

Patient focused case based learning – mixed method analysis in clinical science learning.

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Paramedicine, a relatively new profession in comparison to nursing and medicine in Australia, has progressed positively in the last 20-30 years. This paper reports on a research project designed to investigate the student experiences and perceptions of a patient focused case based learning model designed to increase student activity and engagement with the learning materials in two undergraduate courses within a three year bachelor degree in paramedicine. A patient focused case based learning model with greater emphasis on teacher socialisation with students, helped draw links between the students' prior foundational science knowledge to patient presentation clinical scenarios. This study builds on the findings of previous research investigating patient focused case based learning by adding student interactivity into learning and teaching research design and identifies an agenda for further research into paramedic curriculum.

Keywords: Paramedic education; case-based learning; patient safety

Introduction

Paramedicine as a discipline in higher education and as an emerging health profession has grown significantly over the last 20-30 years (Michau, Roberts, Williams, & Boyle, 2009). As opposed to ambulance drivers or public safety personnel, paramedics function as out of hospital emergency healthcare providers. Paramedics have an advanced clinical scope of practice, which is under constant review, expansion and change. Until a few years ago, employment requirements for ambulance personnel were a first aid certificate and a driver's license. Later, requirements grew to post-employment vocational training as demands on out of hospital care providers increased (O'Brien, Moore, Dawson, & Hartley, 2014). More recently, the preparation for paramedicine has transitioned to pre-employment tertiary education in Australia, pending professional regulation and registration and a health care profession taking on roles otherwise traditionally held by physicians and advanced practice nurses (O'Brien, et al., 2013).

Researchers have posited that due to the scarcity of literature examining the effectiveness of interventions employed in health professions' education, there needs a greater spotlight on the design, implementation and consensus of the desired outcomes in educational research

(Waltz, Jenkins, & Han, 2014). Evidence driven from nursing and allied health has guided the formation of paramedic curriculum (Hou, Rego, & Service, 2012) however the environment and speciality of paramedicine is vastly different from nursing making the two care processes distinctly separate entities (Whyte, Madigan, & Drinkwater, 2010; Carter & Thompson, 2015). Published evidence highlights difficulties with the student's transition to practice (O'Brien, et al., 2014), the student perceptions of inadequate preparation (Waxman & Williams, 2006), the theory practice gap between skills and learning outcomes (Michau, et al., 2009) and knowledge transfer of clinical evidence over experience (Williams, Jennings, Fielder, & Ghirardello, 2013). However, there is little evidence of the development or benchmark of paramedic tertiary education.

A specific pedagogy guiding the principles of tertiary paramedic education development is yet to be identified. In an effort to highlight nursing and as distinct disciplines, Carter and Thompson (2015) differentiated the process of care between them. In the paramedic process, the paramedic is required to practice in an unstructured, unpredictable and often dangerous environment whereas the nurse does not. To carry out such a processes, a patient centred approach to the systematic assessment, interpretation and intervention is needed to account for such complex environments (Carter & Thompson, 2015). Learning and teaching this process goes beyond the clean, sterile ward and textbook of nursing therefore the proposal for a distinct learning and teaching process focused on patient specific presentations is needed to develop a novice graduate practitioner. Such a process could involve cooperative learning where students work together collectively in groups to not only achieve individual goals but also contribute to the success of the group as a whole (Waltz, et al., 2014). This method of learning places a central focus on the student, their cooperation with fellow students and collective participation and interaction socially toward these common goals and learning outcomes (Hoskins, 2012). It is the collective and mutual achievement of goals that is key to cooperative learning, not the competitive or individualistic attainment of grades (Johnson & Johnson, 2015).

