

Summer 6-27-2016

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## Recommended Citation

Lin-Stephens, Serene; Smith, Stephen; Peso, Marianne; and Pang, Vincent, "THE CAREER INFORMATION LITERACY LEARNING FRAMEWORK: A CASE STUDY OF INFORMATION SYSTEMS, INFORMATION TECHNOLOGY AND ENGINEERING CAPSTONE UNITS OF AN AUSTRALIAN UNIVERSITY" (2016). *PACIS 2016 Proceedings*. 52.

<http://aisel.aisnet.org/pacis2016/52>

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# THE CAREER INFORMATION LITERACY LEARNING FRAMEWORK: A CASE STUDY OF INFORMATION SYSTEMS, INFORMATION TECHNOLOGY AND ENGINEERING CAPSTONE UNITS OF AN AUSTRALIAN UNIVERSITY

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## Abstract

*Universities worldwide are under increasing pressure to ensure graduate work-readiness upon degree completion. However, the linkage between employability enhancement and disciplinary learning is problematic for many academics. To address this, a conceptual framework of student learning and career development is required. We propose the development of a Career Information Literacy Learning Framework (CILLF) by integrating three key theoretical frameworks, namely experiential learning, career development and information literacy.*

*This study uses the CILLF to investigate capstone units, which are final year subjects. These units' aim is to combine disciplinary knowledge and skills whilst preparing students for the next phase transitions (work, future studies or other life plans). We examine capstone units in three disciplines specifically: Information Systems, Information Technology and Engineering in an Australian university. Academic and professional staff involved in these capstone units participated in semi-structured interviews to share their insights in five areas: unit aims, current practices and resources, student outcomes, needs/concerns, and assessment/measurement. We adopted a phenomenographic approach and found patterns using SAS analysis. Our findings support the conceptualisation of the CILLF, uniting the dimensions of learning approaches, career development and information literacy. We address limitations of the research and identify further research directions.*

*Keywords: Capstone Units, Career Information Literacy, Employability, Qualitative Research, Topics Modelling*

# 1 INTRODUCTION

The context of university learning and teaching is changing, and graduate employability has been identified as a key outcome of higher education in many countries (Kreiber 2006). Employability is a combination of “achievements, skills, understandings and personal attributes that make graduates more likely to gain employment and be successful in their chosen occupations” (Yorke 2004, p.7). When it is integrated into education, students learn how to recognise, identify and pursue career opportunities (Fugate et al. 2004). This has wider implications for employers and the wider society (Tymon 2013).

In Australia, since the Department of Education, Science and Training (DEST) (2002) report of *Employability Skills for the Future* and the establishment of *The Australian Blueprint for Career Development* (MCEECDYA 2010), the demand has been increasing on universities to fulfil their roles and responsibilities in preparing students for the world of work. Progressively, students have begun to view themselves as consumers of higher education, who ‘hire’ universities to prepare them for working lives (Weise & Christensen 2014). It is clear to parents and students that credentials alone are no longer enough to gain positional advantage in the labour market. To gain a return on their educational investments, students anticipate gaining the ability to not only ‘do’ a job but also ‘get’ a job (Tomlinson 2008).

The problem is, nowhere in the Australian university curricula do employability skills claim a rightful place. The curricula are already jam-packed with subjects and content that are essential for understanding a particular discipline. There is also no shortage of critics of the employability discourse who condemn the act of reducing scholarship to narrow, job-related skills trainings (Boden & Nedeva 2010). What is more, it has been argued that market influences on the ‘values’ of degrees and skills may place some graduates at higher risk than others of unemployment or under-employment (Moreau & Leathwood 2007). Fitting employability in the curriculum is a complex task, making it necessary to reframe employability discussions within higher education. We need an approach that links discipline-based learning with personal development so as to bring about the outcomes of employability from the experience of an academic voyage.

A critical unit of analysis is the capstone unit of a degree program, which is the final year unit aiming to consolidate students’ prior learning and prepare them for next stage transitions. In our case study institution, capstone units are designed with academic discretion, but share several characteristics. The characteristics include: integrating and synthesising knowledge across topics, consolidating graduate capabilities, making sense of degree programs and linking it to personal career planning, fostering industry and professional connections, aiding university-to-work transitions and enabling reflection for lifelong learning. Some of the units incorporate work-integrated learning. In broad terms, students need to make a strong link between curricula and their career building with projected sustainable professional development. Growing emphasis on meeting this need is evident in the proliferation of work integration courses and professional industry participation activities (Australian Collaborative Education Network 2015; Australian Council for Educational Research 2015). However, how these characteristics are incorporated into the capstone units varies and there is a lack of research-based capstone unit discussion in the literature. Given this discrepancy, we were motivated to investigate the many permutations of capstone units across the institution looking for common threads, effective practices and needs and concerns.

