RELEVANCE OF INFORMATION QUALITY STUDIES IN INFORMATION SYSTEMS EDUCATION IN AUSTRALIA

(Research-in-Progress)

IQ Education and Curriculum Development

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Abstract: Tertiary degrees in Information Systems offered in Australian Universities seem to align in favor of advertised job requirements. The advertisements themselves are influenced by the understanding and awareness of the actual requirements of the job by the advertisement writer/ publisher. Often, replicated from other websites or old documents, these advertisements may offer misleading insights into the actual requirements of long term employment in a particular Information Systems related field. This research aims to investigate the requirement for Information Quality skills in Information System related jobs. This will ultimately assist Information Systems curriculum developers to update existing Information Systems course structures to meet Information Quality technical skill demands in long term Information Systems employment.

Key Words: IS degree, IQ Skills, IS Job Demand, IS Job Skills, IQ competencies

INTRODUCTION

Despite growing awareness about Information quality (IQ) within the academic and the industrial sectors, owing a great deal to the persistent contributions of leading IQ experts, its presence in tertiary Information Systems (IS) education in Australia is surprisingly lacking in depth and significance. Given the extensive research on the skills and capabilities that are most valued by employers, the view that IS programs fail to meet the evolving technology market requirements [29] demonstrates a curious state of complacence among tertiary IS curriculum developers towards practicalities of the market. Indeed, it could be construed as a lack of IQ in the data compiled by IS curriculum developers, which may be the only way to rationalize why IQ finds such little relevance in IS course structures in the leading Universities of Australia. This is particularly interesting as the trend is at odds with evidence from literature [34] that IS curriculum has generated a great deal of interest over the last decade, leading to customized specifications for IS curricula, especially at the under-graduate level. Several studies have also been conducted that recommend the inclusion of IQ management in IS curricula ([11]; [23]; [13]).

Considering the criticality of IQ as a tool for effective information retrieval in IS [18] and the findings by [33] that people, by and large trust in the IQ of IS, except for the web, this research is the preliminary stage of a study on IS curriculum development in Australia that focuses on how certain core IS competencies like the practical knowledge of IQ tools are ignored while several non-technical skills like report writing finds predominance with Australian tertiary IS course structures. This is not

to say that non-technical skills are irrelevant, rather this paper simply aims to conduct a review of IS courses in Australian Universities to assess the challenge of teaching IQ to students, when clearly academicians and practitioners seem to have other goals in mind. This paper focuses on the issue of deciding the extent to which certain entry-level employment skills must be focused upon in IS courses as opposed to teaching students valuable technical skills in IQ that can enhance personal career opportunities, as well as uplift industrial work standards and performance, in a spiraling Information and Communication Technology (ICT) skill shortage scenario in Australia [27].

Rationale & Purpose

Therefore, this paper attempts to answer the questions, "How significant is IQ skill development to the professional growth of IS graduates in Australia"; "Do IS professionals' employers need IQ/ DQ (Data Quality) technical skills" and "Should IS degrees in Australian Universities be looking towards a curriculum that gives higher weight-age to IQ/ DQ skill development". The research is relevant as there are significant potential impacts of such a study on IS education as well as a cascading influence on the employability of IS graduates. [20] discuss the significance of gap assessments in the technical curriculum's ability to meet job ready requirements for students and educators; where students can better choose their elective courses based on the studies; and educators can use it to design and updated curriculum. The review of IS courses in Australia can assist academicians in building sustainable curricular structures in IS as there is no arguing the currency and relevance of IQ education over the coming years in Australia. The IS field is dynamic and graduates need to be equipped with the right skills to meet job demands [27]. Existing research points to the absolute necessity of IQ in the field of IS, thus making it a valuable asset for graduates to have, particularly with the predicted boom in IT/ IS requirements in Australia.

For the purpose of this research, IQ and Data Quality (DQ) both will be used interchangeably due to their popular use in place of each other in the industry, and both terms have also been used for web based searches of job descriptions and university curricula for IS.

The structure of the paper is as follows. A review of the relevant literature from Australian Universities teaching IS based courses at under-graduate and post graduate levels is provided, along with popular IS job requirements gathered from a search of web-based job advertisements in Australia. This is followed by the discussion section which analyses the available literature. The conclusion reflects upon the insights from existing literature. This is followed by some observations and recommendations for the future. Finally, limitations and future research options are discussed.