Patient focused learning

Popular methods in the clinical education of medicine and nursing students are the problem based and the case based design (Franklyn-Miller, et al., 2009). The main differences between these designs lie in the student-teacher interaction and cooperative learning between the students. Rather than driving the learning as a prescription to outcomes, the teacher facilitates an inquiry of learning towards a goal. Case based learning (CBL) involves the telling of a story with a set sequence of events and order in a discipline context. CBL brings a higher order level of thinking, as students collaboratively devise strategies to analyse the case presented, problem solve, and make decisions to fulfil the story ending in accordance with learning outcomes (Blackmon, Hong, & Choi, 2007). CBL uses trigger moments to recall cognitive information covered in areas of curriculum and allows for the application of cognitive knowledge in a practical contextual sense (Cardiff University, 2016). Problem based learning (PBL) is where a problem is presented to students and the student utilises self-directed, teacher facilitated or group collaboration to seek the answers and solve the problems (ACS Distance Education, 2016). The gaps in knowledge are identified individually and the student alone plans the bridging of information in order to find solutions to the problem presented (University of Queensland, 2016). PBL presents an issue that needs to be solved whereas CBL presents an unknown case where information is drawn out through investigation, questioning and examination in order to plan a solution. Student satisfaction and perception of the CBL paradigm, shows it enhances the learning experience and learning attitudes of students (Kantar & Massouh, 2015; Zhang, et al., 2012). Linking theory with practice and drawing prior clinical sciences knowledge into realistic patient contexts, leads to increased motivation, appreciation of the integration of the clinical sciences and promotes a

self-directed life long learning approach to patient centric care long after graduation (Harman, et al., 2015; Malau-Aduli, et al., 2013; Gordon & Hughs, 2013; Gray & Apsland, 2011).

The call for a patient centred approach allows for the identification of trigger points, which guide the formation of differential diagnoses during the paramedic process of care (Carter & Thompson, 2015). Segmented or compartment teaching does not allow the student to link the prior knowledge and experiences of process with the affective behaviour of clinical care which drives reflection and deeper learner for recall and use later in the professional context (Gray & Apsland, 2011). Franklyn-Miller and colleagues (2009) proposed patient focused case based learning as a substitute for the loss of the clinical sciences in medical education to the humanities. In a patient focused design, students are exposed to the trigger events otherwise lost in a problem based teaching curriculum. Teaching a problem based segment on the presenting signs and symptoms of a heart attack will develop the knowledge and skills of looking for a heart attack. A patient presenting with chest pain, for example, can have a heart problem, a lung problem, a rib problem, a rib muscle problem or an abdominal problem. Without the patient specific triggers to guide investigation, critical illness and injury could be overlooked leading to medical error. The traditional focus of bedside teaching with real patients is restrictive to the presenting condition of the patient being investigated, driving an increased use of and over-reliance on technology, diagnostic devices and testing instead of questioning patient history, clinical hands on patient examination and experiential recall of defining moments with patient elicited triggers (Franklyn-Miller, et al., 2009).

Teachers as supportive peers

Building a supportive and creative learning space can help build lasting integration, retention and success of the new non-traditional adult learners into their profession, driving higher education and research and growth in the university sector (Wyatt, 2011). Adversarial views of students by teaching staff drive students away, decreasing persistence to complete study programs, motivation and student self-efficacy (Christe, 2013). University support structures commenced during the student recruitment stage need to develop well into the post-enrolment phase of programs to retain and graduate successful students (Pittman & Koshy, 2015). The literature voices the development of teacher behaviours as supportive peers rather than professors and knowledge givers. This peer view will help drive a student's desire to learn, become involved and strive for professionalism (Powell & Lines, 2010). Measurements of student engagement fail to show significance quantitatively whereas informal connections, taking the time to socially communicate and personalise the learning environment collegially helped increase qualitative satisfaction with the learning (Christe, 2013).

