

Building the Professional Readiness of Graduates from Day One: An Empirical Approach to Curriculum Continuous Improvement

Fiona Wahr, Sitalakshmi Venkatraman

I. INTRODUCTION

Abstract—Industry employers require new graduates to bring with them a range of knowledge, skills and abilities which mean these new employees can immediately make valuable work contributions. These will be a combination of discipline and professional knowledge, skills and abilities which give graduates the technical capabilities to solve practical problems whilst interacting with a range of stakeholders. Underpinning the development of these disciplines and professional knowledge, skills and abilities, are “enabling” knowledge, skills and abilities which assist students to engage in learning. These are academic and learning skills which are essential to common starting points for both the learning process of students entering the course as well as forming the foundation for the fully developed graduate knowledge, skills and abilities. This paper reports on a project created to introduce and strengthen these enabling skills into the first semester of a Bachelor of Information Technology degree in an Australian polytechnic. The project uses an action research approach in the context of ongoing continuous improvement for the course to enhance the overall learning experience, learning sequencing, graduate outcomes, and most importantly, in the first semester, student engagement and retention. The focus of this is implementing the new curriculum in first semester subjects of the course with the aim of developing the “enabling” learning skills, such as literacy, research and numeracy based knowledge, skills and abilities (KSAs). The approach used for the introduction and embedding of these KSAs, (as both enablers of learning and to underpin graduate attribute development), is presented. Building on previous publications which reported different aspects of this longitudinal study, this paper recaps on the rationale for the curriculum redevelopment and then presents the quantitative findings of entering students’ reading literacy and numeracy knowledge and skills degree as well as their perceived research ability. The paper presents the methodology and findings for this stage of the research. Overall, the cohort exhibits mixed KSA levels in these areas, with a relatively low aggregated score. In addition, the paper describes the considerations for adjusting the design and delivery of the new subjects with a targeted learning experience, in response to the feedback gained through continuous monitoring. Such a strategy is aimed at accommodating the changing learning needs of the students and serves to support them towards achieving the enabling learning goals starting from day one of their higher education studies.

Keywords—Enabling skills, student retention, embedded learning support, continuous improvement.

F. Wahr is with Melbourne Polytechnic, 77 St Georges Rd, Preston VIC 3072, Australia (corresponding author phone: +61 3 9269 1171; fax: +61 3 9269 1484; e-mail: fionawahr@melbournepolytechnic.edu.au).

S. Venkatraman Melbourne Polytechnic, 77 St Georges Rd, Preston VIC 3072, Australia (e-mail: SitaVenkat@melbournepolytechnic.edu.au).

WITH the growing business competitive environment, the current perception of employers about new graduates is that they come in with a range of KSAs to immediately perform well in the job assigned to them [1]-[3]. Typically, these KSAs will include both discipline-specific as well professional outcomes that will give graduates the required capabilities to be technically competent to deal with a range of stakeholders in solving business problems [4], [5]. Whilst these are often generic KSAs, contextualisation to the specifics and complexities of the profession supports relevance for work readiness. Thus, students must be intentionally supported to develop in these areas as they progress through their qualification [6], [7]. A dedicated learner-centred approach to teaching and assessing students’ development of the relevant KSAs is recognised as key to achieving these learning goals [8], [9].

The paper reports on an ongoing project to support student academic success and retention in a Bachelor of Information Technology (BIT) degree program. There are many dimensions to this project worth reporting. The focus of this paper is on the significance of an evidence-based continuous improvement process employed by the original curriculum design team, expanded into the curriculum delivery phase of an ongoing research project [10]-[12]. The process and impact of ongoing review to inform in-situ and just-in-time improvements to support student success is presented.

Typically, curriculum change is reviewed post-delivery [13]. The approach chosen for this curriculum change combined in-situ literacy, numeracy and research skill specialists with the lecturer’s workshop program of two key first semester subjects. The benefits and challenges of this approach are explored based on accounts of the teaching staff involved. The paper also considers how this research informs ongoing continuous improvement of the curriculum. Further research will include an evaluation of actual student learning achievement in these subjects.

II. NEED FOR THE STUDY

The curriculum redevelopment focuses on identifying current student learning needs of students entering the degree and designing responsive learning experiences in order to support students to achieve appropriate learning goals progressively. Such a continuous monitoring approach helps them to move through the degree with the necessary presage

KSAs to enable further learning at every stage [14]-[16].

