participate were received from the public participants, and were followed by offers from their peers in the private faculty. Faculty by faculty interviews allowed the researcher to remain focused on the context of study as losing sight of the data collected might have affected the validity of the data.

The interview questions were delivered using an 'interview guide approach' (Cohen et al. 2007). The questions were written in advance based on the research questions, research objectives, the literature, the conceptual framework and pilot work. Although this method of designing interview questions from the literature is important for the explorative nature of the study, they were based upon a limited number of studies and therefore remain bound to the ontological and epistemological assumptions of their authors. In other words, interview questions tend to have an orientation towards the

views of their authors as suggested in previous studies. To overcome such a limitation, interviews were designed as open ended questions to allow the exploration and discussion of all potential new views. To achieve this, the flow of questions was decided during the course of the interview to render the discussion conversational in nature and thus enable the collection of richer and deeper data. Participants were given the chance to add and express their opinions at will. It is important to note that different samples were asked different questions. For example, academics were asked questions related to graduate attributes in the area of their teaching as well as employment. Graduates were asked about the importance of graduate attributes for employment as well as universities' effectiveness in that regard. Employers were asked about their views regarding graduates' readiness for the labour market and the developments needed to improve graduates' transition into that market.

The size of the interview sample was unchanged from that originally decided in (3.5.2). This was because, by the end of the process, the interviews had ceased to provide new information. In other words, the sample had reached theoretical saturation (Arksey and Knight 1999).

To conduct the interviews successfully, certain procedures were followed. For instance, academics were approached through their heads of departments who were the key contacts. For both faculties, a meeting was arranged with heads of departments to introduce the research topic, its purpose, significance, sampling, interview questions and to discuss data confidentiality. It was important to contact the head of department first, before the potential sample participants, in order to confirm the e-mail addresses of the academics to whom the sampling criteria in (3.5.1) applied. Also, it was to gain participants' trust, as they would know that their head of department is aware of their participation; this is important in Egyptian society for cultural reasons. It is also important to note that the role of the heads of departments was not to force academics to take part in the study as the process was completely

voluntary (see section 3.6.1). They were approached first simply to facilitate communication between academics and the researcher.

Graduates were contacted after obtaining their e-mail addresses from the alumni office of their faculty. To obtain those addresses the research purpose, importance, sampling and data confidentiality arrangements were clarified to the responsible person in the alumni office. As for employers, they were contacted by e-mail, their addresses have been obtained from their contact details on the Internet.

After receiving feedback e-mails from each participant, the time, date and location of the interview were decided. The overall setting of the interview location was appropriate in terms of seating and privacy. Before starting the interviews, the researcher used 'ice breaker' informal conversations with the participants as a means of building rapport. Participants were asked to sign their consent forms (Appendix C). The researcher then started the interview by restating the purpose of the research and its importance. She also confirmed the interview duration, and the data protection and confidentiality arrangements. The meetings were tape recorded. During the interview, the researcher allowed participants to express their opinions freely while refraining from voicing any biased opinions that could affect the interviewee's views and perceptions.

It is important to mention that interviews were carried out in the English language, which was a second language for all participants. However, this seemed not to worry the respondents. Nevertheless, to ensure the validity of the data collected, interview transcriptions were validated by their respondents (respondent validation) which gave them an opportunity to correct any inaccuracies. All participants' feedback on validation was positive and no change occurred to the original transcripts.

### **3.6.1 Ethical considerations**

To ensure the validity and reliability of data collected throughout the study, ethical considerations were maintained in accordance with Bournemouth University Research Ethics Code of Practice 2011 (BU 2011), the British Educational Research Association (BERA)-Revised Ethical Guidelines for Educational Research (BERA 2004) and the Economic and Social Research Council (ESRC)-Framework for Research Ethics (FRE) (ESRC 2010). The ethical principles stated by these guidelines and codes were addressed throughout this research by: (i) designing, reviewing and undertaking quality research with integrity and transparency; (ii) informing research participants of the research purpose, importance, associated risks, right to withdraw and any detrimental possibility arising from participation in the research; (iii) maintaining data privacy and confidentiality, since the collection and storage of research data was undertaken with the UK Data Protection Act of 1998 (DPA 1998) and with the BU data protection policy and guidelines (BU 2011) in mind; (iv) applying no pressure to participants to take part in the research study as the process remained completely voluntary; (v) avoiding any emotional harm or deception to research participants; and (vi) maintaining research independence of any conflicts of interest.

To comply with these regulations, ethical procedures were maintained prior to and during the main interviews. For instance, prior to the interviews the researcher introduced herself through an e-mail to participants (Appendix A) requesting volunteers to take part in the research study. The research and its importance were also introduced to volunteers through a participant information sheet (Appendix B), which clarified the interview duration, requested permission to tape record the interview, and assured the confidentiality of the data. A consent form (Appendix C) was also sent to participants confirming that they had the right to withdraw and to ask questions during the interview, and that the data would be confidential. Moreover, in order to conduct this research with transparency, the interview was covered by permission from heads of departments who were informed of the purpose of the study and its importance in order to encourage and not to enforce academics' participation.

During the interviews ethical procedures were also followed. For instance, the researcher was open to all opinions, allowed enough time for respondents to answer questions, paid good attention to the tone and emphasis of the interviewee to overcome any signs of irritation or confusion, avoided leading questions, listened carefully to responses without rushing to the next question, and refrained from causing any emotional harm or deception to research participants. To maintain the privacy of data, all participants' transcripts were kept in a safe place and softcopies secured with a computer password. Also, it is important to note that the researcher maintained research independence from any conflicts of interest since she did not previously know any of the research participants.

### **3.7 The Pilot Study**

In order to ensure that questions were tested and modified before they were used in the final version of the interview, a pilot study was carried out as suggested by Teijlingen and Hundley (2001) and Cohen et al. (2007). This was to (i) test the reliability of the semi-structured interviews; (ii) resolve possible problems that could have appeared during the data collection phase; (iii) make sure that questions asked exactly what was meant to be explored to ensure the construct validity of interview questions; (iv) revise question sequencing and wording to make them as clear and understandable as possible; and to (v) improve the researcher's interviewing skills.

The participants from the private faculty were piloted first because offers to participate were received from them before they were received from the participants of the public faculty. Pilot interviews were carried out face to face. The researcher took into consideration that the selected sample did not come from the same pool of participants targeted for the actual study. She also took into consideration not to feed in any conducted analysis or quotes related to these interviews into the main study to prevent contamination of data (Teijlingen and Hundley 2001).

To contact participants, the researcher sent e-mails at random (Appendix A) to an equal sample of academics, graduates and employers. The sample size was fifteen. There were no particular criteria set to select the samples except work experience and working in the engineering field. The e-mails explained the study purpose, objectives, importance, interview questions, voluntary nature of the study, and the arrangements surrounding data confidentiality. E-mail contacts were obtained from the website of the Faculty of Engineering, graduates' contact details were obtained from the alumni office, and employers' contact details from the Internet. Of the entire sample only three volunteers replied. The academic was a professor in the Department of Electronics and Communication, Faculty of Engineering. She had taught the third and fourth year core courses in her discipline for ten years. The graduate was an Electrical and Power Engineer who had two years' experience in his workplace. He worked in an electrical power station in Egypt. The employer was an interior design engineer. The three volunteers showed their interest in being interviewed and accordingly the times, dates and locations of the meetings were decided.

The academic's interview was conducted in her office, the graduate's interview was conducted in a quiet place, and the employer's interview was conducted in his workplace in the conference room. The overall setting of the interview locations was appropriate in terms of seating and privacy. Before starting the interviews, the researcher thought of ice breaking the discussion with the participants through an informal conversation as a means of building rapport. Participants were asked to sign their consent forms (Appendix C). The researcher then started the interview by restating the purpose of the research and its importance. She also confirmed the interview duration, and the data protection and confidentiality arrangements. The meetings were not tape recorded but answers were written down by the researcher. During the interview, the researcher allowed participants to express their opinions freely while refraining from any biased opinions that could affect their views and perceptions. The interviews lasted for 45-60 minutes.

The interview experience taught the researcher some useful lessons which were taken into consideration during the data collection phase. How for example, to (i) ask probing questions to enrich the amount of data collected; (ii) change a few words to clarify the meaning of some questions; (iii) re-order the sequence of some questions to adjust the flow of the interview; (iv) design a participant information sheet (Appendix B); and also (v) of the need to tape record the interviews to concentrate on the flow of the interview.

As part of Bournemouth University training programme, the researcher conducted a fourth pilot interview with one of the university academics. The aim of the interview was to further develop the researcher's interviewing skills. To find a volunteer, the researcher was supported by her supervisor who sent e-mails to the academics of the Faculty of Science and technology (previously named the Department of Design and Engineering). It is important to note that the supervisor's role in this respect was to facilitate communication between the academics and the researcher without any pressures on any academic to take part in the research as the process was completely voluntary, in accordance with (3.6.1). The e-mails described the study purpose, objectives, importance, interview questions, voluntary nature of the interviews and the arrangements made concerning data confidentiality. This time, however e-mails included a participant information sheet along with the consent form. The researcher received one immediate reply upon which the meeting was set up. The meeting took 90 minutes and covered most questions. The interview questions were not read out in any particular order and were left up to the flow of the interview. The meeting was conducted in the university conference room which was spacious and convenient for the interview in terms of privacy and confidentiality. The interview with the non-Egyptian academic produced richer data in comparison with that from the Egyptian academic for many reasons which were as follows. The researcher: (i) followed better interviewing procedures, such as using a tape recorder, which enabled her to ask probing questions since she had more time to concentrate on the interview; (ii) designed a participant information sheet which gave the participant much more



details about the study; and (iii) allowed interview questions to flow in their natural order without being constrained by a certain structure.

The outcomes of the pilot study were indeed useful to prepare and train the researcher for the data collection phase. The repeated interviews developed her skills with regards to managing and conducting interviews so that sufficient valid rich data was collected in the allocated time. Also, the analysis of data was useful because it informed the researcher of the appropriateness of the interview questions as well as providing guidance on the documentation needed in the study to support the interview outcomes. However, the analysed pilot data were not used in the main study since participants' scope of work was different from the intended scope of this research.

### **3.8 Data Analysis**

In order to answer the research questions, an analysis of what was going on in the study and why it occurred was necessary. Robson (2002) suggested four different approaches to qualitative data analysis: the quasi-statistical approach, the template approach, the editing approach, and the immersion approach. As the nature of this study is qualitative, the quasi-statistical approach was inappropriate. This is because it relies largely on the conversion of qualitative data into a quantitative format by using the frequency of a repeated word or phrase and inter-correlations as a key technique to determine the relative importance of terms and concepts (Robson 2002; Gray 2004). Also, it appears that the immersion approach would be difficult to use in this study because it relies on the researcher's expert knowledge, insight, intuition and creativity, which makes it a difficult approach to reconcile with scientific research (Robson 2002). The editing approach, however, might be more appropriate for analysing interview derived qualitative data, but since coding is based on the researcher's previous knowledge, then it may not be free of bias. Accordingly, the template approach was found most appropriate for this research. This is because the template approach encourages codes to come from the data itself which keeps bias to a minimum. It also enables in depth understanding and interpretation of the meaning

of data which is what tends to interest qualitative researchers. The template approach depends on three techniques to analyse qualitative data (Miles and Huberman 1994; Robson 2002). These are: creating a list of codes prior to data collection, creating a list of codes after data collection, or a mix of both. In the first technique, the list of codes is obtained from the literature, the conceptual framework, or the research questions which are then linked to the research main study. In the second technique, data is not coded until collected and analysed, which allows the researcher during data analysis to be more open minded, flexible and case sensitive (Miles and Huberman 1994). This technique is most common in inductive research. The third method is a mixture of both, where the researcher does not create codes, but instead defines the areas that may be codified in later stages.

The interviews data analysis occurred in three stages: data reduction, data display, and conclusion drawing and verification (Miles and Huberman 1994). After finishing all interviews, data were reduced by first transcribing the conversations. Transcribed conversations were read several times (after obtaining respondents' validation) line by line and understood in relation to the phenomenon being explored (i.e. the contextual factors affecting the teaching and learning of graduate attributes). Such an approach allowed an in depth understanding of participants' answers which is important because it enabled the researcher to come to grips with the content of the discussions. There was no particular order for reading the transcripts as the aim was to get a broad understanding of participants' answers in relation to each other rather than having a focused view on content if the transcripts were read sample by sample. Such an approach was helpful for developing initial thoughts about the thematic codes which could arise during the analysis process.

After extensive readings and cross readings of interview data, template analysis was carried out on all transcripts resulting in a number of codes (Appendix H). These codes were identified by grouping the keywords or patterns of data emerging from participants' quotes relevant to research questions, research objectives, the

conceptual framework and leading to theoretical development (Miles and Huberman 1994). In other words, codes emerged from important incidents/instances of phenomena (i.e. the contextual factors affecting the teaching and learning of graduate attributes). Common patterns of data or key words were identified from the interview transcripts using similar colours or symbols (e.g. dashed lines, **bold** or *italics*) (Appendix H).

The codes were labelled and identified according to the definitions and accurate content of grouped patterns of data. It is important to note that these codes were chosen subjectively by the researcher who was continuously questioning the data in this study and also guided by previous readings of the topics of graduate attributes and the factors affecting their teaching and learning in courses of study. It is also important to note that the list of codes did not contain any codes from the literature where they were only derived from participants' answers depending on the grouping of similar key words or quotes together. Such a subjective approach for coding and grouping could therefore be considered a limitation of this type of analysis.

Interviews were first coded sample by sample to maintain the focus on the nature of enquiry. Codes were coloured with the same colour as their patterns and numbered as Cx, where C is an abbreviation of the word code and x is the code serial number. Under each code, similar patterns of data were grouped and numbered as Cxy, where Cx is the pattern code number and y is the pattern of data serial number. There was no particular sequence for grouping the patterns of data under their codes, however coding involved a process of making constant comparisons. Every time a pattern of data was found and it was compared with previous ones, if they were similar in meaning and relevance to the research questions and objectives they were grouped together. If a new quote did not fit the original definition, then a new code was created. It should be noted that the researcher was open to any unanticipated results that could emerge from the interview data, or an outcome that is completely new or surprising.

To generate the list of codes, re-reading and validation by cross checking across all transcripts was carried out. Following this exercise, codes were reviewed and were combined under themes which became categories for analysis (Braun and Victoria 2006). There was no particular sequence for grouping the codes under a theme; therefore it was possible that some codes would be allocated to more than one theme. Every code was compared with previous ones. If they were similar in meaning they were grouped together under a common theme and if a code did not fit the original theme a new theme was created. Themes were labelled according to the definitions and meanings of codes as well as the explorative and thorough organisation of the overall ideas affecting the research aim and objectives and the phenomenon being explored (i.e. the contextual factors affecting the teaching and learning of graduate attributes). As these steps were implemented, thematic analysis went beyond counting phrases or words in the documented transcripts and documents as the focus was on identifying implicit ideas within the collected data. Thematic analysis employed in this research adopted the inductive approach rather than the deductive one. This is because the identified themes were linked or grounded in the data rather than fitted into a pre-existing frame or model unlike deductive approaches (Charmaz 2006).

Documentation was analysed in the same way as interviews using the template analysis approach. Examples of documents read were the Egyptian higher education reform plan (HEEP 2009a), the Quality Assurance and Accreditation Handbook for Higher Education in Egypt (HEEP 2009b), the law governing universities (SCU 2006), the Quality Assurance and Accreditation Project Handbook (HEEP2 2009b), the National Academic Standards (NAQAAE 2009a), NAQAAE quality forms, records of the faculty council meetings with CEO members from the industry, status reports which described in detail the nature of programmes, and courses and services offered to students to enable them to complete a bachelor's degree. After coding interviews, these documents were read carefully in relation to the research objectives and the phenomenon being explored (i.e. the contextual factors affecting the teaching and learning of graduate attributes). Such an approach allowed an in depth understanding

of the documents' content which was important to the researcher. These documents were read in no particular order as the aim was to generate thoughts about the thematic codes which could arise during the analysis process. Throughout the readings of the documents key words or patterns of data were selected as relevant to the research questions and objectives and leading to theoretical development (Miles and Huberman 1994). The words were compared to the keywords of interviews and if similar in meaning, they were similarly coloured and then coded as (Cxy) and grouped under the same code (Cx). The outcome of documentation analysis was also a list of codes which was merged with the codes produced from the analysis of the interviews then all were brought together under common themes which became categories for analysis.

Data display was facilitated by a matrix which eventually enabled the researcher to knit together all codes and themes that constituted a common thread, meaning, or were conceptually similar, to arrive at an understanding of the Egyptian university sector. As a result of template and thematic data analysis, a total of seven themes and twenty two codes emerged from the coding process. Appendix H shows the codes and themes generated from the interview and documentation analysis. Some codes were allocated to more than one theme during the thematic analysis process where the content they described was found to be adequately suitable, and these codes were marked so that they could be tracked without difficulty.

Research participants' names were also coded. Their code consisted of three letters: the first shows the nature of the sample either academic, graduate or employer, the second is the participant first name initial and the last letter is the case to which the participant belongs, either the private or the public. For employers, the code consisted of two letters only, the first and the second.

To draw theoretically valid, unbiased conclusions, complexity theory was used to analyse and interpret the multi-factorial causalities of the phenomena. This will be discussed in detail in chapter four.

### **3.9 Quality of the Research**

There are a number of processes which contributed to the overall quality of this research. For instance, the literature reviews at the start of the study evaluated current knowledge/theories related to the research problem, clarified the research problem, identified the gap in knowledge, selected a suitable research conceptual framework and identified methods of data collection and analysis. Similarly with data collection, the quality of the data was maintained throughout the research by collecting it from different groups of participants (triangulation) - academics, graduates and employers - according to a number of criteria as set out in (3.5.1). Semi-structured interviews with open ended questions allowed the researcher to ask probing questions to gain new insights into the research problem in a direct way as well as seek clarification from the interviewee through in depth detailed responses.

The quality of research data was also maintained by collecting more data from the documents related to universities, faculties and academics' work processes. These documents were important for the support they gave to the outcomes of semi-structured interviews. In qualitative studies, because data continuously change and findings are often based on subjective views, achieving the same results is difficult and not always a common aspect (Miles and Huberman 1994). In qualitative studies, the key to credibility and trustworthiness (reliability and validity) is to show, through argument and analysis, that the process of exploration (i.e. data generation and analysis) has been an appropriate means of answering the research questions logically, honestly and accurately (Miles and Huberman 1994; Daymon and Holloway 2010; Walther et al. 2013). This potentially reduces biases in the study. In this research, credibility and trustworthiness were maintained by using an interview guide and pilot studies as described in sections (3.6) and (3.7).

### **3.10 Research Output Validation**

After completing the data analysis and arriving at the research contribution to knowledge, it was necessary to produce output that would suggest to the higher education authorities in Egypt what needs to be done to improve the implementation of graduate attributes in undergraduate university courses. However, prior to its design, the researcher chose first to validate the research findings (i.e. the contextual factors affecting the teaching and learning of graduate attributes) with a number of Egyptian experts in higher education to gain initial thoughts on the content of the policy document as a research output. This was necessary to lessen the chances that the suggested policy document would not achieve its intended goal.

To validate the research findings a focus group was set up. It consisted of a number of experts who included: an ex-dean of the faculty of engineering of a private university, a member of the Supreme Council of Universities, an ex-dean of the public faculty of engineering of a public university and a member of the National Quality Assurance and Accreditation Agency in Egypt. The experts chosen from a sample of experts listed on the acknowledgement page of the Quality Assurance and Accreditation Handbook (HEEP2 2009b), are not identified in the research for ethical reasons. They were particularly chosen for their areas of expertise which indicated their long experience in the quality, management and development of higher education in Egypt.

The focus group was planned by sending an e-mail to the four experts (Appendix E). The e-mail described the purpose of the focus group and the research findings and included a consent form (Appendix D). Once the four experts agreed to attend the focus group, the date, time and location of the meeting were decided.

The meeting was conducted in the office of one of the members which was accessible to all. The overall setting was appropriate in terms of seating (round table) and privacy. Before starting the meeting, the researcher thought of ice breaking the discussion with the participants through an informal conversation as a means of

building rapport. She then introduced the members to one another and asked them to sign their consent forms. The researcher then started the focus group by restating the purpose of the research and its importance. She also confirmed the interview duration, and the controls in place for data protection and confidentiality. The meeting was tape recorded and lasted for 90 minutes. During the focus group, the researcher allowed the experts to express their opinions freely while refraining from voicing any biased opinions that could affect participants' views and perceptions.

Throughout the meeting, the researcher moderated the discussion by periodically restating the original focus of the meeting as well as the research objectives. Experts took turns to answer and when needed the researcher set certain limits to the discussions. There were no particular questions prepared for the focus group. The researcher felt that they would develop from the comments of the experts and therefore the flow of the questions was decided in the course of the meeting. This allowed the focus group to be more conversational in style. It is important to mention that the focus group was carried out in the English language, which was a second language for all experts. However, this seemed not to worry respondents them.

The outcomes of the focus group were indeed useful in supporting the design of the policy document. It provided a broad understanding of the research findings in relation to the current policies implemented in Egypt, particularly where areas for improvement were needed. At a later stage of the research, when the policy document was designed, it was sent by e-mail (Appendix I) to the four experts and three other authors acknowledged in the Egyptian literature. The choice of the three authors was based on their experiences in the Egyptian university sector, policies and procedures and quality assurance. It was also based on their advisory role to the Egyptian government regarding higher education improvement. The evaluators included: a person responsible for setting up higher education accreditation policies and quality assurance standards in Egypt, an expert in education and a manager for human development and economist both belonging to one of the institutions offering policy



advice, research and analysis, technical and financial assistance to developing countries. The choice of the first evaluator was based on advice received from the other two evaluators who thought that his comments would contribute to the design of the policy document.