We examine the capstone units in their specific contexts, which involve a myriad of stakeholders, including higher education institutions, government agencies overseeing quality assurance, lecturers, students, parents, employers, industry bodies, professional associations, accreditation authorities, etc. We refer to the various terms used by these stakeholders to describe the type of learning they seek to see in the higher education curriculum. They include employability skills, professional identity,

professional standards, graduate capabilities, discipline-specific knowledge, generic skills, soft skills, transferrable skills, ICT skills, critical thinking, resourcefulness, life-long learning, transformational learning and so on (DEST 2002; Hager & Holland, 2006; Reid et al. 2011; Sachs 2014). These terms represent different stakeholder interests and add to the complexity of capstone learning and teaching.

A conceptual framework is necessary to form our analysis of capstone units, given that in the literature there is no single theoretical framework that encapsulates how university learning experiences facilitate transition to a career. For this purpose, we construct a Career Information Literacy Learning Framework (CILLF) that demonstrates a three-dimensional guided inquiry process, incorporating learning approaches, career development learning and information literacy. The first stage of this project is to capture capstone unit instructors' perspectives by conducting a population study of 14 academic staff in the disciplines of Information Systems (IS), Information Technology (IT) and Engineering and 7 professional staff in central learning and teaching services in the university. We investigate the integration of employability and discipline-based capstone learning through the collaboration between academic and professional staff in selected departments at an Australian university.

The paper is arranged in the following order: first, the authors present the theoretical underpinnings of the CILLS framework, followed by details of the framework, the background of the study, research methodology, data collection and analysis, and discussion of the findings. The paper concludes with addressing potential limitations of the study and recommendations for future research.

## **2 LITERATURE REVIEW**

Three distinct, substantial bodies of literature inform our conceptual framework to address the multifaceted nature of higher education, which includes disciplinary learning, lifelong personal and professional learning, graduate capability development and employability. These are experiential learning (Kolb & Kolb 2005), career development learning (Watts 2006) and information literacy learning (Lupton 2008). With this literature, we formed the Career Information Literacy Learning Framework (CILLF), which will be detailed in the next section.

### **2.1 Experiential Learning Approaches**

Theories of experiential learning follow a long line of tradition (Dewey 1897; Piaget 1952; Lewin 1957; Kolb 1976; Honey & Mumford 1982). Notably, Kolb crystallises learning as “a process whereby knowledge is created through the transformation of experience” (1984, p.38). In this model, learning is depicted as a cyclical translation of experience into new concepts, which then guide the choice and formation of new experiences. Kolb portrays a learning model consisting of two related modes of *taking in experience*, namely Concrete Experience (CE) and Abstract Conceptualisation (AC), and two related modes of *shaping experience*, namely Reflective Observation (RO) and Active Experimentation (AE), that are constantly feeding back and updating when new information is acquired. Through the interaction of these four learning modes, the learner experiences, reflects, thinks, acts and responds to the demands of a given situation (Kolb & Kolb 2005).

Following decades of iterative refinement, the 2015 revised Kolb Learning Style Inventory (LSI) Version 3.1 is based on norms developed from a large and diverse sample. Additionally, the LSI's technical specifications meet the standard for testing developed by educational and psychological professional bodies (Kolb & Kolb 2005). The LSI has been applied and researched in a wide range of academic fields including management, computer science, law, accounting, computer science and so on, and it has been applied to extensive fields as well (e.g. accounting, marketing, education, and engineering). Neuroscience research also suggests a link between brain functions and experiential learning, whereby concrete experiences propagate through the sensory cortex, reflective observation

comes through the integrative cortex, the frontal integrative cortex forms new abstract concepts and the motor brain initiates active testing (Zull 2002).

Four distinct learning approaches are identified through research and clinical observations using the LSI: Diverging, Assimilating, Converging and Accommodating. The approaches are associated with distinctive behaviours (Table 1).

<i>Learning Approach</i>	<i>Associated Behaviour</i>
1. Diverging	Information gathering, brainstorming, exploring interests, receiving personal feedback
2. Assimilating	Understanding a wide range of information, being interested in factual and structural information, focusing on logical exploration
3. Converging	Finding practical uses for ideas, problem solving, decision making, devising ideas for experimentation
4. Accommodating	Carrying out plans, taking on new challenges, completing tasks, testing out different approaches

*Table 1. Learning approaches and associated behaviour (adapted from Kolb & Kolb 2005)*

## 2.2 Career Development Learning

Career development learning was first introduced to the education sector in the 1970s under the general term of ‘career(s) education’ in high schools (Schools Council 1972) and higher education in UK (Watts 1977). In the following two decades, specific terms of career management skills and career self-management skills came into common usage through government initiatives and businesses organisations’ developmental schemes (Hustler et al. 1998; King 2004). In higher education, the use of the term ‘career development learning’ is increasing due to the limitations of skill-based views of employability and the need for knowledge-based frameworks (AGCAS 2005; Watts 2006).

