

# From the International Desk

## Integrating Research and Professional Learning-Australian Capstones

In 1998 the Boyer Commission recommended that all undergraduate programs in the U.S. should culminate with a capstone experience and that “the final semester should focus on a major project and utilize to the full the research and communication skills learned in the previous years” (1998, 27). Capstones or senior seminars are now relatively common in the U.S., with increasing numbers implemented since the 1980s (Hauhart and Grahe 2015). Hauhart and Grahe indicate that capstone courses are offered at 70 to 80 percent of U.S. higher-education institutions, most commonly at smaller private institutions. The research focus of many capstones is evident in the literature. Schermer and Gray (2012) suggest that capstones are characterized by independent but guided research experiences, while Hauhart and Grahe (2015) argue that the most successful capstones consist of a research project and that students who undertake “research-based capstones have positive experiences and develop cognitive and practical skills that students who do not engage in a research experience do not develop” (5). They further argue that research-based capstones dominate in many disciplines, particularly in the social and natural sciences and humanities (8).

In Australia, there has also been substantial and growing interest in the role of undergraduate research (Brew 2010) and the final-year experience, including capstones (van Acker et al. 2013). However, this is contested ground. In the Australian context, as elsewhere, institutions of higher education have recently been subject to a great deal of criticism that focuses on the need for vocational, rather than research-oriented, curricula. Much of this debate has focused on the role of higher education as a contributor to the national economy (Commonwealth of Australia 2014a; Hout 2012; Norton 2012). Confronted with high numbers of youth who are neither employed nor undertaking education, international development bodies are also questioning the role of education systems in improving employment rates, citing a need for better alignment of higher-education curricula with labor-market needs. A report on improving youth outcomes from the recent G20 summit concluded that, “Preparing youth for the labour market is one of the key functions of the education system” (International Labour Organization and Organisation for Economic Co-operation and Development 2014, 11).

These arguments can be polarizing, leading to negative comparisons between professional and research outcomes and “academic” becoming synonymous with “irrelevant.” The emotional nature of the debate in Australia has created pres-

**Table 1. Respondents’ Discipline Groupings in Survey Sample**

LTAS Discipline Group	Number	Valid Percent
Arts, Social Sciences and Humanities	56	26.0
Business, Management and Economics	49	22.8
Health, Medicine and Veterinary Science	43	20.0
Engineering and Information and Communication Technology	28	13.0
Creative and Performing Arts	13	6.0
Science	10	4.7
Architecture and Building	7	3.3
Law	5	2.3
Non Discipline / Interdisciplinary	4	1.9

Disciplines were mapped to the eight identified in the Learning and Teaching Academic Standards (LTAS) exercise (see <http://www.olt.gov.au/standards/FAQs>).

One participant did not list a discipline.

Non-Discipline / Interdisciplinary capstones were not focused on any discipline and accepted students from all disciplines.

sure on universities to justify the undergraduate curriculum in terms of its capacity to develop students who are work-ready, and to justify the place of the university as a contributor to national economic success rather than to individual development or social good (Green 2014). The stakes in these arguments are high. In Australia, media and government reports regarding return on investment (Norton 2012) have also been woven into justifications for reduced government funding to universities (Commonwealth of Australia 2014b).

In Australia, it has become clear that students do not generally believe that their undergraduate degree has prepared them for employment. The results of the 2012 Australasian Survey of Student Engagement (AUSSE) show that only 33.5 percent of graduates in later years believed their college experiences had contributed very much to their development of work-related knowledge and skills. Only 26.4 percent felt strongly that their studies prepared them to work effectively with others, and just 25.2 percent felt their studies contributed significantly to their ability to solve complex, real-world problems (ACER 2012). Given that most students undertake a degree as the first step in a career, those statistics have further heightened concerns about the quality and purpose of undergraduate education.