BACKGROUND

The dynamic nature of the IS technology and the rapid growth in IS employment opportunities have created the need for a quickly deployable IS skilled force. This puts curriculum developers and tertiary education providers in the dilemma of meeting the currently advertised requirements as opposed to building courses based on industry best practices [14]. In many ways, IS professionals themselves may be blamed for a lack of active intervention in academic development of future graduates, thus precipitating the dubious practice of basing curriculums on immediate demand than knowledge of sustainable technical and business skills.

The accelerated pace of economic growth, the global nature of IT/ IS business and the introduction of new technologies like cloud computing have brought about an urgent need for educated professional who can manage information as well as produce new knowledge [24], both of which require recent graduates to be possessed with IQ skills that can help tackle complex information related issues at the work-place. IQ is critical for all types of IS [43]. With more organizations shifting towards Enterprise Resource Planning (ERP) IS implementations [43], the increasing use of GIS to enhance business information [6] and the significance of IQ for asset management IS [26], the market for IQ skills is great and the need to train IS graduates in IQ related skills is absolutely imperative for the successful

management of organization's IS.

A pilot study conducted by [27] reveals the mismatch between IQ skills requirements of organizations that rely on the quality of information churned out by the IS to support the various organizational data users and the actual job skills of IS graduates. [19] substantiate the findings through their research on knowledge workers that revealed the ability of experienced professionals to make better use of Knowledge Management Systems (KMS) than lesser experienced workers, implying the need for graduates to be more job ready if they have to be productive within a small amount of time. [39] and [7] concluded about a decade ago of the relevance of IQ in the successful implementation of IS.

As skills shortage increase, outsourcing of many basic tasks and the deployment of immigrant work force for the same within Australia, will leave the more experienced IS professionals in roles calling for more business oriented skills, involving strategic management of information and resources through an in depth understanding of how organizations work ([14]; [12]; [21]; [16]). [16] blames the lack of facilities to train IS professionals as being partly responsible for a work force unable to cope with employer demands for specific technical knowledge. This is hardly surprising when considering the average investment in IS research (Figure 1) and development in Australia as opposed to the actual market requirements based on booming demand for skilled IS graduates.

By Research Field – Information and Computing Sciences 2007-8 ($Amillion)	Business	Higher Education	Government
Artificial intelligence and image processing	$106.59	-	-
Computation theory and mathematics	$137.77	-	-
Computer software	$1,484.02	-	-
Data format	$210.99	-	-
Distributed computing	$0.00	-	-
Information systems	$1,537.21	-	-
Library and information studies	$0.00	-	-
Other information and computing sciences	$177.77	-	-
Total information and computing sciences	**$3,677.66**	**$218.21**	**$212.00**
Total of R&D in all research fields	**$14,379.90**	**$6,717.11**	-
ICT % of all R&D undertaken	**25.58%**	**3.25%**	-

Fig. 1 ICT Research in Australia [1]

[38] conducted a survey of students that revealed that a lack of knowledge about IS career prospects made them hesitant to choose IS courses as a major; which in turn reflects on the lack of preparedness of higher education institutions in meeting the new, aggressive job market in Australia. [36] assessed the Management Information Systems education on the basis of four core personal competencies that are relevant for a range of IS and Information Technology (IT) jobs, including technology competence, project management competence, team competence, and business knowledge and skills. [21] notes the challenges faced by higher education institutions in meeting the employability requirements of their graduates, which is worrisome in the light of the IBM Worldwide survey, that puts Customer Relationship Management (CRM) and Business Intelligence (BI) at the top of Australia's mid-market focus for 2011 [15]. All research points to the absolute necessity of superior IQ expertise to deal with both of these fields ([40]; [44]; [8]; [30]; [10]).

Academicians and education policy makers are duty bound to design and deliver an effective curriculum that will benefit the students and meet the job market requirements [25]. An understanding of IQ and its interrelationship with core IS areas of study like enterprise architecture, data warehousing, analytical IS, data integration, data modeling are essential to the job-worthiness of an IS graduate [11]. Thus, assessing the significance assigned to core IS competencies like IQ skills within the IS curricula for undergraduates and post graduates in Australia can have many potential benefits

for both the education and the IS employment sectors.