The e-mail sent to the evaluators included the policy document and a consent form (Appendix D). E-mail was chosen as a method of validating the research output for two reasons. First, it was difficult to discuss the policy document in a focus group due to the complication of gathering all members at the same time. Second, there was a need to obtain clear, precise and written feedback on the content of the policy document which could have been limited by a focus group. This was necessary to ensure that the amended policy document would not have unintended content. After designing the policy document, it was sent to the suggested experts who responded with a number of comments. Of the seven evaluators, only five replied and their comments are discussed in detail in chapter five (5.4).

### **3.11 Summary**

This chapter has discussed the methodology used for conducting this research. In order to answer the research questions, this section described how semi-structured interviews were used to collect in depth qualitative data from a purposive sample of educators, graduates and employers. The chapter also described the documentation used to understand universities, faculties and academics' work processes, information which was important to support the outcomes of the semi-structured interviews. Template analysis, thematic data analysis, and complexity theory were the analytical methods used to analyse the collected data and to arrive at the research conclusions. The next chapter will present the results of the research study. It includes a presentation of the results collected from interviews and documentation. The interpretation of the data is discussed at the end of the chapter as is the contribution to knowledge for this research.

# Chapter Four: Research Results

## 4.1 Introduction

In the previous chapter the research methodology and methods were discussed, including the research approach, design, tools and conceptual framework. The chapter described how research data were collected using semi-structured interviews and documentation, and explained how interviews were constructed and validated through a number of pilot studies. The chapter also demonstrated the procedures for exploring the research problem including the research sample, interviewing techniques, ethical considerations, data analysis and research quality.

This chapter presents the findings of the research study. It discusses the responses received from academics, graduate participants from the private and public faculties, and employers. The chapter presents the outcomes of the document analysis, in support of the outcomes of the interview data, in order to answer the research questions.

## 4.2 Main Study Results

Based on the outcomes of template and thematic data analysis, the following were the generated themes: perceptions of graduate attributes, development of graduate attributes in courses, attributes required by the labour market, central role of faculty, quality measures, and improvements to the skills gap.

### **Theme A: Perceptions of graduate attributes**

The Quality Assurance and Accreditation Handbook (HEEP2 2009b, p.71-72) together with NARS for engineering (NAQAAE 2009a) clustered graduates' learning outcomes under four different categories: knowledge and understanding, intellectual skills, professional and practical skills, and general and transferable skills (Appendix K). Under each category students' learning outcomes were described as:

Knowledge and understanding: the basic information and understanding the graduate should have gained upon completing the programme.

Intellectual skills: the intellectual capabilities gained by the graduate after completing the programme, such as the ability to select from different choices, concluding and discussing, innovation, specifying problems and finding solutions, etc.

Professional and practical skills: the capability to use academic material in professional applications, which should be gained by the student upon completing the programme, such as use of remote sensing maps, managing water resources, performing an engineering design and designing a computer programme.

General and transferable skills: the different general or transferable skills that should be gained by the student upon completing the programme such as computing skills, communication skills, management skills, working in a group and problem solving.

The Accreditation Board for Engineering and Technology ABET (ABET 2013, p.2) described students' learning outcomes as follows:

Student outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviours that students acquire as they progress through the program.

It is important to note that ABET was implemented in the private faculty only.

With respect to academics' interviews, all academics, irrespective of their faculties, had different understandings of graduate attributes. For instance, public academics perceived them as "characteristics" that graduates should possess, "abilities" that graduates need in order to carry out engineering tasks, "skills" gained by students from taught courses, "an understanding" of labour market needs and "a non-technical skill" attained by the graduate.

*Some characteristics that need to be in the graduate (DAC).*

*It is an ability with which the graduate will practise his engineering work (DHC).*

*They are the skills that students gain from the courses (DNC).*

*It is an understanding of what the labour market requires (DSC).*

To further clarify their understanding of graduate attributes, public faculty academics gave a number of examples. These were: self dependence, self learning, teamwork, analytical skills, mathematical skills, patience, resisting frustration, and research skills.

*For example, being self dependent, self learner, knows how to present one's own work, things of that sort (DAC).*

*For example, analytical skills, mathematical skills, teamwork and research skills (DNC).*

*It is a matter of solving a problem, a matter of knowing how to present one's own work (DSC).*

*Working in a group is one of the skills...patience in our field is very important otherwise he will not be able to make a good programme because at first he makes a programme...then he runs it...then he fixes the bugs...also if he does not resist frustration and things like that, he will not be able to continue his work (DIC).*

With respect to private faculty academics, they perceived graduate attributes as “things that allow graduates to compete” in the labour market, “abilities” that graduates gain from the educational process, “attitudes” or professional engineering “ethics”, “things” required for employment or “qualities” needed for work.

*The things or attitudes beside the technical work that allow the graduate to compete in the labour market (DME).*

*Abilities gained with time and which are quite different from the technical or theoretical skills that students gain from the educational process (DZE).*

*They are the things that employers look for (DNE).*

*These are the ethics of engineering, the non-technical part of the course (DEE).*

*On a personal basis, I look at this topic from the perspective that I graduate a student who needs to be complete... knows how to work and deal with life and is not just stuffing his mind with knowledge that he will forget once he graduates (DYE).*

*In very simple terms they are students' qualities that enable them to do their work effectively (DOE).*

To further clarify their understanding of graduate attributes, private faculty academics also gave a number of examples. These were: presentations skills, teamwork skills, problem solving skills and communication skills.

*Examples of these [attributes] are working in a team and communicating ideas and presenting them to managers and subordinates (DNE).*

*Examples of skills are task management, communication skills and problem solving (DZE).*

*You have many examples such as communication skills and presentation skills (DOE).*

With respect to the literature, Barrie (2004, 2006) identified four different qualitative conceptions that academics hold for graduate attributes. These logical, in sequence, conceptions were: precursory, complementary, translation and enabling. By comparing these conceptions to Egyptian public and private academics' perceptions of graduate attributes, from the words and verbs they used to describe the concept, it is suggested that academics' understandings, irrespective of their faculties, were both different and interchangeable, yet consistent with some of Barrie's (2004, 2006) conceptions. For example, some academics such as DNC and DZE understood graduate attributes as complementary to disciplinary knowledge, that is they are part of the usual course curriculum yet they do not interact with disciplinary knowledge, whereas other academics, such as DHC and DOE understood them to be abilities that make use, apply or translate disciplinary knowledge in the world. Nevertheless, there were perceptions for academics which were not consistent with any of Barrie's (2004,

2006) conceptions. In addition to academics' variation in interpretations were the examples given by academics to clarify their understandings of graduate attributes, which were no more than a variable mixture of different level attributes according to Barrie's (2006) qualitative conceptions. For example, mathematical skills and patience could be understood as precursory abilities that most students on entry to university are expected to have, whereas presentation and teamwork skills could be understood as enabling abilities that are learned in the context of disciplinary knowledge or from the student's engagement in the broader experience of participation in the university community. As for the Quality Assurance and Accreditation Handbook (HEEP2 2009b, p.71-72) and NARS for engineering (Appendix K) (NAQAAE 2009a) when compared to the ABET definition of student learning outcomes as well as Barrie's (2004, 2006) four qualitative conceptions, it is suggested that quality documentation used different terms to express graduate attributes without a clear explanation of what each term means. For example, graduate attributes were categorised as knowledge and understanding, intellectual skills, professional and practical skills, as well as general and transferable skills without an understanding of what they mean, yet with only a few examples to clarify each category.

Also, when comparing these different terms to academics' perceptions of graduate attributes, it is suggested that there was a difference in the terms used. For example, academics interchangeably described graduate attributes as the abilities, characteristics or non-technical skills that complement disciplinary knowledge or translate disciplinary knowledge into the world, whereas documents described them as abilities gained upon completion of a course of study. Further to these variable interpretations were the collective examples academics used to clarify their understanding of graduate attributes such as: self dependence, self learning, teamwork, presentations skills, and problem solving, in comparison to the documentation which identified graduate attributes as, innovation, communication skills and management skills, working in a group, information technology and problem solving (HEEP2 2009b; NAQAAE 2009a).

In the light of all these variations and differences in interpretations academics' perceptions of graduate attributes, documented expressions of graduate attributes, Barrie's four qualitative perceptions of academics' understanding of graduate attributes, and ABET's definition of student learning outcomes,

*Variation in understandings would suggest that some academics are unlikely to be receptive to calls for a university education to address the development of such attributes and provides an insight into some of the reasons that may underlie the inconsistent implementation of graduate attributes curricula (Barrie 2006, p.238).*

Based on such an argument (Barrie 2006), it is apparent that there is uncertainty on the part of academics as to what graduate attributes mean the undergraduate level. It could also mean that meanings of graduate attributes are different within and across the faculties and therefore there is no single way of understanding the concept, but rather, that academics have a range of interpretations. Such an outcome draws attention to (Barrie 2006, 2009; Jones 2009, 2013) why there is an uneven implementation of graduate attributes as students' learning outcomes in taught courses. The findings indicate that the variation in understandings of graduate attributes is a common problem in Egypt as well as in Australia.

Despite these different perceptions and examples of graduate attributes, all interviewed academics recognised the importance of graduate qualities in term of communicating effectively in the workplace, managing challenging situations and projects, and improving work productivity.

*Of course they are important, skills help graduates communicate within the work community (DAC).*

*Very important to be able to deal with whatever situation he is placed in to be successful in managing a group of people...a project may be...for productivity....for success in his life....(DSC).*

With respect to public faculty graduates, they described graduate attributes as a “skill” that “helps” or “enables” certain practices such as: teamwork, knowledge sharing, leadership and task management.

*Skills enable one to work in a team, share knowledge, lead, communicate with others (GRC).*

*Skills help one manage one’s work and communicate with others in the workplace (GMC).*

Private faculty graduates also described graduate attributes as a “skill” that helps with presenting one’s own work, with communicating with others, thinking and solving problems.

*My skills helped me present my own work to managers, or explain it to others (GGE).*

*Skills help one think and search to solve any problem (GFE).*

Despite these different examples for graduate attributes, all interviewed graduates whether public or private, recognised the importance of attributes for the workplace.

*Of course skills are important and not only here but everywhere. I remember during my interview my employers asked me about my communication and presentation skills (GAC).*

*Skills are very important at work even if one is a junior developer (GMC).*

*Skills are very important for the workplace, the syntax is not important, how to write code is not important, what is important are personal skills (GFE).*

The employers described attributes as the “tools”, “soft skills” and “skills” needed to improve work performance, business profit and quality of work.

*Of course they are important as any shortage in skills will greatly affect work performance and business profits (EG).*

*They are very important. How will an employee deal with a customer or with his colleagues without soft skills? (EN).*



*Yes, I see them as very important because these are the tools he will use to show how much knowledge he has to solve a particular problem. If he doesn't have the right presentation skills to talk and convince the customer, he won't sell his product (EE).*

*100% important...the most important thing in an engineer are his skills. Tell me, if one of the engineers here did not know how to deal with our customers, then what would the situation be like? (EM).*

The majority of employers perceived graduate attributes to be as important for the work place as work experience and technical knowledge. The majority said that most recruits are questioned about their personal qualities prior to recruitment, but that this could happen in an indirect way. For example, interviewees' attributes could be assessed against a sport they play, their role at the graduation project, or through an IQ test. All these aspects inform employers indirectly about the nature of attributes which the new recruit might possess. For instance, if a person plays a group sport like football then s/he is most likely to be good at teamwork and vice versa with a sport like tennis. IQ tests and questions related to graduation projects also provide information about attributes such as problem solving, leadership, communication, and presentation skills.

*We sometimes do an IQ test which tells us about his problem solving skills (EH).*

*We ask them if they play any sports and what it is. If they choose a team sport like football, then we do understand that they are good at teamwork and if they choose an individual sport like tennis, then we know that they are not quite happy with teamwork (EU).*

*I ask him about his graduation project and his role in it, his answer will tell me a lot about his leadership skills, communication skills, presentation skills, group work, task management, things of that sort (EE).*

### **Theme B: Development of graduate attributes in courses**

With respect to academics' interviews, irrespective of their faculties, academics stated that graduate attributes were developed in taught courses in different ways depending

on the nature of the course. For example, they could be gained by students through a course taught separately from disciplinary knowledge, or as part of the taught curriculum. Academics also provided examples of some of the attributes developed by their students during courses of study.

*In our programme, we have both techniques, attributes that are taught in a separate course yet in the area of teaching such as the introduction to problem solving courses I teach, or as part of the curriculum for example when a student is required to present his or her own work through a PowerPoint presentation (DOE).*

*Attributes are embedded in courses to directly link theory with practise...in the courses I teach students learn how to conduct seminars and group based projects which allow them to develop a number of skills such as presentation skills, communication skills, writing skills and teamwork (DME).*

*In most of my courses, attributes are developed through course activities such as sheet assignments, group based projects, presentation and lab work which allow the student to acquire certain skills to communicate effectively, present his/her own work and think logically, yet there is another course that I teach separately but integrated to the curriculum for fourth year students, which is technical report writing (DHC).*

*It is better to embed them in the courses. In my courses which are project based in principle, my students work on a number of projects throughout the term and from those projects they tend to develop as many skills as you can think of [counting on fingers] teamwork, presentation skills, communication skills, and logical thinking skills (DSC).*

*Attributes are central to the curriculum. If they are not developed as part of the taught knowledge, the student will not gain them. I personally assign real time projects, home assignments, report writing and mini projects. We make visits to some factories to see their automatic control systems (DIC).*

With regard to attribute assessment during courses, interviewed academics stated that there was no fixed method for assessing graduate qualities; everything depended on the academics' views of the course.

*We really don't have a strategy, it is a personal matter, we should have a strategy but we don't (DIC).*

*Quizzes, exams, seminars, lots of ways to assess students' attributes (DNC).*

*There is no particular way. I, for instance, assess my students through presentations or group based projects (DEE).*

*There is no particular way. It varies according to course content (DOE).*

With respect to literature, Barrie (2007) identified six different categories of academics' conceptions of how students acquire generic attributes from taught courses. These were: remedial, associated, teaching content, teaching process, engagement and participatory. By comparing these conceptions to Egyptian public and private faculty academics' teaching and learning methods, it is apparent that all academics irrespective of their faculties had different as well as interchangeable teaching and learning methods of graduate attributes, although these were consistent with some of Barrie's (2007) different conceptions. Some academics, for example DSC and DME encouraged their students to acquire graduate attributes through their engagement with the learning process whilst another such as DIC encouraged his students to develop them as a core element of the course content, and another, DOE encouraged his students to acquire them as a core element of course content and through engagement with the learning process. Nevertheless, students' acquisition of graduate attributes through their courses was the most common approach employed by academics. It became evident from the interview data that, these approaches had been chosen by the academics themselves as they had not been advised by the Quality Assurance and Accreditation Handbook (HEEP2 2009b) or by NARS for engineering (Appendix K) (NAQAAE 2009a). Similarly, attribute assessment techniques which were devised by academics according to the nature of the course and took the form of activities such as presentations, seminars or quizzes to assess their students' abilities. As proposed by Barrie and Hughes (2010), this may be due to academics' varied conceptualisation and development of attributes through faculty courses.

*Perceptions of the very nature of graduate attributes are central to the ways in which they are taught and assessed.*

In the light of all these variations and differences among academics as to how graduate attributes should be developed in courses, as compared to Barrie's six qualitative conceptions, it is suggested that:

*This difference in perspectives reflects fundamental differences in how these academics conceive of what generic attributes are and how they are developed. Different perspectives explain the reasons for the limited implementation of graduate attributes within university courses (Barrie 2007, p.441 & p.454).*

Accordingly and with reference to Barrie (2007, 2009), Jones (2009), and Barrie and Hughes, (2010), it is clear that the different conceptions for developing, teaching and assessing attributes in courses, together with the previous notion that academics have different conceptual understandings of what graduate attributes are, mean that the academic community do not share the same notion about graduate attributes. It also means that graduate attributes mean different things to different people who are responsible for developing, delivering and assessing a university education. Such an outcome draws attention (Barrie 2007; Barrie 2009; Jones 2009; Barrie and Hughes 2010) to the cause of the inconsistent implementation of graduate attributes as students' learning outcomes in taught courses. Moreover, and after a considered comparison between the attributes academics suggested should be embedded in courses, the ones articulated in their course specifications, and the "general skills" requirements of NARS for engineering, there are visible inconsistencies. NARS, for instance, puts forward a number of attributes for engineering education. These were: "collaborate effectively within a multidisciplinary team", "work in stressful environment", "communicate effectively", "demonstrate IT capabilities", and "lead and motivate individuals" (Appendix K) (NAQA 2009a, p.6). Course specifications reflected other attributes such as:

Course #1 general skills (public faculty):

- Use general computer and software tools professionally.
- Analyse the local and global impact of computing on individuals, organisations and society.

Course #2 general skills (private faculty):

- Use general computer and software tools professionally.
- Analyse the local and global impact of computing on individuals, organisations and society.
- Use current advanced techniques, skills and tools necessary for computing practices.
- Use computer-related terminology.

With respect to ABET criteria for accrediting engineering programmes (2013, p.3), they also described a number of students learning outcomes such as “an ability to apply knowledge of mathematics”, “an ability to design and conduct experiments”, “a knowledge of contemporary issues, and “an ability to communicate effectively”. When comparing these criteria to NARS learning outcomes there were differences as well as similarities (ABET 2013; NAQAAE 2009a). For example ABET learning outcomes were only eleven in total, whereas NARS identified a larger number which were grouped into four different categories. These were knowledge and understanding, intellectual skills, professional and practical skills, and general and transferable skills (NAQAAE 2009a) (Appendix K).

With respect to the literature, Barrie (2006, 2009), Green et al. (2009), and Barrie and Hughes (2010) argued that lists of attributes developed by different stakeholders (e.g. quality assurance agencies such as NARS and ABET) may have variable descriptions of graduate attributes which can range from simple technical skills to complex intellectual abilities. Such variance leaves the stated outcomes open to different interpretations and thus raises the potential for uneven implementation of graduate attributes in courses.

In spite of such variation in interpretation, all interviewed academics said that the choice of attributes to be developed in courses was based on labour market requirements of which they remained aware due to colleagues working in industry, interns, gatherings with graduates, meetings with industry members, or consultancy services offered to businesses.

*Feedback from the industrial sector, we meet informally because most of them are my friends and they tell us what our graduates lack and what needs to be improved (DHC).*

*I have been an IT consultant. The other thing is the good and real feedback I get from our working graduates (DNC).*

*Through our contacts with the industry, through students training and the industrial committee that consists of industrial CEOs (DOE).*

*We hear from our friends who are working in the market what is needed and what is not needed as well as from our graduates whom we are still in contact with (DEE).*

*Through the feedback I get from my graduates every now and then and meetings with industry members that happen every six months (DME).*

The public faculty academics stated that they did not explicitly inform their students of the attributes developed in their courses because the students would become aware of them anyway when promoted to senior classes or when working.

*I don't make them aware all the time but some of them are aware... top of the class students are aware (DNC).*

*Explicitly no, but he will get to know its importance when he works (DHC).*

*Actually they get to find out from students in higher classes (DSC).*

Similarly, most private faculty academics said that they did not keep their students informed of the attributes developed in courses.

*Not always, but it becomes obvious as the course runs (DEE).*

The graduates, irrespective of their faculties, mentioned a number of methods through which they had gained their attributes while in faculty. These were: group based projects, presenting their own work in exhibitions and seminars, oral discussions, making presentations, lab work, home assignments, and internships.

*Through group based assignments, and these were carried out at home...we also had lots of sheet assignments (GRC).*

*The graduation project was an important asset to improve my communication skills (GMC).*

*We had group based projects which helped develop our communication skills (GSC).*

Some private faculty graduates commented:

*Working in projects... This is very useful because you work in groups plus you get to learn and understand something new from your colleagues who share with you the same problem and thinking. How you will solve the problem is very important (GDE).*

*By presenting my work in exhibitions and conferences....projects were also very useful for me....also the training I had while in faculty was very useful through the companies the faculty suggested for me (GAE).*

When questioned about the attributes gained while in faculty, most public graduates listed: working hard, self dependence, time management and working under pressure.

*Working hard, to be self dependant...[grimace] we used to search for knowledge and information...struggling and trying to understand everything (GMC).*

*Time management, working under pressure... we were always suffering from work stress, due dates, issues of that type. Self learning,... this was very important. We were given the problem statement and we were expected to learn everything on our own, read about it, implement it and make it work all on our own (GAC).*

Private faculty graduates also identified a number of attributes which they gained while in faculty. These were: teamwork, working under stress, time management, communication skills, presentation skills and leadership skills.

*Teamwork, presentations and leadership skills (GFE).*

*Working in teams, working under stress, time management (GDE).*

*Besides presentations we used to have competitions such as Robocon where we used to practise teamwork (GAE).*

*We used to do group based projects and presentations (GGE).*

When questioned about their awareness of these attributes while in faculty, all graduates commented that most of their respective academics had not informed them about the attributes developed in their taught courses.