It has been suggested that teachers have a greater influence on engagement, encouragement and motivation than is appreciated and the negative traditional belief among teaching staff (Vogt, 2008; Christe, 2013) may adversely impact the growth and immersion of students into the learning cycle (Powell & Lines, 2010). The success in first year science courses for nurses and paramedics are strong predictors of program success suggesting completion is a matter of ability rather than capability (Whyte, et al., 2010). More recently, it was found that science ability plays no role in success or failure to persist until program completion (Micari & Pazos, 2012). Traditional science, technology, engineering and mathematics (STEM) educators believe student attrition is a positive event, clearing out those students who are not capable of STEM program completion. An adversarial practice ends up causing harm to students and contributing to attrition (Christe, 2013; Vogt, 2008). Educational research findings, particularly in the STEM professions, suggest by connecting to students, faculty have been found to assist students to gain confidence, develop self-efficacy and help seeking behaviours, link critical theoretical concepts to practice, improve program satisfaction and foster student participation in STEM research and postgraduate study (Harris, Bellew, Cheng, Cendan, & Kibble, 2014; Hoskins, 2012).

This research provides a systems view of learning and integrating learning domains through the presentation of patient case studies and socialised facilitated teaching. It is the purpose of this study therefore to examine if a cooperative systems view of learning and teaching practices can play a role in improving the experiences of clinical science education. The role of the clinical educator and the method of developing clinical knowledge linkage into practice is suggested to be key to engaging student paramedics preparing for transition to clinical practice.

Methods

The Hawthorne Studies of the 1920's and 1930's (O'Leary, 2014a), investigated the effects of variables on work outputs, noting that variations in the work environment affected worker productivity and motivation. Action research involves the investigation of a process, process outcomes and onward application of process variations in response to analysed participant feedback. The process, outcomes and applications are linked collectively, guiding additional research designs to explain processes and experiences, improve practices and describe the effect of interventions for participants, as opposed to a singular phenomenon experienced by subjects (O'Leary, 2014b). The outcome of action research is an attempt to improve a process by adding the experience of the participants to the research design (Bowling, 2009). The major benefits of a mixed method research approach in this study was the ability to gather different avenues of perspective from the participants in order to understand the students learning process for distance learners (McManamny, Sheen, Boyd, & Jennings, 2015). Published evidence from STEM notes the existence of poor teaching attitudes towards students and the recommendation of improvements in student engagement with socialised teaching. To gauge satisfaction with socialised teaching and student engagement, it is suggested that a mixed method approach to highlight the quality perceptions of satisfaction and the extent of variable shifts to enhance that satisfaction (Whitehead & Elliot, 2007). Although qualitative and quantitative approaches to research lie on opposite philosophical spectrums in describing a participant's reality, when added to the context of the patient centric care process, evidence guided quantitative interventions can explain the qualitative experiences of the student and complement the richness of the data value being interpreted (O'Leary, 2014b).

This research project follows third year paramedicine students from a regional Australian university enrolled in a three year, 24 course Bachelor degree program in paramedic science. The subjects were instructed over two, 12 week terms to consolidate the theoretical medical science and foundational paramedic skills and procedures together, in order to assess the integration of cognitive, psychomotor and affective learning of the previous two years of courses. As discussed by Carter and Thompson (2015), the paramedic care cycle coordinates all three aspects of learning with clinical practice to deliver safe and clinically relevant out of hospital care. Paramedic Consolidated Practice (medical/surgical consolidation) and Trauma Care for Paramedics (trauma) were designed as capstone courses prior to graduation to provide stakeholder employers with a level of assurance of clinical safety for graduating intern paramedics. By using an action research approach, this investigation was able to integrate a mixed-method analysis of quantitative students' perceptions and qualitative response feedback to structured surveys of the medical/surgical course design. These results guided the development and improvements of the trauma course structure. The gathering of qualitative and quantitative data concurrently to gauge the students' satisfaction in undergraduate science studies in paramedicine was developed.

As illustrated in Figure 1, in Term 1 the medical/surgical consolidation course was resourced with voice recorded PowerPoint lectures, internet readings, clinical YouTube videos, self-

directed textbook readings posted on a course webpage and a weekly live video-conference tutorial where a patient focused case study was presented for discussion. Each case study was representative of the weekly topic in medical and surgical emergency conditions and each weekly topic related to an online case study quiz where interpretation of presented patient conditions and clinical vital signs (blood pressure, pain, medical history and medications) was required by the students. At the end of the term of study, students attended a week long intensive residential school to carry out patient case study scenarios individually and practice medical procedures. These scenarios were assessed individually as short case presentations with a manikin, long case presentations with a trained actor portraying a realistic medical patient, verbal examinations for common emergency conditions and a written paper examination of the hearts electrical activity (cardiac tracings). At the end of the residential school, students were asked to complete two qualitative and quantitative surveys and provide feedback to the University and the researchers about their course satisfaction.