Information System Job Profiles

[3] makes a simple yet very significant differentiation between information management and information system jobs; commenting that 'Information management projects are data centric and require skilled specialists to fill information management jobs' while 'Management information system projects ... require specialists to fill management information system jobs'. [3] also gives a detailed description of the various IS related positions and the possible range of responsibilities that are part of each position, including –

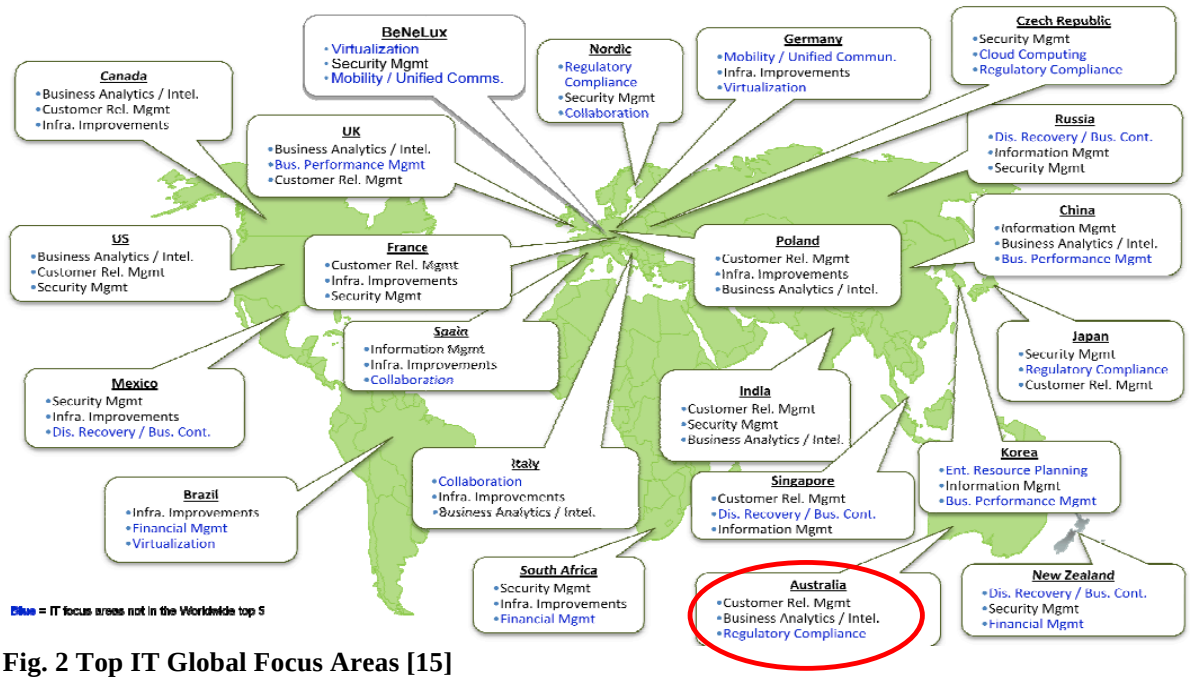

Fig. 2 Top IT Global Focus Areas [15]

a) Business owners responsible for quality of user input
b) Systems/ Service managers responsible for adherence to enterprise information management standards
c) A systems analyst or a data modeller responsible for IS design requirements gathering and involved in quality assurance of the system development project

These roles and some others were used for a web-based search to identify DQ/ IQ requirements of employers in Australia that have been listed in Table 1. [14] point to the emphasis of short-term needs in job advertisements that distract students, employers and curriculum developers from actual long-term skill requirements for IS professionals.

METHOD

Given the resource and time constraints, a representative sample of Australian career web site based information about IS jobs over a month and IS course information from Australian universities have been analysed and the list has been filtered to include only IQ relevant descriptions and course content to assess the existing mismatch between IS job skill requirements for IQ and IQ education content in IS degrees.

DISCUSSION

Information Quality Skills for IS related Employment

The pervasive nature of IS and the increasing investment in IT/ IS by organizations together create a scenario where an organization's strategic and operational activities are heavily dependent of IS projects [14]. This reliance on IS puts great responsibility on the shoulders of IS professionals, as errors in information gathered from organizational IS can have devastating implications for the entire organization. In other words, IS experts cannot afford to be lax about information quality. The emergence of BI and analytics has brought about a need for extreme information management. [2] categorize the majority of issues related to extreme information management to fall into the categories of quantification; access; and quality assurance. Thus, IQ takes on great significance in view of its potential impacts on not only the parent organization or a single business unit, but it also has starts a ripple effect of corrupted data through the entire path of the information flow. [31] developed a list of relevant IQ skill based on research, that should be part of the IS curriculum (Refer Table 1).