The abundance of career development theories reflects the complexity of career development. Many of these theories share a common interest in counselling and assessment practice, notably the theory of Career Choice (Holland 1992), the Systems Theory Framework (Patton & McMahon 2006), and the Career Construction Theory (Savickas et al. 2009), to name a few. Since the 1990s, new perspectives started to address contemporary social and technological changes which brought about boundaryless and protean career models (Arthur 1994; Hall 1996). The boundaryless career emphasises crossing objective and subject dimensions of work while the protean career centres on personal drive and values to redefine working relationships. Individuals’ awareness of organisations and their own adjustment of expectations and attitudes begin to foreground career development learning.

The most widely-used of these career development theories in higher education (particularly in university career services in UK, US and Australia), is the non-linear DOTS model (Watts 2006) comprising decision learning (D), opportunity awareness (O), transition learning (T) and self-awareness (S) (Table 2). Many curriculum designs incorporate features of this model in the settings of work-integrated learning or professional skills units through collaboration with learning and teaching centres, career services and professional and community participation services. The facilitation, delivery, and levels of integration of DOTS in curricula vary between institutions.

<i>Elements</i>	<i>Objectives</i>	<i>Learning outcomes</i>
Self-awareness	Identify and articulate motivations, skills, values and personality	<ul style="list-style-type: none"> <li>○ Identify knowledge, abilities and transferable skills developed in one’s degree</li> <li>○ Identify personal skills, interests, values, personality, strengths/weaknesses and areas requiring further development</li> <li>○ Develop a self-reflective stance to academic work and other activities</li> </ul>

Opportunity Awareness	Research and gain knowledge of opportunities, employment and industry requirements	<ul style="list-style-type: none"> <li>○ Synthesise one's key strengths, goals and motivations into a rounded personal profile</li> <li>○ Demonstrate knowledge of employment, opportunities, work environments and entry requirements</li> <li>○ Demonstrate research-based knowledge of career options</li> </ul>
Decision Making	Assess personal and environmental factors to make a plan	<ul style="list-style-type: none"> <li>○ Identify key elements of career decision-making</li> <li>○ Relate self-awareness to knowledge of opportunities</li> <li>○ Evaluate personal priorities</li> <li>○ Devise short to medium term action plan</li> </ul>
Transition Learning	Take action to seek, try out and secure opportunities	<ul style="list-style-type: none"> <li>○ Apply understanding of recruitment methods to applications</li> <li>○ Demonstrate effective application techniques and strategies to secure opportunities or achieve goals</li> <li>○ Identify challenges to adapting to new environments and strategies for addressing them</li> </ul>

Table 2. DOTS career learning model (adapted from AGCAS 2005; Watts 2006)

### 2.3 Information Literacy Learning

Information literacy learning is a way of learning through engaging with information (Bruce 1995). The Council of Australian University Librarians (2001) created the Australian Information Literacy Standards, which characterise information literacy as an understanding and a set of abilities enabling individuals to recognise when information is needed, and to access, evaluate and use the information effectively. Information literacy is part of an enquiry skill to locate, interpret, and evaluate evidence to build personal knowledge base (Lupton 2012). As such, in the context of higher education, learning information literacy will mean different things to different disciplines as their knowledge base and approach to enquiry differ (Diehm & Lupton 2014). Thus, flexibility is paramount in delivery models of information literacy in curricula (Orr et al. 2001).

Following a review of existing literacy models, Lupton (2008) distinguishes information literacy levels as Generic, Situated and Transformative in a hierarchical relationship, with the Generic level being the base level included in Situated level, and the Situated level being included in the Transformative level, as shown in Table 3. These levels correspond to higher education outcomes of graduate capabilities and generic skills (Barrie 2003), notably with information literacy listed as a common graduate attribute by Australian universities.