In recent years, higher education programs on one hand are witnessing a more diverse, mature and less academically elite student cohort, and on the other a changing demand on the graduate skill set required by industry employers [17]. The changing requirement of graduate attributes is even more pronounced in the IT industry due to its fast-paced technology developments [4]. While specific IT skills could become obsolete with changes in technology, life-long generic skills are required to recontextualise and update knowledge and skills. That is, they allow professionals to interpret new contexts and problems and to transfer and apply existing knowledge and skills to be able to design appropriate solutions which utilize appropriate technology [18], [19]. Hence, it is important for higher education institutions to continuously improve their curriculum in order to equip graduates with the current discipline-specific skills as well as generic skills [10], [20]. Such an approach would facilitate in preparing the students to become professionally ready for the workforce. In addition, various factors affect students' progression in the first year of their tertiary education and their high attrition rates are of increasing interest to the higher education sector [17], [21]. These ramifications form the motivation and need for our research reported here. In the next section, we present the results of an empirical pilot study conducted to estimate the current level of literacy, numeracy and research skills of the students undergoing old curriculum as well as the students entering into the new curriculum for an in-depth understanding of the required rigor in enabling KSAs for these BIT students.

III. INITIAL FINDINGS OF THE EMPIRICAL STUDY

This empirical study involved two cohorts of BIT students to complete a questionnaire aimed at establishing their skill levels. Cohort 1 consists of students studying the old version of the course. These students underwent the survey at the end of their semester as a benchmark for comparison. Cohort 2 consists of first semester students in the renewed course and these data were collected at the start of the semester when the new subjects were introduced. Further data from Cohort 2 will be collected at the end of the semester to study the after-effect. This pilot study consisted of a small group of students in each of Cohort 1 and Cohort 2. All the students who willingly participated had completed the Australian Core Skills Framework (ACSF) assessment in literacy (reading) and numeracy. Though the study still awaits the final survey to be conducted at the end of the semester, this paper describes how the first set of results was used to 1. Justify the curriculum redesign in the first instance, and then 2. Inform the selection and delivery of the necessary scaffolding enabling KSAs. The survey results of the reading literacy and numeracy knowledge and skills possessed by these two cohorts of students as well as their perceived research ability were analysed. As a sample in Table I, we provide the results comparing the literacy (reading) levels and Table II the results comparing numeracy levels of Cohort 1 and Cohort 2 students. The skill levels are determined on a scale of 5, with 1 being the lowest.

Overall, both cohort students require their literacy and numeracy skills to be enhanced to reach Level 5, which is the required graduate skill level for successful employability. It is observed that students from the old curriculum possessed reading as well as numeracy skills on an average one level lower than the new curriculum students. Two key attributing factors are:

1. The higher education entry level for English proficiency has been increased by the Australian Government for the new intake of students (Cohort 2), while Cohort 1 belongs to previous lower entry level; 2.
2. The survey was conducted in the first week of the semester when the new subjects were introduced for Cohort 2 students. Cohort 2 students are from year 1, fresh intake after completing their literacy and numeracy of secondary school education. This could have had a positive influence in the ACSF scores as compared to Cohort 1 students, who were not fresh entry students already doing their studies under old curriculum.

These results provide a benchmark for monitoring the achievement of students in the first semester as they progress in their new curriculum.

TABLE I
BIT STUDENTS' LITERACY LEVELS

ACSF Reading Level	New Curriculum Cohort 2 Students	Old Curriculum Cohort 1 Students
Level 5	-	-
Level 4	4	-
Level 3	5	4
Level 2	1	7
Level 1	-	-
Total	10 students	11 students

TABLE II
BIT STUDENTS' NUMERACY LEVELS

ACSF Numeracy Level	New Curriculum Cohort 2 Students	Old Curriculum Cohort 1 Students
Level 5	-	-
Level 4	7	-
Level 3	6	3
Level 2	10	5
Level 1	1	3
Total	24 students	11 students

Based on the evidence that the incoming students require assistance to improve their literacy and numeracy levels to achieve the appropriate graduate attributes [15], [22], next we present our proposed approach for developing the "enabling" learning skills, such as literacy, research and numeracy KSAs.

