

المستويات العليا (هيرالديا) لخليج ليلايا في موميات

المستويات العليا في موميات

Key Skills for Chemistry Graduates of Iraqi Higher Education Institutions

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المستويات العليا

غالباً ما يجد خريجو مؤسسات التعليم العالي العراقي انفسهم غير مؤهلين التاهيل الجيد لمستقبلهم في مجالات العمل المختلفة بسبب تركيز هذه المؤسسات على تزويد طلبتها بالمعرفة التخصصية والمهارات التخصصية فقط. اخذين بنظر الاعتبار أن الامكانيات المادية والموارد الطبيعية التي يمتلكها العراق لاسيما الاحتياط النفطي الكبير سوف تجعل من هذا البلد محط انظار الشركات العالمية الكبيرة عامة والشركات الكيميائية خاصة اذا ما تحسنت الاوضاع الامنية وشرعت قوانين الاستثمار مستقبلاً. فخرىجو اقسام الكيمياء من العراق اذا ما ارادوا الحصول على فرصة جيدة للعمل في هذه الشركات العالمية في حال قدومها للعراق يتطلب عليهم امتلاك المزيج الصحيح من المهارات والقدرات والصفات الشخصية فضلاً عن معرفتهم و مهاراتهم التخصصية من اجل زيادة فرصهم للتوظيف في تلك الشركات. الغرض من هذا البحث هو اقتراح نظام لمؤسسات التعليم العالي في العراق لغرض تزويد خريجي اقسام علم الكيمياء في هذه المؤسسات بالمهارات الاساسية غير التخصصية والتي تشترطها الشركات العالمية الكبرى وخاصة الكيميائية منها لجعلهم اكثر كفاءة واعدادهم الاعداد الجيد لتلبية متطلبات هذه الشركات لغرض زيادة

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فرصهم في التوظيف. ويمكن لاقسام التخصصات الاخرى في مؤسسات التعليم العالي في العراق الاستفادة من هذا النظام لغرض تطوير مهارات خريجيهم.

1. Abstract:

Graduates of Iraqi Higher Education Institutions (IHEI's) often find themselves inadequately prepared for their future employment as these institutions focus on providing their students with the subject knowledge and subject related skills only. With its wealth and natural resources especially the big oil reserve Iraq has, will make this country a good spot for the world class companies in general and the chemical companies in particular to invest in. For chemistry graduates of this country to stand with a good chance of working for such companies, they'll need to have the right mix of skills, abilities and personal qualities in order to increase their chances of employability. The purpose of this paper, however, is to suggest a system to (IHEI's) to provide their chemistry graduates with the key skills that may need to make them more competent and well prepared to meet the requirements of world class chemical industries in order to increase their chances of employability. Other subject's departments can also benefit from this suggested system to develop the skills of their graduates.

2. Key Words:

Chemistry: Can be defined as the science that studies systematically the composition, properties, and reactivity of matter at the atomic and molecular level.

Key Skill: An ability and capacity acquired through deliberate systematic, and sustained effort to smoothly and adaptively carry out complex activities or job function.

Graduate: Someone who has completed the requirements of an academic degree.

Employment: Means someone being paid to work for a company or organization.

Iraqi Higher Education Institutions (IHEI's): Private and public universities and colleges in Iraq.

3. Introduction:

After decades of wars and economic sanctions, Iraq's infrastructure have been to a large extent dimensioned. However, the natural resources and wealth Iraq has, will make this country a very attractive place for most of the big world class industries to invest in. If this to happen as most people predict so or just for the fact that this world has become a small village and these graduates have the right to move on to anywhere in the world and be able to work for the top industries, in either cases, IHEI's should raise to the challenge and prepare their graduates in all specialties, especially chemistry graduates to be more employable by equipping them with skills top industries demand .

Key skills refer to a particular set of skills that are commonly needed in a range of activities in education and training, work and life in general. They are transferable skills which means once you've got them, you can use them in different situations (www.nidirect.gov.uk). Along with good technical understanding and subject knowledge, employers often outline a set of skills that they want from an employee. In general, employers have identified a group of five skills that are key to learning and are most likely to be needed in any work environment in today's world. These are communication, numeracy, information and communication technology, problem solving and working with others. This does not mean that every job will need people who are proficient in all five skills but it does mean that every job will require some level of ability in some or all of these skills (www.sqa.org.uk). While we talk about the key skills as 'separate' skills, in practice the boundaries between the skills are not well defined and there is overlap between them .

People with sound key skills are argued to perform better, and to be essential to modern organizations. At senior levels, a wider range and depth of key skills is needed. Sound key skills help people progress, where opportunities for promotion exist. Those with good Key Skills are also in a stronger competitive position in the labour market more generally (www.employment-studies.co.uk).