*It depends on the nature of the professor, but it was not explicitly or clearly stated (GAC).*

*No. Not all professors would tell us. I only got to know the importance of skills when I graduated (GMC).*

*Not all professors, some do, some don't (GDE).*

*Few professors did so verbally (GAE).*

*Well, it was not explicitly stated but we knew that certain courses address soft skills (GFE).*

With respect to students' awareness of graduate attributes, the literature stressed their significance and criticality to the successful implementation of the learning outcomes (Dearing 1997; Crebert et al. 2004; Yorke and Harvey 2005; Barrie 2009; Barrie and Hughes 2010). Based on this argument, any failure to involve the student in directing his/her own learning by not discussing the attributes developed and assessed on courses affects the success of the teaching and learning experience. It could therefore be suggested that students' centredness affects their learning outcomes, as no matter



how much effort is put into teaching graduate attributes, the strategy does not work unless students actively perceive and engage in the development of those qualities.

### **Theme C: Attributes required by the labour market**

When questioned about the attributes required for employment, public faculty academics listed a number of skills which were a combination of technical and non-technical attributes. Examples were: analytical skills, design skills, software design, web design and programming skills, decision making, resisting frustration, managing to work hard under stress, teamwork, language skills and presentation skills.

*Analytical skills, design skills, software skills, programming skills, and web development skills (DSC).*

*Analytical skills, logical thinking and decision making (DNC).*

*Technical knowledge, working hard, working under stress, resisting frustration, working in teams and in groups (DIC).*

*English language and presentation skills (DHC).*

However, private academics listed communication skills, presentation skills, sense of initiation and teamwork.

*Good communication skills, good determination and good presentation skills (DYE).*

*Ability to communicate and how to think (DME).*

*Teamwork and sense of initiation (DNE).*

One of the interviewed private faculty academics did not give examples of the attributes required by the labour market and referred to ABET instead as an implemented system in the faculty that described the attributes required by the labour market.

*If we look at the ABET requirements, you will find them all listed (DZE).*

With respect to graduates, they all said that the labour market was interested in a number of attributes such as: cooperation, teamwork, knowledge sharing, professionalism, communication skills, management skills, time management, self learning, task management, presentation skills, motivation, and problem solving.

*How to cooperate with a team...how to share knowledge with a team...how to work as a team member....how to lead the team...these are all important skills (GRC).*

*I think it is mainly communication skills and management skills, both are important when dealing with customers (GMC).*

*I think dealing with problems, trying to solve them. Convincing people and dealing with them are also quite important (GME).*

*Good communication skills, professional behaviour, teamwork are also very important here (GAE).*

*Keeping my team motivated all the time and working under stress to meet project deadlines (GFE).*

As for employers, they felt that the labour market valued: communication skills, presentation skills, problem solving, social intelligence, teamwork, reading and writing skills, business knowledge, English language, personal appearance, a sense of criticism, cooperation with team members, logical thinking and common sense, quality work, an ability to report to senior management, decision making, reliability, patience, analytical skills, leadership skills, creativity, working to plan, task management, and management skills.

*Ability to learn and ability to read (EU).*

*Knowledge, presentation skills, having a sense of criticism, cooperation, teamwork and independent learning (EA).*

*Technical awareness, communication skills, teamwork and personal appearance (EM).*

*I always emphasise on quality, quality in everything, quality in coding, quality in writing documents, quality in the e-mail he writes, quality in the design and analysis, quality in everything, in addition to problem solving, setting work priorities, organising tasks, reporting to senior management and writing skills (EH).*

*First, he needs to be smart in his work, quick, competent, know how to work in teams, innovative and creative, knows how to deal with the user to take information to design software systems, works to plan, organised and committed to work (EE).*

When comparing NARS attributes for computer engineering, which are employers' assessment of the attributes required for employment (NAQAAE 2009a), and ABET criteria for accrediting engineering programmes (ABET 2013), to the attributes employers and graduates consider to be important, the inconsistencies were marked. This potentially means that attributes embedded by academics in their courses do not align with the attributes required by Egyptian employers. This also means that there is risk that graduate qualities will not address employment demands.

#### **Theme D: Central role of faculty**

Most public faculty academics agreed that it is the role of the faculty to equip its graduates with the necessary attributes for employment.

*It is the role of the faculty but unfortunately we don't have the luxury of spending some time or enough time to develop this skill for our students because of the number of the students and the time dedicated to the courses (DIC).*

*Before the faculty prepares the student to work, it needs to provide him with basic knowledge which should be recent and up to date then develop in him the necessary skills needed by the labour market (DNC).*

Yet, some public faculty academics believed that the faculty role was not central and that students should also participate in developing their attributes while in education.

*It is the responsibility of the student and the faculty. The student needs to play a role in developing his skills by practising and acquiring more skills on*

*his own and the faculty needs to work on linking skills to its academic programme (DHC).*

*The faculty should start and the student should continue (DSC).*

Private faculty academics were agreed that it was purely the role of the faculty to equip its graduates with the necessary attributes for the labour market.

*It is purely the role of the faculty (DYE).*

*Sure it is the role of the faculty (DME).*

*It is the role of the faculty for sure (DEE).*

*The faculty should take a role in this (DNE).*

With respect to the literature, Jones (2009) stated that one of the cultural problems affecting the implementation of graduate attributes in taught courses was the faculty teacher who does not see attributes as one of his central roles.

From this perspective, it is posited that academics' lack of awareness of the central role of the faculty in equipping its students with the necessary attributes for employment caused the uneven teaching and learning of graduate attributes in courses in Egypt.

With respect to graduates, all said that the role of the faculty was central to equipping them with the necessary attributes.

*The graduate can help but it remains the role of the faculty to develop its students' skills (GMC).*

*No, it is the faculty's central role to do that. My role is only to assist the faculty to achieve its educational mission (GRC).*

*Both the faculty and me. The faculty acts as the sender and I am the receiver of knowledge or skills but anyway it is the role of the faculty (GDE).*

Similarly, all interviewed employers commented that it was the role of universities to prepare graduates for the labour market. They even recommended that the government should play a role in this by forcing universities to engage with the labour market.

*In the end, I think it is the role of the faculty... definitely the government has a role. In the end, the government is the entity that puts the laws through which universities and companies operate inside the country... so I am sure that it must have a role...at least to fill the gap between the private sector and the university (EM).*

*Yes, it is the role of universities, for the business market wants a student ready for work (EU).*

#### **Theme E: Quality measures**

All public faculty academics perceived their faculty to be effective in preparing graduates for the labour market because graduates are recruited immediately into the labour market. Their graduates meet 70% of labour market needs and the faculty has good facilities.

*On the local level, the faculty produces good graduates, and especially our department that is well known for its quality graduates to the extent that sometimes big companies may recruit 40 out of 70 fresh graduates all at once (DAC).*

*Seventy per cent of our graduates meet labour market demanded skills (DHC).*

*Very effective because we have very good computer labs (DIC).*

Most private faculty academics, however, perceived their faculty to be ineffective in preparing its graduates for the labour market because it mainly focused on teaching technical knowledge rather than attributes and did not communicate with the labour market to understand its needs.

*The faculty teaches students too many technical issues that stuff their minds whereas instead they should pay some attention to non-technical skills (DYE).*

*There is a big difference between what happens in the faculty and what happens in the labour market. Both sides are not keeping communication channels between one another to achieve the small transition for the graduate (DYE).*

*Well actually we are not strongly connected to the labour market, we are not engaged with the labour market to know what it wants and what it doesn't want (DEE).*

However, one private academic did perceive his faculty to be effective in preparing graduates for the labour market because, he said, they were not only capable of competing on the local market scale but also in the global market.

*Our graduate is quite different because of the non-technical aspects that we teach him here that allows him to compete in the global market...not only in Egypt, but also outside Egypt (DZE).*

With regard to public faculty graduates, most of them perceived their faculty to have been effective in preparing them for the labour market.

*They were very useful but the working environment here is different than the learning environment at the faculty (GMC).*

*They were very useful, we were taught the basics, those skills helped me achieve my work successfully (GAC).*

*Quite useful, communication and teamwork were most useful for my work here...actually teamwork is more important than communication in my job here (GSC).*

One public faculty graduate, however, considered her faculty to have been ineffective in preparing her for the labour market.

*The faculty unfortunately has not equipped us with enough skills to prepare us for work...we graduated well prepared technically but not with soft skills (GRC).*

As for private faculty graduates, most of them perceived their faculty to have been effective in preparing them for the labour market.

*It was effective for sure; most of the skills I gained were from the faculty (GDE).*

*The faculty in principle equipped me with the principal tools for employment but to be honest the work experience is completely different (GFE).*

One private faculty graduate felt his faculty had been ineffective in preparing him for the labour market.

*There weren't any...nothing.. look the faculty gave me quite a good experience like any place would do, it is not that I am not content with the faculty but it gave me a good education only... also experience in life. To be honest with you I gained my personal skills like leadership skills from my work in charity organizations (GME).*

All employers stated that universities were not doing enough to prepare their graduates for the labour market.

*Some of them do come prepared...and some of them do not come prepared (EU).*

*Some graduates come prepared and some graduates don't come equipped at all (EM).*

*Unfortunately no, they are not equipped (EH).*

*There is no single rule; sometimes I get someone prepared for work and sometimes I don't (EN).*

Employers were concerned that engineering faculties mainly focused on teaching technical knowledge and there was no communication between them and the labour market.

*Currently, engineering faculties only focus on teaching technical knowledge (EE).*

*Engineering faculties mainly focus on the technical parts not on soft skills (EU).*

*Not quite effective because the faculty teaches pure technical technical courses till you get blind (EG).*

With respect to the literature, Abdallah et al. (2008), the OECD (2010), Kandeel (2011), Bond et al. (2013), Korany (2011), El Nashar (2012) and UNESCO (2012), all stated that Egyptian universities can be criticised for not improving graduates' readiness for the labour market because their faculties mainly focus on the technical aspects of the curriculum rather than the attributes required for work. From this perspective, it is appears that the focus on teaching disciplinary knowledge affects graduates' readiness for the labour market.

#### **Theme F: Addressing the skills gap**

In order to improve attribute development in courses and thus graduates' readiness for the labour market, all public faculty graduates suggested that academics need to have a clearer method within their courses of emphasising employment qualities to students because technical knowledge remains most dominant in the teaching and learning experience.

*I suggest that academics need to have a clearer strategy for reflecting attributes embedded in courses to us, I could only feel technical content in all of what I studied (GAC).*

*I think the faculty should bring attributes to the foreground of the learning process and why they are important for the labour market (GMC).*

*I think courses need to be taught in a different way, they were all theoretical, I could hardly feel the soft bits we are talking about (GRC).*



All private faculty graduates said that “training” or student internships were important to improve graduates’ readiness for employment.

*The faculty needs to increase the training period so that the graduate can really touch ground with the labour market and the student needs to give this training considerable attention by comparing what he is studying and what the labour market offers (GDE).*

*I suggest more training during the summer to expose the students to what the labour market needs (GME).*

All employers said that graduates’ readiness for employment could be improved by developing graduates’ training experience while in faculty.

*Before he works, he needs during his academic life to practice teamwork in companies through training, for example (EA).*

*Training is very important; I wish students would take it seriously (EH).*

*I think real life practice is fundamental, students need to see real life while in faculty (EU).*

### **Theme G: Barriers to developing attributes in courses**

Interviewed academics identified a number of factors which they thought affected attributes development in courses. These factors were: attribute assessment strategies, centralised management, class size, faculty teaching load, and lack of communication with the labour market. One public faculty academic DAC suggested that the strategy adopted by his department, which allocated a large share (80%-90%) of the course marks to final examinations, had encouraged students to focus merely on course technical content rather than coursework assignments.

*Here in Egypt most of the mark or a big part of them is assigned to the final exam according to procedures so if the total mark assigned for a course is 150 you will find the final marked out of 90...so eventually when you weigh the final exam with 80 or 90% of the total mark, students will only focus on the*

*final exam and perhaps not giving the tasks assigned to them throughout the year adequate attention (DAC).*

*[with] a final exam representing 90% of the total weight, then what kind of skill will the student develop here? (DAC)*

DAC suggested that the strategy for assessing taught courses could be reviewed and revised so that assessment procedures would allocate course marks differently, for example on a 50%-50% basis, only then would there be a change with respect to attribute development in courses. This is because the main concern and constraint for attribute development within the courses, DAC claimed, is the high mark assigned to final examinations.

*If the procedures reweigh, reallocate or redistribute the grades otherwise, I think it will make a big difference....my only concern really is the large assigned weight for the final mark and accordingly the non technical skills part does not receive adequate attention, but if I assign 40% or 50% to the projects, it will make a difference (DAC).*

DAC also said that the faculty centralised management system, which adopts a top down approach, acts as a barrier to changing the assessment procedures, even if academics would be in favour of such a move. DAC commented that such a centralised management system affects course management since the faculty is the entity that controls the teaching process.

*The problem is in our university system which is centralised so everything is top to bottom. So if the doctor wishes to change anything, he cannot...So at the end it is not our decision (DAC)*

*It is a strange thing that the faculty tells the doctor how to distribute the marks... this limits how the course can be managed by the professor... (DAC)*

The law governing universities, part I: Clause 4: sub clauses 51 and 55: educational programmes (SCU 2006), says that educational programmes are to establish their own internal educational procedures that describe their course structures, outlines, textbooks, references and methods of assessment.

*Part I, clause 4, sub clause 51: educational programmes shall establish their own internal procedures for all available specialisations where each programme maintains its independent educational, administrative and financial structure (SCU 2006, p. 15-16).*

*Part I, clause 4, sub clause 55: academic programmes are required to develop their own internal procedures taking the following into consideration: (i) a clear description of course structure and outline, (ii) textbooks and references, (iii) methods of continual assessment ... (SCU 2006, p.16).*

In line with the legal requirements was a quote from DAC's head of department who said that the department's internal procedures allowed enough flexibility for student assessments.

*Our faculty members set their own assessment methods and how they wish to grade their students. Our internal procedure allows them to do so (DHC).*

By comparing the thoughts of DAC to clauses 51 and 55 of the law governing universities it could be argued that the law does not constrain attributes in courses since it allows academics enough flexibility to decide on their own assessment procedures. This means that some academics are not aware of the requirements of the law regarding student assessment procedures, which further explains why there is an uneven implementation of graduate attributes as student learning outcomes from taught courses.

Other public faculty academics DIC and DHC said that high student numbers were the main cause of all educational problems, and that, if solved, all problems within the university sector would be solved.

*We don't have the luxury of spending some time or enough time to develop this skill for our students because of the number of the students (DIC).*

*The massive student numbers if controlled, everything would solve itself (DHC).*

DIC suggested that large class sizes led most professors to focus on the technical side of the course rather than the non-technical side.

*Because of the student number, most of our professors care more about technical content than attributes in their courses (DIC).*

DHC said that decreasing academics' teaching load would allow them more time to focus on attribute development, since they require a lot of preparation time, unlike the technical skills which already exist in books.

*Off loading the instructor off loading [repeated three times] the instructor because skills are not in books and require a lot of preparation (DHC).*

The literature states that large student numbers and high teaching loads have a profound effect on teaching and the construction of graduate attributes (Sumsion and Goodfellow 2004; Jones 2009; Jones 2013). Yet, from the available data, computer departments have average student numbers of sixty to seventy in comparison to other departments such as civil engineering which can have up to 1,300 students. Also, the law governing universities sets a teaching load of 12 hours per week for assistant professors or professors in order to allow enough time for course preparation and delivery (SCU 2006).

*Part II, clause 15: assistant professors teaching load is 12 hours per week.*

*Professors teaching load is 10 hours per week.*

Comparing the findings concerning the law, student numbers within departments and faculty workloads, it could be argued that class size and faculty workloads do not constrain the development of attributes in courses as suggested by public academics. This means that some academics are not aware that this is the case, which in turn explains why there is an uneven implementation of graduate attributes through in taught courses.

Furthermore two private faculty academics, DYE and DEE, said that the teaching and development of attributes was not supported by the faculty since most academics maintain their awareness of employment needs informally, through their friends and graduates. This is was because there is no communication or discussion within the department or faculty with regard to graduate attributes or employment demands.

*Actually there is no agreed framework between employers and academics so they get to know about labour market needs by themselves and on a personal basis, such as by asking friends or graduates (DYE).*

*This lack of communication between departments in the faculty affected the way curricula are developed as well as taught by most academics (DYE).*

*Actually attributes development in courses is not discussed at all among academics (DEE).*

The minutes of the private faculty Advisory Board meeting revealed that every six months there is an industrial committee meeting that gathers CEOs and faculty department heads in the faculty to discuss all aspects of employability. From the minutes of these meetings, it is understood that CEOs advised academics to take the initiative and use their experience to solve industry problems, as currently they are not keeping track with industry needs. They also advised academics to take the initiative to visit the industrial sector to understand its problems and try to solve them. CEOs also emphasised the importance of changing curricula to address the need for certain employability skills such as teamwork, which is a necessity for employment.

*Universities must take the initiative to solve industry problems...currently the university is not keeping track with the needs of industry which has a severe need for academics' experience and knowledge (one of the CEOs).*

*Academics need to visit the industrial sector to understand the existing problems and hence be able to set up common projects between both sides to find solutions to the existing problems (one of the CEOs).*

*Curricula must be changed at the bachelor's level to keep students aware of the importance of teamwork that is very much missing in the Egyptian society (one of the CEOs).*

The outcomes of the documentary analysis suggest that communications with the labour market occur on the faculty level and thus should not be a principal cause affecting attribute development within courses. This means that some academics are not aware that there is a system in place to communicate with the labour market,

which further explains the limited implementation of graduate attributes in taught courses.

In conclusion, it is apparent that a number of factors affected teaching of attributes in courses and thus students' learning outcomes and eventually the skills gap. These factors were: academics' conceptual understanding of graduate attributes, their development and assessment in courses; students' lack of awareness of the nature of attributes embedded in courses; the gap between the attributes embedded in computer engineering courses and NARS requirements; the gap between NARS for computer engineering, ABET criteria for accrediting engineering programmes and the attributes suggested by interviewed employers; and the few academics who think that the faculty does not have a central role in equipping its students with the necessary attributes. It is important to note that there is no major difference between the public and private faculties except that some academics in the public faculty believe it is not the faculty's central role to equip its graduates with the necessary attributes for employment. These findings could be classified according to the literature into pedagogical, epistemological, student centredness, quality assurance and cultural factors (Barrie 2009; Barrie and Hughes 2010; Green et al. 2009; Jones 2009). As such, it is suggested with reference to the literature that academics in Egypt, the UK and Australia share common factors regarding the uneven implementation of graduate attributes in taught courses which means that the skills gap is a common phenomenon found across countries.

With particular focus on the Egyptian university sector, it is noted, based on research findings, that the public and private faculties share common factors that affect the teaching of attributes in courses. Although both faculties have different management systems, the similarity of findings can be understood and attributed to the governance under which they operate. For instance, they are both governed by the same law which controls Egyptian universities (SCU 2006), and the same Council which is the Supreme Council of Universities (SCU 2006; MOHE 2007; SCU 2010). These two

bodies may influence the within which academics of the private and public faculties operate, leading them to behave in a common way.

With further reference to the literature and the findings of this research, it is suggested that public and private academics' different conceptual understanding of graduate attributes, and development and assessment of such qualities in courses, have the most significant impact on students' acquisition of attributes and thus learning outcomes. This is not to suggest that other factors are not important, but to stress that the variation in the interpretation of the concept among academics is most significant or influential to attribute development and thus student learning outcomes. This has been previously identified by various authors (Harpe et al. 2000; Sumsion and Goodfellow 2004; Barrie 2006, 2007, 2009; Barrie and Hughes 2010; Green et al. 2009; Harpe and David 2012; Jones 2009, 2013). In order to understand why this variation in interpretations occurred among private and public academics (irrespective of their faculties and educational programmes, as well as why academics believed that attributes assessment strategies, centralised management, class size, faculty teaching load and communication with the labour market constrain the teaching of attributes in courses), the educational context in which they exist was analysed and explained using complexity theory. This is discussed in the next section.

#### **4.3 Analyzing Study Results using Complexity Theory**

With reference to the analysis of data and through an in-depth understanding of complexity theory ontological assumptions about context stripping, multiple processes, system connectedness, multi-factor causalities, de-centralised emergence, and its assertion that knowledge must be contextual as explained in detail in section (3.3.1.1 and 3.1.1.2), the factors affecting the teaching and learning of graduate attributes in computer engineering undergraduate degree courses were explored, as follows.

First, the recruitment process adopted by the faculties allows only graduates of high academic excellence at the bachelor level to be appointed as academics without a

teaching qualification and to continue in the system without penalisation or sifting at any stage (SCU 2006; UNESCO 2007). According to the law governing Egyptian universities

*Part III, clause 1, sub clause 68 & 136: appointed faculty members must: be graduates of the same department, and have a grade of very good or higher in the required speciality (SCU 2006, p.18 & 28).*

Such a recruitment system has indeed encouraged and privileged distinguished graduates to work within the system. However, it has also limited and constrained the emergence of new and innovative teaching and learning methods, thoughts and hence practices, and allowed these people to teach and assess students in the same way that they themselves were taught and assessed (UNESCO 2007; OECD 2010). As one of the public academics commented, “everyone tries to imitate his professor.” Such a mechanical system not only creates an imitative or iterative method of course teaching, learning and assessment, but also promotes an academic/department culture/environment that embeds imitated thoughts, work practices and behaviours (Divedi 1995; Greenberg and Baron 2000; Johns and Saks 2001; Dawson 2010). As such, academics might have become less motivated and empowered to recognise, introduce and affect change in the implementation of their work practices thus affecting work effectiveness.