As a result, universities in Australia have made significant efforts over recent years to develop a range of curricula and

**Table 2. Respondents' Rankings of Purposes of Capstones\***

Domain	Item	M (SD)	Med
Skills	Communication (verbal, written)	4.64 (.56)	5
Skills	Thinking (e.g. critical decision making)	4.60 (.58)	5
Knowledge	Application to practice	4.58 (.66)	5
Knowledge	Synthesis of prior learning	4.55 (.61)	5
Quality	Ensuring quality of graduates	4.54 (.66)	5
Personal	Responsibility	4.52 (.56)	5
Preparatory	Preparation for industry/employability	4.41 (.77)	5
Skills	Creative (e.g. problem-solving)	4.34 (.73)	5
Personal	Confidence	4.29 (.67)	4
Personal	Independence	4.27 (.73)	5
Skills	Organization/work management	4.26 (.84)	5
Preparatory	Broadening student experience	4.23 (.82)	5
Knowledge	Analysis of an in-depth topic	4.19 (.85)	5
Quality	Confirmation of knowledge gained in course	4.16 (.83)	4
Personal	Resilience	4.16 (.78)	4
Personal	Self-efficacy	4.15 (.75)	4
Personal	Professional identity	4.12 (.91)	5
Quality	Demonstrating course standards	4.03 (.10)	4
Skills	Refinement of technical skills	3.94 (.93)	4
Preparatory	Adding to student CVs	3.87 (.92)	4
Knowledge	Acquisition of new knowledge	3.73 (.93)	4
External	Meeting institutional requirements	3.67 (1.22)	4
External	Enabling academic/industry linkages	3.46 (1.10)	3
Preparatory	Future postgraduate study	3.15 (1.15)	3
External	Meeting industry/professional accreditation requirements	3.14 (1.50)	5
Quality	Benchmarking with other institutions	3.04 (1.16)	3
Preparatory	Training for research careers	2.85 (1.22)	3
External	Supporting staff research activities	2.37 (1.02)	2

\*Purposes drawn from research literature. Participants were asked: "In your view, what are the primary purposes of this capstone?"

M (SD) refers to Mean and Standard Deviation. Med refers to Median.

co-curricular opportunities for students to engage with industry and develop job-seeking skills. Nonetheless, the notion of professional or workforce preparation at times sits uncomfortably with the broader role of universities in developing students' capacity to challenge accepted worldviews and to act as change agents through knowledge production and critique—and the role of research as a stimulus for those skills.

Historically, this division can be seen most clearly in the separation of research degrees from undergraduate and postgraduate coursework degrees. As a result, there have been numerous moves to integrate coursework and research programs either through embedding coursework in research programs or embedding research in coursework programs (Bradley et al. 2008). However, a push for the integration of research and industry with undergraduate academic curricula is more complex, with rapid shifts in policy—from a research-teaching nexus to work-integrated learning—posing challenges for sustaining systemic improvements (Brew and Cahir 2014). Certainly, undergraduates' engagement with research has remained patchy and largely discipline-dependent, as has the integration of professional skills and contexts with academic coursework.

The complexity of this task for faculty should not be underestimated, nor should the differences among disciplines. In newer fields (to higher education), research may not have played a strong part in the educational or work experiences of faculty, and it may still not be considered an important component of undergraduate education by industry. For example, business and para-professional fields typically require graduates to have high-level and wide-ranging work-based competencies and knowledge, with research capacity less emphasized. Hauhart and Grahe (2015, 7) also point to differences in disciplinary priorities, particularly in the performance arts, where training for performance is intensive and often takes the place of more traditional forms of academic research. In other fields, the difficulty may be in identifying how industry might play a part in what has traditionally been an environment of deep engagement with issues of humanity, such as the disciplines of philosophy and politics. Further, in many disciplines, there is an ongoing debate about what we might consider to be valid research activity, leading to confusion about what a research-enhanced and professionally relevant curriculum might look like.

In addition, an obvious and often-articulated challenge lies in a crowded curriculum and the competing needs for depth and breadth. How do we build in the knowledge, skills, and attributes of the exceptional thinker and researcher and at the same time develop the exceptional industry professional in an already overloaded and content-heavy curriculum? Combining standard academic learning-and-teaching practice with equal measures of research capacity-building and industry experiences is not a simple task.