Capability Area	**Description**	**Skills Applied to Data Quality**
Technical	Ability to understand and use computational theories and practical skills	Data Mining / Knowledge Discovery Analytic Models (ex. Regression) Data Warehouse Setup Relational Algebra (ex. SQL) Statistical Techniques (ex. SPC) Programming Languages
Adaptive	Ability and knowledge for effectively interacting with data users, managers, and other stakeholders.	Data Quality Measurements Total Quality Management Data Entry Improvement Data Quality User Requirements
Interpretative	Ability to identify and describe the complex interplay between technologies and organizational structure	Change Process DQ Implications & Potential Impacts DQ Cost/Benefit Analysis Database Error Detection

Table 1 General Systems Theory Framework for Data Quality Education [31]

[13] identifies three major IQM principles, the first one being 'Information produce and information system design', and its characteristics to include 'Defining Information Quality Requirements', along with 'Defining Information Product characteristics' and 'Defining an Information Manufacturing System'. For example, a single failure of validating the age of patient at a medical facility, because of poor IS design, will transfer itself to all information systems that are linked to this data. The inaccurate data will travel to any other refereed doctor's records, the government health benefits records, insurance related records and so on. In the end, a medical insurance to be paid out to a pensioner may simply not occur because of a mistake in the age, with the victim being none the wiser about why his payment may have been cancelled.

Results

Web based advertising results for IQ skills in IS profession in Australia

A simple search of popular Australian web-based advertising website Seek.com with keywords 'information quality' or its popular synonym 'data quality' yield a range of IQ/ DQ skill requirements among the essential criteria for applications to IS related jobs. The IQ/ DQ requirements are of two main types – a) generic IQ management requirements that are part of the job description; b) Specific tools meant for IQ improvement and maintenance. The following table 2 summarizes the search results for the key words for a month's worth of advertisements in MIS/ GIS related jobs. The job designations range from MIS/ GIS data quality managers, system architects, data modelers and analysts to administrators and operators of IS.

Generic DQ requirements

- Tertiary qualifications in IS discipline
- Ensure information currency and quality, including undertaking data quality activities (data profiling/auditing, reporting on data issues, and data manipulation and cleansing).
- Experience in Data Quality and Data Governance
- Experience of working with Data Quality, Financial Reporting
- Experience in data Warehouses, Reporting Systems, ETL, SQL or similar
- Delivering data quality improvement and data remediation solutions
- Improving data quality and business processes
- Establishing processes to maintain and improve quality
- Experience in Data Quality Management within Business Intelligence and Data Warehouse environments
- Providing assistance to the Program Information & Analysis section on data and information management related projects, particularly in relation to data quality, extraction and manipulation, and presentation.
- Measure data quality, investigate and interpret trends and patterns in the source data
- Experience with extracting data from database systems using reporting tools and T-SQL
- Experience in investigating, quantifying and reporting on data quality issues, and in undertaking data manipulation
- Identify and implement data quality improvement initiatives
- Provide assistance with the analysis of data quality and data integrity across integrated applications
- Accountable for the data quality, accuracy and timeliness of the reporting provided to key stakeholders
- Experience to analyse source / transactional data for quality, integrity and consistency to support Data Quality improvement activities
- Provide advice on MDM/DQM related matters
- Master Data Management (MDM) and Data Quality Management (DQM)
- Maintaining hierarchical data and reporting cubes
- Establish measures to chart progress related to completeness and quality of metadata for enterprise information, to support reduction of data redundancy and fragmentation, elimination of unnecessary movement of data, and improvement of data quality.

Technical DQ Requirements

- Oracle Essbase, Oracle PeopleSoft Financials
- Oracle Data Relationship Management tools
- SAP Master Data Management and SAP Workflow.
- Data Quality (Profiling, Root Cause Analysis, Remediation)
- Data Architecture and Modelling
- Data Warehousing and ETL
- Deep understanding of RDBMS and related technologies
- Experience with SQL, T-SQL, PL/SQL and DTS in SQL Server and/or Oracle
- Experience with ETL and data quality tools such as Informatica
- Strong experience analysing data issues and preparing written reports using MS SQL
- Experience with QualityStage, Information Analyser
- A working knowledge of SAS, SPSS
- Perform data quality checks on requests for new and existing global and local data for material, customer and vendor that are submitted by data initiators.
- Conduct data quality audits through system checks and site checks to determine integrity and compliance status of market data to the company standards.
- Prepare and publish Data Quality KPI's, and work with business the resolution of any issues.
- Solid data concepts, data modelling, data management, data warehouse skills
- Experience in working with at least 3 of the following: Cognos, DataStage, QualityStage, Information Analyzer, Teradata, SQL Server, Oracle or DB2
- Implement an enterprise-wide centralised information system to improve patient information