Second, academics are only required and encouraged to conduct academic disciplined research for their career progression as well as academic promotions according to the requirements of the Supreme Council and the internal regulations of their departments.

*Part II, clause 1, sub clause 69 #2: Faculty members shall conduct academic disciplined research and publish it as appropriate (SCU 2006, p.17).*

In an academic teaching environment there is no obligation for scholarship of teaching and learning (SOTL) although they are encouraged to attend as part of their professional development a number of training courses offered by the NCFLD related



to teaching, scientific research, communication and leadership (SCU 2006; HEEP 2009a). However, training is not always an effective mechanism for changing and developing cognition since it lacks continuity of practice, as suggested by Chalam (2006). Tying academics' promotions and progression in the system solely to technical disciplinary research or projects has directed academics to favour technical knowledge. Over time, this has created an academic culture that favours only technical knowledge.

Third, there is no formal feedback system to appraise academics on their academic performance (UNESCO 2007; OECD 2010; SPU 2010), hence they remain unaware of potential areas for their improvement. This could be argued to have affected academics' awareness, understanding, motivation and empowerment to introduce change to their learning and teaching practices hence leaving their behaviour unchanged.

Fourth, the work environment includes a number of variables, such as the pay scale, fringe benefits, remuneration, and lack of equal opportunities, which could be inappropriate, frustrating and give academics an excuse to stay detached from the system and its operational procedures, hence leaving teaching practices unchanged (UNESCO 2007; OECD 2010).

Fifth, there is no incentive or encouragement to conduct industry based research or collaborative projects although CEOs have invited academics to do so in their meetings with them.

Sixth, industrial practitioners are not allowed to teach in academia because of the regulations set by the law governing Egyptian universities which allows only academics to teach (SCU 2006). These two last aspects have affected the potential to bring practitioners from the labour market into academia and vice versa, which would share the experiences of both sides (Leckey and McGuigan 1997; Harpe et al. 2000).

Finally the faculty system does not encourage or provide incentives for industry secondments (SCU 2006, p.21).

*Part II, clause 2, sub clause 84: Academics may be delegated to work on a full time or part time basis in other universities or other works subject to the approval of the department council followed by the college council then the president of the university.*

This indeed could be useful for academics to learn more about engineering technical and non technical practices through real life experiences which would potentially develop their awareness of how courses could be developed.

In a similar comparison to these findings, Jones (2013) using activity theory identified a number of contextual factors that affected Australian academics' teaching of graduate attributes. Examples of these were: department culture, class size, marking, delegation of teaching, organisational and administrative tasks and research, lists of graduate attributes generated in whatever way, how curricula were taught, the sequencing of subjects and methods of assessment.

#### **4.4 Conclusion**

The findings of this study suggest that if an academic is to engage in teaching and assessing attributes in computer engineering undergraduate courses, attention should focus on a number of factors. These are: academics' conceptual understanding of graduate attributes, their development and assessment in courses; students' awareness of the nature of attributes embedded in courses; the gap between the attributes embedded in computer engineering courses and NARS requirements; the gap between NARS for computer engineering, ABET criteria for accrediting engineering programmes, and the attributes suggested by interviewed employers; the few academics who think that the faculty does not have a central role in equipping students with the necessary attributes. According to the literature (Barrie 2009; Barrie and Hughes 2010; Green et al. 2009; Jones 2009), these factors could be grouped into:

- Epistemological: academics' different conceptual understanding of graduate attributes, their development and assessment in courses.
- Pedagogical: the gap between the attributes embedded in computer engineering courses and NARS requirements.
- Student centredness: students are not kept aware of the attributes developed in courses.
- Quality assurance: the gap between NARS for computer engineering, ABET criteria for accrediting engineering programmes and the attributes suggested by interviewed employers.
- Cultural: attributes are not seen as one of the central roles of the university teacher.

Based on these findings, it is suggested that there is no major difference between the public and private computer engineering departments with respect to the factors affecting the skills gap. Therefore, these factors could be understood as 'generic' for the computer engineering undergraduate discipline in Egypt. Yet by applying complexity theory across the full range of data, the contextual factors that caused the limited success of graduate attributes implementation and thus the skills gap were revealed. These factors for both faculties were: academics' recruitment, promotion and progression procedures, department/faculty culture which has an orientation towards disciplinary knowledge, lack of scholarship of learning and teaching, performance appraisal, the pay scale, fringe benefits and remuneration, no incentive to conduct industry based research, collaborative projects or industry secondments, and the fact that industrial practitioners are not allowed to teach in academia. The reason why both educational programmes produced similar factors is that the Egyptian higher education sector governs universities with the same law (SCU 2006).

To this end, this research has arrived at its contribution to knowledge by identifying the contextual factors that affect the teaching and learning of graduate attributes in computer engineering undergraduate studies, both private and public, in Egypt. In

order to affect change in the implementation of graduate attributes and thus reduce the skills gap, these factors were translated into a number of procedures to be implemented by higher education authorities in conjunction with the existing higher education policies which were not sufficient to promote the teaching and learning of graduate attributes in Egypt. These procedures were written into the policy document by grouping the different contextual factors based on their meanings and intentions for improvement. This is discussed in detail in the coming section.

#### **4.5 Summary**

In this chapter, the research findings were presented. The interview data were analysed based on the samples' experiences and perceptions which through analysis outlined the factors that affect the teaching of graduate attributes in computer engineering courses. The findings of the documentation analysis were also presented in support of the outcomes of the interview data. To remain specific, and through a detailed critical examination of the higher education sector based on complexity theory, the contextual factors which affected the teaching of attributes in courses were revealed. This allowed for an understanding of the drivers affecting the skills gap in Egypt. The findings of this chapter were the basis upon which the research output, which is a policy document for improving the skills gap in Egypt, was designed and proposed.

The next chapter presents the output of the research designed to improve the conditions for teaching graduate attributes in higher education in Egypt, particularly in computer engineering. It also includes how this strategy was reviewed and evaluated by a team of acknowledged practitioners in higher education.

# Chapter Five: Research Output and Validation

## 5.1 Introduction

In the previous chapter the research results were presented, analysed and discussed to arrive at an understanding of the different contextual factors that affected Egyptian academics' teaching and learning of graduate attributes in computer engineering undergraduate courses (both public and private). In this chapter the output of this research, which is a policy document, is presented. The following sections describe the basis of the policy document as well as the validation feedback received from a panel of experts in the Egyptian higher education sector.

## 5.2 Basis of the Policy Document

In 2000 the Higher Education Reform Strategy (HERS) was implemented through a number of reform plans or Higher Education Enhancement Projects (HEEP) to improve the Egyptian higher education sector (HEEP 2009a). Despite the efforts made to implement the strategy and the conditions created to improve the quality and efficiency of the higher education system the skills gap still remains (Abdallah et al. 2008; OECD 2010; Kandeel 2011; Bond et al. 2013; Korany 2011; El Nashar 2012; UNESCO 2012).

To reduce the skills gap and in line with the current laws and policies created by the Ministry of Higher Education to improve the university sector in Egypt, this study has created a policy document as research output. The decision to produce this form of output rather than other (e.g. physical model, process, tool, or a conceptual model) was made for a number of reasons. First, the current policies for higher education, which have been criticised for not achieving HERS intended outcomes, including the development of graduate attributes in taught courses, require the immediate attention of the Egyptian government with a view to improvement. This means that the Ministry

of Higher Education needs to take prompt action to change the existing policies while reform is under progress. According to Dawson (2010), policies are most appropriate for driving change because they seek to manipulate or influence complex systems such as governments, educational systems or societies (Dawson 2010). In the case of this research, the university system is the complex system under exploration. Second, a policy document would indeed assist the Egyptian government to make decisions compared to laws which can compel or prohibit behaviours. This is because policies guide towards a number of actions which are most likely to achieve a desired outcome (Dawson 2010).

For these reasons, a policy document was suggested as the output of this research. The designed policy document consisted of six main clauses (Appendix J). These are: 1. Purpose, 2. Scope, 3. Definitions, 4. Responsibilities, 5. Procedures and 6. References. Clauses 1&2 introduce the purpose and scope of the policy document; clause 3 defines a number of key terms used in the policy; clause 4 gives the details of any stated responsibility in the policy; clause 5 describes in detail procedural steps to be implemented in order to improve academics' performance in the teaching of graduate attributes in undergraduate degree courses (which is the main purpose and scope of the policy document); and clause 6 identifies relevant references used to develop the policy. The policy also consists of a cover page and a second page that describe the controls of the document. They include the document title, document type and nature of document, document reference #, document issuer and approver, document issue/revision #, document date of issue, and who the document should interest.

The overarching aim upon which the policy document was developed is to suggest to higher education authorities in Egypt as well as interested bodies such as the Supreme Council of Universities, National Agency for Quality Assurance and Accreditation in Education (NAQAAE), and the presidents of private and public universities, what needs to be done to improve the contextual factors (arrived at from

the research findings) that affect academics' performance in teaching graduate attributes on undergraduate degree courses. As universities in Egypt operate under the same contextual conditions identified in this study in (4.3), since they are managed by a common law (SCU 2006), the scope of the policy was set generic. This means that the content of the document could be transferred to inform other taught degrees or disciplines within the Egyptian university sector.

In this study the application of complexity theory (as described in 3.3.1) allowed an understanding of the Egyptian university sector through its ontological assumptions about context stripping, multiple processes, system connectedness, multi-factor causalities and de-centralised emergence (Haggis 2008). This understanding had identified, through data analysis, the contextual factors affecting the teaching and learning of graduate attributes in computer engineering undergraduate courses, which were found to be similar in both private and public faculties. It is important to note, however, that although there are contextual similarities in the area in which graduate attributes are taught that affect their implementation, there are also differences bounded to the nature of the discipline being taught (Haggis 2008; Jones 2013). These include class size, which is an important factor. Computer engineering undergraduate programmes of study, which are the scope of this research, are among the disciplines that are characterised by their small population size in comparison to other disciplines such as commerce, law or education where student numbers in one lecture hall can reach two thousand (SCU 2010). According to the regulations set by the Supreme Council of Universities, faculties such as engineering, medicine and pharmacy accept students with high secondary marks which forces students with lower marks to attend other faculties to continue in higher education (e.g. law, commerce or education). This has encouraged a high student to academic ratio in lecture halls as well as tutorials which, according to SPU (2010) and Bond et al. (2013), constrains student to academic interaction inside the class. Although measures were taken to improve teaching halls, laboratories and equipment, introduce open courseware for e-learning, improve academics' capacities to cope with large

cohorts of students, and to change a number of university branches into fully fledged universities, reports continued to criticise the suitability of graduate attributes for the labour market (OECD 2010; SPU 2010). According to OECD (2010), there is an urgent need to introduce new admission procedures to public universities to contain the high student numbers if universities aim to produce graduates fit for the labour market. The OECD (2010) report suggested that high student enrolments over the years in certain subjects such as the humanities and social sciences, have not only created a surplus of graduates for employment but also of graduates who lack many important attributes. This eventually led employers to become dissatisfied with graduate qualities (OECD 2010). With respect to the literature, Sumsion and Goodfellow (2004), Green et al., (2009), and Jones (2009, 2013) all agreed that large student numbers have a profound effect on teaching and the construction of graduate attributes which has an impact on students' learning outcomes.

Second to class size are the facilities and resources (libraries and information sources) that are required for public university education. Over the years, their limited provision affected the implementation of graduate attributes in specific disciplines such as law, commerce and agriculture (OECD 2010; Bond et al., 2010; UNESCO 2012). The engineering discipline, through the Engineering and Technical Education Project (ETEP), introduced in 1989, improved the quality and performance of public engineering faculties in order to improve engineering graduate qualities for the labour market (The World Bank 1999). The project involved a number of activities such as restructuring the labs and workshops of public engineering faculties (The World Bank 1989; HEEP 2010). In comparison to the engineering discipline, other specialisations were unchanged which had an impact upon academics' and students' teaching and learning experiences (UNESCO 2007; OECD 2010). Although HEEP aimed to modernise certain Egyptian faculties in line with global scientific and professional development by introducing the Faculty of Education through the FOEP, restructuring scientific departments, improving library and learning resources, establishing a unified network that links all universities with digital libraries and research centres through



ICTP, increasing education funds to form 4% of Egypt's GDP, and changing a number of university branches into fully fledged universities yet there are no reports on the success of these initiatives (HEEP 2014). With respect to the literature, universities' facilities and resources have a profound effect on the development of graduate attributes, and thus on student learning outcomes (Barrie and Hughes 2010; Green et al., 2009; Jones 2009, 2013).

Third, are the traditional teaching, learning and assessment methods which in some undergraduate disciplines emphasise rote learning and memorisation (UNESCO 2007). In comparison to the engineering curriculum which is largely based on 'know how', other disciplines encourage students to learn by rote in accordance with the nature of the course (e.g. law and business) (UNESCO 2007). The SPU (2010) and OECD (2010) suggested that rote memorisation across the years has hindered graduates from developing the necessary attributes required by the workplace. Despite HEEP initiatives to improve students' learning outcomes in Egyptian undergraduate degrees, including changes to academics' traditional teaching and learning methods through different NCFLD training programmes, academics still adopt traditional methods for student learning and assessment (UNESCO 2007; Golia 2008; OECD 2010; Bond et al., 2013). With respect to the law governing Egyptian universities, Part I: Clause 4: sub clauses 51 and 55: educational programmes (SCU 2006), says that educational programmes are to establish their own internal educational procedures that describe their courses structure, outline, textbooks, references, and methods of assessment.

*Part I, clause 4, sub clause 51: educational programmes shall establish their own internal procedures for all available specialisations where each programme maintains its independent educational, administrative and financial structure (SCU 2006, p. 15-16).*

From the law it appears that academics have enough flexibility to decide on their own teaching and assessment strategies. It is deduced that academics' mechanisms for teaching, learning and assessment have an orientation towards rote learning because

the Egyptian education system, from the early stages until university, emphasises rote learning and assessment although the law encourages otherwise (UNESCO 2007; OECD 2010; UNESCO 2012; Bond et al., 2013). In that regard Barrie and Hughes (2010) and Jones (2013) suggested that teaching and assessment methods have a profound effect on the implementation of graduate attributes and thus students' learning outcomes. This means that Egyptian academics need to change their teaching and assessment methods in a way that would encourage graduates to develop the necessary attributes for work and life.

In the light of the above factors class size, rote learning, faculties' limited facilities and resources it is suggested that there are a number of specifics that exist in the Egyptian university sector which are related to certain disciplines and that affect the teaching and learning of graduate attributes in taught courses. These specifics were not taken into consideration when designing the policy document. The latter was designed based on the findings of this research, as explained in (4.3), which reflect the common, generic contextual factors that affect the implementation of graduate attributes in all undergraduate courses and disciplines. Academics' recruitment process, promotion and progression into academia, for example, is a common process that is implemented in a similar way across all Egyptian faculties according to the law governing the country's universities (SCU 2006). The intention of the policy document is to provide generic guidelines (rather than specific or discipline oriented) for advice on how to improve Egyptian academics' performance when teaching graduate attributes in all undergraduate degrees. To achieve this goal the generic, similar, and common contextual factors arrived at in this study through the application of complexity theory were used to form the basis of the policy document. This is not to suggest that differences among undergraduate disciplines are not important, they are, because they affect attribute implementation in taught courses, yet they are too specific to be part of a generic policy document intended to improve all undergraduate disciplines. This could be considered a limitation of the policy document. It is important to note that if policy makers choose to implement the policy document for a particular

discipline, then specifics such as class size, rote learning, and the availability of limited facilities and resources must be taken into consideration.

In order to develop the content of the policy document (Appendix J) consideration was also given to the research problem which was first determined through the literature review that was carried out to identify the factors, reasons and barriers affecting the skills gap in Egypt and internationally. As mentioned in the literature review, a number of factors were highlighted as affecting the teaching of graduate attributes and thus the skills gap. These were: pedagogical, epistemological, cultural, intrinsic and structural, and also had to do with student centredness, quality assurance. Yet, there was a gap in knowledge with respect to the contextual factors affecting the teaching and learning of graduate attributes in taught courses in most studies, including the Egyptian university sector. Second, the assessment of the research problem and the evidence base built through the results, reached by applying complexity theory as a conceptual framework, to identify the contextual factors affecting the skills gap in Egypt. Using complexity theory, and by collecting data from eleven academics and nine graduates belonging to two different computer engineering undergraduate programmes (one private and the other public), the contextual factors that affected the teaching of graduate attributes in the computer engineering discipline in Egypt were identified. To ensure the validity of the data, more was collected from seven employers, as well as from the documentation that represents the different educational policies and practices implemented in both private and public programmes of study. This data was also analysed and considered to arrive at the factors. At the end of the data analysis and synthesis, the research results identified the contextual factors that affected the teaching and learning of graduate attributes in computer engineering undergraduate studies. These factors were then translated into a number of policies and procedures that could be implemented by higher education authorities as well as interested parties.

With reference to the policy document which can be seen in Appendix J, the procedures in sections 5.3 to 5.7 are groupings of the contextual factors that affect the implementation of graduate attributes. This grouping was based on factors' meanings and goals for improvement. For example, clause 5.3 describes all that is related to graduate recruitment in academia, scholarship for teaching and learning, the pay scale, fringe benefits and remuneration; clause 5.4 describes aspects related to academics' career development within the academic system (i.e. progression, promotion and appraisal), including department/faculty culture and collaborations with the labour market; clause 5.5 describes rewards for academics; clause 5.6 describes aspects related to Egyptian employers; and clause 5.7 describes improvements to quality standards.

With respect to clause 5.3, the policy document proposes that new graduates recruited to the post of Graduate Teaching Assistant (GTA) are appointed based on a number of factors rather than disciplinary knowledge alone, as currently required by the law governing Egyptian universities (SCU 2006). These factors are: graduates' awareness of disciplinary knowledge, graduates' previous work experience in a field related to his/her degree specification (preferable one year or more), graduates' assessment and feedback on internships/training/clinical work while in university, and that no special preference should be given to recruit graduates of one school in the same school (as applicable). The aim of these procedures is to improve current policies for recruiting graduates into academia in order to ensure that they acquire the necessary attributes for work. This is important for creating an academic teaching and learning culture that appreciates and values graduate attributes rather than disciplinary knowledge alone (more details about these factors are given in the policy document). These different factors were suggested in line with previous literature (Green et al. 2009; Barrie 2009; Barrie and Hughes 2010; Harpe and David 2012; Jones 2009, 2013).

In clause 5.4, the policy document indicates that academics be promoted and progress into the academic system based on interdisciplinary and multidisciplinary research, rather than on interdisciplinary research alone as currently required by the law governing Egyptian universities (SCU 2006). This allowance is intended to improve academics' teaching and learning practices which should in turn create a culture that appreciates different types of researches (JISC 2012; HEA 2013). Besides non-disciplinary research work, it was also proposed in clause 5.4 that there should be more formalised relationships between industry/the labour market and the university in the form of industry/labour market based research, community service, collaborative projects or industry/labour market secondments for interested academics. Such relationships should take into account the necessary incentives that would encourage academics to perform these tasks. The aim of this bond would be to keep academics aware of the attributes most needed by labour market, to keep the labour market aware of the disciplinary knowledge and attributes taught in faculties; this should bridge the skills gap between the two. Clause 5.4 further suggests that there is a need to appraise academics for progression within the academic system based on their personal attributes and abilities to teach students rather than just allowing students to evaluate them based on their ability to teach disciplinary knowledge.

In clause 5.5, the policy document says that universities should encourage a system to reward academics based on their teaching performance as well as effective implementation of graduate attributes in taught courses. This might include salary increases, more fringe benefits, and better remuneration for those academics showing commitment to quality in teaching and learning. The necessary funds should form part of the university annual budget set for education and this should be announced to all academics to inform and motivate them with regard the value of effectively teaching graduate attributes in taught courses.

In clause 5.6, the policy document advises that well-recognised employers should be invited to teach a course of study in academia or to conduct lectures on a frequent

basis. The aim would be to create a learning environment that is similar to the workplace and to feed experiences from industry/the labour market into the design of courses. The main focus of these lectures should not only be the improvement of disciplinary knowledge but also awareness of the labour markets' needs, particularly with regard to graduate attributes. Academics could make use of these visits to obtain regular feedback from businesses or employers on their learning outcomes.

In clause 5.7, the policy document recommends that there should be formalised reviews of National Academic Reference Standards (NARS) developed by NAQAAE to update and forecast the attributes required for employment. This is a significant aspect in the light of the study findings which showed that NARS for computer engineering do not address the attributes required for Egyptian employers. Also, it was suggested that NARS should be developed with the support of Egyptian employers as their feedback would inform higher education practitioners of the important learning outcomes for employment.

### **5.3 Research Findings Evaluation**

As previously mentioned in (3.10), the research findings and contribution to knowledge were discussed in a focus group with a panel of acknowledged experts in the field of higher education. Their feedback included a number of important remarks which were taken into consideration when designing the policy document. First, they all agreed that computer engineering graduates lack the necessary attributes for employment; this despite initiatives such as HEEP taken to improve them. Second, they all agreed that the second Egyptian revolution had an impact on academics' awareness of graduate attributes, as before the revolution there were meetings and initiatives between higher educationalists and other parties, such as the World Bank, the French Institute, the British Council and the Goethe Institute, to conduct training sessions with a view to improving academics' teaching skills. After the second Egyptian revolution, these meetings decreased in number, negatively affecting academics' teaching performance. Third, they all agreed that a range of factors affected attribute

development in engineering courses. These were: academics' resistance to the amendment of their traditional teaching methods; academics' lack of teaching skills; the recruitment process, which by law appoints top of class graduates without considering any teaching qualifications or personal attributes; students' appraisal outcomes, which are not fed into the learning process because they are not taken seriously by academics; and academics' progression within the system with a lifetime contract and no sifting or penalisation based on performance. Fourth, two evaluators agreed that to change academics' practices with respect to attributes development in courses, the Egyptian law governing universities should be changed, because it is too old to align with contemporary higher education dynamics. Two other evaluators thought that the law was not adequate and that changing academics' beliefs will and desire with respect to the teaching and learning process were key to changing work practices, behaviour, and culture.