## Capstones in the Australian Context

While capstones vary substantially in scope and format, a broad definition is possible. In the simplest terms, capstones are substantial, culminating learning experiences that take place in the final stage of an educational program, offering closure and a focus for the sense of achievement that comes

**Table 3. Cross-Tabulation of Respondents' Importance Rankings (in number of respondents and percentage of total respondents) for Two Capstone Items Reflecting Professional and Research Focus\***

		Preparation for industry/employability					Total
		Not at all important	Very unimportant	Somewhat important	Very important	Extremely important	
Training for research careers	Not at all important	0	0	2 (1.1%)	13 (7.0%)	21 (11.2%)	36 (19.3%)
	Very unimportant	0	0	1 (0.5%)	8 (4.3%)	19 (10.2%)	28 (15.0%)
	Somewhat important	0	2 (1.1%)	10 (5.3%)	14 (7.5%)	41 (21.9%)	67 (35.8%)
	Very important	1 (0.5%)	1 (0.5%)	4 (2.1%)	19 (10.2%)	14 (7.5%)	39 (20.9%)
	Extremely important	0	0	1 (0.5%)	8 (4.3%)	8 (4.3%)	17 (9.1%)
	Total	1 (0.5%)	3 (1.6%)	18 (9.6%)	62 (33.2%)	103 (55.1%)	187 (100%)

\*Participants were asked: "In your view, what are the primary purposes of this capstone?"  
 A significant inverse relationship was present ( $r = -.14, p = .03, n = 187$ ) between the two items. Valid percentages are reported.

ects may include approvals from research-ethics boards and/or quantitative data collection and analysis; others may incorporate document or auto-ethnographic research, although in many, the research utilizes secondary, rather than primary, data. Some undergraduate capstones provide students with opportunities for research that can be published in academic journals, moving the work beyond merely "practicing" research skills into work capable of winning academic recognition among peers. (See the Australian National University's *Undergraduate Research Journal*, Victoria University's *Offset* magazine, and the joint publication of Monash University and the University of Warwick, *Reinvention: an International Journal of Undergraduate Research*). For many undergraduates, capstones provide the first opportunity to substantially engage in a research culture or at least to be introduced to the concept of doing academic research.

with completing a degree. Many authors describe characteristic features of the capstone experience as the synthesis and application of prior learning. It is broadly agreed that capstones involve students in authentic and complex problems requiring an increased level of independence and decision-making (Healey et al. 2013; van Acker et al. 2014; Weimer 2013).

Much like the American capstone, the Australian capstone has typically been described as a culmination of disciplinary coursework—required to ensure that students are able to synthesize prior learning. In Australia, capstones are most often described as having a professional focus, providing an opportunity for students to "both look back on their undergraduate study in an effort to make sense of what they have accomplished, and to look forward to a professional existence where they can build on that foundation." (McNamara et al. 2012). This concern with work-readiness is present in much of the Australian literature. Multiple authors have argued directly or indirectly that capstones should be concerned with the enhancement of work-readiness and the transition to work (Keller, Parker, and Chan 2011; Holdsworth, Watty, and Davies 2009; Lee 2014). McNamara et al. (2012) further argue that capstones support students in gaining direct and authentic experience in the workplace or in community organizations, which aim to immerse students in their post-graduation career setting. Similar concerns are evident in the UK, with some work under way to make capstones work-relevant (see, for example, Hill et al. 2011).

Nonetheless, there is evidence that numerous capstones involve students undertaking the research activities typical of their fields. Many of these cases can be found on capstone-related project websites and associated reports (For examples see [www.capstonecurriculum.com.au](http://www.capstonecurriculum.com.au); [www.businesscapstones.edu.au](http://www.businesscapstones.edu.au) and the "Rethinking final year projects and dissertations" site at <http://insight.glos.ac.uk/tli/activities/ntf/creativehops/Pages/default.aspx>.) In some cases, proj-

Having students conduct research does not, however, mean forgoing the development of professional workplace skills. We argue that many of the skills and attributes of professionals closely reflect the skills developed through research and inquiry, and we believe that these can be integrated effectively in the curriculum.

### Government Research into Capstones

In 2013, the Australian Government Office for Learning and Teaching funded a fellowship for author Nicolette Lee to carry out research and development of practical resources for capstones. The fellowship included a substantial analysis of current capstone curricula with a focus on Australian practice. This included in-depth, semi-structured interviews with 13 capstone coordinators, a curriculum-focused survey with 216 respondents, and collection of 14 case studies. The project also included wide engagement with faculty members across Australia, resulting in a network of some 309 capstone coordinators and discussions with 215 capstone faculty at workshops and meetings across the country. (For in-depth details, see the "Australian Capstone Appendix" in *CURQ on the Web*.)