Educational organizations and employers are increasingly interested in ensuring that people acquire a range of key skills to enable them to adapt to new work and learning situations. These skills are what they believe will equip the employee to carry out their role to the best of their ability (www.exeter.ac.uk).

Surveys reflected the opinions of the employers of graduates in the workplace concluded that graduates did not have the necessary skills and could be better prepared for the world of work by their university education (Duckett *et al.*, 1999: 1). Duckett *et al.* published the results of an extensive survey of chemistry graduates. Summarizing the results of the survey (Duckett *et al.*, 1999: 2-6):

1. The following seven areas are the ones that were identified as very important, and for which graduates felt that their university training had been inadequate:
 - Time management
 - Updating one's skills/knowledge by oneself
 - Contributing to discussions
 - Presenting information using computer software
 - Self-appraisal
 - Understanding/evaluating the views of others
 - Talking/writing persuasively to non-specialists
2. The following top seven areas of deficiency of chemistry graduates, as perceived by chemical company employers:
 - Awareness of intellectual property
 - Communication/presentation skills
 - Ability to relate to all levels
 - Innovative thinking
 - Leadership qualities
 - Commercial awareness
 - Practical skills

Although several reports have discussed the graduate skills required by employers (Archer & Davison, 2008: 6), relatively little has been reported on the knowledge and skills which graduates have found of value when they enter into employment or further study. (Hanson *et al.*, 2010: 1) of the Higher Education Academy, University of Hull in collaboration with the Royal Society of Chemistry (RSC) Education Division in November 2010 has conducted a survey study on graduates of chemistry programmes of nine universities across the UK. The survey focused on the 2007 graduate cohort, i.e. about two and half years after graduation. Such graduates have had sufficient time to gain some understanding of the skills requirements of their employment (or further study), whilst retaining a reasonably up-to-date knowledge of their chemistry degree programmes. The aim of the survey was to identify which areas of the chemistry curriculum including generic skills are particularly useful for new graduates and to evaluate how

well they are developed within undergraduate chemistry degrees. The generic skills were scored at a higher level of usefulness than the chemical knowledge/skills (Hanson et al., 2010: 28). The study recommended that when undergraduate chemistry degree programmes are being revised, additional opportunities should be provided for developing generic skills. Undergraduates should be advised about the range of skills new graduates require.

The Confederation of British Industry (CBI) report in 2009 entitled *Future fit: Preparing graduates for the world of work* recommended that universities should obtain regular feedback from former students/alumni on how well the universities are fostering employability skills in their students (CBI, 2009: 19).

In Britain, there has been a focus on the development of generic skills for graduates. The Dearing committee, Quality Assurance Agency (QAA) and employers who look to higher education as a major provider of highly able and skilled people and who say that higher education needs to become more relevant to business needs were the major drivers who have led to the acceptance in the United Kingdom that graduates should not only possess their subject-specific skills, but also that they need to have transferable skills (Bailey, 2008: 2).

The Dearing committee was composed of individuals from a diverse range of backgrounds: academic, industrial, educational and public sector (Dearing Report, 1997: 5). This committee produced in 1997 what is called the Dearing report. This report stated that "The need for higher education to do more to develop a range of key skills in students, in addition to the cognitive capabilities traditionally associated with higher education, was a major theme of the evidence from employers, both in our own survey (Appendix 4: 'Consultation with employers') and in evidence from representative bodies" (Dearing Report, 1997: 34).

This report requires all degrees (Dearing Report, 1997: 141) to have a 'programme specification', which "gives the intended outcomes of the programme in terms of:

1. Knowledge/understanding of subject (syllabus)
 2. Special subject skills (e.g. lab work)
 3. Cognitive skills (methodology, critical analysis)
 4. Key skills
- Communication
 - Numeracy
 - Use of Information Technology (IT)

- Learning how to learn

Traditionally, chemistry degree programmes and most other degree programmes in (IHEI's) covers first three aspects of the 'programme specification', but 'key skills' have been a minor feature of degrees, or were not explicitly covered at all.

The Quality Assurance Agency (QAA) in Britain required all subjects to specify programme outcomes for all degrees, and a range of transferable skills are now embedded in the descriptors for all degrees. In order to provide some sort of national framework for the core requirements of degrees in particular subjects, the benchmark documents were produced by appropriate bodies; For Chemistry, this was the Royal Society of Chemistry (RSC). Their programme specification for chemistry mirrored Dearing's, with 4 main headings as summarized below (QAA, 2007: 3):

Programme specification - Chemistry benchmark:

1. Subject knowledge (syllabus).
2. Chemistry related cognitive abilities and skills.
3. Chemistry related practical skills.
4. Transferable skills.