Consideration was given to these comments while designing the policy document, as described in (3.10). Of the seven evaluators, only five replied and their comments are discussed in the next section.

#### **5.4 Evaluators' Feedback on Policy Document**

The five evaluators were agreed on the importance of the policy document for reducing the skills gap in Egypt. They also agreed to the timing of the policy, especially that Egypt's higher education sector is undergoing a period of reform through HEEP.

*I think the timing of the policy is appropriate especially that HEEP is still under implementation (EV2).*

All evaluators made a similar comment with respect to including more details in the policy document about the research study undertaken to reduce the skills gap (clause 5.1.1, 5.1.2 and 5.1.3). This would involve writing more about the contextual factors that affect academics' performance with regard to teaching graduate attributes in undergraduate courses. Among other suggestions was the need to improve Graduate

Teaching Assistants' (GTAs) skills in language and computer literacy to improve their teaching performance rather than just focusing on pedagogical skills as was proposed in the policy document (clause 5.3.3).

*A Pedagogical Training Certificate is a must when applying for a GTA, in addition to language and computer literacy requirements (EV1).*

EV1's opinion was appropriate and was therefore included in the policy document as it aligns with the existing literature which pointed to the importance of equipping students with the appropriate language and computer skills for employment (Dearing 1997; CBI 2009; MENA 2009; OECD 2010; SPU 2010; RAEng 2010). In fact, the literature pointed to other important attributes for employment, such as communicating with others, teamwork, thinking innovatively and creatively, and self-esteem and motivation, all attributes which ensure for graduates' preparedness for the labour market. Yet, to equip students with these attributes, academics need to acquire them first, as EV1 suggested. This means that academics should attain the necessary attributes (including language and computer skills) in order to ensure effective teaching methods in courses. With regard to clause (5.3.1) of the policy document, EV1 also suggested that if graduates were needed to teach in one faculty, they should not be graduates of the same faculty. This, he felt, would reduce the closed loop effect of recruiting GTAs from the same faculty which currently occurs as a result of the legal requirements governing Egyptian universities (SCU 2006). According to EV1, such a practice has, over the years, allowed an academic/department culture/environment that embeds imitated thoughts, work practices and behaviours since GTAs tend to teach the same way they have been taught by their professors.

*An open advertisement policy for GTAs should be observed with no special preference for graduates of the same school to reduce self-breeding effects (EV1).*

EV1's comment was appropriate and was therefore included in the policy document as it aligns with the literature which stated that the diversification of a work culture including knowledge, habits, values and attributes improves work practices as well as behaviours (Divedi 1995; Greenberg and Baron 2000; Johns and Saks 2001; Dawson



2010). In her research, Jones (2013) stressed the role of context in influencing the conceptualisation and teaching of graduate attributes. She argued that to successfully implement graduate attributes in taught courses, consideration should be given to departmental work culture since at this level graduate attributes are operationalised in the form of descriptors, course outlines and curriculum structures. In the same way, regarding academics' performance, EV1 suggested that in order to change (clause 5.4.3), community service and projects must be considered as a condition for faculty promotion within the academic system and not only non-disciplinary research as was originally stated in the suggested policy. EV1 believes that communication and interaction with real life events, projects, and community services promote personal attributes and knowledge which are core characteristics required of an academic involved in designing and teaching courses of study.

*Community service and projects should be strongly considered in addition to research work (EV1).*

EV1's comment was appropriate and was therefore included in the policy document as it aligns with current literature which states that human cognition is developed through the continuity of practice be it projects, activities or both (Chalam 2006). HEA (2013) and JISC (2012) also suggested that self learning is an important attribute that needs to be acquired by academics. This, however, may not happen except through the exchange of experience with peers, community service or societal activities. Another evaluator (EV2) was pleased by and agreed with the contents of the policy document, particularly the parts that aimed to change the law governing Egyptian universities (SCU 2006). In his opinion, the current law does not meet the requirements of the current strategies set for developing the higher education sector in Egypt.

*In principle I agree with the content of your policy. It discusses in detailed steps how to improve academic performance for teaching employability skills which as a NAQAAE board member I see as an important aspect of student learning outcomes. I am happy that you referred to the law governing Egyptian universities which definitely requires change as its legislations are outdated and do not align with many strategies set for improving the higher education sector in Egypt. In general terms, your policy is comprehensive and*

*has many new thoughtful, ideas which I can recommend from my position to reduce the skills gap (EV2).*

EV3, EV4 and EV5 agreed with the content of the policy document, but had a number of recommendations to make, such as: reviewing and revising some of the stated responsibilities of the NAQAAE, NCFLD and GTAs (clause 4); adding more detail in clause 5.1.1 about the research findings that produced the policy document, and adding a few words to give more meaning to some of the written sentences. Also, there were comments such as the one made by EV4 in relation to clause 5.4.3 which, prior to validation, stated that: “besides non-disciplinary research work, there should also be more formalised relationships between industry/the labour market and the university in the form of industry/the labour market based research, collaborative projects or industry/the labour market secondments for interested academics”. Her comment was that if this were to occur, then not only should the universities be accountable, but also the labour market.

*This is an important point but does not depend only on the university, but also on the industry firms (EV4).*

EV4's opinion was seen to be appropriate and was therefore considered as part of the policy document as it aligns with current literature which necessitated the mutual role of the labour market and the university to improve the teaching of graduate attributes in taught courses (Leckey and McGuigan 1997; CBI 2009; HEA 2013). The International Labour Conference (2008) and CBI (2009) both stressed the importance of employers' engagement with universities to share knowledge and experience through lectures or workshops to encourage enterprise and entrepreneurship. They also stressed the need for employers to run skills sessions on campus to introduce students to the skills employers value. EV4 questioned some clauses that discussed the need to financially reward academics who show commitment in effectively teaching graduate attributes in taught courses and to determine the source of funding. EV4's opinion was seen to be appropriate and the policy document was therefore amended in some clauses to give more information about funding and financial detail.

According to Egyptian policies, the higher education sector accounted for 10% of the state budget (MOF 2013) and this was criticised by many Egyptian members of parliament who believe that it should be increased if the country aimed to improve the quality of its higher education (OECD 2010). After the second and third Egyptian revolutions (2011 and 2013), however, the constitution was changed and approved and academics' salaries were increased. Furthermore, the budget for Egypt's higher education sector changed to form 4% of Egypt's GDP (Bond et al. 2013; Serageldin 2013), which means that more finance could be provided to improve university education, including a contribution for graduate attributes. Based on the feedback obtained from the evaluators, the necessary changes were made to the suggested policy document (Appendix J).

### **5.5 Summary**

This chapter discussed, the research output; namely, a policy document suggesting how academics' performance when teaching undergraduate courses (responsible for the skills gap) could be improved. The chapter also discussed how the policy document was evaluated, and the feedback received.

# Chapter Six: Research Contribution to Knowledge, Conclusion and Recommendations

## 6.1 Introduction

In the previous chapter, the output of the study and the validation process were presented and discussed. In this chapter, the contribution to knowledge is presented, pointing out what has been achieved in comparison to the stated aims and objectives. At the end of the chapter, the research conclusion and recommendations are presented.

## 6.2 Achievement of Research Aims and Objectives

As stated in chapters 1, 2 and 3, the research asked two main questions:

- 1- What are the contextual factors which affect the skills gap within the Egyptian computer engineering undergraduate discipline?
- 2- How can the skills gap be reduced to meet the demands of the Egyptian computer engineering labour market?

In order to answer these research questions, the objectives of this study are to:

- 1- Evaluate the current status of university education in Egypt, with particular focus on engineering undergraduate education.
- 2- Identify the contextual factors that affect the skills gap within the Egyptian computer engineering undergraduate discipline.
- 3- Analyse these factors to understand how to reduce the skills gap.
- 4- Provide guidelines through a policy document for higher education authorities in Egypt to reduce the skills gap.

The research questions, aims and objectives were addressed through several stages. The first stage was mainly theoretical as it was based on a review of literature resources. A review of previous studies showed that there are a number of factors affecting the teaching and learning of graduate attributes in undergraduate courses.

These were: pedagogical, epistemological, cultural, intrinsic, structural, student centredness, and quality assurance. However, there was a gap in knowledge with respect to the contextual factors affecting the implementation of graduate attributes internationally and in Egypt. The literature review informed the researcher of how to explore these factors in terms of the conceptual framework to be adopted, the sample type and size, and the questions to be asked of interviewees, in order to arrive at an in depth understanding of the different contextual factors affecting the teaching and learning of graduate attributes in undergraduate courses. The review enabled the achievement of the first objective as it gave a clear picture of the current status of university education in Egypt as well as how previous studies had arrived at an understanding of how to improve the development of graduate attributes in courses. The second stage consisted mainly of collecting, analysing and synthesising semi-structured interview data from different sample groups - academics and graduates – who belonged to two different computer engineering undergraduate programmes, one private and the other public. To ensure the validity of the data, more was collected, analysed and synthesised from seven employers and also from the document that presented the different educational policies and practices implemented in both private and public programmes of study. Thus through the literature review data collection, and analysis, the first research question was answered, as were the second and third research objectives. This step allowed the identification, analysis and synthesis of the factors which might be affecting the skills gap in computer engineering undergraduate courses. The second question posed by the research was how to reduce the skills gap to meet the demands of the Egyptian computer engineering labour market. This question was answered through the policies and procedures proposed in the policy document (Appendix J) and thereby addressing the fourth objective.

### **6.3 Research Contribution**

The research contribution to knowledge was identifying the different contextual factors that affected the teaching and learning of graduate attributes in the computer engineering undergraduate discipline (in both public and private universities). This contribution was developed by analysing and synthesising the full data collected from

various participants (academics, graduates and employers) as well as the relevant documentation, using complexity theory, to provide for the first time a comprehensive understanding of the contextual factors affecting the skills gap within the Egyptian university sector. For the computer engineering undergraduate discipline, public and private, these factors were: academics' recruitment, promotion and progression procedures, department/faculty culture which has an orientation towards disciplinary knowledge, lack of scholarship of learning and teaching, performance appraisal, the pay scale, fringe benefits and remuneration, no incentive to conduct industry based research, collaborative projects or industry secondments, and industrial practitioners who are not allowed to teach in academia.

Based on the findings of this study, these factors provide a source of information which was not available before as, throughout the literature reviews conducted, it was difficult to find recent data related to the contextual factors affecting the skills gap in Egypt. Although previous studies identified a number of factors that affect the teaching and learning of graduate attributes in Australia, these studies were not sufficient in the context of teaching strategies to effectively promote the development of generic attributes. From this view-point, it became pertinent to provide newer insights into the contextual factors that affect the teaching and learning of graduate attributes. Previous studies overlooked the contextual factors that affect the development of graduate attributes in taught courses in wider contexts of study (i.e. the educational programme, faculty and university levels) (Harpe et al. 2000; Sumsion and Goodfellow 2004; Barrie 2004, 2006, 2007, 2009; Green et al. 2009; Barrie and Hughes 2010; Harpe and David 2012; Jones 2013). In this study, these factors were revealed within the Egyptian university sector. Through the lens of complexity theory and its ontological assumptions about context stripping, multiple processes, system connectedness, multi-factor causalities and de-centralised emergence, and the assumption that what emerges depends on what interacts, there was a shift from determining key specific factors existing in local contexts to multi-layered descriptions and analysis (on the

university, faculty and educational programme levels) that document the complexity, nonlinearity and critical connections of the processes involved.

In comparison to traditional approaches for data analysis as well as activity theory used by Jones (2013) to identify the contextual factors affecting the implementation of graduate attributes, complexity theory (described in 3.3.1) provided a much more comprehensive understanding on the conceptualisation of graduate attributes in relation to context. A complexity framing was able to investigate the ways in which aspects of larger system interactions (e.g. universities, faculties, educational programmes, councils, committees, administrative structures and stakeholders) function within a specific smaller case. Where, traditional approaches appreciate the similarities encountered by comparison (leading to the ability to formulate a common theme) the complexity method highlighted the differences as well as the similarities. The complexity approach was also helpful in relation to the conceptualisation of the Egyptian university sector, and the confusion that results from the merging of the context of the case with the contexts of the lives and histories of those being interviewed within the case. Thinking of individuals (academics, students, graduates, employers) and systems (educational programmes, faculty, university) as a complex, open, dynamic systems allowed for the separation of these two different types of context, even though they are embedded in each other. The shift from analysing sub-systems constituting the Egyptian university sector as if from outside sub-units (as in traditional approaches), to thinking about both the sector and its sub-components as open systems made it possible to study specificity in relation to academics teaching and learning practices from a very different perspective thus arriving at an understanding of why earlier reform plans in Egyptian universities have not achieved their expectations with respect to improving the skills gap. Through complexity theory, each academic was seen as a point within a number of different intertwined dynamic systems which also has its own history through time.

With respect to research findings, complexity theory provided new insights into processes such as academics' recruitment, which revealed that existing procedures have indeed encouraged and privileged distinguished graduates to work back into their faculties, yet at the same time it has limited and constrained new innovative teaching and learning methods, thoughts, and hence practices, leaving graduates to teach and assess students in the same way they had themselves been taught and assessed. In the educational context, this had not only allowed imitated or iterative methods of course teaching, learning and assessment in academia but rather an academic/department culture/environment that embeds imitated thoughts, work practices and behaviours which potentially trigger academics to become less motivated and empowered to recognise, introduce and affect change in the implementation of their work practices.

Another aspect illuminated by complexity theory was the method by which academics' move into the academic system, where career progression and promotion are based solely upon the undertaking of disciplined research, as laid down in the requirements of the Supreme Council of Universities and the internal regulations of departments. Furthermore and according to law governing Egyptian universities, academics are not obliged to have a scholarship of teaching and learning (SOTL) qualification, although as part of their professional development they are encouraged to attend a number of training courses offered by the NCFLD (a certified training centre in higher education) and related to teaching, scientific research, communication, and leadership. Yet, as previous studies have revealed, training is not always an effective mechanism for changing and developing cognition since it lacks the continuity of practice. It could therefore be said that tying academic promotions and progression within the system to technical disciplinary research or projects alone has led academics to place greater value on technical knowledge, and this over time has created an academic culture that appreciates only technical knowledge.



Among the factors complexity theory made it possible to uncover is the lack of a formal feedback system for appraising academics on their academic performance, which leaves them unaware of areas for their potential improvement. This could be said to have affected academics' awareness, understanding, motivation and empowerment to bring about change to their learning and teaching practices, hence leaving those teaching practices unchanged. Also the work environment, incorporating a number of variables including the pay scale, fringe benefits, remuneration and lack of equal opportunities, may seem inappropriate and frustrating to academics, thus giving them excuses to stay detached from the academic system and its operational procedures.

Also, complexity theory allowed for a better of further contextual factors that influence academics' teaching and learning of graduate attributes. These included: 1.) the lack of incentives or encouragements to conduct industry based research or collaborative projects, although CEOs have invited academics to do so in their meetings; 2.) industrial practitioners who are not allowed to teach in academia because of the regulations set by the law governing Egyptian universities which only allows academics to teach. These two aspects could be said to have affected the potential to bring practitioners from the labour market into academia and vice versa which could be a useful experience for both sides; and 3.) the faculty system which does not encourage or provide incentives for industry secondments. If reversed, this factor could provide academics with a way to learn more about engineering technical and non technical practices through real life experiences which would help develop their awareness of how courses could be developed.

Based on these multi-layered explorations of the Egyptian university sector, complexity theory has thus allowed for an in depth appreciation that graduate attributes, as a concept, are at the heart of a number of complexities and that to improve them, such complexities need to be addressed. This means that reform plans and changes to laws will not bring about the expected changes in contexts of studies

unless they are preceded by a critical examination of the context to which they will be applied. Complexity theory thus informs us - through its ontological assumptions about time, multi-factor causality, emergence and the assumption that what emerges depends on what interacts - that the problem of effectively implementing graduate attributes in educational contexts will remain in existence until change occurs in a number of contextual parameters that exist in the area in which they are implemented.

Another contribution of the research was the first time introduction of a policy document to guide the improvement of graduate attributes in undergraduate degree courses. The policy aims to provide solutions that move on from what has been published to date about the improvement of graduate attributes in undergraduate taught courses. It identifies in depth the improvements that need to be made to existing policies to reduce the skills gap in Egypt. The document is generic which means that its content of the document could be transferred, applied to and used to guide all taught disciplines within the Egyptian higher education sector and not just the computer engineering discipline. This is because the whole of the university sector in Egypt operates under the same policies since universities (public and private) are governed by a common law (SCU 2006). The policy document provides a set of procedures that are deemed helpful in guiding the improvement of the teaching and learning of graduate attributes in university undergraduate disciplines (both public and private). It was developed in accordance with:

- The research problem which was determined through the literature review.
- The assessment of the research problem and the evidence base built through the results reached by applying complexity theory as a conceptual framework to identify the contextual factors affecting the skills gap in Egypt.

The policy document (Appendix J) successfully answered the research questions and achieved its goals and objectives. It could be used to guide other university sectors on how to improve their skills gap. The method, starting with an appropriate contextual literature review, and followed by an application of the research methodology until

enough contextual data have been collected, would allow the development of a policy document appropriate to that country.

#### **6.4 Research Limitations**

Although the output of this research provided deep insights and new understandings of the contextual factors affecting the effective implementation of graduate attributes in undergraduate courses, these insights remain only explanatory. This means that this research explains why the problem existed and how it can be improved, but there is no guarantee that the skills gap will be reduced if research suggestions are put into action. This is because complexity theory is a theory for the here and now. It provides direct advice on how to focus efforts when preparing for teaching. For educationalists this is to know that, whilst complexity theory may offer suggestions for practice, it gives no guarantees; it is a theory without responsibility, accountability or predictability. Certainty is elusive. Also, research findings may not offer a complete reading of education. This is because they only highlighted the factors affecting the teaching of graduate attributes without pointing to how much or how little they do so, without discussing which suggested improvement needs to be implemented first; and without an explanation of why participants gave the answers they gave.

Complexity theory is highly pragmatic and regards knowledge as a social construct made by its participants at a particular socio-historical-geographical juncture. This means that the findings of this research cannot be generalised and are only applicable to Egypt based upon the abstract knowledge created in relation to academics' practices. Yet, the study could inform other university sectors that implement educational and quality assurance policies and procedures similar to those of the Egyptian university sector. This could, for example, be applicable to regional countries as well as OECD developing countries.

#### **6.5 Conclusion**

The key conclusion from this research is that a concept such as graduate attributes is at the nexus of a number of complexities that affect their teaching and assessment in

taught courses. Yet, these complexities are not only pedagogical, epistemological or cultural but also contextual. Based on this research it should be understood that, because the contextual conditions influencing the effective implementation of graduate attributes were overlooked in previous studies, that implementation was patchy and of limited success. It should also be understood that in order for Egypt's higher education reform plan to be successful, the environment or wider context in which graduate attributes are taught and assessed should be critically examined and evaluated. Furthermore, the existing policies laid down by the law governing Egyptian universities should be amended to address the contextual factors found by this study.

### **6.6 Recommendations**

The output of this research was a policy document which aimed to guide higher education authorities in Egypt on how to improve academics' teaching and learning of graduate attributes in undergraduate courses to reduce the skills gap. In order to achieve such an aim, it is first important to raise the awareness of decision makers about graduate attributes, and especially concerning the contextual factors affecting their effective implementation in university education. To do so, the policy document needs to be presented to decision makers or at least to those who have access to decision makers. This could be achieved most appropriately by publishing the findings of this research, including the policy document, at national conferences and in academic journals where people concerned with the educational process in Egypt usually look for developmental ideas. In parallel to this, awareness and implementation of the policy document could be significantly enhanced by a powerful person who understands and has empathy with the philosophy of education and particularly those areas relating to graduate attributes and the opportunities offered through its improvement. This person or 'champion' should have access to the highest political and decision making levels. His/her role would be significant in the implementation process of the policy document as higher level authorities' awareness and understanding could remove any obstacles to the implementation process. This 'champion' should have a positive perception about graduate attributes and their

impact on employment and should work on transferring this positive perception to other higher level management and academic staff at universities.

The search for a 'champion' would begin with further publicity through academic presentations and publication at national conferences to raise awareness of the policy document. This could be expected to lead to discussions with academics and would continue through contact with government officials who are concerned with the development of higher education. These include but are not limited to members of the Supreme Council of Universities, the National Agency for Quality Assurance and Accreditation in Education, and presidents of private and public universities. These officials could be accessed using several forms of communication. On a general level, forums and conferences or other academic events focused on higher education development could be used to build a background for the research purpose, aim, objectives, findings and output. On a more focused level the research would also be discussed at conferences with senior academics as well as key governmental officials concerned with the development of higher educational processes, the research will also be discussed. If these meetings are granted, the policy document would be presented to the officials with a brief introduction of the research findings and how they were reached. The discussion with government officials should include and emphasise the following issues:

- The need to improve the contextual factors affecting the teaching and learning of graduate attributes in Egyptian universities.
- The importance of amending the law governing Egyptian universities to include new policies that address these contextual conditions.
- The need to raise academics' awareness regarding the effective implementation of graduate attributes in taught courses. This is an opportunity for academics to 'unpack' graduate attributes so that they can better understand and implement them according to the National Academic Reference Standards (NARS).