IV. PROPOSED APPROACH FOR ENABLING KSAS

In this section, we describe our approach for enabling KSAs in the new subjects' design and delivery of the new BIT curriculum by adopting a learner-centred approach with the premise that there exists a strong relationship between enabling KSAs and student graduate attributes [8], [16].

Graduate attributes, generic skills and academic and learning skills — Graduate employability is a primary driver

for higher education institutions [9], [15]. Prospective students are attracted to courses with high graduate demand. High demand for graduates indicates the course is relevant to the roles industry seeks to fill and that the educational quality of the course has resulted in appropriately equipped graduates [13], [14]. Industry thus significantly influences the KSAs it seeks from graduate employment entrants. These are presented as broad graduate attributes and generic skills by governments and industry bodies [19], [20]. Generic graduate/professional KSAs are contextualised within individual course curricula development processes responding to local industry feedback.

Students develop generic skills and graduate attributes more effectively when they are made explicit to students taught in the discipline context and through authentic learning activities and assessments [18]. At the other end of the student learning experience, there are the foundational KSAs that students need to be able to fully engage in the learning. Students, who will have met the course prerequisites, may present with gaps in some enabling KSAs necessary to support engagement in course learning. And there are some discipline specific foundational skills which students cannot be expected to have entered the course with and which require support to develop foundation skills that assist them in the specifics of aspects of the course learning outcomes.

These foundational KSAs are likely to be more basic levels of the graduate KSAs, which having been established/taught early in the course, will have a better impact on their course learning outcomes [1]. These are often the soft skills or enterprise skills which require students to engage meaningfully in their life-long learning process [23]. Hence, ensuring a foundation level early in the course will allow for these KSAs to be systematically reinforced, applied in a range of contexts, built upon and to be further developed throughout the course, in order to reach the standards of the graduate and industry work readiness required. Fig. 1 gives a representation of the relationship between enabling KSAs and graduate attributes KSAs development over the student experience.

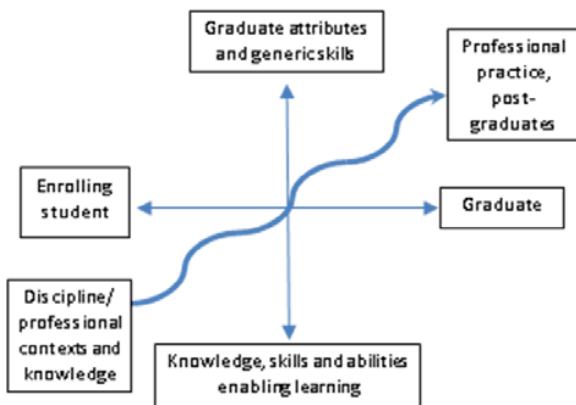


Fig. 1 Relationship between enabling KSAs and graduate attributes

Employing a learner-centred approach – This involves understanding the concept of student learning and the different learning styles. In a seminal work by [24], various conceptions

of learning and their impact on higher education are described as follows:

Learning is not associated with the increase in knowledge and its subsequent recall but rather is related to the understanding of fundamental principles and concepts which can be applied to both familiar and unfamiliar situations in the real world. [24]

There is a general consensus in the literature that students from tertiary and higher education systems exhibit a number of different approaches to learning. According to the much again -accepted learning theory [25], each person's learning style differs just as individuals differ in their experiences; however, learning can be identified as involving four sequential stages, as follows:

Effective learners rely on four different learning modes: concrete experience (CE), reflective observation (RO), abstract conceptualisation (AC) and active experimentation (AE). That is, they must be able to involve themselves fully and openly, and without bias in new experiences (CE); they must be able to reflect on and observe these experiences from many perspectives (RO); they must be able to create concepts that integrate their observations into logically sound theories (AC); and they must be able to use these theories to make decisions and solve problems (AE) [25].

Embracing the above concepts of learning for different learner styles, the curriculum redevelopment of BIT undertaken in this project focuses on identifying current learning needs of students entering the degree and designing active learning and assessment strategies [26], [27] in order to support students to achieve academic success and professional readiness right from their first year of study.