<i>Information Literacy</i>	<i>Generic</i>	<i>Situated</i>	<i>Transformative</i>
Definition	A set of discrete, cognitive skills and processes that individuals use for finding and managing information	A range of information practices in personal, professional, disciplinary and community contexts	A range of information practices used to transform oneself and society
Purpose	To evaluate, manage and organise information	To create new knowledge, solve problems	To question the status quo, challenge existing practice, empower oneself and others
Acquisition	Search skills practices	Engage in authentic information practices	Engage in collaborative and participatory information practices
Assessment	Standardised tests	The process and outcome of engaging in authentic information practices	The process and outcome of social critique and action

Table 3. Hierarchy of information literacy (adapted from Lupton 2008)

### 3 THE CAREER INFORMATION LITERACY LEARNING FRAMEWORK (CILLF)

We propose a new pedagogical framework CILLF (see Figure 1) to conceptualise the interrelation of learning approaches, career development learning and information literacy. It incorporates Kolb & Kolb’s learning approaches (2005), Watts’ career development learning (2006), and Lupton’s information literacy learning (2008). This conceptual framework capitalises on the essence of three streams of theoretical framework but does not aim to encapsulate all of their theoretical components. It does not claim to represent each of the theories in their entirety but only addresses their intersection.

To describe the features of the curriculum that constitute marrying employability and discipline-based learning, we propose using the term ‘Career Information Literacy’ (CIL) as an enabler of employability. To become career information literate, students must simultaneously exercise graduate capabilities, such as critical thinking, research capability, life-long learning as well as social and professional engagement. CIL affords significant conceptual interconnectivity between the graduate attributes that constitute employability and the discipline-specific skills students acquire during the course of their studies. For the purpose of this project, we define Career Information Literacy as *the range of abilities to inquire, search, select, evaluate, and synthesise data to generate knowledge for the purpose of whole person developing their life and sustaining their living.*

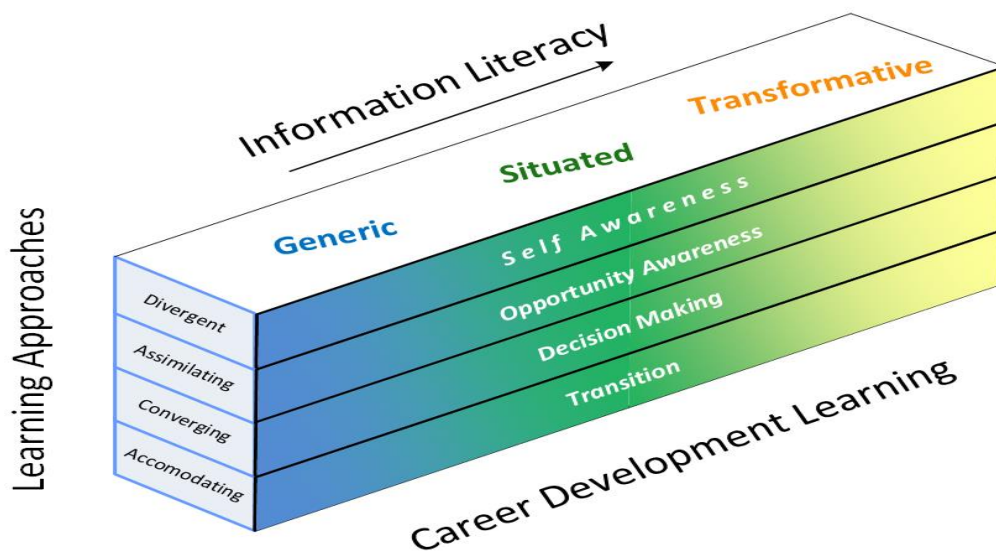


Figure 1. The Career Information Literacy Learning Framework (CILLF)

In this framework, learning approaches facilitate specific developmental tasks needed for individual career exploration and progression. The diverging learning approach facilitates open-minded self-inquiry so an individual can examine a range of self-interests, values, strengths, and allow their feelings and intuition to play a role in the choice of careers. The assimilating learning approach facilitates the observation of work environments and the acquisition of factual information and knowledge, which assist in person-occupation matching. The converging learning approach facilitates problem-solving skills for effective decision-making. The accommodating learning approach seeks to apply knowledge and skills for planning and action taking.

To the extent of a guided inquiry, information literacy for career purposes also comprises levels of sophistication, namely Generic (transferrable, cross-disciplinary), Situated (contextual, discipline-

based), and Transformative (social, interdisciplinary). For instance, at the base Generic level, students' developing self-awareness may mean understanding what they like and dislike, skills they have and do not have, and what they can do and cannot do. At the Situated level, students' self-awareness factors certain perimeters into their thinking; therefore what they like doing or can do is not absolute and how they behave or act is influenced by contextual factors. At the transformative level, students achieve conceptual changes, adopt multiple perspectives and go beyond their disciplinary boundaries, showing insights into themselves, the wider society, and the world.