- The importance of having more formalised bonds between industry/labour market and universities where such established engagement should take account of the necessary incentives that would encourage academics to perform the necessary tasks.
- The need to develop NARS with the support of Egyptian employers as their feedback will inform higher education practitioners of the important learning outcomes for employment.
- The importance of having more formalised reviews of NARS developed by NAQAAE to update and forecast the attributes required for employment.
- The need to encourage employers to teach a course of study in academia, or to conduct lectures on a frequent basis, to acquaint students and academics with labour market needs.

All of these points are important to be informed and in depth discussion with government officials, following which the 'champion' can take the lead. However, the 'champion' should be convinced first that graduate attributes form a core element of the educational process and they are necessary to driving the country's socio-economic goals.

With reference to the policy document, the implementation of the procedures suggested to reduce the skills gap should be prioritised so that it begins by changing the Egyptian law governing universities which dates back to 1972. This is because the law is the main driver of all universities' (public and private) work operations. In that regard, the clauses which relate to graduate recruitment should stipulate that new graduates are employed according to their: awareness of disciplinary knowledge, personal attributes, potential to teach in academia, previous work experience in the field related to his/her degree specification (preferable one year or more), assessment and feedback on internships/training/clinical work while in university, and that there should be no preference given, as appropriate, to the recruitment of graduates to the school from which they graduated. The law should also encourage public universities

to recruit graduates of other universities, either within Egypt or outside, into their academic system to create an academic culture that allows the diversification of personal attributes, ideas, and disciplinary knowledge. Such a move would help to improve academics' performance in relation to teaching and learning graduate attributes in courses of study. Similarly, as regards academics' promotion and progression in the academic system, which is currently based on disciplinary research, the law should be amended to allow interested academics more flexibility for promotion and progression based on pedagogic research related to their disciplines. This would improve academics' teaching and learning practices, which in turn would create a culture that appreciates such practices, rather than one that values only disciplinary knowledge as is currently the case. Also, there should be more formalised relationships between industry/the labour market and the university in the form of industry/the labour market based research, community service, collaborative projects or industry/labour market secondments for interested academics. Such a relationship should take into account the necessary incentives that would encourage academics to perform these tasks. However, it should not only depend on the university, but also on the industry/the labour market, where assessment of interest of both sides should be taken into consideration to decide on the most suitable approach for their mutual relationship. The aim of these formalities is to keep academics aware of the labour market's most needed attributes for employment as well as to keep the labour market aware of the disciplinary knowledge and attributes taught in faculties, in order to bridge the skills gap between the labour market and academia. It is also suggested that academics are appraised for progression in the academic system based on their personal attributes and abilities to teach students rather than just allowing students to evaluate them based on their ability to teach disciplinary knowledge.

With regard to employers, the law should encourage universities to invite them to lecture on a course of study or to conduct lectures on a frequent basis. Universities could also invite employers to review the attributes embedded in taught courses and how they are taught and learned and to give feedback on areas for improvement. The

aim is to create a learning environment that is similar to the workplace to feed in experiences from industry/the labour market into the design of courses. The main focus of these lectures should be based on the improvement of disciplinary knowledge and awareness of the labour markets' needs, particularly with regard to graduate attributes. These visits could be an opportunity for academics to show case how well they are addressing labour market needs in their courses. With respect to quality assurance, there should be formalised reviews of National Academic Reference Standards (NARS) developed by NAQAAE to update and forecast the attributes required for employment. This is a significant change to ensure that national standards for graduate attributes align with the contemporary demands of employers. Another important consideration is that NARS should be developed with the support of Egyptian employers as their feedback would inform higher education practitioners of the important learning outcomes for employment.

Finally, academics need to be kept motivated towards the effective implementation of attributes in courses. This includes providing the appropriate rewards in the form of salary increases, fringe benefits, and remuneration. Now that the higher education budget accounts for 4% of Egypt's GDP, funds for remuneration and rewards should be considered as part of the university annual budget set for education and this should be announced to all academics to inform and motivate them about the value of effectively implementing graduate attributes in taught courses.

### **6.7 Further Research**

The scope for further research continuing on from this body of work is exciting and challenging. Following the two revolutions (2011 and 2013), there is a definite need to change education management in Egypt. This provides opportunities in a number of areas that have the potential to further enhance attributes teaching and learning in university undergraduate courses.



There is a need for studies that support legislative reform in Egypt to change the laws and policies governing higher education. Changing Egyptian laws is fundamental to improving the learning experience in universities.

It is suggested that the proposed policy document in this research is applicable to all disciplines within the Egyptian university sector and is also informative to other educational systems particularly in the Arab World, but cannot be generalised. This is because what is considered contextual, for example as a process or a system in Egypt, will be different in another geographic locations. Equally, something that is possible in a regional or global environment may not be so in a specific context. This is not to say that ideas presented in the policy document could not be adapted for use in other university sectors. If they are, they would need to take into consideration the local contextual parameters.

There is also an opportunity to study the higher education sector in terms of its Higher Technical Institutes. HTI are important educational institutions that require attention and are already part of higher education reform projects. It could be possible to study the area in which technical education occurs to address the necessary improvements for the labour market while HTI reform is in progress.

Within the postgraduate programmes taught in the Egyptian university sector, there is an opportunity to study the area in which they are taught in order to derive the necessary improvement for teaching and learning of graduate attributes.

Most importantly, there is a need for studies which support the general philosophy for education in Egypt; studies that advise the higher education authorities on how to manage the educational sector within the changing dynamics of the world.

## **6.8 Summary**

This chapter demonstrated how the study objectives have been achieved and the research questions were answered. It also explained the contributions made by the research, including the design of the policy document. The chapter discussed future works as well as recommendations which the researcher intends to pursue and focused strongly on how to ensure that the policy document is implemented and the procedures conducive to this.

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**Appendix A: E-mail sent to participants to take part in interviews**

Dear xxxx,

My name is Iman Nassef, teaching assistant at the Arab Academy for Science and Technology and Maritime Transport based in Alexandria, Egypt. I am currently undergoing a research as part of my PhD study at Bournemouth University in the UK. I was looking for volunteers that can contribute to my study as described in the attached participant information sheet.

Your reply and involvement in my research study will be highly appreciated.

Best regards,

Iman

## **Appendix B: Participant information sheet**

### **Research Title: An investigation into the improvement of graduate attributes within the Egyptian university sector**

Current research has shown that many university students worldwide (including Egypt) graduate into the labour market lacking the necessary attributes for employment causing employers' dissatisfaction in that regard. Current research has also shown that academics play a prime role in that problem and therefore universities are accountable. From such perspective, this research aims to investigate the causes underpinning such phenomenon within the Egyptian university sector suggesting how the teaching and learning of graduate attributes in undergraduate courses could be improved. In order to achieve research objectives, the research seeks to take the views of Egyptian academics, graduates and employers by conducting a number of interviews that are likely to take up to 60 minutes in a private location convenient to the interviewee.

If you agree to take part in my research, I would like to inform you that your involvement is entirely voluntary and at your own discretion. The interview will take into consideration all ethical guidelines and part of it is to sign the attached consent form. You may ask any questions at any time before and during the interview. You also have the right to withdraw at any time from the interview or not answer any question that you may find inappropriate. The interview will be tape recorded and the data collected during the interview will be used as part of my research. However, it will remain confidential and anonymous and if you wish you have the right to view the transcription of the interview data once it is ready.

If you have any questions about the research, please do not hesitate to contact me on my e-mail ([inassef@hotmail.com](mailto:inassef@hotmail.com)). Your involvement will be highly appreciated for its contribution to my study.

Best regards,

**Appendix C: Interviews consent form**

This consent form is designed to check that you understand the purposes of the study, that you are aware of your rights as a participant and to confirm that you are willing to take part		
Please tick as appropriate		
	Yes	No
1- The interviewer described the purpose of the study.		
2- I have received sufficient information about the study for me to decide whether to take part.		
3- I understand that I am free to refuse to take part if I wish		
4- I understand that I may withdraw from the study at any time without having to provide a reason.		
5- I know that I can ask for further information about the study from the researcher.		
6- I understand that all information arising from the study will be treated as confidential and safeguarded against unauthorised use.		
7- I know that it will not be possible to identify any individual respondent in the study report, including myself.		
8- I am aware that the interview will be tape recorded and data will be transcribed as verbatim.		
9- I agree to take part in the study.		
I confirm that quotations from the interview can be used in the final research report and other publications. I understand that these will be used anonymously and that no individual respondent will be identified in such report.		
Signature:	Date:	



**Appendix D: Consent form for research output findings/validation**

This consent form is designed to check that you understand the purposes of the study, that you are aware of your rights as a participant and to confirm that you are willing to take part		
Please tick as appropriate		
	Yes	No
1- The researcher described the purpose of the study and my role in it.		
2- I have received sufficient information about the study to decide whether to take part.		
3- I understand that I am free to refuse to take part if I wish		
4- I understand that I may withdraw from the study at any time without having to provide a reason.		
5- I know that I can ask for further information about the study from the researcher.		
6- I understand that all information arising from the study will be treated as confidential and safeguarded against unauthorised use.		
7- I know that it will not be possible to identify any individual respondent in the study report, including myself.		
8- I am aware that my feedback could be transcribed as verbatim.		
9- I agree to take part in the study.		
I confirm that quotations from my comments/feedback can be used in the final research report and other publications. I understand that these will be used anonymously and that no individual respondent will be identified in such report.		
Signature:	Date:	

**Appendix E: E-mail sent to focus group to participate in validating research findings**

Dear xxxx,

My name is Iman Nassef, teaching assistant at the Productivity and Quality Institute belonging to the Arab Academy for Science and Technology and Maritime Transport situated in Alexandria, Egypt. I am currently undergoing a research as part of my PhD study at Bournemouth University in the UK. The aim of this e-mail is to kindly ask you as a professional expert in Egypt's higher education sector to validate the findings of my research.

The point of interest in my research was to investigate the causes underpinning the skills gap currently existing between the Egyptian university and the Egyptian labour market with respect to graduate attributes. Through a number of interviews conducted with employers, academics and graduates particularly in the field of computer engineering, my research arrived at an understanding of why the skills gap exists. From my findings it is suggested that a number of contextual factors played a role in affecting academics' teaching and learning with respect to graduate attributes and that those factors require improvement to reduce the skills gap.

If you wish to take part in my study, kindly e-mail me to arrange for a focus group that will include experts from higher education in Egypt. Also please sign off the attached consent form. Your contribution to my research study will be highly appreciated.

Best regards,

## **Appendix F: Alternatives to conducting interviews**

**Alternative 1: Interviewing all academics then all graduates from faculty X, then interviewing all academics, all graduates from faculty Y and then interviewing all employers.**

### **By applying this alternative the pros are that:**

- The researcher will remain focused on the data collected from each group of samples within their context hence not losing sight of the context under investigation. Such method supports the researcher in overcoming any potential tensions which may arise from interviewing different/similar groups of samples belonging to different domains.
- The researcher's interviewing skills will improve and develop from repeated interviews to same samples in their context. This would allow the generation of richer more valid data from interviews.

### **By applying this alternative the cons are that:**

- There is a limitation in gaining broader insights into the themes which could arise from interviewing different/similar samples belonging to different domains.
- Once a group of samples is interviewed it may be hard to question them again if the researcher wishes to clarify any further details arising from other interviews carried on afterwards. This method may create unequal interviewing opportunities between the samples.

**Alternative 2: Interviewing all academics from faculty X then all academics from faculty Y, then interviewing all graduates from faculty X then all graduates from faculty Y and then interviewing all employers.**

### **By applying this alternative the pros are that:**

- The researcher will remain focused on the data collected from each group of samples within their context, hence not losing sight of the context under investigation. Such method supports the researcher in

overcoming any potential tensions which may arise from interviewing different groups of samples belonging to different/similar domains.

- The researcher's interviewing skills will improve and develop from repeated interviews to same samples in their context. This would allow the generation of richer, more valid data from interviews.

**By applying this alternative the cons are that:**

- There is a limitation in gaining broader insights into the themes which could arise from interviewing different samples belonging to different domains.
- Once a group of samples is interviewed, it may be hard to question them again if the researcher wishes to clarify any further details arising from other interviews carried on afterwards. This method may create unequal interviewing opportunities between the samples.

**Alternative 3: Interviewing one academic from faculty X then one graduate from faculty X until academics are all interviewed. Afterwards, interviewing one academic from faculty Y and then one graduate from faculty Y until they are all interviewed. Finally, interview all employers.**

**By applying this alternative the pros are that:**

- The researcher will remain focused on the data collected from each group of samples within their context, hence not losing sight of the context under investigation. Such method supports the researcher in overcoming any potential tensions which may rise from interviewing different/similar groups of samples belonging to different domains.
- The researcher's interviewing skills will consequently develop from repeated interviews for the different group of samples in their context. This would allow the generation of richer, more valid data from interviews.
- The researcher gains insights into the themes which could arise from interviewing different samples belonging to the same context.

**By applying this alternative the cons are that:**

- Once a group of samples is interviewed it may be hard to question them again if the researcher wishes to clarify any further details arising from other interviews carried on afterwards. This may cause unequal interviewing opportunities between samples.
- There is a limitation in gaining broader insights into the themes which could arise from interviewing similar samples belonging to different domains.
- This alternative is very time consuming for the researcher.
- Interviewees may not be available to conduct interviews in that sequence.

**Alternative 4: Interviewing one academic from faculty X then one academic from faculty Y until academics are all interviewed. Afterwards, interviewing one graduate from faculty X then one graduate from faculty Y until they are all interviewed. Finally, interviewing all employers.**

**By applying this alternative the pros are that:**

- The researcher will remain focused on the data collected from similar groups of samples, hence not losing sight of the data collected. Such method supports the researcher in overcoming any potential tensions which may arise from interviewing different groups of samples belonging to different/similar domains.
- The researcher's interviewing skills will consequently develop from repeated interviews for the same samples from different domains. This would allow an opportunity to ask any newer questions important to generate richer, more valid data from interviews.
- The researcher provides equal interviewing opportunities to both samples of different faculties thus reducing bias to the minimum.
- The researcher gains broader insights into the themes which could arise from interviewing similar samples belonging to different groups.

**By applying this alternative the cons are that:**

- There is a limitation in gaining broader insights into the themes which could arise from interviewing different samples belonging to different domains.
- Once a set is interviewed it may be hard to question them again if the researcher wishes to clarify any further details arising from other interviews carried on afterwards.

**Alternative 5: Interviewing one academic from faculty X, then one graduate from faculty X then one employer until all the samples are interviewed. Then interview one academic from faculty Y, then one graduate from faculty Y, then one employer until all the samples are interviewed. (Chosen alternative)**

**By applying this alternative the pros are that:**

- The researcher remains focused on the data collected from different groups of samples within their context, hence not losing sight of the data collected. Such method supports the researcher in overcoming any potential tensions which may arise from interviewing similar/different groups of samples belonging to different domains.
- The researcher gains broader insights into the themes which could arise from interviewing different samples belonging to different groups. Such method is similar to the setting of a focus group, which is important to view and understand a given topic from different perspectives at the same time.
- The researcher provides equal interviewing opportunities to both samples of different faculties, thus reducing bias to the minimum.
- The researcher's interviewing skills will consequently develop from repeated interviews for the different samples from similar domains. This would allow an opportunity to ask any newer questions important to generate richer, more valid data from interviews.

**By applying this alternative the cons are that:**

- Once a set is interviewed it may be hard to question them again if the researcher wishes to clarify any further details arising from other interviews carried on afterwards.
- This alternative is very time consuming for the researcher.
- Interviewees may not be available to conduct interviews in that sequence.

**Alternative 6: Interviewing one academic from faculty X, then one graduate from faculty X and then one employer. Then interview one academic from faculty Y, then one graduate from faculty Y and then one employer.**

**By applying this alternative the pros are that:**

- The researcher gains broader insights into the themes which could arise from interviewing different samples belonging to different groups consecutively. Such method is similar to the setting of a focus group, which is important to view and understand a given topic from different perspectives at the same time.
- The researcher's interviewing skills will consequently develop from repeated interviews for the different samples from similar domains. This would allow an opportunity to ask any newer questions important to generate richer, more valid data from interviews.

**By applying this alternative the cons are that:**

- The researcher may lose sight of the context under investigation due to the large amount of collected data from interviews.
- This alternative is very time consuming for the researcher.
- Interviewees may not be available to conduct interviews in that sequence.

## **Appendix G: Interviews questions**

### **Academics**

- 1- Could you give me a brief description of the courses that you teach at the moment?
- 2- Can you explain to me what do you understand by the term graduate attributes?
- 3- Do you think graduate attributes are an important focus of employability? Why?
- 4- Do you think graduate attributes are an important focus of the faculty? Why?
- 5- In the courses you teach, how are attributes developed? How do they fit in? For example, are they part of the curriculum or separate?
- 6- How are these attributes approached in your courses? For example, through seminars, presentations, or group based projects?
- 7- How do you ensure that your students acquire these attributes?
- 8- Why were these attributes chosen in particular?
- 9- Do you inform your students of their course learning outcomes? How do you do that?
- 10- In your opinion what are the attributes required by the labour market?
- 11- Do you think the faculty is addressing labour market demands or is there a skills gap? How?
- 12- Do you think graduates' readiness for the labour market can be improved? How?

### **Graduates**

- 1- Do you think graduate attributes are an important focus of employability? Why?
- 2- Were you aware of that prior to working here? How?



- 3- If you look back at the time you were in the faculty, do you think it equipped you with any attributes that you find now useful in the workplace? How did it do that?
- 4- In your current job, what are the necessary attributes to accomplish the work?
- 5- Do you think graduates' readiness for the labour market should be improved? Why?

### **Employers**

- 1- Do you consider graduate attributes an important aspect of employability? Why?
- 2- Which attributes do you consider most important for the workplace?
- 3- Do any of your new recruits come prepared with any attributes?
- 4- Do you think the faculty is effective in addressing labour market demands or is there a skills gap? How?
- 5- In your opinion, what needs to be done to improve graduates' readiness for the labour market?

**Appendix H: Codes and themes emerging from interviews and documentation analysis**

**Stage one: selecting data patterns from interviews and documentation**

#	Quotations <i>and their source</i>
1	some <b>characteristics</b> that need to be in the graduate such as being <b>self dependant</b> , <b>self learner</b> , knows how to <b>present one's own work</b> things of that sort <i>DAC</i>
2	it is an <b>ability</b> with which the graduate will practise his engineering work <i>DHC</i>
3	they are the <b>skills</b> that students gain from the courses for example <b>analytical skills</b> , <b>mathematical skills</b> , <b>teamwork</b> and <b>research skills</b> <i>DNC</i>
4	it is an <b>understanding</b> of what labour market requires it is a matter of <b>solving a problem</b> , a matter of knowing how to <b>present one's own work</b> <i>DSC</i>
5	<b>working in group</b> is one of the skills... <b>patience</b> in our field is very important otherwise..... also if he does not <b>resist frustration</b> and things like that <i>DIC</i>
6	the <b>things or attitudes</b> beside the technical work that allow the graduate to compete in the labour market meaning that he needs to have certain <b>attitudes</b> certain <b>ethics</b> certain <b>presentation skills</b> ... <b>abilities</b> to <b>work in a team</b> and <b>communicate ideas</b> to his managers and subordinates <i>DME</i>
7	<b>abilities</b> gained with time which are quite different from technical or theoretical skills that students gain from the educational process such as <b>task management</b> , <b>communication skills</b> and <b>problem solving</b> <i>DZE</i>
8	<b>they are the things</b> that employers look for such as <b>working in a team</b> and <b>communicating ideas</b> and <b>presenting them</b> to managers <i>DNE</i>
9	these are the <b>ethics</b> of engineering, the non-technical part of the course <i>DEE</i>
10	on a personal basis, I look to this topic from a perspective that I graduate a student who needs <b>to be complete</b> ...knows how to work and deal with life and not just stuffing his mind with knowledge that he will forget once he graduates <i>DYE</i>
11	in very simple terms they are <b>students' qualities</b> that enable them to do their work effectively you have many examples such as <b>communication skills</b> and <b>presentation skills</b> <i>DOE</i>
12	<b>skills</b> enable one <b>to work in a team</b> , share knowledge, lead, <b>communicate</b> with others <i>GRC</i>
13	<b>skills</b> help one manage works and <b>communicate</b> with others in the workplace <i>GMC</i>
14	your <b>communication skills</b> , <b>presentation skills</b> <i>GAC</i>
15	good <b>communication skills</b> to be able to deal and <b>communicate</b> with the clients... <i>GSC</i>
16	my <b>skills</b> helped me <b>present</b> own work to managers, or explain it to others <i>GGE</i>