In Term 2, the medical/surgical consolidation course feedback was integrated into the learning structure of the trauma course. Voice over PowerPoint presentations were replaced with video recorded PowerPoint presentations, lecturing staff monitored students activity on the learning management system web page and informal email messages were sent to students who showed decreased levels of activity in the course resources. Students were required to complete patient focused case study assignments during the term each week and interacted with lecturing staff via video conference tutorials discussing the case studies and assignment expectations. At the end of the term of study, students attended a week long intensive residential school to carry out patient case study scenarios with a trauma application. In the trauma exams, students were required to complete five clinical case study scenarios in teams to simulate the working environment of paramedics. Each scenario had a trained actor portraying a realistic patient suffering a traumatic injury with specific scripted responses to the paramedic student's actions during the simulation. At the end of the residential school, students were asked to complete two qualitative and quantitative surveys and provide feedback to the University and the researchers about their satisfaction with the course.

Ethics

The CQUniversity Australia Office of Research Services provided the ethical review and supervision for conducting this research, (medical/surgical course H15/03-043; trauma course H15/05-104).

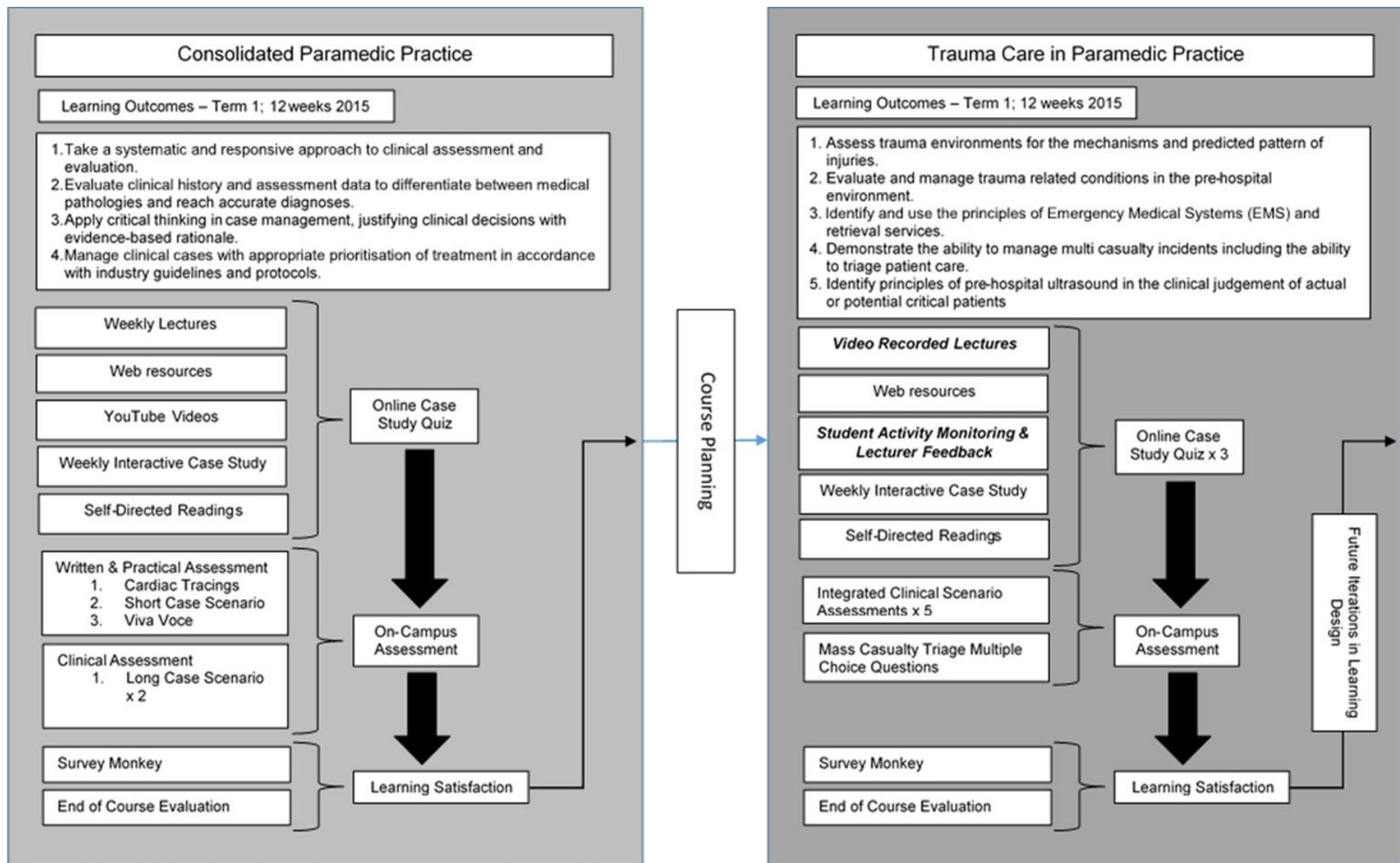


Figure 1: Course design and structure with improvement variations based on quantitative and qualitative feedback from students.

Results

Patient focused CBL with an informal, social and facilitation teaching method, led to an increased satisfaction in the courses to link prior science knowledge with the contextual paramedic processes of care. This satisfaction helped bridge knowledge gaps from prior science subjects into the unstructured, unpredictable patient interaction that paramedics encounter. Students indicated that the courses were well resourced and helped fill gaps in their knowledge from previous paramedic science courses. For the