New subject design and delivery – The challenge for educational institutions, especially those claiming to cater for a breadth of student backgrounds, is to ensure the curriculum is responsive to the need to recognise and then develop the enabling skills required by students in a given context [28]. Further skill development is then scaffolded on the back of these enabling skills over the duration of the course to support achievement of the graduate attributes and generic skills that are much valued by employers.

The cross-discipline group of staff who worked on the subject design, and who were involved in the subsequent delivery of the subjects have:

1. Researched the need for academic, literacy and numeracy skills by students and graduates, and
2. researched their practice as a non-traditional collaborative group working in a cross-discipline space, bringing expertise from a range of areas to develop a more efficacious learning program for students.

In addition, it has been a comprehensive collaborative project surrounding the development and planned delivery of two new subjects for numeracy and literacy in the first semester of the BIT curriculum. The group have come together to work through ideas and to create the subjects maximizing the utilization of the range of expertise present amongst the group to enhance this work. Staff involved have

documented and reflected on their practice and related this to other work with similar intent and/or practice undertaken elsewhere [29]. The changed curriculum included closer attention to how the curriculum embedded learning support could help students to develop the enabling skills and the movement of these into the discipline-specific professional skills. The weekly feedback on student learning and progress gained through various active learning assessments, both formal and informal mechanisms was used by the delivery team to maintain continuous improvement on the development of enabling KSAs.

V. SIGNIFICANCE OF THE FINDINGS

This ongoing project has arrived at a number of findings that are of significance both in academic and practical implementation perspectives for enabling student learning skills. The final survey would be conducted after the semester ends to know the numeracy and literacy levels achieved by the students through our new approach of curriculum design and delivery. However, key outcomes realised until this stage of the study are listed as follows:

1. The new BIT students' academic, literacy and numeracy skills are lower than the required level of standards and benchmarking.
2. Developing students' academic, literacy and numeracy KSAs is valuable to student success and relevant to the needs of industry for graduate employability. This is in line with the previous survey conducted by Department of Education, Employability and Workplace Relations (DEEWR) in Australia [30].
3. To support the development of students' academic, literacy and numeracy skills, the BIT teaching team valued the involvement of academic, literacy and numeracy experts in the development and delivery of the new subjects.
4. Whilst IT academics and academic, literacy and numeracy experts agreed on the goals of skill development for students, there were different perspectives amongst the group as to how the subjects should be developed and delivered and the learner-centred approach was adopted successfully.
5. The new cohort of BIT students show promise in improving their literacy and numeracy skill levels to reach the required graduate levels with the new curriculum under delivery.
6. The project has successfully established a group dynamic, which continues to work collaboratively to refine the subjects and their delivery to support better student learning outcomes.

Realising the goals for the design of the new subjects required a dedicated and facilitated project to support the cross-discipline group to collaborate and work through differences and challenges in a way where the change and new approaches would be acceptable to all. This relied on developing and maintaining trust amongst the group in regard to the professionalism and the on-going commitment each brought to the project. Whilst there have not been problems in

this regard, there have been challenges for the teaching team. In a busy workplace, where status quo has tended to prevail, to create the opportunities for staff to come together and to feel safe to critique their practice, with a view to identifying assumptions and opportunities for improved practice has proved both logistically challenging and both epistemologically challenging and rewarding. Prevailing ideas are predominant in these processes and every member of the group has been able to challenge themselves in this regard.

Overall, the project team and the teaching team have adopted ways to be open to finding ways of working together respectfully through the learning and teaching issues that came up and has been delivering the agreed subject design and delivery plan. It can be said that a by-product of this project is the establishment of new collaborative relationships amongst staff, which strengthens professional and academic practice going forward in a number of areas of higher education.

VI. CONCLUSIONS AND FUTURE WORK

This study emphasized the growing need for discipline-specific higher education programs to embed the "enabling" KSAs that form the essential common starting point in assisting students from day one of their higher education studies to engage in active learning. An empirical study was conducted on a small group of students from two cohorts undergoing a Bachelor program under the old curriculum and proposed new curriculum with enabling the KSAs teaching strategies adopted.

The results showed differences in the students' level of literacy and numeracy skills. Overall, the gap in their skill requirement for graduate employability was identified and a student-centred approach was successfully adopted to design and deliver two new subjects to enhance the literacy and numeracy skills of the students in a discipline specific context, such as the BIT.

