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Paramedic capstone education model: Building work-ready graduates

James Thompson
Flinders University, Adelaide

Hugh Grantham
Flinders University, Adelaide

Don Houston
Flinders University, Adelaide

Education

Paramedic capstone education model: Building work-ready graduates

James Thompson BNurs, DipAmbulance Studies, BHlthSci(Hons), GradCert Autonomous Practice, GradCert Higher Education, PhD Candidate, Lecturer¹, Hugh Grantham MBBS, FRACGP, Paramedic Professor¹, Don Houston BA(Hons), PhD, Senior Lecturer¹

Affiliation:

¹Department of Paramedic Science, Flinders University, Adelaide, South Australia

Abstract

In Australia, the past decade has witnessed considerable changes to both the scope of paramedic practice and the education of these practitioners. Notably, within education there has been a national trend to move from on-the-job training towards a pre-employment, undergraduate university qualification. Despite increases in depth, breadth and consistency to the curriculum and delivery by subject experts with training in education, criticism remains targeted at the preparation of the graduate for readiness to undertake the paramedic role. Australian undergraduate courses are currently experiencing unprecedented enrolment numbers, with complex student learning expectations and requirements. Producing work-ready graduates within traditional curriculum frameworks is a challenge. Capstone subjects target the final preparation of the graduating student, with a strong emphasis on articulating them successfully with their chosen industrial settings. While widely accepted in other disciplines such as engineering, capstone is a new concept to the discipline of paramedicine. This paper discusses how a capstone topic was created and implemented at Flinders University, South Australia, within the Bachelor of Paramedic Science degree. It describes the differentiated student learning methodology employed and the strategies used to respond to specific student and industry concerns regarding university teaching.

Keywords

paramedic education; capstone; differentiated learning; active learning; graduate qualities

Corresponding Author: James Thompson, james.thompson@flinders.edu.au

Introduction

Criticism exists surrounding the effectiveness of Australian universities in preparing students for the expanding role of the paramedic (1). Central to much of the debate is an industry-led challenge to paramedic graduate preparation (1). New graduates must be able to demonstrate that their training has effectively prepared them to be work-ready to the level of a paramedic (2). The authors, who possess over 30 years collective experience in paramedic education, note that traditional models of ambulance education involved chronologically progressing students through well-worn and confined pathways of study, signing off areas that had been satisfied before moving onto new fields of learning. With each prerequisite learning milestone informing the next, there existed an assumption that all that was taught was learnt and stayed learnt. Re-testing of previous learning was regarded as inefficient academic double jeopardy, and yet universities often were subject to criticism surrounding theory practice gaps. For the graduating paramedic student, the impact of having the value of their studies challenged was significant. A set of graduate attributes for the universities paramedic course was created through consultation with industry and served to benchmark the industry standard expected of the completing student. Unfortunately, these were mostly unfamiliar to those paramedics working directly with graduates, or were discounted in favour of their own valued principles regarding performance.

The need to respond to these criticisms presented opportunities for the redesign of a culminating degree subject. In response to the need to integrate prior learning and produce a more rounded graduate, a capstone topic was created. Capstone education methods are recognised as deliberate attempts to address theory-practice gaps through attending to graduate attributes, making them ideal for a final subject (3). Teaching is aligned more closely with industry practices; curriculum is consistent with the real world that the graduate is about to enter and student performances are considered in parallel to industry standards (4). The rewards of capstone models are not limited to the student. Feedback from capstone subjects also provides invaluable insight into how successfully a course has been in achieving its curriculum goals (5).

The highly pragmatic subject 'Applied Paramedic Practice' was developed at Flinders University (South Australia) in response to the need for graduate knowledge and skills consolidation. It is now locally recognised as a type of 'finishing school' for paramedic students.

This paper offers a qualitative reflection of the topic development. The following sections provide a description of the challenges, the proposed solution of a student-centred, technology enhanced capstone experience, and the educational considerations behind the design. The final sections discuss student responses to the new learning experience created through the design and the initial conclusions and implications from the design and implementation of the capstone experience

for students.