• Experience with ETL, Data Warehousing, Data Migrations, MDM, Data Quality • Database purging and cleansing • Create appropriate standards, processes and tools to promote and facilitate to Map, Document, Design and Define Data Sources and Data Movement. • Design and delivery of CRM based solutions with solid understanding of integration points, data quality and automation with SalesForce • Data Warehousing - ETL/ELT, data profiling, data quality analysis, EDW/Data Mart architecture design • Data Governance - metadata management, stewardship, data quality control

Table 2. DQ/ IQ Job Requirements taken from IS job advertisements in Australia [35]

[42] notes the shift in the Australian economy from an industry-based one to a service based one that requires educated professionals to perform value added tasks in their respective roles, a trend that calls for more job ready graduates who can undertake strategically significant decisions for the organization. This research insight based on the Organization for Economic Cooperation and Development's (OECD) observations for Australia, made in 2008 [42]. The findings take on relevance on a global scale, when placed alongside observations made by [22] who refers to a study in the United States over a period of two decades from 1970 to 1990, that concludes that technical skills have much greater significance in long-term employment as opposed to the popular 'soft skills' that are promoted by many experts as the key to bagging a job in the IS field. [9] supports this view through his study that reveal the undeniable significance of technical skills in IS based jobs. [5] on the other hand stress upon a combination of technical and business skills/ soft skills to meet employer requirements in the IS sector.

Information Quality Skills taught to students of IS degrees in Australian Universities

[14] classifies the role of IS education in universities into three different categories based on the profiles expected to be taken up by graduates upon entry into the job market, including (a) citizen/society; knowledge worker; and IS/knowledge expert. Students must not be carried away by superior sounding advertisements; but rather, they must focus on investigating IS course content against actual requirements. Comparing the "essential job criteria" description of IS job advertisements against course content of IS programs may only reflect the short-term demands of the market, instead, reading "job responsibilities", "list of duties", "description of role" etc. sections in job advertisements, wherever such information is available and then reading the detailed course objectives of IS degree objectives on University websites or course booklets gives a better idea about where a possible mismatch is present and how best to leverage available courses to meet actual competency requirements of IS jobs.

Meeting the curriculum requirements that can prepare students to face these roles is a challenging task for academicians. The first master's level curriculum review in IS based degrees was prepared by the ACM Curriculum Committee on Computer Education for Management [37]. Following the trend, several researchers have presented ideas on how to integrate IS job requirements effectively into IS curricula in Universities, so as to produce a productive, job ready IS work force from the start of their careers. [17] expound on the need for updated IS curriculum that can balance the employment ready requirements for IS professionals with the IS body of knowledge. The following Figure 3 provides a glimpse at the core competencies required among students in several countries, placing information management skills as the major part of Australian needs [28].

AUSTRALIA		USA	UK	SOUTH AFRICA	CANADA
Key Competencies • Collecting,	**Clusters of Practice (New Basics)**	**Scans Workplace Know-How**	**Core Skills** • Communicatio n	**Critical Cross-Field Outcomes**	**Employability Skills Profile** • Fundamental