## **4 RESEARCH METHODOLOGY AND DATA COLLECTION**

### **4.1 Background and research questions**

We investigate CIL development in capstone units within the disciplines of Information Systems, Information Technology and Engineering at a mid-sized research-intensive university in Australia. We deem capstone units as a most appropriate unit of analysis in this project for two reasons. First, capstone units are the designated, culminating units where both the consolidation of discipline-based learning and transitioning into professional engagement take place. Second, capstone units provide teaching staff an opportunity to intervene on potential poor graduate outcomes and insufficient learning for professional depths. We conduct a population study and employ a phenomenographic approach to differentiate conceptions. We explore *what current CIL teaching practices (comprising learning approaches, career development and information literacy) have been in place*. We are especially interested in five areas: the unit aims, current practices/resources, student outcomes, needs/concerns, and assessment/measurement. These areas concern pedagogical designs whilst taking resource constraints, discipline traditions, departmental cultures and environments, and stakeholder influences, etc. into consideration.

### **4.2 Data Collection**

A total of 21 staff that designed and delivered capstone units in Information Systems, Information Technology and Engineering participated in this project. Of which, 14 are academic staff. The academic staff's backgrounds are highly diverse, with their teaching experience ranging from 4 months to 35 years. Some have extensive industry experience whilst some had been career academics. Seven participants are professional staff from the career service, the work-integrated and participation learning unit, the library, and the learning and teaching centre. These professional staff provided input into the development or delivery of capstone units in the targeted disciplines. Their involvements include quality assurance, unit approval, evaluation design, resource support, career skills training, industry connection facilitation, information literacy training, and so on. The professional staff's years of experience within the university range from 2 to 20 years.

Face-to-face interviews were considered as the best technique for gathering information for this study. Conducting semi-structured interviews allowed for clarification and for appropriate follow-up questions depending on the responses given by the participants (Yin 2003). We aimed to uncover participants' conceptions of capstone units in five areas: the unit aims, current practices and resources, student outcomes, needs and concerns, and assessment and measurement. We did so by asking participants questions related to their unit aims, activities, assessments, current practices, resources used, observed and anticipated student outcomes, student assessment, unit evaluation, and any needs and concerns. Outcomes (including employability but more broadly refer to career outcomes) were operationalised as 'consequences of processes concerning whole persons developing their life and living' (Lin-Stephens et al. 2015). We used a 'soft laddering' interview technique, aiming to detect motivations behind actions and thinking. This technique is particularly suitable for a small population size and exploratory research, and has been used in other IS research and proved to be effective (Guo et al. 2012). The academic staff interviews were audio recorded and transcribed in 67,471 words.



Professional staff's interviews were transcribed in 20,141 words. A total of approximately 700 minutes of interviews from 21 staff were transcribed in 87,612 words.

### 4.3 Data Analysis

Content analysis of the transcripts was conducted firstly by using SAS Enterprise Miner 13.1 with a Text Miner component. As part of the preparation of importing data into SAS Enterprise Miner (see Figure 2), all the interviews were copied into an Excel spreadsheet. In the spreadsheet, we also added columns to indicate (a) the course, (b) interviewer or interviewee, (c) question or answer, and (d) text covers under topic areas.

We took standard text mining steps and create stop lists, synonyms, multi-word terms, and dictionary to perform data cleaning through multiple iterations of review. The reason for using SAS rather than NVivo or Leximancer is because we anticipated much more text data to come from further interviews with academics in other disciplines, as this study is part of a larger project. Also, by using SAS Text Miner we parsed the text with a reduced coder bias, which occurs in other analytical tools. That is, unlike the normal process where a researcher codes and builds themes manually, SAS Text Miner analyses the text using algorithms. Topic Modelling (Blei 2012; Arora et al. 2012) is applied in this paper to analyse interview text data.

Topic Modelling uses algorithms and statistical methods to analyse words and/or phrases to discover and classify themes (Blei 2012). In the Text Cluster node, Singular Value Decomposition (SVD) was used as a linear algebra approach to text mining. We used the default Expectation-Maximization cluster algorithm. In SAS, the Text Topic node uses the SVD values from the Text Cluster node to derive topics. Thus, a topic reflects term frequency and association between the terms from the Cluster node. For brevity, we call each topic a theme. The default setting generated 25 themes under each topic node, with five terms under each theme. Although only top five terms by ranking of each theme appear on the report of Text Topic node, the rest of the terms could be viewed using Text Viewer option in the Text Topic node. Thus, each theme is not represented only by five terms but a list of terms associated with the themes. This is defined as explicit associations between terms and phrases.

The five topic nodes generated in the SAS Text Miner are shown in Figure 2. The five topic areas regarding unit aims (Q1), current practices and resources (Q2), student outcomes (Q3), needs and concerns (Q4), and assessment and measurement (Q5) were analysed separately.