Background

Defining the problem

Prior to university involvement, ambulance education was delivered to small groups of students for whom attendance was an employment condition. Teaching delivery methods reflected first aid training conventions and available technology of the time, with assessments also serving as a control measure for career progression. Today, education of the paramedic undergraduate student is complex, with high expectations of the student's knowledge and ability to reason. At Flinders University, paramedic students embark on studies from a myriad of enrolment pathways. School leavers with very high Australian Tertiary Admission Rank (ATAR) scores enter education alongside international applicants for whom English is an additional language. Other students use this program as a feeder program to medicine (who have no intention of practising paramedicine). These are coupled with mature aged students embarking on a change of career, and sponsored students who may not have completed high school. These all contribute to the modern and complex student cohort. Student needs and expectations differ considerably as a result. The compulsory attendance mandates and other employment expectations seen in the former vocational education training environment do not readily align with the adult learning and flexible delivery principles of the higher education setting. This is a setting where student opinions and satisfaction wield powerful influence and teachers must balance student attitudes regarding curriculum content and teaching with standards and expectations from all levels of industry and the university alike. There is a further challenge of delivering this learning to unprecedented enrolment numbers. Many of these completing students are also now for the first time having to consider the uncertainty of the next stage of their lives, a feature that study programs had, until now, mapped for them (6).

In 2009, a course accreditation review committee noted student criticism that questioned the relevance and quality of the teaching. Simultaneously, industry criticism of teaching in the degree occurred whenever a gap in a graduate's knowledge or clinical skills was exposed.

The original 'Applied Paramedic Practice' subject was the final academic requirement for the degree. This carried an added demand of ensuring the student had 'learnt enough' before being considered safe to practise on the public. The format of the final subject at that time had students first being issued with subject guides and statements of learning outcomes. Lectures and workshops were preceded by encouraging students to access a selection of pre-readings. The subject was approached mostly in isolation from other curriculum content. Practical sessions involved tutor demonstrations followed by student practice, with theory and practical assessments at the end of the topic.

Electronic media was incorporated principally as a communication platform to support teacher-student interactions and students would look to the teaching provisions with the view to passing a single final test. Students received feedback after testing, which largely related to their abilities to make the grade, with no capacity for the student to respond to the feedback through development (Figure 1). The intensity or complexity of the final testing was regarded as providing academic rigor. This pre-existing design was seen as problematic.

These design issues were compounded by class sizes exceeding 100 students, which tested all the available teaching resources, including staffing and teaching spaces. Unsurprisingly, student engagement with learning appeared to be declining. It was considered essential to clearly identify the problems, and with many stakeholders in play, careful attention was afforded to all views. Each facet of the wider curriculum was explored, as were the assessment formats. A number of key areas of concern were identified:

- 1) The pace of classroom-based learning was a point of contention, with varied student levels and cultural backgrounds fuelling frustration. Both slower and faster teaching deliveries were sought.
- 2) It was evident that much of the prerequisite topic knowledge had not been retained upon commencing the final subject, and many students struggled to see the relevance of some of the earlier curriculum to their future career paths.
- 3) While the convenience of online teaching provisions were recognised, students were largely critical of the level of engagement they generated.
- 4) As local industry recruitment processes at the time were perceived by students not to give consideration to the graduate's academic performance, students were not connecting their university performance with their future career success.
- 5) Industry partners were unfamiliar with the curriculum being taught: the depth and breadth of content were not well understood.
- 6) Graduates were thought to be lacking in fundamental skills

and knowledge when they underwent specific industry based internship testing methods. This served to perpetuate a cycle of graduate and industry disconnection.

For such a complex set of teaching and learning challenges, widespread reforms were considered essential. They would need to go beyond the teaching content to target student attitudes towards how they valued their learning experience as well as the role that local industry played in contributing to student regard for their education.

The solution: A capstone experience

There is emerging interest in the specific needs of the completing student (7). Although new to paramedicine, capstone education has strong traditions within engineering and computing courses (8,9). The signature work integrated learning characteristics have resulted in growing popularity of capstone experiences within finishing year university subjects (10). Their introduction has been historically linked with existing issues of articulation between university programs and industry need (3,11), a concept known in healthcare education as the 'theory practice gap'.

The purpose of a capstone experience is not always to introduce the student to volumes of new material, but instead to assist them to revisit and contextualise and integrate their existing knowledge. Characterised by strategies that cause students to look back on what they have been taught, while simultaneously looking forward to how the learning connects with their future work (6), capstone experiences symbolise a movement away from education traditions. Capstone interpretations vary considerably between disciplines and range from a final project (12) to simulations which are faithful to industry practice (13). Distinguishing capstone subjects are a culminating education experience that unites academia and industry through a partnership in the process of learning (14). For students, their activities of learning are specifically targeted at authentic, real world experiences or standards (13). Alongside the goals of developing skills and knowledge, consideration is given to the student acquisition of professional identity (15).