analyzing and organizing ideas and information • Communicating ideas and information • Planning and organizing activities • Working with others and in teams • Using mathematical ideas and techniques • Solving problems • Using technology (Cultural understanding) **Core Skills (Queensland)** • Comprehend and collect • Structure and sequence • Analyze, assess and conclude • Create and present • Apply techniques and procedures **Employability Skills Framework** • Communication • Technology • Problem-solving • Teamwork • Initiative and enterprise • Planning and organization • Self-management • Learning	• Live in and prepare for diverse family relationships • Collaborate with peers and others • Maintain health and care of self • Learn about and prepare for new worlds of work • Develop initiative and enterprise • Blend traditional and new communications media • Make creative judgments and engage in performance • Communicate using languages and intercultural understandings • Master literacy and numeracy • Interact within local and global communities • Operate within shifting cultural identities • Understand local and global economic forces • Understand the historic foundation of social movements and civic institutions	*Foundation Skills* • Basic skills (reading etc.) • Thinking skills • Personal qualities *Competencies* • Resources (time allocation etc.) • Interpersonal • Information (acquires & evaluates information etc.) • Systems (understands systems etc.) • Technology **National Committee of Inquiry into Higher Education** • The knowledge and understanding that a student will be expected to have upon completion of a program *Key skills* • Communication, numeracy, the use of information technology, and learning how to learn *Cognitive skills* • Understanding of methodologies or ability in critical analysis and so on	• Personal skills • Numeracy • Information technology • Problem solving • Competence in modern language **QCA, England** • Taking part in discussions and making presentations • Reading and responding to written material • Producing written material *Information Technology* • Preparing information • Processing and presenting information • Reviewing the use of information technology *Application of Number* • Collecting and recording data • Working with data • Presenting findings *Working with Others* • Planning activities • Working towards identified targets *Improving Own Learning & Performance* • Setting targets and action	• Identify and solve problems in ways which display that responsible decisions using critical and creative thinking have been made • Work effectively with others as a member of a team, group, organization, community • Organize and manage oneself and one's activities responsibly and effectively • Collect, analyze, organize and critically evaluate information • Communicate effectively using visual, mathematical and/or language skills in the modes of oral or written presentation • Use science and technology effectively and critically, showing • responsibilit	Skills • Communicate • Manage information • Use number • Think & solve problems • Personal & Management Skills • Demonstrate positive attitudes & behaviors • Be responsible • Be adaptable • Learn continuously • Work safely • Teamwork Skills • Work with others • Participate in projects & tasks **OECD DeSeCo Key Competencies** • Acting autonomously and reflectively • Using tools interactively • Joining and functioning in • heterogeneous groups

	• Develop a scientific understanding of the world • Work with design and engineering technologies • Build and sustain environments		planning • Following plan to meet target • Problem solving	y towards the environment and others • Demonstrate an understandin g of the world as a set of related systems by recognizing that problem solving contexts do not • exist in isolation	

Fig. 3 Generic, work-related skills − a collation from different countries [28]

Often, lack of awareness among curriculum designers is compounded by lack of knowledge among professional bodies that are meant to assist the educators with developing an updated curriculum, as seen in the case of [41], where graduates had to take matters into their own hands to develop a suitable IS curriculum. [4] recommend alumni surveys as a means to gather practitioner input while developing an IS curriculum. A report prepared for the Department of Education, Science and Training in Australia refer to the Co-op Program at the University of New South Wales, which engages academicians, students and industry practitioners to develop a professional development program that is mutually beneficial to all included parties [32]. A model for curriculum development that works on a feedback mechanism to maintain its validity and currency in relation to evolving employment market requirements was developed by [29] (Refer to Figure 4).

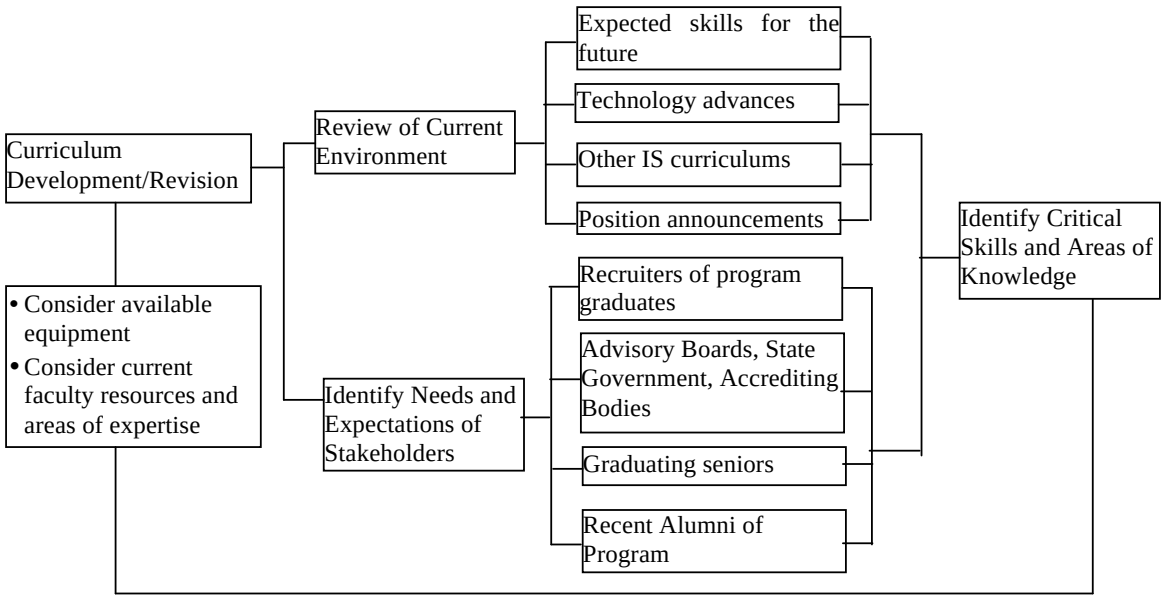

Fig. 4 Curriculum Development Model [29]

The potential benefits of a curriculum that receives a multi-directional input are listed in Table 3.