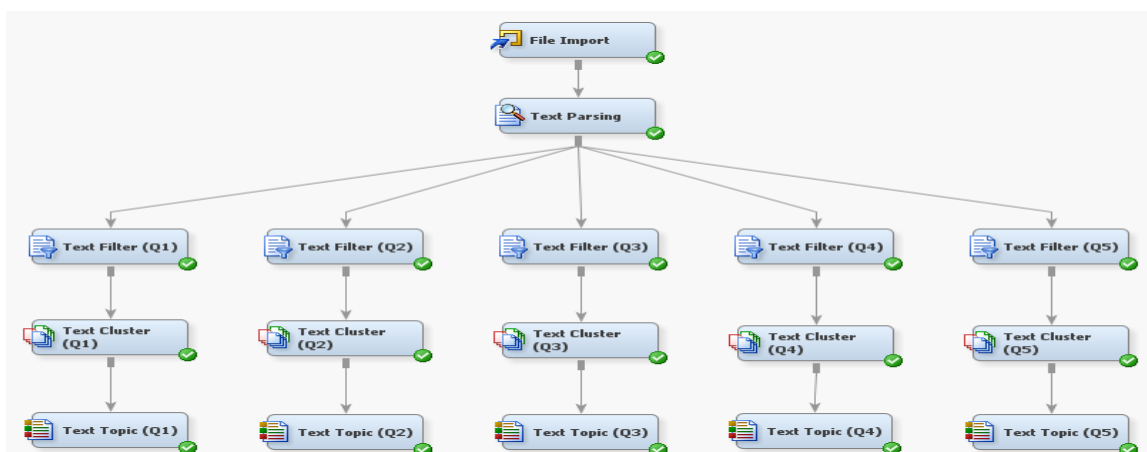


Figure 2. Topic nodes generation process by using SAS Text Miner

Next, we use codes to designate attributes described in the outcome space of the CILLF (Table 4) to code the themes generated by the Text Topic nodes, i.e. *DSG* is made up of *Diverging* (Learning Approaches), *Self Awareness* (Career Development Learning) and *Generic* (Information Literacy). Thus, we pre-defined the attributes for the purpose of coding.

<i>Learning Approaches</i>	<i>Career Development Learning</i>	<i>Information Literacy</i>		
		Generic	Situated	Transformative
Diverging	Self Awareness	<i>DSG</i>	<i>DSS</i>	<i>DST</i>
Assimilating	Opportunity Awareness	<i>AOG</i>	<i>AOS</i>	<i>AOT</i>
Converging	Decision Making	<i>CDG</i>	<i>CDS</i>	<i>CDT</i>
Accommodating	Transition Learning	<i>ATG</i>	<i>ATS</i>	<i>ATT</i>

Table 4. Outcome Space of CILLF- staff input

We returned to the data under each theme and determined their attributes in the three dimensional framework. We took out irrelevant descriptions such as size of class and length of lectures. We coded the descriptions by identifying the learning approach, career development learning type and information literacy level in the description according to the outcome space coding guide (Table 4) based on the three theoretical frameworks. Two researchers coded the data separately at first and then cross-checked the data for differences. Upon finding any differences, they discussed justifications for the codes and negotiated agreed codes before resolving them into a single table.

Table 5 illustrates this process. A theme is formed showing the top 5 terms (e.g. problem, knowledge, year, skill, and activity) deriving from the data. Texts under the topic (from interviewees 1, 7 and 11) show an intention to develop students’ generic, problem solving skill related to accommodating to workplace and client requirements due to knowledge and skill gaps. The elements of accommodating to external commands (A), trying out new approaches (T) and generic inquiry (G) are present (see Tables 1 to 3). Therefore, the outcome of ATG is attributed to this topic based on Table 4.

Terms for a Theme in Text Topic (Q1) Node	<i>problem, knowledge, year, skill, activity</i>
Outcome Space (Theme)	ATG (see Table 4)
Examples (Interviewees)	<p>“You don’t just take little problems and work on the problems. You take the whole project and you work on the project. So it’s that opportunity to do the whole thing rather than everything before. It’s like here is a small part of the problem, work on this part of the problem, that part of the problem. That’s important. It’s seeing how the bits fit together knowing and seeking how they play into one another how design plays into, development plays into play testing, it’s not just here is an exercise, do this. What are the inputs and outputs of that exercise? ...” (Interviewee 1)</p> <p>“And most employers I’ve talked to have felt that’s been a good skill. Obviously employers also just care about someone who’s punctual, is ready to work hard, is ready to stick with the problem for a long time and students often don’t get a sense for how hard a problem in real life are. That they take months of full time work until you make head way on a problem. Unless that’s some problem that you’ve seen before then it’s faster but some...” (Interviewee 7)</p> <p>“We’ve given them a problem and they have to figure out what the steps to the problem are, whereas they’ve never had these sorts of problems before. They don’t have enough knowledge given to them in a third year. They have to figure out what that extra knowledge is. Now on top of not getting that knowledge we don’t tell them how to do it.” (Interviewee 11)</p>

Table 5. An example of theme coding using outcome space - attributes pre-defined in Table 4

## 5 FINDINGS AND DISCUSSION

We were able to use the CILLF to code 119 out of the 125 themes from the five Text Topic nodes and list the results in Table 6. We did not consolidate the themes as per normal step in Topic Modelling because we have already predefined themes (Outcome Space) for the framework (Table 4).