patient focused case based learning model, the students stated *'I think [its] fantastic as it is as close as we can possibly get to the real thing before we start employment. For me it gives me confidence that I have cemented everything I have learnt throughout my degree'*. From a learning method perspective, students stated *'The supported learning environment, coupled with the real patients provided such a rich and invaluable learning environment!'*

There was no statistical significance in the satisfaction perception of the students between the medical/surgical consolidation and the trauma course. Students indicated a significant satisfaction improvement in the time provided to learn the content between the medical/surgical consolidation course and the trauma course ($p=0.0008$ Not at all/A little; $p=0.0009$ A lot/Absolutely). Students also indicated a significant reduction in feeling overwhelmed by the learning material depth between the medical/surgical consolidation course and the trauma course ($p=0.0057$ Not at all/A little; $p=0.0052$ A lot/Absolutely) as shown in Table 1. This increase in overall satisfaction was reflected in the end of course evaluation provided by the university and separate to the Survey Monkey survey platform, as seen in Table 2.

Table 1 Perception of third year students enrolled in medical/surgical consolidation and a trauma emergencies course from Survey Monkey. (*= $p<0.05$)

		MED/SURG	TRAUMA
This course was well resourced	Not at all A little	15.4%	12.8%
	A lot Absolutely	84.6%	87%
This course allowed a good amount of time for learning	Not at all A little	30.8%	6.4%*
	A lot Absolutely	69.3%	93.5%*
I felt overwhelmed with the materials	Not at all A little	69.2%	90.2%*
	A lot Absolutely	30.8%	9.6%*
This course helped fill the gaps in my knowledge	Not at all A little	23.1%	16%
	A lot Absolutely	76.8%	83.8%

Table 2 End of term (university wide) student course evaluation of third year students enrolled in medical/surgical consolidation and a trauma emergencies course overall satisfaction rated as agree or strongly agree. (*= $p<0.05$)

QUESTION	MED/SURG	TRAUMA
Overall, I was satisfied with the quality of this course.	53%	88%
The Moodle site for this course was easy to navigate.	65%	92%