Stakeholder	Benefit
Academic staff	University staff are made aware of employer needs
Learner	Students learn employability skills and get the opportunity to practice these skills at actual workplaces
Employer	They get a chance to influence curriculum and student development, in a manner that favors their own requirements in many ways

Table 3. Stakeholder Benefits in participating in curriculum development (Adapted from [32])

A search for the key words "Information System" on the course search facilities of leading universities of Australia yielded a list of the courses undertaken by both under-graduate and post graduate students of IS degrees. A list of courses that are closest to DQ/ IQ technical skills requirements listed in Table 2 have been included in Table 4.

DQ/ IQ related courses in Australian Universities
• Business Data Analysis • Knowledge Management Systems • Information System Management • Information Systems Analysis & Model • Geographic Data Analysis • Geographic Information Systems Management • Spatial Data Handling • Information Management and Control • Information Policy and Governance • Enterprise Business intelligence • Data Resource Management • Database Management Systems • Business Information Systems Management • Decision Support Systems • Data Warehouse Concepts and Design • Statistical Data Analysis • Business Information Systems Strategy and Governance • Systems Analysis and Modelling • Business Applications and Architectures

Table 4 DQ/ IQ related courses in Australian Universities *

* Note: Only courses that yielded direct results were considered. Graduate certificates, diplomas, GIS courses and Business IS courses were also considered along with the IS programs offered by the Computer Science and Information Technology departments of various Australian universities.

It is interesting to note that not a single IS degree/ diploma offers IQ management as part of its course structure. Analyzing the IQ skill requirements against the IQ education within IS curricula in Australian Universities, the mismatch between supply and demand for IQ skills is clearly evident [36]. There is a definite need to address this gap to prevent the rising lack of compatibility between work skills expected by the industry and the so-called 'work-ready skills' offered within the academic curriculum for Information Systems.

CONCLUSION

From Table 2 and Table 4, it is obvious that IQ skills are required in IS related jobs, but IS degrees fail to offer the relevant skill development as part of the curriculum. Out of the 39 Universities of Australia, not a single one offers IQ tools/ IQ management as part of its IS course. Changes are called for in the IS current IS curriculum in Australian Universities, that would equip IS students with the technical IQ skills required to meet the demands of the Australian IS job market, as well to improve

the quality of information used in Australian organizations, that may well trigger higher growth rates for the economy and a better economic future for the country. Such a change cannot be made in a short period of time, but there is a need to begin wide spread assessments of University offerings in the IS education sector.

Taking up expensive professional development programs and industry certifications on top of available programs in the IS sector, to meet demands that were either not anticipated or ignored within the degree course structures, reflects badly on the quality and effectiveness of the Australian IS education on a global front. Also, the cross-disciplinary nature of IS course delivery has implications not only for fresh graduates, but also for senior professionals who take business degrees at an advanced stage of their careers. With several business programs offering IS courses as part of the curriculum, students at different stages of their professional careers will benefit from tailored programs that meet IQ skill requirements at multiple levels – from fresh graduates to executives.

IQ skills are indispensable in the evolving job market that requires extensive data management capabilities. Poor IQ simply impairs judgment and can have disastrous impacts on a range of stakeholders, considering the pervasiveness of IS in Australian businesses. The mismatch also points to a dangerous complacence among Universities to simply replicate course content based on existing models or to update them to a limited extent to meet short term goals. This is a negative trend and there is an urgent need to address the issue before Australia enters a further skill deficit despite extensive immigration of skilled labor, outsourcing and availability of a workforce waiting for the right opportunities.

There is a call for academicians and professional development agencies to work together to determine the answers to questions like –

- Are the current IS program specifications driven by short term industry demands or insight into actual IS responsibilities likely to be encountered by IS graduates?
- Are the multitude of IS courses on offer a simple replication and cross-matching of subject content or is the curriculum design driven by industry standards and best practices?
- Are the IS courses capable of meeting not only the local demands, but also global demands in an increasingly connected economy?
- Are IQ courses where offered, sufficiently updated to meet specific skill requirements of IS IQ management?