The whole process of including a research project to evaluate the introduction of the new subjects has contributed to the development of research skills and confidence in research practice amongst the group of staff involved. The model used for the group process can be applied in other contexts.

The main purpose of this ongoing project is to enable students to achieve academic success in their studies, leading to employability, and to support student retention in the course. These have not yet been fully realized since the final survey is yet to be conducted at the end of the semester. Future work of this project will be to compare the data collected at the start of the new curriculum with those to be collected at the end of the semester. Results would indicate the effectiveness of the two new subjects on literacy and numeracy introduced in the curriculum towards enhancing student learning.

ACKNOWLEDGMENTS

The research fellowship grant received from Victorian Development Centre for this project has served as a key

motivation in bringing staff from various departments together. The authors wish to thank all the team members of the project, the Learning Skills and Assessment staff and the teaching academics whose continuous support in the design and delivery of the new curriculum has led to the successful implementation of this ongoing project.

REFERENCES

- [1] National Research Council, "Education for Life and Work: Developing Transferable Knowledge and Skills in the 21st Century," Washington, DC: The National Academies Press, 2012.
- [2] OECD Report, "OECD Skills Outlook 2013: First Results from the Survey of Adult Skills," Organisation for Economic Co-operation and Development, OECD Publishing, Paris, 2013.
- [3] N. Detsimas, V. Coffey, Z. Sadiqi and L. Mei, "Workplace training and generic and technical skill development in the Australian construction industry". *Journal of Management Development*, Vol. 35, No. 4, pp. 486-504. 2016.
- [4] OECD Report, "Adults, Computers and Problem Solving: What's the Problem?," Organisation for Economic Co-operation and Development, OECD Publishing, Paris, 2015.
- [5] AIG Report, "Tackling Foundation Skills in the Workforce," The Australian Industry Group, pp. 1-20, January 2016.
- [6] H. Schomburg and U. Teichler, "Employability and Mobility of Bachelor Graduates in Europe". Key Results of the Bologna Process. Sense Publishers, Rotterdam / Boston / Taipei. 2011.
- [7] QCCA Report, "21st century skills for senior education - An analysis of educational trends", Queensland Curriculum and Assessment Authority (QCCA), pp. 1-16, November 2015.
- [8] Precision Consulting, "Graduate employability skills: An examination of the development, teaching, assessment and reporting of graduate employability skills in the higher education sector", Canberra, DEST, 2007.
- [9] F. Suleman, "Employability skills of higher education graduates: Little consensus on a much-discussed subject", 2nd International Conference on Higher Education Advances, HEAd'16, 21-23 June 2016, València, Spain, Procedia - Social and Behavioral Sciences, vol. 228, pp. 169 – 174, 2016.
- [10] S. Venkatraman, F. Wahr, A. de Souza-Daw, and S. Kaspi, "Integrating Generic Skills into Disciplinary Curricula," *International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering*, International Scholarly and Scientific Research & Innovation, Vol. 11, No. 1, pp. 102-106, 2017.
- [11] Wahr, F. Venkatraman, S., Bourke, G., de Souza-Daw, A. and Tully, C. (2017) 'Building potential for Transformation Through a Cross-Institutional Approach to Curriculum Change', Proceedings of Conference of Higher Education Research and Development Society of Australasia (HERDSA), 28-30 June 2017, Sydney.
- [12] S. Venkatraman, F. Wahr, S. Kaspi, and A. de Souza-Daw, "Enhancing Foundation Skills for Learning and Employability", Proceedings of 233rd International Conference on Education & E-Learning, September 9-10, 2017, Singapore.
- [13] AQF Council, "Australian Qualifications Framework Second Edition January", 2013.
- [14] S. Venkatraman, "A Framework for Implementing TQM in Higher Education Programs" *Journal of Quality Assurance in Education*, Vol. 15, No. 1, 2007, pp. 92-112.
- [15] R. Townsend and P. Waterhouse, "Whose responsibility? Employers' views on developing their workers' literacy, numeracy and employability skills," National Centre for Vocational Education Research (NCVER), Australian Government, pp. 1-40, 2008.
- [16] Australian Graduate Survey (AGS), "Graduate Careers Australia", 2013.
- [17] A. Harvey and M. Luckman, "Beyond demographics: Predicting student attrition within the Bachelor of Arts degree," *The International Journal of the First Year in Higher Education*, Vol. 5, No. 1, pp. 19-29, 2014.
- [18] S. Arkoudis, "Integrating English Language communication Skills into Disciplinary Curricula: Options and Strategies". Sydney: Office of Learning and Teaching, Department of Education, 2014.
- [19] DEEWR, "Assessment of Generic Skills". Canberra: DEEWR, 2011.
- [20] DIISRTE, "Assessment of Generic Skills", Discussion Paper. Canberra: DIISRTE, 2011.
- [21] M. Maher H. Macalliste, "Retention and attrition of students in higher education: Challenges in modern times to what works," *Higher Education Studies*, Vol. 3, No. 2, pp. 62-73, 2013.
- [22] Centre for Education Statistics and Evaluation, "How schools can improve literacy and numeracy performance and why it (still) matters", NSW Department of Education, pp. 1-13, 2016.
- [23] ACARA, "General Capabilities in the Australian Curriculum", 2013.
- [24] D.J. Hargreaves, "Student Learning and Assessment are Inextricably Linked", *European Journal of Engineering Education*, Vol. 22, No. 4, 1997, pp.401-409.
- [25] D. A., Kolb, J. S. Osland and I. M. Rubin, "Individual and Organisational Learning", Chapter 3, *Organisational Behavior: An Experiential Approach*, Sixth Edition, Prentice Hall, Inc., U.S.A, 1995.
- [26] S. Venkatraman, "Student-Centred Assessments and their Impact on Learning—An IS Case Study," Proceedings of 11th Pacific Asia Conference on Information System (PACIS2007) 2-6 July, New Zealand, pp. 254-368, 2007.
- [27] L. Thomas, "Developing inclusive learning to improve the engagement, belonging, retention, and success of students from diverse groups," Widening higher education participation. A global perspective, pp. 135-159, 2016.
- [28] A. J. Harris and J. Ashton, "Embedding and integrating language and academic skills: An innovative approach". *Journal of Academic Language and Learning*, Vol. 5, No. 2, pp. 73-87, 2011.
- [29] M.S. Knowles, "Self-Directed Learning - A Guide for Learners and Teachers", Cambridge Adult Education, Prentice Hall Regents, U.S.A., 1975.
- [30] DIICSRTE and DEEWR, "Core Skills for Work Developmental Framework: The Framework", 2013.