Figure 1. Former final topic design

The Flinders University paramedic capstone pedagogy

Following careful consideration of the impacts of each of the characteristics of the existing provisions in conjunction with the wider systemic problems, the prototype capstone model was designed to place the student at the centre of a carefully contextualised and individualised learning system (Figure 2). The design sought to replace all didactic delivery with a heavily student led format and encourage the use of the paramedic process of pre-hospital enquiry (16). The design was not intended to introduce new content. Rather it was intended to provide a process through which students could contextualise, consolidate and integrate content from previous subjects. Periodic testing and feedback were integrated into the intended student experience.

To achieve student centric active learning as a core characteristic of the design, a complete overhaul of the subject was performed. A summary of the design innovations is listed below:

- Diagnostic assessment at the beginning of the subject as the basis for a differentiated learning experience for each student
- The formation of small study groups to encourage engagement and peer-to-peer interaction and learning
- The use of problem based learning (PBL) scenarios which are supplemented by student generated wikis as a core learning experience
- Practical simulation testing of themes corresponding to the PBL content
- A mid-subject formative assessment to provide further diagnostic feedback to guide individual student learning pathways
- The involvement of practising paramedics in assessment of clinical skills and reasoning
- Student maintained portfolio and skills records.

The broad design revised the role of tutors, placing them as support links to information, learning materials and clinical standards, compared to a former role as a source of central instruction. Students are allocated to study groups, with deliberate intent made to separate friendship circles, blend student skill mix and integrate cultural groups. This strategy

was intended to develop a capacity to work confidently and effectively with unfamiliar people and not allow retreat into the comforting support networks of familiar peers. The specific components within this broad design and linkages between them are detailed in the following sections. Table 1 shows a summary of the new curriculum pathway.

Initial diagnostic assessment

On the first day of the subject, students are given a multiple-choice exam that samples questions from all the prerequisite subjects. This practice attempts to establish the student's prior knowledge and understanding (17). Students' awareness of their level of understanding is considered an important feature if they are to have control of their learning (18). Questions that are sampled for inclusion cover the specific curriculum areas of anatomy, physiology, pathophysiology, pharmacology and clinical practice, with feedback on performance aligned with these. While initial testing does not directly contribute to the student's overall grade, students are required to reflect upon their performance in another of the initial assessments: a portfolio.

Personal learning portfolio

The student portfolio offers a valuable teaching tool within the subject. As an assessment item it offers an authentic representation of the student's academic performance (19). As it features an introductory student biography, coordinators are able to become more familiar with the individual characteristics of students. The portfolio captures the student's learning experiences (20). Initial student reflections, self-evaluations and perceived areas of learning challenges further aid to personalise targeted learning. The portfolio maps achievements in learning (like a graduate 'growth chart') and is submitted at three points in the semester: commencement, mid-way and end. This record allows students to celebrate their own learning achievements.

Problem based learning and wikis

At the heart of the design are PBL sessions, which are complemented by the student reporting of identified learning topics in their autonomously run wiki page. Learning arises from a series of plausible paramedic cases that are presented in class. The student-led PBL sessions are constructed around the paramedic process, a systematic approach to pre-hospital care delivery (16). Case information is revealed to students as they undertake chronological investigations and share, via fellow student teaching and demonstration, an understanding of key features relating to the case. Akin to a complex emergency patient case, students must initiate enquiries, unpack the findings and apply their knowledge and clinical reasoning (22). While the sessions are framed by learning outcomes with distinct linkages to degree curriculum areas, students are required to make the connection between the skills and knowledge they require to manage the case and the relevance of the previous teachings that provided their underpinning foundational learning. Using a collaborative approach, learning benefits include knowledge, skills and attitude (23).

Figure 2. The new capstone framework

Table 1. Differentiated learning paths

Group based learning	Differentiated student learning
1. Pre-test	<ul style="list-style-type: none"> • Initial self-evaluation • Goal setting • Portfolio and curriculum vitae (CV) (initiates professional image design)
2. Practical skills testing	<ul style="list-style-type: none"> • Reflection on practice • Goal setting • Directed skills practice
3. Problem based learning	<ul style="list-style-type: none"> • Current understanding validated • Knowledge gaps self-identified • Learning reported on wiki
4. Wiki	<ul style="list-style-type: none"> • Reports student learning • Student critiques submissions and has their own submission critiqued by peers • Pages inform formative exam content
5. Formative examination	<ul style="list-style-type: none"> • Student nominated learning areas evaluated • Feedback identifies ongoing learning opportunities • Weakest area of performance informs viva assessment (eg. cardiovascular pathophysiology)
6. Viva	<ul style="list-style-type: none"> • Personalised assessment of exam identified learning areas • Standards are benchmarked at road ready/operational paramedic
7. Exit interview	<ul style="list-style-type: none"> • Student portfolio and CV critiqued • Student receives tutor collated tutor feedback regarding their performance • Ongoing learning areas and recommendations suggested

Unlike traditional delivery models where pre-reading materials are provided before a class, support material and direction are provided retrospectively, reinforcing the relevance and value of other subject matter. Students are in charge of the learning pace and support each other with coaching and identification of learning gaps.