OBSERVATIONS

- All things being equal, IQ education must be a mandatory part of IS tertiary education. But given that IQ skills will be taught, there is a need to analyze what aspect of IQ skills be taught in which IS course.
- Since IS courses are also offered as part of business studies in many Australian Universities, there is a further need to investigate the IQ requirements from a business program perspective before developing any framework for possible changes to IS curriculum.
- There is a need to spread awareness among students to investigate IS course content against actual requirements. An idea would be to read not only the “essential job criteria” listings, but also the responsibilities section of job advertisements, and then read the course objectives on University websites wherever such information is available.
- There is a need to educate curriculum developers on the need for IQ skill development for sustainable professional growth of IS graduates in both the under graduate and post graduate levels.
- There is a need to involve practitioners to a higher extent in IS curriculum development activities.
- There is an obligation on the part of alumni and expert IS practitioners to identify and report upon IQ skill requirements in long term job requirements and to promote the significance of integrating IQ education within IS curricula to policy makers and Universities in Australia.

- There is an obligation of the part of education departments to monitor the IS education scenario and to guide students in choosing the right combination of courses, that will profit both the job seekers and the industry in general.

Recommendations

1. **'Educate' IS educators, learners, policy developers and supporters about the relevance of IQ technical skills in IS careers**

   Lack of awareness, more than a lack of resources or willingness to take action plagues the education sector, perhaps more strongly than most other sectors. Close engagement with the industry to monitor changing trends is absolutely essential for effective curriculum development. While workshops, conferences and seminars are important platforms for experts to exchange views, there exclusivity can create gaps in understanding certain ground realities faced by the job-seekers. It may be a good idea to have open forums, perhaps once or twice every year, in each University, where the students and ordinary members of society (working parents, retired professionals, unemployed alumni etc) who have to grapple with market realities are welcome to share their anxieties and experiences with the experts. The observations from such forums can then be passed on to experts for further review, so that true need for IQ skills in each region/ or a particular discipline can be assessed more accurately.

2. **'Adopt' industry best practices and lessons from alumni IS experts as well as those who may have changed their discipline or taken professional training on top of their degrees.**

   While value add IQ certifications and short courses have their place (especially for mid-career professional development), it may be a good idea for curriculum developers to keenly observe the particular content of such programs and 'adopt' certain aspects into professional IS degrees. The short courses, workshops, certifications claim to provide specific skills required by the industry – so why is this element missing in professional degrees? It certainly raises some doubts when both the degree and the short courses are offered by the same University – a student has the right to demand why the content of 'industry relevant' short courses and training programs are not offered within professional degrees.

3. **'Promote' the relevance of IQ skills in staff for sustained business development in the organization, to both job seekers and job providers.**

   A problem with the industry is that people, by nature are defensive about their business data; they refuse to accept that there may be DQ issues in their data that can be solved only by staff that possess expert IQ skills. On the other hand, job seekers also tend to believe in the illusion that they are applying for work in the 'perfect' companies where all data can be trusted. Thus IS professionals and job providers may not foresee the need for IQ skills in the position descriptions of certain jobs; which is why there is a need to openly advertise and promote the relevance of IQ skills within the IS careers.

Limitations and Future Research

One limitation is the ambiguity of some job advertisements developed by Human Resources personnel who do not possess a technical background – analysis performed on such data may be slightly less accurate than actual interviews with IS practitioners and academic experts. There is no conflict, however, in the fact that such advertisements are essential to conduct preliminary assessments of candidates.

Another is the search optimization capability of University search engines that may have led to some courses being missed, that may have a low level of impact on the produced tabulations; though care was taken to include as much search alternatives as possible for maximum coverage.

A third possible shortcoming is that this paper focuses greatly on IQ Skills demand from a technical perspective. Considering that IS education is also delivered by business schools, an investigation of the business manager's requirements of DQ/IQ understanding may lead us to several new insights which are beyond the scope of this paper.

Despite these weaknesses the search results are proof of the existing mismatch of IQ skill development in IS degrees and IS jobs. This can be expanded to include IT and other related fields for a comprehensive review of currently offered options in Universities. This can then be used to update the IS curriculum suitably to meet the skill requirements in the job market.

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