'Transferable skills' were largely equivalent to Dearing's 'key skills', and had the following sub-headings:

- Communication (written and oral)
- Problem-solving (and critical thinking)
- Numeracy and computing
- Information retrieval
- Information Technology (IT) skills
- Interpersonal skills
- Organizational skills (including time management)
- Skills for continuing professional development

Since then in Britain, accredited chemistry degrees have had to address the issue of key (transferable) skills, and these remain an essential component of degrees. When Professor Pulham *et al.* were asked to develop commercial skills material by the Royal Society of Chemistry, the first thing they did was to ask some important employers what they look for in their graduate recruits? Key findings were that potential recruits need to be good at innovation, working in team based activities, problem solving, working through formal project/process systems, integrating their specialist knowledge with others and communication skills. When asked what would you regard as being the key skills of chemistry graduate recruits? Some of employers comments were "It's rare that people use more than 10% of the

science they know at any time with us. But what we need is for them to understand, interface and interact with people from other disciplines (commercial and technical such as engineers and life scientists)", other comments were "We interview hundreds of potential 'strategic recruits' each year. Most fail their technical interviews, not because they don't know their science but because they are not good at applying what they know to problems we might ask about" (Pulham *et al.*, 2012: 2).

Most British universities in corroboration with big industries have developed a list of skills for chemistry graduate to develop during their undergraduate studies. Examples of this is the list of skills for Sheffield university chemistry graduates (www.careers.dept.shef.ac.uk) which include analytical skills, communication skills, commercial awareness, creativity & innovation, data collection& interpretation, decision making, health & safety awareness, information technology skills, numerical ability, organizational ability, project management, research skills, risk assessment and technical skills.

Other universities in the world have also established skills centers to develop their graduates skills. Examples of these are Learning Skills Centre in the University of Canterbury in New Zealand (www.lps.canterbury.ac.nz), Academic Skills Centre in Trent University in Canada (www.trentu.ca) and the Academic Skills Centre in Canberra University in Australia (www.canberra.edu.au).

From the above there is much evidence that chemistry graduates must possess a range of key skills, as well as the subject-specific abilities that one would expect of a graduate chemist.

4. Should Key Skills Be Embedded Into The Subject Curriculum or Delivered Separately By (IHEI's)?

There is much evidence of support for the further development of a range of skills during higher education but the argument or debate is about whether key skills should be embedded into the subject curriculum or delivered separately. Some universities have a university-wide key skills certificate available that students can enrol onto. They then can graduate with their degree in their chosen subject and the key skills certificate (Washer, 2007: 63). One benefit of this model may be that an already-overcrowded curriculum does not get overloaded with any more content. The problem with this model is that there are resource issues, for example who is going to teach and assess the extra certificate, particularly in universities where budgets are devolved to departmental level? In this

model, the key skills are separated from the core academic content, which may lead to patchy uptake by the students. Another potential problem is that pressures of academic and paid work lead to few students completing the certificate where it is offered as an add-on skills certificate (Fallows et al, 2000: 133). Although some argue that 'working in' key skills into an existing programme may prove to be a distraction rather than providing a learning opportunity, Washer P. (Washer, 2007: 66) argues that integrating key skills into the existing curriculum has proved to be a more practical alternative model to the stand-alone skills model used in some universities. Key skills are already present in existing curricula in various forms: in group work, presentations, use of information technology and so on. So it may be possible through group projects, presentations of their course work or diversifying assessments to teach and assess key skills through relatively minor changes in the existing curriculum.

Bailey has also discussed this argument and stated that "Despite the strong case for the centralized tuition of communication skills, I think that these skills must be taught within a chemistry context, so that the students understand their relevance" (Bailey, 2008: 5).

A study conducted by Barrie (Barrie, 2006: 234) described the qualitatively different ways academics understand the concept of graduate attributes. In doing so it has highlighted the fact that the academic community does not share a common understanding of graduate attributes as the 'core outcomes of university education'. The nature of the 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 attribute curricula.

Bennett *et al.* in 1999 suggested that teaching employability skills during a degree could be met with reluctance from some academics who resist the idea of such direct usefulness of an undergraduate education and who do not believe it is a part of their role to provide skills for employment (Bennett et al, 1999: 92).

5. Why Having a University Key Skills Centre (UKSC) is The Answer For (IHEI's)?

Looking into the research and publications mentioned in section three and taking current status of Iraqi higher education system into consideration, the researcher recommends that (IHEI's) should invest in establishing a University Key Skills Centre (UKSC). The responsibility of

this centre will be to deliver generic key skills for all university students and to work closely with each department requiring specific skills.