	<i>Unit description</i>	<i>Current resources</i>	<i>Student outcome</i>	<i>Needs/Concerns</i>	<i>Assessment/ Measurement</i>	<i>Total</i>
DSG	0	3	1	1	0	5
DSS	0	1	0	1	2	4
DST	0	2	0	1	3	6
AOG	2	5	0	0	0	7
AOS	4	7	3	0	3	17
AOT	0	1	1	1	0	3
CDG	0	1	5	5	3	14
CDS	0	0	9	8	2	19
CDT	0	0	3	4	4	11
ATG	14	2	1	1	4	22
ATS	3	2	2	0	2	9
ATT	0	0	0	2	0	2
Total	23	24	25	24	23	119

Table 6. *CILLF staff-input outcome result- IS, IT and Engineering*

The CILLF attributes are summarised in Table 7. At the single theme's level, it is clear that the ATG (Accommodating-Transition learning-Generic) conception appeared to be the key area of focus by staff (22). This confirms the purpose of capstone units being a unit preparing students for their transition into the workplace. CDS (Conversing-Decision making-Situated) conceptions also had a strong presence (19), which may be explained by the large number of discipline specific work integrated learning activities built into the capstone units at this university. Also, the focus on the AOS theme (Assimilating-Opportunity Awareness-Situated) (17) reflects particular teaching arrangements mentioned in the data as multiple lecturers engage industry guest lecturers, career services, librarians, employers and professional associations to provide discipline specific career information.

<i>Learning Approach</i>	<i>Career Development Learning</i>	<i>Information literacy</i>			<i>Total</i>
		Generic	Situated	Transformative	
1. Diverging	Self Awareness	<i>DSG (5)</i>	<i>DSS (4)</i>	<i>DST (6)</i>	<i>15</i>
2. Assimilating	Opportunity Awareness	<i>AOG (7)</i>	<i>AOS (17)</i>	<i>AOT (3)</i>	<i>27</i>
3. Converging	Decision Making	<i>CDG (14)</i>	<i>CDS (19)</i>	<i>CDT (11)</i>	<i>44</i>
4. Accommodating	Transition Learning	<i>ATG (22)</i>	<i>ATS (9)</i>	<i>ATT (2)</i>	<i>33</i>
Total		<i>48</i>	<i>49</i>	<i>22</i>	<i>119</i>

Table 7. *The CILLF staff-input outcome distribution - IS, IT and Engineering*

Looking at dimensions of 1-4 DS, AO, CD and AT (row) learning approaches/career development learning, it is intriguing to see Diverging-Self awareness (15) being the least developed among the four learning approaches/career development dimensions across the five areas of unit description, current resources/practices, student outcomes, needs/concerns, and assessment/measurement. This may indicate a gap in developing student self-awareness. It does not necessarily mean that lecturers

have not facilitated students' experience in exploring self-interests, values, skills, etc., but it may indicate that lecturers can enhance the explicit instruction to heighten student awareness even further. More participants, however, emphasised on the Converging- Decision making dimension (44), as one lecturer pointed out:

*"At the end of the semester I would expect some students to say I'm just gonna finish my degree, and use it to move onto something else, or say I like Information Systems and I want it to be a major part of my career." (Interviewee 6) (CDS)*

Looking at the three levels of CIL (Generic, Situated, Transformative), at a glance there seems to be an equal interest on the Generic (48) and Situated (49) levels of information literacy. However, we observed contrast between the two levels- much more emphasis on situated level than the generic level of Assimilating- Opportunity Awareness (AOS). This reflects a strong degree-to-industry alignment and a more defined career path in the discipline cluster we studied.

*"The goal of the unit is to expose them to the different roles that are important in the industry. It is very clearly focused on the web industry and one particular area of development really and so we can't give them exposure to things outside of that, but within that they can see hopefully the different aspects of the jobs and the different parts of the careers." (Interviewee 3)*

*"Students need to understand exactly what electronics engineering is all about. So I'll make sure students understand what sort of work they are likely to deal with." (Interviewee 8)*

Some degree programs are accredited by professional and industry bodies and therefore a high degree-to-industry alignment is compulsory:

*"We have an industry advisory board. We also have the accreditation process where we get feedback on the unit and we've done very well in the accreditation boards' comments." (Interviewee 11)*

In contrast, in the Accommodating-Transition learning (AT) dimension, more emphasis is on the Generic level than the situated level, indicating a focus on a general ability to transfer a set of skills from one context to another within the AT dimension. At this level, even very strongly technically oriented degree programs also emphasises transferability.