17	skills that help one think and search to solve any problem GFE
18	having good communication skills that enable me to convince him with my point of view GAE
19	experience dealing and working with others GME
	affect work performance and business profits EG
20	how the employee deals with the customer EN
21	the tools used to show how much knowledge he knows to solve a particular problem EE
22	special skills... such as communications skills, presentation skills to be able to conduct a training session EA
23	someone with experience... someone who knows what I am working in...someone ready for work EM
24	his capability of leaning and accepting more knowledge and more technologies EU
25	the intellectual capabilities gained by the graduate after completing the programme such as: concluding and discussing, innovation, specifying problems and finding solutions documentation
26	the capability to use academic material in professional applications such as performing an engineering design, designing a computer programme documentation
27	the different general or transferable skills that should be gained by the student upon completing the programme such as computing skills, communication skills, management skills, working in a group and problem solving documentation
28	very important because graduates need to work in groups DIC
29	of course they are important because it supports him to find a career and to be wanted in the market DHC
30	very important to be able to deal with whatever situation he is placed in to be successful in managing a group of people...a project may be...for productivity...for success in his life....DSC
31	of course they are important because later on when work they can apply those things DNC
32	of course they are important, skills help graduates communicate within the work community DAC
33	absolutely important .... of course...DYE
34	yes and they are actually quiet important to be able to communicate and I think there is a problem with our GTAs in that regards DZE
35	graduate it is important for the whole nation, our aim is to develop ourselves to reach developing countries DEE
36	I believe that this part is very important for our graduates in their workplaces...DOE
37	of course they are important...and not only here but everywhere...GRC
38	of course skills are important and not only here but everywhere, I remember during my

	interview my employers asked me about my communication and presentation skills <i>GAC</i>
39	skills are <b>very important</b> at work even if one is a junior developer <i>GMC</i>
40	skills are <b>very important</b> for the workplace, the syntax is not important, how to write a code is not important, what is important are personal skills <i>GFE</i>
41	<b>exactly but these skills that are very important to teach</b> <i>DZE</i>
42	and this is <b>very important</b> because it allows the student to speak freely and to express his ideas openly in front of his professors and colleagues.... <i>GAE</i>
43	skills are <b>very important</b> to work, it is a necessity! <i>GDE</i>
44	skills are <b>very important</b> at work even if one is a junior developer <i>GME</i>
45	skills are <b>very important</b> for the workplace, the syntax is not important, how to write a code is not important, what is important are personal skills <i>GFE</i>
46	of course <b>they are important</b> as any shortage in skills will highly affect work performance and business profits <i>EG</i>
47	they are <b>very important</b> , how will an employee deal with the customer or with his colleagues without soft skills? <i>EN</i>
48	yes, I see them as <b>very important</b> because these are the tools he will use to show how much knowledge he knows to solve a particular problem. if he doesn't have the right presentation skills to talk and convince the customer, he won't sell his product. in interviews I ask him about his graduation project and his role in it, his answer will tell me a lot about his leadership skills, communication skills, presentation skills, group work, task management, things of that sort <i>EE</i>
49	100% important... <b>the most important thing</b> in an engineer are his skills, tell me if one of the engineers here does not know how to deal with our customers, then how will the situation be like? <i>EM</i>
50	because it will affect my projects that's why I <b>see them important</b> ...we sometimes do an IQ test which tells us about his problem solving skills <i>EH</i>
51	this <b>is important</b> to manage time constrains <i>EA</i>
52	we ask them if they play any sports and what it is. if he chooses a group play sport like football, then I do understand that he is good at teamwork and if he chooses a single play sport like tennis, then I would know that he is not quite ok with teamwork so this is <b>very important</b> for the candidate whose is being interviewed <i>EU</i>
53	in most of my courses, attributes are <b>developed through course activities</b> such as <b>sheet assignments, group based projects, presentations and lab work</b> which allow the student to acquire certain skills <b>to communicate effectively, present his own work and think logically</b> , yet there is another course that I teach separately <b>but integrated to the curriculum</b> for fourth year students, which is <b>technical report writing</b> <i>DHC</i>
54	the skills <b>developed from</b> the courses they study in general if we are speaking about a course then it is <b>the skills the students gain from the courses</b> he studies...for example <b>analytical skills, mathematical skills teamwork if they can do team work or not...emmmm ability to lead teams sometimes...</b> things like <b>developing some</b>

	<b>research skills, lab work and developing applications...DAC</b>
55	yes the <b>skills are embedded</b> within in the courses themselves such as the introductory course for the preparatory year we are just teaching them basics about <b>how to think about developing simply a flowchart to a problem DNC</b>
56	it is better to <b>embed them</b> in the courses, in my courses which are project based in principle, my students work on a number of projects throughout the term and from those projects they tend to develop as many skills as you can think of [counting of fingers] <b>teamwork, presentation skills, communication skills and logic thinking skills DSC</b>
57	attributes are central to the curriculum. if <b>they are not developed as part of the taught knowledge</b> , the student will not gain them I personally assign <b>real time projects, home assignments, report writing and mini projects DIC</b>
58	in most of my courses attributes are <b>developed through course activities</b> such as <b>teamwork, presentation skills, leadership skills....the ability to articulate</b> own ideas and thoughts.... <b>the ability to do research.. the ability to study a new topic and understand what the literature said about it....the ability to innovate and create...</b> usually courses <b>have projects</b> through which <b>the students work in teams</b> they need to participate together... after they finish their work they have <b>to present it to the class...</b> everyone starts to present his work as they divided it...so it is mainly through <b>the project</b> that this happens.... <b>DNE</b>
59	how to <b>think as a team</b> and this team needs to be from different disciplines and I do this in my <b>graduation projects and in competitions</b> ..this is useful to allow <b>integration</b> and expansion of knowledge and skills across the various disciplines...how to make a <b>presentation</b> is something that I care about in my work and <b>project</b> outcomes need to be reflected through presentation at the end of the semester... <b>DEE</b>
60	for example if we <b>teach him team work or presentation skills</b> or how to design a product either hardware or software this remains quite <b>important</b> because it is not only a matter of technical knowledge...in the <b>assignments and projects</b> I assign my students, they are required to do some kind of literature survey or review, or to <b>gather information</b> from the internet or to <b>communicate</b> with other departments to gather information....to do that <b>they need to integrate</b> with other departments and to <b>communicate</b> with other students to exchange information to strengthen their knowledge about what they are trying to study.... <b>DZE</b>
61	I think they could be <b>a separate course</b> for how to <b>communicate</b> or pass interviews or how to <b>write a report</b> technically and non technically...I think those issues can be addressed <b>as part of the course or separate from it</b> ...part of the course credit should be assigned to how he <b>communicates</b> how he presents how he relays information what he focuses on when he prepares his report... <b>DYE</b>
62	attributes <b>are embedded</b> in courses to directly link theory with practise...in the courses I teach students how to conduct <b>seminars and group based projects</b> which allow them to develop a number of skills such as <b>presentation skills, communication skills, writing skills and teamwork DME</b>
63	in our programme we have both techniques, <b>attributes that are taught in a separate course</b> yet in the context of teaching such as <b>the introduction to problem solving</b>

	<b>courses</b> I teach, <b>or as part of the curriculum</b> for example when a student is required to <b>present his or her own work</b> through a powerpoint presentation, <i>for example DOE</i>
64	<b>working hard, to be self dependant</b> ...[grimace] we used to <b>search for knowledge and information</b> ...struggling and trying to understand everything <i>GMC</i>
65	<b>time management, working under pressure</b> ... we were always under work stress, due dates, issues of that type. <b>self learning</b> ,.... this was very important, we were given the problem statement and we were expected to learn everything on our own, read about it, implement it and make it work all on our own <i>GAC</i>
66	<b>teamwork, presentations and leadership skills</b> <i>GFE</i>
67	it was a gained issue in university as much as it is demanded now in my work for example <b>working in teams, working under stress, time management</b> <i>GDE</i>
68	besides <b>presentations</b> we used to have <b>competitions</b> such as robocon where we used to practise teamwork <i>GAE</i>
69	we used to do <b>group based projects</b> and <b>presentations</b> <i>GGE</i>
70	<b>through group based assignments</b> and these were carried out at home...we also had lots of sheet assignments <i>GRC</i>
71	<b>the graduation</b> project was an important asset to improve my communication skills <i>GMC</i>
72	we had group <b>based projects</b> which helped develop our communication skills <i>GSC</i>
73	<b>working in projects</b> ... <i>this is very useful because you work in groups plus you get to learn and understand something new from your colleagues who share with you the same problem and thinking how you will solve the problem is very important</i> <i>GDE</i>
74	<b>by presenting my work in exhibitions and conferences</b> ....also projects were very useful for me....also the training I had while in faculty was very useful through the companies the faculty suggested for me <i>GAE</i>
75	we really <b>don't have a strategy</b> , it is a personal matter, we should have a strategy but we don't <i>DIC</i>
76	<b>quizzes, exams, seminars</b> , lots of ways to assess students' attributes <i>DNC</i>
77	<b>there is no particular way</b> . I, for instance, assess my students through presentations or group based projects <i>DEE</i>
78	<b>use general computer and software tools</b> professionally <i>documentation</i>
79	<b>analyse the local and global impact of computing on individuals, organisations and society</b> <i>documentation</i>
80	<b>use general computer and software tools professionally</b> <i>documentation</i>
81	<b>analyse the local and global impact of computing on individuals, organisations and society</b> <i>documentation</i>
82	<b>use current advanced techniques, skills and tools necessary for computing practices</b> <i>documentation</i>
83	<b>use computer-related terminology</b> <i>documentation</i>

84	<b>feedback from industrial sector</b> , we meet informally because most of them are my friends and they tell us what our graduates lack and what needs to be improved <i>DHC</i>
85	<b>I have been a consultant for IT</b> the other thing is the good and real feedback I get from our working graduates <i>DNC</i>
86	however we take feedback but not from <b>the employers from the graduates informally</b> <i>DSC</i>
87	the first thing is to see <b>what foreign universities</b> do <i>DAC</i>
88	<b>through our contacts with the industry</b> , through students training and the industrial committee that consists of industrial CEOs <i>DOE</i>
89	we only hear from <b>our friends who are working</b> in the market what is needed and what is not needed as well as from our graduates whom we are still in contact with <i>DEE</i>
90	<b>through the feedback i get from my graduates</b> every now and then and meetings with industry members that happen every six months <i>DME</i>
91	everyone used to work independently and individually through the <b>feedback obtained from the graduate or industry or even through standards</b> in order to improve his teaching methods <i>DZE</i>
92	<b>through our contacts with the industry, through students training</b> <i>DME</i>
93	from <b>working graduates</b> ...as much as we can we try to keep contact with those graduates <i>DYE</i>
94	I don't keep them <b>aware</b> all the time but some of them are aware... top of class students are aware <i>DNC</i>
95	<b>explicitly no</b> , but he will get to know its importance when he works <i>DHC</i>
96	<b>actually they get to know it</b> from students in higher classes <i>DSC</i>
97	<b>it depends on the course professor</b> but in a course such as technical report writing, the student is made aware of the importance of writing a report <i>DAC</i>
98	<b>students don't like to listen</b> to any advices....so I have to say it in an indirect way and sometimes in a direct way .... it depends on the situation <i>DYE</i>
99	<b>not always</b> , but it gets obvious as the course runs <i>DEE</i>
100	<b>to be honest not clearly</b> but the first week of the course we introduce the course we discuss the syllabus, we discuss grade distributions <i>DZE</i>
101	it depends on the nature of the professor, <b>but it was not explicitly or clearly stated</b> <i>GAC</i>
102	<b>no... not all professors would tell us</b> . when I graduated I only got to know the importance of skills <i>GMC</i>
103	<b>not all professors</b> , some do, some don't <i>GDE</i>
104	<b>few professors</b> did so verbally <i>GAE</i>
105	well, it <b>was not explicitly stated</b> but we knew that certain courses address soft skills <i>GFE</i>



106	analytical skills, design skills, software skills, programming skills and web development skills <i>DSC</i>
107	analytical skills, logical thinking and decision making <i>DNC</i>
108	technical knowledge, working hard, working under stress, resisting frustration, working in teams and in groups <i>DIC</i>
109	English language and presentation skills <i>DHC</i>
110	good communication skills, good determination and good presentation skills <i>dye</i>
111	ability to communicate and how to think <i>DME</i>
112	teamwork and sense of initiation <i>DNE</i>
113	how to cooperate with a team...how to share knowledge with a team...how to work as a team member....how to lead the team...these are all important skills <i>GRC</i>
114	I think it is mainly communication skills and management skills, both are important when dealing with customers <i>GMC</i>
115	I think dealing with problems, trying to solve them, convincing people and dealing with them are also quite important <i>GME</i>
116	good communication skills, professional behaviour, teamwork are also very important here <i>GAE</i>
117	keeping my team motivated all the time and working under stress to meet project deadlines <i>GFE</i>
118	<b>it is the role of the faculty</b> but unfortunately we don't have the luxury to spend some time or enough time to develop this skill for our students because of the number of students and the time dedicated for the courses <i>DIC</i>
119	before the faculty prepares the student to work, <b>it needs to provide him with basic knowledge</b> which should be recent and up to date then develop in him the necessary skills needed by the labour market <i>DNC</i>
120	<b>it is the responsibility of the student and the faculty</b> , the student needs to play a role in developing his skills by practising and acquiring more skills on his own and the faculty needs to work on linking skills to its academic programme <i>DHC</i>
121	<b>the faculty should start</b> and the student should continue <i>DSC</i>
122	<b>it is purely the role of the faculty</b> <i>DYE</i>
123	<b>sure it is the role of the faculty</b> <i>DME</i>
124	<b>it is the role of the faculty for sure</b> <i>DEE</i>
125	<b>the faculty should take a role in this</b> <i>DNE</i>
126	the graduate can help but it remains <b>the role of the faculty</b> to develop its students' skills <i>GMC</i>
127	no, it is the faculty's <b>central role</b> to do that. my role is only to assist the faculty to achieve its educational mission <i>GRC</i>
128	<b>both the faculty and me</b> . the faculty acts as the sender and I am as the receiver of



	knowledge or skills but anyway it is the role of the faculty <i>GDE</i>
129	at the end, I think it is <b>the role of the faculty</b> ... definitely the government has a role. at the end, the government is the entity that puts the laws through which universities and companies operate inside the country... so I am sure that it must have a role...at least to fill the gap between the private sector and the university <i>EM</i>
130	yes, it <b>is the role of universities</b> , for the business market wants a student ready for work <i>EU</i>
131	on the local level, the faculty produces <b>good graduates</b> and especially our department that is well known for its quality graduates to the extent that sometimes big companies may recruit 40 out of 70 fresh graduates all at once <i>DAC</i>
132	70% of our <b>graduates meet</b> labour market demanded skills <i>DHC</i>
133	<b>very effective</b> because we have very good computer labs <i>DIC</i>
134	there is a <b>big difference</b> between what happens in the faculty and what happens in the labour market both sides are not keeping communication channels between one another to achieve the small transition for the graduate <i>DYE</i>
135	well actually <b>we are not strongly connected to the labour market</b> , we are not engaged with the labour market to know what it wants and what it doesn't want <i>DEE</i>
136	our graduate is quite different because of the non-technical aspects that we teach him here that allows him to <b>compete</b> in the global market...not only within the Egyptian context, but also outside Egypt <i>DZE</i>
137	they were <b>very useful</b> but the working environment here is different than the learning environment at the faculty <i>GMC</i>
138	they were <b>very useful</b> , we were taught the basics, those skills helped me achieve my work successfully <i>GAC</i>
138	<b>quite useful</b> , communication and teamwork were most useful for my work here...actually teamwork is more important than communication in my job here <i>GSC</i>
140	the faculty unfortunately <b>has not equipped us</b> with enough skills to prepare us for work...we graduated well prepared technically but not with soft skills <i>GRC</i>
141	it was <b>effective</b> for sure; most of the skills I gained were from the faculty <i>GDE</i>
142	the faculty in principal <b>equipped me</b> with the principal tools for employment but to be honest the work experience is completely different <i>GFE</i>
143	there <b>weren't any...nothing</b> .. look the faculty gave me quite a good experience like any place would do, it is not that I am not content with the faculty but it just gave me good education only... also experience in life <i>GME</i>
144	<b>some of them do come prepared</b> ...and some of them do not come prepared <i>EU</i>
145	<b>some graduates come prepared and some don't graduates</b> don't come equipped at all <i>EM</i>
146	unfortunately no, they <b>are not equipped</b> <i>EH</i>
147	there is no single rule; sometimes I get someone prepared for work and <b>sometimes I</b>

	<b>don't</b> <i>EN</i>
148	currently, engineering faculties mainly focus on the technical parts <b>not on soft skills</b> <i>EU</i>
149	<b>not quite effective</b> because the faculty teaches pure technical technical technical courses till you get blind <i>EG</i>
150	I suggest that academics need to have <b>a clearer strategy</b> for reflecting <b>attributes embedded</b> in courses to us, I could only feel technical content in all of what I studied <i>GAC</i>
151	I think the faculty should <b>bring attributes to the foreground of the learning process</b> and why they are important for the labour market <i>GMC</i>
152	I think courses need to be <b>taught in a different way</b> , they were all theoretical, I could hardly feel the soft bits we are talking about <i>GRC</i>
153	the faculty needs to increase <b>the training period</b> so that the graduate can really touch grounds with the labour market and the student needs to give this training considerable attention by comparing what he is studying and what the labour market offers <i>GDE</i>
154	I suggest more <b>training</b> during the summer to expose the students to what the labour market needs <i>GME</i>
155	before he works, he needs during his academic life, to practice teamwork in companies through <b>training</b> , for example <i>EA</i>
156	<b>training</b> is very important; I wish students take it seriously <i>EH</i>
157	I think <b>real life practise</b> is fundamental, students need to see real life while in faculty <i>EU</i>
158	my only concern really is <b>the large assigned weight</b> for the final mark and accordingly the non technical skills part does not receive considerable attention but if I assign 40% or 50% to the projects, it will make a difference <i>DAC</i>
159	<b>a final exam representing 90% of the total weight</b> , then what kind of skill will the student develop here? <i>DAC</i>
160	here in Egypt most of the mark or a <b>big part of it is assigned to the final exam</b> according to procedures so if the total mark assigned for a course is 150 you will find the final marked out of 90 <i>DAC</i>
161	it is a strange thing that the faculty tells the doctor how to <b>distribute the marks...</b> this limits how the course can be managed by the professor... <i>DAC</i>
162	the problem is in our <b>university system which is centralised</b> so everything is top bottom So, if the doctor wishes to change anything, he cannot....So, at the end, it is not our decision <i>DAC</i>
163	our faculty members set their own <b>assessment methods</b> and how they wish to grade their students. Our internal procedure allows them to do so <i>DHC</i>
164	we don't have the luxury to spend some time or enough time to develop students' skills because of the <i>number of the students</i> <i>DIC</i>
165	the <i>massive student numbers</i> if controlled, everything will solve itself <i>DHC</i>
166	<b>off loading the instructor off loading</b> the instructor because skills are not in books and

	require a lot of preparation <i>DHC</i>
167	actually <u>there is no agreed framework</u> between employers and academics so they get to know about labour market needs by themselves and on personal basis such as asking friends or graduates <i>DYE</i>
168	this <b><i>lack of communication</i></b> between departments in the faculty affected the way curricula are developed as well as taught by most academics <i>DYE</i>
169	actually attributes development in courses <b><i>are not discussed at all among academics</i></b> <i>DEE</i>

**Stage 2: Codes generated from the grouping of similar data patterns emerging from interviews and documents**

Code #	Code name
<b>C1</b>	<b>Basic skills</b>
<b>C2</b>	<b>Personal skills</b>
<b>C3</b>	<b>Thinking skills</b>
<b>C4</b>	<b>People related skills</b>
<b>C5</b>	<b>Business skills</b>
<b>C6</b>	<b>Design skills</b>
<b>C7</b>	<b>Importance of attributes</b>
<b>C8</b>	<b>Teaching methods</b>
<b>C9</b>	<b>Graduate attributes</b>
<b>C10</b>	<b>NARS skills</b>
<b>C11</b>	<b>Attributes selection</b>
<b>C12</b>	<b>Assessment methods</b>
<b>C13</b>	<b>Students awareness</b>
<b>C14</b>	<b>Employability skills</b>
<b>C15</b>	<b>Faculty central role</b>
<b>C16</b>	<b>Faculty effectiveness</b>
<b>C17</b>	<b>Graduates readiness</b>
<b>C18</b>	<u>Training</u>
<b>C19</b>	<u>Faculty management</u>
<b>C20</b>	<i>Class size</i>
<b>C21</b>	<u>Teaching load</u>
<b>C22</b>	<b><i>Communication with employers</i></b>

### **Stage three: themes emerging from codes**

<b>Theme A</b>	<b>Perceptions of graduate attributes</b>
<b>C1</b>	<b>Basic skills</b>
<b>C2</b>	<b>Personal skills</b>
<b>C3</b>	<b>Thinking skills</b>
<b>C4</b>	<b>People related skills</b>
<b>C5</b>	<b>Business skills</b>
<b>C6</b>	<b>Design skills</b>
C7	Importance of attributes
<b>Theme B</b>	<b>Development of graduate attributes in courses</b>
<b>C8</b>	<b>Teaching methods</b>
<b>C9</b>	<b>Graduate attributes</b>
<b>C10</b>	<b>NARS skills</b>
<b>C11</b>	<b>Attributes selection</b>
<b>C12</b>	<b>Assessment methods</b>
<b>C13</b>	<b>Students awareness</b>
<b>Theme C</b>	<b>Attributes required by the labour market</b>
C14	Employability skills
<b>Theme D</b>	<b>Role of faculty</b>
<b>C15</b>	<b>Faculty central role</b>
<b>Theme E</b>	<b>Quality measures</b>
<b>C16</b>	<b>Faculty effectiveness</b>
<b>C17</b>	<b>Graduates readiness</b>
<b>Theme F</b>	<b>Addressing the skills gap</b>
<b>C8</b>	<b>Teaching methods</b>
C18	<u>Training</u>
<b>Theme G</b>	<b>Barriers to attributes</b>
<b>C12</b>	<b>Assessment methods</b>
C19	<u>Faculty management</u>
C20	<i>Class size</i>
C21	<u>Teaching load</u>
C22	<b><i>Communication with employers</i></b>

**Appendix I: E-mail sent to volunteers to participate in validating the policy document**

Dear xxxx,

My name is Iman Nassef, teaching assistant at the Productivity and Quality Institute belonging to the Arab Academy for Science and Technology and Maritime Transport situated in Alexandria, Egypt. I am currently undergoing a research as part of my PhD study at Bournemouth University in the UK. The aim of this e-mail is to kindly ask you as a professional expert in Egypt's higher education sector to validate my research output, which is a policy document (attached in this email).