Some critics of the PBL method highlights the resource implications linked with very small class sizes, with increased numbers linked with diminished participation levels and reduced group reporting (22,23). Funding and resource limitations constrained our minimum group sizes to around 20 students, so a wiki activity was introduced as a way to extend these learning interactions outside of the classroom. The wiki provides a common electronic page where students are able to report on the material they identified in the classroom as being important to revisit. With all students contributing to its content, information is entered, critiqued and edited by the group, resulting in a collection of information that shows the consensus of its 20 student authors.

Practical skills and reasoning assessment

Following an intensive morning of theory within the PBL, student

groups divide again (to enable reduced class sizes) as students commence intensive clinical simulation assessments with tutors who are recruited directly from local industry. These tutors undergo educational development within the university prior to teaching students. Supervised and assessed by the same industry paramedics they are soon to work alongside, students respond as ambulance crews to simulated emergency cases that are aligned with the theoretical themes introduced within the PBL. Within the class, every student has an active role to play during the assessment, which may be any of: timekeeping, peer assessment, equipment logistics or scenario coordination, as well as individual and teamwork responses within the scenario (Table 2).

This represents a multidimensional learning partnership between the student, their peers, the university and industry. Each simulated case is graded and students must satisfy a level of competence with each intensive session, with the performance standard set at the level of a practising paramedic (by a practising paramedic). Students are encouraged to reflect in their portfolio on the cases, the skills they demonstrate and their own ongoing development needs.

Table 2. Active student roles during practical scenarios/assessments

Industry paramedic supervisor <ul style="list-style-type: none"> Ensures standards of practice Delivers direct performance feedback to all 			
Student scenario instructor role <ul style="list-style-type: none"> Delivers a pre-prepared clinical scenario 	Student peer Assessors role <ul style="list-style-type: none"> Critiques performance Feedback to students being assessed 	Scribe/time-keeper role <ul style="list-style-type: none"> Records clinical events in real time 	Logistics role <ul style="list-style-type: none"> Identifies resource use during scenario Restocks equipment post each scenario
Student paramedic being directly assessed <ul style="list-style-type: none"> Principle clinical attendant during the scenario Coordinates care Executes clinical decisions 			
Student paramedic crew mate(s) <ul style="list-style-type: none"> Works under direction of assessed student Demonstrates clinical skills 			

Formative examination and feedback

Students sit a formative mid-way examination, which is presented in a series of sections that reflect the broad themes of the PBL cases and the specific topics that students have published on the wiki sites. In essence, the students have contributed to writing their own examination items, as these were the self-identified areas for development. As student understanding has up until this point only been validated by their peers and industry paramedics, the assessment by academic staff serves to endorse student knowledge and identify areas for ongoing learning focus. An automated marking program returns detailed prompt feedback to students soon after the test. Results reported against each section in the assessment indicate to the student where the focus of their study needs to be invested next.

Final viva and exit interview

The final assessment component of the subject is an individualised oral examination (or 'viva') for each student. Viva interviews have long been a recruitment tool used within ambulance services. Offering insight into a potential candidate's understanding of physiological concepts and reasoning skills, practice in the viva situation can often be the difference between gaining an appointment or not. There have been many anecdotes of very capable and high performing graduates not coping effectively under the pressure of the viva or interview, or not being able to confidently respond to the questioning. Students are made aware of the area in the formative exam that they scored the least well in, and this area subsequently defines the student's individual learning path, with this specified material forming the focus for a viva assessment at the end of the topic. Themes are very broad (eg. cardio-thoracic) so each student must review a great breadth of material in preparation for the 15 minute interview. This prepares the student to respond under stressful conditions – where performance may be affected by nerves – as well as their clinical understanding.

Exit interview

Shortly after the viva, each student has an exit interview with the subject coordinator. This one-on-one private forum offers an opportunity for both parties to discuss the learning that has taken place throughout the semester and to provide each other with candid feedback. It is a time when students are encouraged to speak freely of their learning journey and its challenges, and share their future goals and plans. The subject coordinator in turn can offer advice about ongoing development needs and opportunities, and acknowledge the student has completed a demanding subject. While the interview is designed to provide the student closure on the subject and their studies, it also aims to reinforce that the student's learning is not yet over.