The reason why a (UKSC) is much suited for chemistry and could be all other subjects delivered by (IHEI's) may be due to the following:

1. Lack of experience for most Iraqi academic staff for the real need and importance of such skills.
2. Lack of feedback from top industries regarding graduate needs due to their unavailability in Iraq.
3. Difficulties facing universities and departments to change their curriculums due to very much complicated routine in higher education systems.
4. Employ the right professionals to deliver courses in their specialty.
5. Help students planning their time for courses required by their degrees during their years of university.
6. Key skills are generic, therefore there are advantages with teaching the skills using general examples and exercises, rather than within a subject-specific context.
7. The teaching can be carried out more efficiently centrally than in departments, both concerning resources and time. Concerning resources, examples include reference materials (books, CD-ROMS, Web information), computing facilities (hardware and software), videoing capabilities, team exercise material, and dedicated rooms. Concerning time, both central timetabling, and the use of experts to teach large groups, might help to make efficient use of time by both students and tutors (Bailey, 2008: 4).
8. By having a special university course, it is easier to identify the content of the programme, makes it easy to monitor the topic, and preserving the chemistry content as there is already insufficient time to teach the students all the chemistry they need to know; an intensive central course would provide the teaching they need with minimum disruption of delivering the all-important syllabus (Bailey, 2008: 4).
9. This centre can serve the university as a whole.

6. Suggestions:

It can be suggested at this stage that the (UKSC):

1. Should deliver the skills required by chemists according to the benchmark documents produced by the RSC in Britain which were largely equivalent to Dearing's 'key skills' as there is no such appropriate bodies in Iraq for this subject as in Table 1.

Table (1): Generic skills in bachelor's degree for chemistry programmes according to the benchmark documents produced by the RSC in Britain (QAA, 2007: 6).

No.	Generic Skills
1	Communication skills, covering both written and oral communication.
2	Problem-solving skills, relating to qualitative and quantitative information.
3	Numeracy and mathematical skills, including such aspects as error analysis order-of-magnitude estimations, correct use of units and modes of data presentation.
4	Information retrieval skills, in relation to primary and secondary information sources, including information retrieval through online computer searches.
5	Information Technology (IT) skills.
6	Interpersonal skills, relating to the ability to interact with other people and to engage in team working.
7	Time management and organizational skills, as evidenced by the ability to plan and implement efficient and effective modes of working.
8	Skills needed to undertake appropriate further training of a professional nature.

2. Should work with each department to design courses focuses on the key things employers are looking for from their graduates.
3. Can benefit from the experience of other key skills centers in universities around the world.
4. Due to high competition and customers' requirements, and from my own personal work experience with some of the world top industries such as Honeywell and Johnson Matthey, most industries work hard to meet and maintain the requirements of quality assurance and health and safety and environmental standards. I, therefore, recommend here that the (UKSC) should also consider delivering courses related to quality assurance (QA), Health and Safety and Environmental (HSE) standards knowledge which may be important to most industries

especially chemical industries as they are the future employers of most chemistry graduates.

5. Language skill: Since the English language is the international number one language and considered to be the science language so having a qualification or certificate by the graduates provided to them by their universities will surely increase their chances of employability or help them achieve higher qualification.

The question will be, however, how can you get students engaged with these skills? This may be achieved by asking students to take the responsibility of enrolling themselves in their free time (may be during their summer holidays) in the (UKSC) prior to their graduation as a condition of their degree award.

7. Conclusion:

Graduates need to be equipped with skills that they can use to 'sell themselves' to employers as learning today is not the accumulation of information, but having the right skills involved in knowing what to do with information. It is the responsibility of higher education institutions to help their students developing general key skills and make them well prepared and aware of the qualities and skills required by their future employers. If graduates can clearly demonstrate skills required by employers in conjunction with their knowledge and qualifications then they will be in with a fighting chance for any job that they are qualified for.

Taking current status of Iraqi higher education system into considerations and looking into research and publications discussed the way these skills should be delivered, it has been suggested here that (IHEI's) needs to establish a (UKSC) in order to enhance the quality of their chemistry graduates and may be graduates of other disciplines. Skills required by chemists according to the benchmark documents produced by the RSC in Britain, QA & HSE and English Language courses have been suggested here to be delivered by this centre to chemistry undergraduate students and may be other science and engineering undergraduate due to their relevance to their future work. This paper has also suggested that students should take responsibility of enrolling themselves in their free time during their undergraduate period in the (UKSC) courses prior to their graduation as a condition of their degree award.

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