The point of interest in my research was to investigate the causes underpinning the skills gap currently existing between the Egyptian university and the Egyptian labour market with respect to graduate attributes. Through a number of interviews conducted with employers, academics and graduates, particularly in the field of computer engineering. My research arrived at an understanding of why the skills gap exists. From my findings it is suggested that a number of contextual factors played a role in affecting academics' teaching and learning with respect to graduate attributes and that those factors require improvement to reduce the skills gap. Based on this, a policy document was developed as a suggestion for improvement.

If you wish to take part in my study, kindly read the policy document attached in this e-mail and feed me back with comments/suggestions about it. Also please sign off the attached consent form. Your contribution to my research study will be highly appreciated.

Best regards,

**Improving Egyptian Academics' Performance for  
Teaching and Learning Graduate Attributes in  
Undergraduate Degrees**

PD1/2014

## Document Control

<b>Document title:</b>	Improving Egyptian academics performance for teaching and learning graduate attributes in undergraduate degrees
<b>Type of document:</b>	Policy Document
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<b>Document Reference #:</b>	PD1/2014
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<b>Issue/revision #:</b>	1/A
<b>Date of issue:</b>	December 2015
<b>Of interest to:</b>	<ul style="list-style-type: none"><li>- Ministry of Higher Education</li><li>- Supreme Council of Universities</li><li>- National Authority for Quality Assurance and Accreditation of Education (NAQAAE)</li><li>- National Centre for Faculty and Leadership Development (NCFLD)</li><li>- Presidents of private and public universities</li><li>- Deans of faculties</li><li>- Heads of academic programmes</li><li>- Academic staff teaching and learning undergraduate programmes</li><li>- Course designers and reviewers for undergraduate degrees</li></ul>

## **1. Purpose**

The purpose of this document is to set out the policies and procedures for improving academics' performance for teaching and learning graduate attributes in Egyptian universities.

## **2. Scope**

This policy applies to all academics teaching graduate attributes in undergraduate degree courses offered in public and private universities in Egypt. It is generic and is not limited to a specific faculty, educational programme, discipline or course of study. If applied to a specific discipline, contextually related parameters must be taken into consideration.

## **3. Definitions**

3.1 Graduate attributes: The skills, personal attributes and values which should be acquired by all graduates regardless of their discipline or field of study. In other words, they should represent the central achievements of higher education as a process (Barrie 2004, p.262).

3.2 Skills gap: The difference between employers' expectations and what graduates actually deliver (Martin et al. 2005).

3.3 University: A high-level educational institution in which students study for degrees and academic research is carried out (Oxford dictionary).

3.4 Faculty: A group of university departments concerned with a major division of knowledge (Oxford dictionary).

## **4. Responsibilities**

4.1 Supreme Council of Universities (SCU): A higher education authority supervised by the Minister of Higher Education and responsible for managing Higher Education executive policies, bylaws and universities' internal regulations.



4.2 National Authority for Quality Assurance and Accreditation of Education (NAQAEE): A National Authority considered to be one of the main pillars of the national plan for education reform in Egypt. It is one of the 25 Higher Education Enhancement Projects (HEEP) established for higher education reform in Egypt. It is supervised by the Prime Minister and is responsible for spreading the culture of quality in educational institutions and society, the development of national standards that keep pace with the international standards for the restructuring of educational institutions, improvement in the quality of operations, and outputs for the fostering of the community trust. NAQAEE remains the entity that can guide and support educational institutions to meet the requirements of national standards, including providing help for the continuous improvement of the quality of its output through the mechanisms of objective assessment and self-reliance.

4.3 National Centre for Faculty and Leadership Development (NCFLD): The centre is one of the 25 Higher Education Enhancement Projects (HEEP) established for higher education reform in Egypt. It is certified by the Middle East and North African Division of the International Board of Certified trainers (IBCT) to grant international certification of the required training, testing and evaluation according to specific quality standards that are fully supervised by the IBCT regional director. NCFLD develops administrative and academic staff capacities and knowledge in four main areas: teaching, scientific research, communication and leadership.

4.4 Graduate teaching assistant (GTA): A graduate newly employed into the academic system responsible for assisting lecturers in the teaching of students, particularly in tutorials, invigilating tests or exams.

## **5. Procedures**

### **5.1 General**

5.1.1 The following procedures have been developed based on the outcome of a research study which aimed to explore the causes underpinning the skills gap currently existing between Egyptian universities (private and public) and the Egyptian

labour market. To identify those causes, sample data were collected from eleven academics and nine graduates belonging to two different computer engineering undergraduate programmes, one private and the other public.

5.1.2 More data were collected from seven employers and from the documentation that represents the different educational policies and practices implemented in both private and public undergraduate programmes in order to arrive at a deeper and more critical understanding of the problem.

5.1.3 Following the analysis and synthesis of collected data, the contextual factors that affected the teaching of graduate attributes in the computer engineering discipline in Egypt were identified. For the public and private faculty these factors were: academics' recruitment, promotion and progression procedures, department/faculty culture which has an orientation towards disciplinary knowledge, lack of scholarship of learning and teaching, performance appraisal, the pay scale, fringe benefits and remuneration, no incentive to conduct industry/labour market based research, collaborative projects or industry/labour market secondments, and the fact that industrial practitioners are not allowed to teach in academia.

5.1.4 Based on these findings, this policy document has been developed to suggest to higher education authorities as well as interested parties, such as the Supreme Council of Universities, the National Authority for Quality Assurance and Accreditation of Education (NAQAEE), and presidents of private and public universities, the improvements which are necessary to academics' teaching of graduate attributes in higher education in Egypt.

5.1.5 From a comparison of findings from both faculties, it was apparent that they were similar since both faculties are governed by the same policies and procedures set by the law governing Egyptian universities.

5.1.6 Based on such similarity and with reference to the contextual factors presented in clause 5.1.3, this policy document is set generic which means that it could guide and inform all educational programmes (as appropriate) taught under the Egyptian university system.

5.1.7 It is important to note that just as there are similar contextual factors that affect the teaching and learning of graduate attributes in undergraduate courses, there are also differences. These are, for example, class size, learning and assessment methods, and facilities and resource limitations. These factors were not taken into consideration in the design of this policy document, as it is intended to be generic. This could be considered a limitation of the policy document. If the content of the policy document is to be applied to a specific faculty, educational programme, discipline or course of study, attention should be paid to these unique, specific factors to assess their impact on students' learning outcomes.

## **5.2 Detailed Policies**

5.2.1 In the existing university sector, the Supreme Council governing Egyptian universities has developed (through an update to the law in 2006) a number of policies pertaining to academics which ensure that university students (both public and private) graduate with minimal disciplinary knowledge for employment.

5.2.2 Some of these policies discuss the procedures for academics' recruitment, promotion, leaves, duties and responsibilities, penalties and end of service to ensure that recruited academics maintain the required standards for teaching undergraduate disciplinary knowledge.

5.2.3 In parallel to the implementation of the law and to achieve higher education strategic goals, Egyptian universities are also required to comply with quality standards set by the National Authority for Quality Assurance and Accreditation of Education (NAQAAE) to improve quality measures for institutional capacity as well as educational effectiveness.

5.2.4 Part of universities' compliance with quality policies is to assure academics' effective teaching of graduate attributes (sometimes referred to as employability skills and soft skills) in taught courses to address the skills gap which exists between the labour market and the university.

5.2.5 As referenced in many studies, graduate attributes represent the skills, personal qualities and values which should be acquired by all graduates regardless of

their discipline or field of study. Examples of these are teamwork, communication skills, problem solving, and information technology.

5.2.6 As stated by NAQAAE's policies, graduate attributes form a core part of students' learning outcomes for all disciplines and play a role in improving graduates' performance at work.

5.2.7 In line with 5.1.1 policies for ensuring that students' learning outcomes address labour market demands, particularly with regards to graduate attributes, this policy describes the necessary steps to be followed by higher education policy makers and education practitioners to ensure academics' effective performance in teaching graduate attributes in undergraduate courses of study.

5.2.8 This policy recognises that improving academics' performance with respect to the teaching of graduate attributes is a strategically important activity that needs to be undertaken professionally and with the full engagement of all those involved in the teaching and learning experience.

5.2.9 The following clauses describe in detail the necessary steps to be followed to ensure the effective implementation of this policy document.

### **5.3 Graduates' Recruitment into Academia**

5.3.1 With respect to recruitment in academia current procedures described by the law governing Egyptian universities should be revised so that universities recruiting new graduates for the post of Graduate Teaching Assistant (GTA) take into account a number of aspects. These are: graduates' awareness of disciplinary knowledge, graduates' personal attributes and potential to teach in academia, graduates' previous work experience in the field related to their specification (preferably one year or more), graduates' assessment and feedback on internships/training/clinical work while in university and when recruiting, no special preference should be given to graduates from the recruiting faculty (as appropriate).

5.3.2 With regard to disciplinary knowledge, current Egyptian law for recruiting new graduates is consistent with the policy set out within the policy document; that is newly introduced candidates for academia must be qualified upon graduation with a total

grade average of at least very good or excellent. Candidates must also show proof of a good disciplinary conduct.

5.3.3 In terms of personal attributes and potential to teach in academia, new candidates must prove to employing faculties that they have the necessary attributes and qualifications (including language skills and information technology) to teach in the faculty system. This could be implemented by setting up an interview committee in every faculty to assess graduates' attributes and potential to teach in the disciplinary field. In any situation, whether qualified for teaching or not, potential candidates for academia must undertake the necessary training or attain a teaching qualification prior to recruitment.

5.3.4 It should be guaranteed through appropriate parties, that the training undertaken by these potential candidates is to be carried out by pedagogical qualified specialists. Similarly, teaching qualifications must be obtained from qualified educational specialists.

5.3.5 Such training could be carried out in coordination with the Faculty of Education or the National Centre for Faculty and Leadership Development (NCFLD) which currently offers training courses to Egyptian academics for capacity development.

5.3.6 Employment experience should be made compulsory for graduates willing to undertake academic roles. This is to ensure that previous working practices are reflected in course work, promoting the creation of a learning culture rather than a teaching culture. This in turn will improve the teaching of graduate attributes and disciplinary knowledge in taught courses.

5.3.7 Student internship/training reports, completed while studying in faculty must be part of the recruitment process since they inform recruiters of graduates' potential and qualities for teaching in academia as evaluated by their trainers (who are possible future employers).

5.3.8 Special efforts should be made not to recruit graduates to the school in which they graduated to avoid the self breeding effect. This is important for creating a teaching and learning culture that does not embrace imitated thoughts, work practices, and behaviours.

5.3.9 The law should oblige universities to equally assess all of these aspects prior to a graduates' employment so that awareness of disciplinary knowledge is no longer accorded the highest priority as is currently the case in most Egyptian universities.

5.3.10 In order to motivate change, all of the points discussed in clause 5.3 should be driven by the law. This necessitates revising clause# 136-2 to include the suggested ideas. It should also be clarified to graduates through an internal announcement prior to employment. This would help graduates as well as academics to recognise and value the importance of graduate attributes as core elements of the teaching and learning process.

5.3.11 Potential candidates willing to work in academia and meeting all the points suggested in 5.3.1 should be financially rewarded or remunerated. This is to encourage an academic culture that appreciates and recognises the importance of graduate attributes as a learning outcome.

5.3.12 Funds for remunerations and rewards should be considered part of the university annual budget set for education and this should be announced to all academics to inform and motivate them about the value of effectively teaching graduate attributes in taught courses.

5.3.13 The law should also encourage public universities to recruit graduates from other universities, either inside or outside Egypt into their system to create an academic culture that allows the diversification of personal attributes, ideas and disciplinary knowledge. Such a culture, when created based on previous studies, will help improve academics' performance when teaching and learning graduate attributes in courses of studies.

5.3.14 To achieve this, the current law should be changed, as it emphasises the recruitment of graduates into the faculty in which they graduated, particularly in public universities.

#### **5.4 Promotion and Progression into the Academic System**

5.4.1 With respect to academics' promotion and progression into the academic system, this policy document is consistent with the law governing Egyptian universities

that for the academics to progress into the academic system, they need to attain a Master's or PHD qualification from an Egyptian or internationally accredited university within the time frame suggested by the law. This timeframe is six years after graduation for lecturers, five years for associate professors after becoming lecturers and five years for professors after being associate professors.

5.4.2 With respect to academics' promotion and progression into the academic system that is currently based on disciplinary research, the law should be amended to allow them more flexibility for promotion and progression into the system based on interdisciplinary and multidisciplinary research. This allowance is to improve academics' teaching and learning practices which will in turn create a culture that appreciates graduate attributes rather than one that values only disciplinary knowledge.

5.4.3 Besides non-disciplinary research work, there should also be more formalised relationships between industry/the labour market and universities in the form of industry/the labour market based research, community service, collaborative projects or industry/labour market secondments for interested academics. Such relationships should take into account the necessary incentives that will encourage academics to perform these tasks.

5.4.4 This relationship should not depend solely on the university but also on industry/the labour market, where assessment of the interest on both sides should be taken into consideration to decide on the most suitable approach for the mutual relationship.

5.4.5 The aim of these formalities is to keep academics aware of the labour market's most needed attributes for employment and to keep the labour market aware of the disciplinary knowledge and attributes taught in faculties in order to bridge the skills gap between the labour market and academia.

5.4.6 Also academics should be appraised for progression into the academic system based on their personal attributes and abilities to teach students rather than just allowing students to evaluate them based on their ability to teach disciplinary knowledge.

## **5.5 Rewarding Academics**

5.5.1 Universities should encourage a system to reward academics based on their teaching performance as well as effective implementation of graduate attributes in taught courses. This may include salary increases, more fringe benefits, and remuneration to those academics showing commitment to quality in teaching.

5.5.2 Funds for remunerations and rewards should be considered part of the university annual budget set for education and this should be announced to all academics to make them aware and motivate them about the value of effectively implementing graduate attributes in taught courses.

## **5.6 Visiting Employers**

5.6.1 Well-recognised employers should also be invited to teach a course of study in academia or to conduct lectures on a frequent basis. The aim is to create a learning environment that is similar to the workplace to feed experiences from industry/the labour market into the design of courses. The main focus of these lectures should be based on the improvement of disciplinary knowledge and awareness of the labour markets' needs, particularly with regard to graduate attributes.

5.6.2 Academics can make use of these visits to obtain regular feedback from businesses on how well the university is fostering graduate attributes in its students.

## **5.7 Improving Quality Standards**

5.7.1 There should be formalised reviews of National Academic Reference Standards (NARS) developed by NAQAAE to update and forecast the attributes required for employment. This is a significant means of ensuring that national standards for graduate attributes align with the contemporary demands of employers.

5.7.2 NARS should also be developed with the support of Egyptian employers as their feedback will inform higher education practitioners of the important learning outcomes for employment.

5.7.3 Employers could also be invited to review the attributes embedded in courses and how they are implemented, and could be asked whether they suggest any changes to course design.



## 6. References

- 6.1 The law governing Egyptian universities and its executive bylaws.
- 6.2 Barrie, S., C., 2004. A research-based approach to generic graduate attributes policy. *Higher Education Research & Development*, 23 (3), 261-275.
- 6.3 Martin, R., Maytham, B., Case, J., Fraser, D., 2005. Engineering graduates' perceptions of how well they were prepared to work in industry. *European Journal of Engineering Education*, 30 (2), 167-180.
- 6.4 Oxford Dictionary.

## **Appendix K: National Academic Reference Standards (NARS) for engineering**

### **1. Attributes of the graduates of engineering**

The graduate must be able to:

- a) Apply knowledge of mathematics, science and engineering concepts to the solution of engineering problems.
- b) Design a system; component and process to meet the required needs within realistic constraints.
- c) Design and conduct experiments as well as analyze and interpret data.
- d) Identify, formulate and solve fundamental engineering problems.
- e) Use the techniques, skills, and appropriate engineering tools, necessary for engineering practice and project management.
- f) Work effectively within multi-disciplinary teams.
- g) Communicate effectively.
- h) Consider the impacts of engineering solutions on society & environment.
- i) Demonstrate knowledge of contemporary engineering issues.
- j) Display professional and ethical responsibilities; and contextual understanding.
- k) Engage in self- and life- long learning.

### **2. Knowledge and understanding**

The graduate must be able to understand:

- a) Concepts and theories of mathematics and sciences, appropriate to the discipline.
- b) Basics of information and communication technology (ICT).
- c) Characteristics of engineering materials related to the discipline.
- d) Principles of design including elements design, process and/or a system related to specific disciplines.
- e) Methodologies of solving engineering problems, data collection and interpretation.

- f) Quality assurance systems, codes of practice and standards, health and safety requirements and environmental issues.
- g) Business and management principles relevant to engineering.
- h) Current engineering technologies as related to disciplines.
- i) Topics related to humanitarian interests and moral issues.
- j) Technical language and report writing.
- k) Professional ethics and impacts of engineering solutions on society and environment.

### **3. Intellectual skills**

The graduate must be able to:

- a) Select appropriate mathematical and computer-based methods for modeling and analyzing problems.
- b) Select appropriate solutions for engineering problems based on analytical thinking.
- c) Think in a creative and innovative way in problem solving and design.
- d) Combine, exchange, and assess different ideas, views, and knowledge from a range of sources.
- e) Assess and evaluate the characteristics and performance of components, systems and processes.
- f) Investigate the failure of components, systems, and processes.
- g) Solve engineering problems, often on the basis of limited and possibly contradicting information.
- h) Select and appraise appropriate ICT tools to a variety of engineering problems.
- i) Judge engineering decisions considering balanced costs, benefits, safety, quality, reliability, and environmental impact.
- j) Incorporate economic, societal, environmental dimensions and risk management in design.
- k) Analyze results of numerical models and assess their limitations.
- l) Create systematic and methodic approaches when dealing with new and advancing technology.

#### **4. Practical and professional skills**

- a) Apply knowledge of mathematics, science, information technology, design, business context and engineering practice integrally to solve engineering problems.
- b) Professionally merge the engineering knowledge, understanding, and feedback to improve design, products and/or services.
- c) Create and/or re-design a process, component or system, and carry out specialized engineering designs.
- d) Practice the neatness and aesthetics in design and approach.
- e) Use computational facilities and techniques, measuring instruments, workshops and laboratory equipment to design experiments, collect, analyze and interpret results.
- f) Use a wide range of analytical tools, techniques, equipment, and software packages pertaining to the discipline and develop required computer programs.
- g) Apply numerical modeling methods to engineering problems.
- h) Apply safe systems at work and observe the appropriate steps to manage risks.
- i) Demonstrate basic organizational and project management skills.
- j) Apply quality assurance procedures and follow codes and standards.
- k) Exchange knowledge and skills with engineering community and industry.
- l) Prepare and present technical reports.

#### **5. General and transferable skills**

The graduate must be able to:

- a) Collaborate effectively within multidisciplinary team.
- b) Work in stressful environment and within constraints.
- c) Communicate effectively.
- d) Demonstrate efficient IT capabilities.
- e) Lead and motivate individuals.
- f) Effectively manage tasks, time, and resources.

- g) Search for information and engage in life-long self learning discipline.
- h) Acquire entrepreneurial skills.
- i) Refer to relevant literatures.

## **Appendix L: National Academic Reference Standards (NARS) for computer engineering programmes**

### **1. Knowledge and understanding**

In addition to the knowledge and understanding of engineers, the graduates of computer engineering programmes should demonstrate:

- a) Engineering principles in the fields of logic design, circuit analysis, machine and assembly languages, computer organization and architectures, memory hierarchy, advanced computer architectures, embedded systems, signal processing, operating systems, real-time systems and reliability analysis.
- b) Quality assessment of computer systems.
- c) Related research and current advances in the field of computer software and hardware.
- d) Technologies of data, image and graphics representation and organization on computer storage media.
- e) Modern trends in information technology and its fundamental role in business enterprises.

### **2. Intellectual skills**

In addition to the intellectual skills of engineers, the graduates of computer engineering program should be able to:

- a) Select the appropriate mathematical tools, computing methods, design techniques for modeling and analyzing computer systems.
- b) Select, synthesize, and apply suitable IT tools to computer engineering problems.
- c) Proposing various computer-based solutions to business system problems. Cost-benefit analysis should be performed especially in sensitive domains where direct and indirect costs are involved.
- d) Identifying symptoms in problematic situations.
- e) Innovating solutions based on non-traditional thinking and the use of latest technologies.

f) Capability of integrating computer objects running on different system configurations.

### **3. Practical and professional skills**

In addition to the practical and professional skills of engineers, the graduates of computer engineering program should be able to:

- a) Design and operate computer-based systems specifically designed for business applications.
- b) Use appropriate specialized computer software, computational tools and design packages throughout the phases of the life cycle of system development.
- c) Write computer programs on professional levels achieving acceptable quality measures in software development.
- d) Conducting user support activities competently.