Together, these activities formed the basis for the development of a comprehensive snapshot of the current status of capstones in Australia, as well as the basis for a range of tools and resources for faculty use. These resources were developed in response to common questions raised by participants in workshops regarding the nature of capstone curricula. One of the most common questions was how capstones might address contemporary pressures involving research and professional outcomes, which we attempt to answer in the following, drawing on the experiences of capstone faculty and some case studies in which research and professional outcomes were successfully integrated.

## Survey Findings, Interviews

Many examples of professional and research skills being developed in separate capstones, sometimes within the same degree program, have been recorded (Schroetter and Wendler 2008). In our research mapping capstones in Australia, coordinators from diverse backgrounds favored professionally oriented curricula and learning outcomes more than they did development of research skills (see Table 1). One coordinator of capstones that involve student internships in industry stated that capstones must contain “a series of topics and activities and exercises that force the students to look forward to the industry and ... reflect on their time in industry.” One coordinator said capstones must build evidence of employability and “a career philosophy ... just as academics we’re told we need to have ... a teaching portfolio.” Another argued that capstones are “an opportunity to develop students’ capacity by taking them into the world of the client.” Another said that, most importantly, through the capstone students “actually understand what real work is like.”

These same coordinators positioned what one described as “research project” capstones, even those with minor industry components, as more academically traditional and a poor alternative to achieving work-related learning outcomes. These coordinators viewed such capstones as limited in scope and focus, particularly for integrating prior learning. One coordinator described the risk that work in such capstones “degenerates into the Research Methods 101.”

Other coordinators, however, favored having students conduct what may be considered traditional inquiry and research. One coordinator stated, “I expect them to do substantial research with anything they are doing; they have to have literature reviews and interim reports and have to be up on the latest government and other reports that might be relevant to their work.” These coordinators noted links between some projects and existing staff research projects. Only one coordinator articulated reciprocity between research and professional skills. This coordinator described students in his institution’s industry-focused capstone as having “an inquiry inside their project of some kind.” Another coordinator went on to detail how one goal of the capstone is for students to develop “a reasonable understanding of how their skills, how their academic research work, [and] how their relationships ... integrate into professional practice.”

The survey data also demonstrated that many coordinators see a dichotomy between goals for development of research skills in capstones and goals for development of workforce skills. This separation of research and employability goals was seen in the survey data. Capstone coordinators in the survey were asked to rank the importance of 28 purposes for capstones, derived from the literature (see Table 2). Preparation for industry/employability was ranked higher than preparation to do research overall. Only one respondent in the whole sample ranked industry/employability preparation as not at all important. By contrast 36 participants ranked train-

ing for research careers as not at all important.

As noted in Table 3, among respondents it appeared that the more important research training for research careers was ranked, the less important preparation for industry tended to be ranked, and vice versa ( $r = -.14$ ,  $p = .03$ ,  $n = 187$ ). Disciplinary differences were apparent in these divergent views (see Table 4). In particular, faculty from health and social sciences disciplines ranked research and preparation for postgraduate study the most highly, while faculty from business and engineering disciplines ranked them the lowest. However, faculty in health disciplines also ranked preparation for industry as very important, suggesting that in some disciplines a need is felt to integrate preparation for both research and industry into the capstone experience.

Regardless of whether a capstone was explicitly focused on development of research or work skills, we found consistent descriptions of the skills and attributes that students were expected to develop and demonstrate in their capstones. Across all survey respondents, the purposes of capstones were almost identically weighted regarding personal attributes, professional outcomes, and academic skills and knowledge. The great majority of respondents (85 percent) ranked as very important the ability to do in-depth analysis, apply knowledge to practice, organize and manage work, solve problems creatively, and communicate effectively.