QUESTION	MED/SURG	TRAUMA
The resources provided in this course supported my learning.	50%	84%
The assessment tasks in this course helped me to learn.	62%	82%
The requirements for each assessment task were clearly explained.	40%	78%
My assessment work was returned in a timeframe that supported my learning.	59%	90%
The feedback given on my assessment work helped me to learn.	31%	71%
	51%	83%*
	95%CI=14.9	95%CI=4.38
	SE=0.072	SE=0.022

Both cohorts were given the same Survey Monkey link with the same questions for each course. Qualitative responses given were isolated into positive and negative responses and thematic analysis undertaken with NVivo 10 for Mac. In the medical/surgical consolidation course, students were very positive in their responses indicating that the content was focused and relevant to paramedic practice. The students stated the course built the final bridges with their science knowledge and helped create an understanding of why they had learnt biological sciences in the beginning of their degree. The students expressed high satisfaction with patient focused case based learning and standardised patient actors to portray real patient presentations as this added realism, authenticity and paramedic context into scenario assessments. It is especially noted the comments from students indicating their increase in confidence to deal with life threatening emergencies in preparation for internship with ambulance services. The students provided feedback in a number of areas to improve the medical/surgical consolidation course notably around assessments. For the trauma emergencies course, students demonstrated exceptionally high satisfaction with the patient focused case based learning in drawing science links from prior knowledge courses. The contextual integration of theory with practice was found to be the predominant driving factor of significant satisfaction ($p=0.0002$) with the method of learning and teaching.

Students expressed a very high degree of satisfaction with situated, personal contact from teaching staff in a socialised, informal way during the trauma emergencies course. It helped to reduce stress, develop a rapport with the teacher as a peer and reduced the tension between the pressure of learning new content and integrating prior knowledge with practice. This reduction in stress is statistically significant in Table 1 with feelings of stress being significantly reduced between the courses and the overall satisfaction in the end of course evaluation noted in Table 2.

Discussion

Paramedic education in the tertiary setting was developed on the premise of nursing and allied health paradigms (Hou, Rego, & Service, 2012). Over time, institutions and academics advanced programs with accreditation standards for graduate paramedics stipulated by the Council of Ambulance Authorities (O'Brien, et al., 2014). There have been calls for more research into paramedic and healthcare provider curriculum design, which continues to be lacking (Waltz, et al., 2014). There exists an opportunity to capitalise on this state of flux in out of hospital care and build an evidence guided paradigm in paramedic education (O'Brien, et al., 2014). As paramedicine is being seen as its own entity among the health professions and striving towards regulation (Carter & Thompson, 2015), the education of its graduates

needs greater contextualisation, integration and research to support the limits of stakeholders and community expectations of safety.

Franklyn-Miller and colleagues (2009) quote Sir William Osler (1849-1919) who stated that the best textbook for learning the clinical science of medicine was the patient, and he used the metaphor “*He who studies medicine without books, sails an uncharted sea, whereas he who studies medicine without patients does not go to sea at all*”. A patient presentation comes with a history, clinical signs and symptoms, distinct experiences and knowledge that is articulated into the story (Carter & Thompson, 2015). Aligning the patient into the center of the case, is the first part of a four step diagnostic process (Franklyn-Miller, et al., 2009). Second is to listen and localise the story with known clinical information. The third step is to recreate the symptoms and identify the red flags which pin point diagnostic knowledge and link with the patient’s presenting history. The last step is to investigate the triggers and intervene clinically to return the patient to better health.

Authentic clinical cases add context in order to associate knowledge with patient presentations, making the knowledge meaningful and adding to the relevance of the knowledge in the discipline thereby motivating the student to learn (Allchin, 2013). Setting the patient as the center of the learning develops the decision making capabilities of the paramedic for it is the decisions about the management and interventions of a patient that can lead to catastrophic diagnostic failure and death or alleviating suffering and decreasing an ongoing disability (Carter & Thompson, 2015). In this study, students appreciated the fact that prior science knowledge finally made sense and was linked directly to practice – in particular, aspects of clinical management for disease and traumatic injuries.