Fiona Wahr obtained her doctoral degree in Higher Education from RMIT University, Melbourne, Australia in 2015. Her thesis explored the need, process, experience and outcomes associated with a facilitated, long-term curriculum change project to support academics to embed sustainability concepts and principles into a higher education curriculum.

She has twenty years' experience in higher education working with academics as an academic developer and researching to support improved learning experiences and outcomes for students.

She is a member of the Higher Education Research and Development Society of Australasia and has contributed a range of articles to the literature which aim to present the collaborative processes and practices which academics engage in to enhance learning and teaching.

Sitalakshmi Venkatraman obtained her doctoral degree in Computer Science, from National Institute of Industrial Engineering, India in 1993 and MEd from University of Sheffield, UK in 2001. Prior to this, she had completed MSc in Mathematics in 1985 and MTech in Computer Science in 1987, both from Indian Institute of Technology, Madras, India. This author is Member (M) of IAENG, Senior Member (SM) of IASCIT, and on Editorial Board of World Academy of Science, Engineering and Technology since 2011.

In the past 30 years, Sita's work experience involves both industry and academics - developing turnkey projects for IT industry and teaching a variety of IT courses for tertiary institutions, in India, Singapore, New Zealand, and more recently in Australia since 2007. She currently works as Lecturer (Information Technology) at Melbourne Polytechnic, Australia. She also serves as Member of Register of Experts at Australia's *Tertiary Education Quality and Standards Agency* (TEQSA).

Sita has published seven book chapters and more than 90 research papers in internationally well-known refereed journals and conferences that include *Information Sciences*, *Journal of Artificial Intelligence in Engineering*, *International Journal of Business Information Systems*, and *Information Management & Computer Security*. She serves as Program Committee Member of several international conferences and Senior Member of professional societies and editorial board of selected international journals.