*"So the idea at the time quite literally was to have students do what we thought their first job assignment would be when they got into the real world. So we pitch a project that would have been, that we thought the employer would have given them as a first assignment and then use that as the vehicle to teach them all the things that they have not learned to that point." (Interviewee 11) (ATG)*

*"I think the engineering skill base, in all universities, is that if you do engineering, you learn about identifying a system, understanding what the crucial components are, identifying where the problem might be, and solving that problem, right?" (Interviewee 12) (ATG)*

Our data showed that less emphasis was placed on the transformative level, which was expected, given that it is a higher level conception characterised by deeper, counterintuitive, critical thinking which transcends disciplinary boundaries. As interviewee 1 expressed:

*"The ultimate aim is really gaining a deeper understanding of a lot of things and couching that all within the terms of games but secretly I'm actually teaching them a lot about how do people interact with the world and how do people experience the world. Sometime I think I*

*dream about being able to strip away the games pretence...But I managed to hide all that under the heading of games And that works because the group of people that get passionately engaged with it I ask them difficult questions. Sometime I think about teaching games, teaching this entirely frivolous thing in many ways. At the same time I realised a lot of the skills you need to learn are quite deep skills they're about psychology, they're about thinking how the systems work...how are people going to interact with the system and what outcomes are going to be.” (DST)*

Using the CILLF, we can now see that data collected from IS, IT and Engineering capstone unit teachers and relevant staff reflect the current, general efforts to help students figure out what to do with their degrees and prepare for life beyond university. The CILLF allows education designers to analyse types of learning behaviour, career exploration, and levels of inquiry skill exercised in a capstone unit. This enables the streamlining of interrelated concepts essential to capstone learning, whilst bridging the gaps in discussions of generic skills, discipline based learning, employability skills and life-long learning.

In summary, from the results in the tables, we found the CILLF did capture the teaching staff's conceptions of a range of factors pertinent to capstone units. As mentioned in the introduction section, various stakeholders use different terminology to express what should go into the curricula to facilitate effective transition from study to work, further studies or other life plans. The CILLF can be used as a single framework to encapsulate concepts of personal and professional development, graduate capabilities, employability, industry understanding and engagement, work integrated learning and so on. We could match the data to the framework as shown in Table 4 and summarised in Table 7, which combines the results of data matches and the 3 dimensions of Learning Approaches, Career Development Learning and Information Literacy in the framework.

## **6 CONCLUSION**

We have developed the CILLF in an endeavour to create a tool featuring the facilitation of diverse learning approaches, career development and information literacy simultaneously. Many of these concepts have been investigated separately. For example, career counselling services and team projects have been suggested to enhance students' levels of academic integration and self-efficacy (Weng et al. 2009). Assessment modes have been developed to improve students' problem solving, interpersonal and self-organisation skills (Venkatraman, 2007). Tan and Sedera (2015) use a roadmap metaphor to outline IS teaching practice. Van Toorn et al. (2011) discuss how students can transfer their research knowledge and research skills to practice in their workplace. However, absent from the literature is a conceptual framework focusing on the linkages between career information literacy learning and employability skills for course design. This paper has fills a void where a plethora of literature has been published, while a system is yet to be established and operationalised.

Navigating the 'world of work' requires considerable career information literacy on the part of graduates in today's world. The establishment of a career information literacy learning framework (CILLF) brings together separate yet related concepts of diverse learning approaches, career development learning and information literacy. This paper has shown that the 3 dimensions of the CILLF (see Figure 1) can be presented as a single framework, combining the 4 learning approaches, 4 career development learning components and the 3 information literacy levels. The CILLF demonstrates a three-dimensional process of a learner's continuous journey of information and evidence seeking by deploying a range of learning behaviours which encourage life-long development skills. This has highlighted the previous limitations of fragmented teaching attributes that now can be integrated into a single unified framework, thus allowing teaching staff to map curricular activities to fulfil course learning outcomes.

However, further studies on other disciplines should be done to test the generalisability of the framework. This study is limited as it reflects only the combined views of IS, IT and Engineering capstone unit academic and professional staff. Comparative studies using data from other disciplines may show variance of career information literacy developmental experience. This study is also limited as it only shows final year capstone unit designs and therefore does not reflect course design in the earlier part of the degree programs. Moreover, it is important to note that these are staff's views; so we expect further studies of other stakeholders' conceptions, such as students, future employers, professional bodies, etc., to contribute to a more holistic view of the learning system.

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