Discussion

The student experience

Any student expectations of being gradually eased into the subject were quickly removed: the initial diagnostic assessment proving to be confronting for many students. With a mean class score of around 60%, it served as an immediate trigger for each student's personal reflection and topic engagement. Formative portfolio entries identified that, even at the earliest stages of the semester, students were looking to analyse gaps in their understanding.

Despite having been involved with the PBL previously, students were slow to get started and find their voice within their unfamiliar groups. This initial hesitation was eventually overcome through tutor persistence and patience with a student-led method. After uncomfortable periods of silence (a period traditionally filled with a lecturer's voice), student thoughts and ideas started emerging and soon grew to healthy debates. Tutor roles were essentially aligned with umpiring student engagement and stimulating appropriate discussions.

This strategy helped to grow student confidence, particularly when it came to communicating their understanding. The gamble of offering 130 students absolute control over a wiki proved to be one of the biggest successes of the design. In an age where social media and instant information acquisition is ubiquitous, any fears about how a new technology would be embraced proved poorly founded. Of particular note was the online confidence it afforded the international student cohorts. In contrast with traditional classroom challenges associated with participation and integration, the wikis witnessed an eagerness of this cohort to become involved in these group activities. In fact, the volume of data entered by students onto the wikis was so extensive that it crashed the computer network allocated to the subject.

The incorporation of practical assessments conducted by local industry partners was a highly effective strategy. With approved on-road paramedics judging the standards of clinical performance and delivering instantaneous, often blunt feedback to students, those previously critical of teaching standards became the teaching team. An unprecedented amount of interest in teaching in the degree has now emerged from industry partners, with many clinically based instructors requesting to share university teaching and assessment material. The partnership has helped to bridge the understanding gap between students, industry and the university.

An unexpected feature that emerged from the formative exam was the rich data related to learning content that the students had either not retained or misunderstood that could be fed back to teaching staff in previous subjects. The data provided indicators of areas of teaching that could be revisited or revised to promote better student learning. This will now become a standard feedback loop for all members within the teaching team. Students embraced the portfolios as a pre-employment preparation tool. Student pride with their portfolio was evident with a number who presented evidence of their work to potential employers during recruitment interviews.

Although students experienced considerable anxiety relating to the oral assessment task, many reported that it helped them to perform well during subsequent recruitment interviews. Industry parties echoed a perception of improved graduate confidence also. Nearly 130 students were able to all undertake a different viva assessment based entirely on their unique specific learning requirements. Student evaluations of the subject and teaching demonstrated a considerable improvement when compared with earlier responses. Student likert response was sought to the statement: "Overall I had a worthwhile learning experience". 2014 responses demonstrated a 96% student agreement, climbing from 81% in 2013 and 69% prior to the capstone topic reforms.

A student response stated: "By far the most challenging and rewarding part of my degree... makes me feel ready for the real world".

Conclusion

Our exploration of the causes of student and industry dissatisfaction with the paramedic degree clearly indicated that the problems associated with delivering a successful subject for the completing paramedic were systemic. Enrolment numbers, complex student requirements and a culture of industry complaints about teaching, all perpetuated an ill-fated cycle of misunderstanding and cross-communication. Simultaneously tackling diversified student learning, knowledge retention, university-industry relationships, student morale and learning engagement, was a sizeable challenge. The paramedic capstone pedagogy was developed as a multi-faceted response to this complex problem. The fundamental redesign of the final degree subject as an integrative capstone experience brought together multiple design aspects to create a student focused learning system to guide the student transition into industry practice. The results from the implementation of the design are encouraging.

For university based paramedic academics, most roles encompass Boyer's four scholarships of discovery, integration, application and, notably, the scholarship of teaching and learning (24). Effectiveness within this domain requires that teaching and learning are researched, tested, reflected upon and peer reviewed. This paper seeks to contribute to the dialogue between those linked with educating paramedic graduates towards being more effective beginning practitioners. Despite being new innovations to paramedic education, most practices incorporated into the subject are not new to higher education. The case described here illustrates the benefits that can be gained by looking beyond our discipline boundaries to explore opportunities to improve practice. The subject also demonstrates that it is possible to considerably improve graduate work-readiness, without having to include an additional year of university, which some suggest is necessary (1).

It is clear from the research that no single teaching approach or assessment method offers the panacea of paramedic education, but what is clear is a need to recognise the different way students learn and be adaptable to embrace new methods and generational technologies.

Conflict of interest

The authors declare they have no competing interests. Each author of this paper have completed the ICMJE conflict of interest statement.

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