Those attributes and skills are largely developed through projects; the vast majority of our survey respondents reported that their capstones were project-based (89 percent). The nature and scale of the projects varies significantly, from one-semester investigations of a single topic to a full year of complex product development. Some elements of the curriculum are more constant: Projects often include high levels of student autonomy in choices of topic, methods, and outcomes. Participants’ responses from across the disciplines and types of capstones also consistently refer to a curricular and outcome focus on inquiry and generic skills, indicating that there is a common set of expectations in both research-focused and professionally oriented capstones.

## Case Studies Combining Inquiry with Professional Outcomes

In our research, case studies provided the most detailed insights into capstones’ structure. Some cases exemplify the successful integration of inquiry and professionally relevant learning outcomes. These cases focus on the development of research skills, while also providing opportunities for community or industry engagement; they also generated outputs that are concrete evidence of a range of transferable skills and capabilities among students. Common elements among many of these cases include use of an applied-inquiry approach that links professionally relevant investigations with more formal academic research skills. These reflect much of the literature on research and inquiry in undergraduate education (for example, Healey 2005; Healey and Jenkins 2009).

**Table 4. Primary Purpose of Capstone (Research Training or Employability), by Respondents' Disciplinary Groupings**

Item	Arts, social sciences and humanities		Business, management and economics		Health, medicine and veterinary science		Engineering and ICT		Pairwise comparison
	M (SD)	Med	M (SD)	Med	M (SD)	Med	M (SD)	Med	
Training for research careers	3.44 (1.01)	3	2.18 (1.09)	2	3.13 (1.17)	3	2.38 (1.01)	2.5	bus<health* bus<arts*** eng<arts**
Preparation for industry/employability	4.19 (.96)	4	4.62 (.53)	5	4.63 (.56)	5	4.33 (.76)	4.5	arts<health*

M (SD) refers to Mean and Standard Deviation. Med refers to Median.

A Kruskal-Wallis test indicated median rankings differed significantly ( $p < .05$ ) across disciplines.

Pairwise comparison significance level was calculated using Bonferroni adjustment.

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

Specifically, students identify a topic of interest, undertake an investigation drawing on external expertise and collaborations, analyse data, and present findings and other outputs. The case consist of a major project undertaken with a high degree of independence and choice about the approach and topic, and demonstrate a general pattern of “just-in-time” guidance and support rather than didactic delivery.

Outputs include substantial written reports that incorporate conventions in both professional and academic writing, as well as products arising from or alongside the inquiry process. As importantly, each orients the project work to external audiences through some form of collaboration with industry or community. It is worth noting here that, while in the U.S. community engagement is well tested (Strand et al. 2003), it has been relatively limited in Australian higher-education curricula to date. We include here brief descriptions of some illustrative capstone projects.

*The Graduating Project at Victoria University, Australia.* As noted by Hauhart and Grahe (2015, 8), while research-based capstones are common in the social sciences and humanities, interdisciplinary research-focused capstones are less common. In the Graduating Project at Victoria University in Australia, students from diverse majors such as Asian studies, political science, visual and performing arts, media, and sociology work together in cross-disciplinary teams for a year on a substantial investigation of an issue or problem on a topic of their choice. Students must navigate diverse worldviews, interests, and skills to progress in their work. They identify an issue or problem, to which they then test, refine, and develop responses through collaborations and research with interested external, non-academic partners. Throughout the capstone, students are provided with mentoring, “just-in-time” workshops, and training in research methods.

Interim reports and presentations are used to identify further learning needs, and the final assessment is based on a final report and presentation, as well as on products such as training resources, videos, and books. While the report’s structure is pre-defined, the student teams define the nature of the products developed, reflecting the highly flexible curricular and assessment regime. The curricular structure operates in such a way that students effectively work as consultant researchers to the external partners, but also engage in a within-team learning process as they come to terms with the disparate views, skills, and knowledge of their team-mates. They develop employability skills through an explicit process for project management and stakeholder engagement. They gain expertise and a broad range of transferable skills, including the capacity to use their skills in “real-world” contexts and in ways that are informed by the needs of their industry and community partners. Detailed information on this capstone approach can be found in Funston and Lee (2014).