Limitations

The major limitation of this evaluation is that it consists of only student satisfaction ratings. Despite there being 49 students and 67 students (n=116) enrolled in the medical/surgical consolidation and trauma emergency course respectively, only 41.38% of the students collectively participated in the online Survey Monkey[®] questionnaires at the end of each course (n=44; 95%CI=8.96; SD=14.1) therefore the generalisability may be poor. In comparison, 69.82% (n=81; 95%CI=1.85; SD=8.48) completed the medical/surgical (n=37) and trauma (n=49) end of course evaluation (overall satisfaction) surveys as run by the institution at the completion of the term. This research was based at a single regional Australian university where the medical/surgical consolidation course in term one was followed by the trauma emergencies course in term two leading to possible selection bias. In the future, research that investigates the views of teachers, students and wider contextual considerations will provide even more significant insights into the benefits of this CBL approach and its impact in field of paramedic education.

Conclusion

Clinical education must evolve to encompass the cumulative contextual integration of subjects for the establishment of practice. As noted by the Institute of Medicine (IOM), clinical education programs need to focus on patient-centred linkages instead of compartmentalised subjects or modules (Keeve, et al., 2012). This integration is designed to combine aspects of learning and draw linkages of knowledge with practical application – to identify the triggers, which create pattern recognition and initiate a process of actions and decisions (Franklyn-Miller, et al., 2009). For example, understanding the theory of normal physiology as applied to a human patient requires an integrated learning and teaching approach (Harris, et al., 2014).

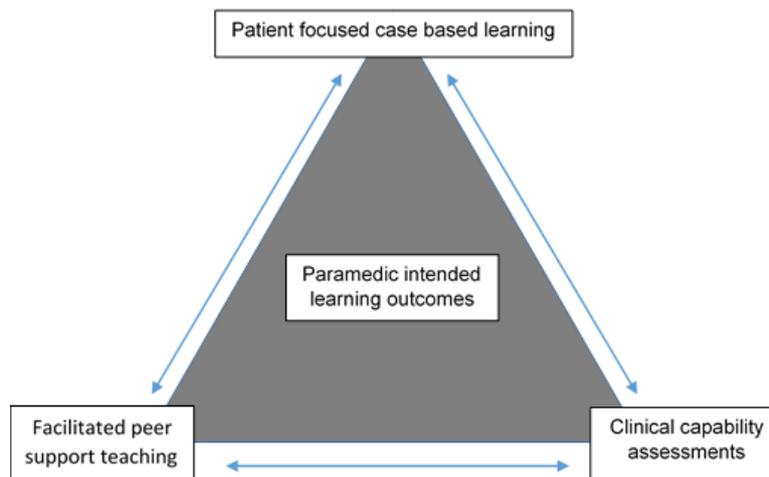


Figure 4 Proposed clinical education curriculum structure in paramedicine

Healthcare starts with the emergency service providers (paramedics) moving to the emergency department nursing staff, to the clinical consultants and interventional diagnostics, surgeons and surgical facilities, nursing wards, outpatient departments and rehabilitation specialists in the collective goal of returning a patient to full health. Integration of all cogs in the healthcare wheel, building a knowledge base of research and collective markers of system efficacy for improving patient care (Kirschner, et al., 2015).

This study combined a systems approach to the learning and teaching paradigm. By introducing patient focused case-based learning as the framework to the consolidation of prior clinical science knowledge with contextualised paramedic science application, students stated they linked theory with practice in preparation for internship roles. Figure 2 graphically depicts the proposed triangulated curriculum structure and is the basis for a much wider future project to align the learning and teaching paradigm, facilitator socialisation and educational outcomes more definitively. The socialisation of teaching undertaken in this study showed significant improvements in student satisfaction and motivation to learn and it is proposed that additional research of this theory of learning and socialised teaching draws evidence of positive learning outcomes from assessment results.

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