*The Music Industry Project at the Royal Melbourne Institute of Technology.* Also noted by Hauhart and Grahe (2015), disciplines such as music often privilege performance skill over development of research capabilities. In the Music Industry Project, we found that both activities are equally weighted and aligned. Each major component (professional and research) is designed to support the other. Specifically, students develop a capstone project aimed at producing a showcase or product related to their individual career goals, such as a performance or recording, documentary, or business plan. The project is accompanied by a written research report aligned with their project. This written work supports their project by demonstrating their deepening understanding of relevant topics.

This process is supported by workshops on research methods. In addition, tutorials provide students with support on writing techniques, along with discussions about the nature of challenges in industry and the application of research to that context. Assessment is continuous, with weekly writing and project updates and presentations, thus ensuring that students receive ongoing feedback. Students are encouraged to make use of and extend their industry networks as part of this work, including engagement with industry to refine their research and production work. As a result, students’ projects develop their research capabilities and align these capabilities with areas of professional interest.

*The Australasian HealthFusion Team Challenge.* Another example of a capstone integrating development of students' research and professional capabilities but using a substantially different model is the Australasian HealthFusion Team Challenge. In this capstone, students from multiple universities and across the health professions compete in inter-professional teams to develop a comprehensive management plan for a provided case study (Boyce et al. 2009). The process involves students undertaking secondary research, supported by their academic supervisors and professional mentors, culminating in a student team's presentation of findings and resulting healthcare proposals (a case-management plan) to a panel of professional and academic judges at a regional or national competition. These presentations are accompanied by a detailed report outlining treatment recommendations.

The inter-professional nature of this process deepens students' understanding of the role of related health professions, as well as testing their understanding of the boundaries and provisional nature of knowledge in sub-disciplines or professions. What emerges from this process is a set of capabilities around structured and dialectical investigation and analysis, professional behaviors, and communication.

Many other examples of the integration of research and professional capabilities can be found in the literature. For example, Julien et al. (2012) describe a capstone in which students in human biosciences carry out research on a topic that prepares them for careers in both industry and research. In more or less explicit terms, other literature discusses cases in which students variously engage with problems in industry using disciplinary research skills (for example, Peterson, Phillips, Bacon, & Machunda 2011) and/or develop creative solutions for trans-disciplinary challenges while explicitly gaining skills in key attributes linked to employability (for example, Reid and Estell, 2010; Siniawski and Patel 2010).

## Conclusion

Despite some academics' feelings that development of research and professional skills cannot be reconciled during students' capstones, there is evidence from both Australia and the U.S. that research and professional outcomes can be successfully integrated. The cases identified through our work with capstones in Australia, as described above, exemplify the flexible and ultimately successful combination of components of research/inquiry and professional learning. In each case, there is a common curricular framework of applied research that involves a rigorous identification of problems and needs for information, followed by deep analysis and then presentation of findings and other outputs. Engagement with professionals from industry or community leaders also appears to be a common factor in these cases, providing an additional grounding of the inquiry process through an expectation that students operate as professionals and orient their work in relation to external needs. These cases suggest that integration of academic and external view-

points provides students with opportunities to gain the research and inquiry skills that are relevant in both settings. In a contested higher-education context in which "academic" curricula can seem less-than-relevant to graduates' employability and thus of limited immediate economic value, these are increasingly important considerations for the design of undergraduate capstones. 

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### Nicolette Lee

Victoria University, Nicolette.Lee@vu.edu.au

*Nicolette Lee is executive director of learning and teaching at Victoria University, Melbourne, Australia, where she is an associate professor and directs the Centre for Collaborative Learning and Teaching. In 2013 she received a National Senior Teaching Fellowship from the Australian national government's Office for Learning and Teaching, to conduct research on capstone curricula (www.capstonecurriculum.com.au). Her research is focused on undergraduate curricula, learning environments, and the student experience.*

*Daniel Loton is an educational research advisor to the Centre for Collaborative Learning and Teaching at Victoria University, Melbourne, Australia. He recently received his PhD in psychology. He has experience in research administration and has contributed to a variety of research projects, particularly in psychology and education. His educational research has focused on improving outcomes for low-income students.*

### Australian Capstone Appendix: Research Methodology

This appendix provides a brief overview of the methodology used in the research supported by the Australian National Senior Teaching Fellowship regarding undergraduate capstones in Australia.

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