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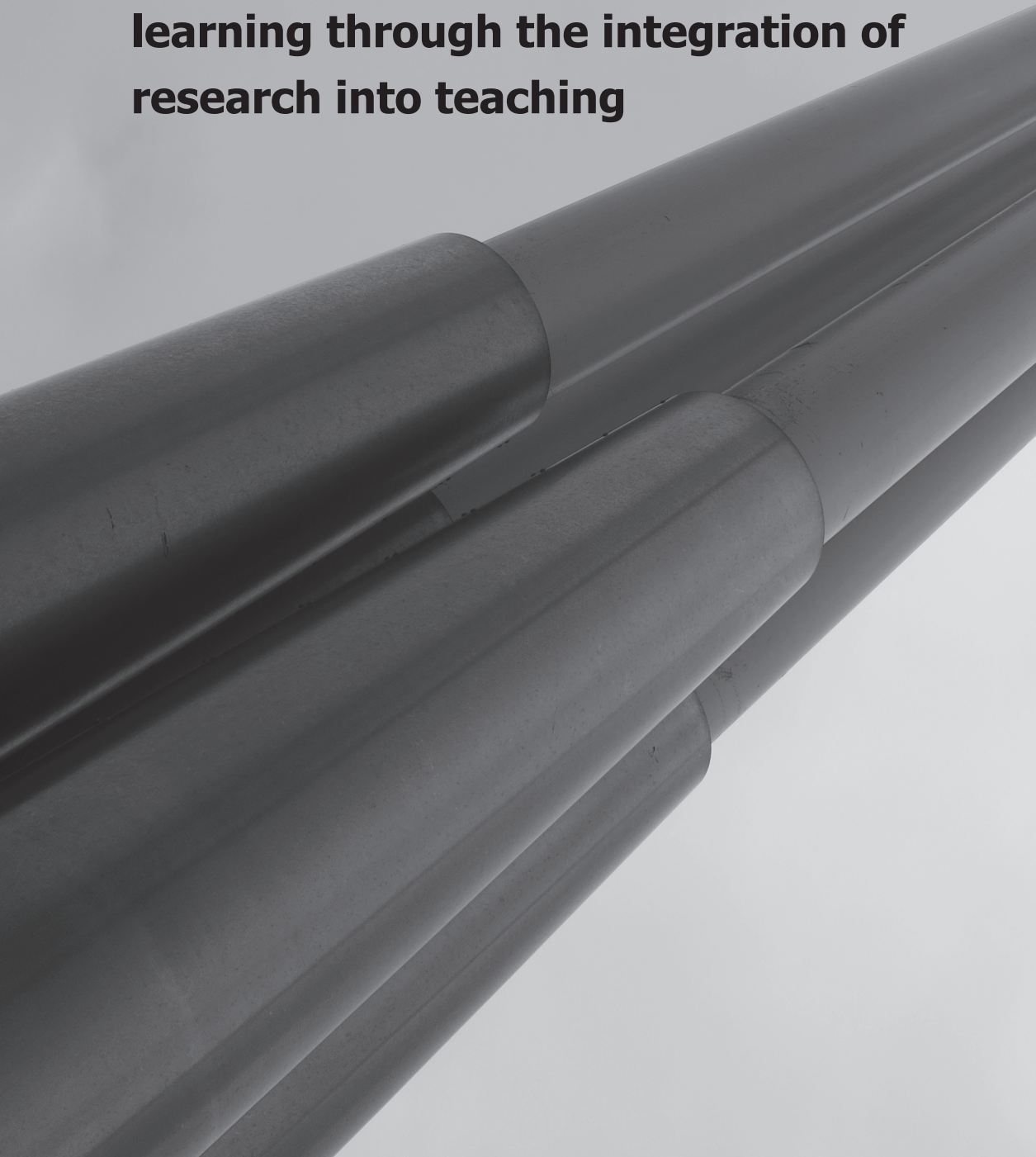
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Chapter 4

Fostering first-year student learning through the integration of research into teaching

4. Fostering first-year student learning through the integration of research into teaching

Research should be explicated within undergraduate teaching in such a way that stimulates student learning. Previous studies in higher education have shown that student perceptions of the integration of research into teaching could promote student learning, although they have also indicated that it can prove difficult to confront first-year undergraduates with research during their courses in order to promote student learning outcomes. In this study, we describe relationships between first-year medical student perceptions of research, their learning outcomes and their beliefs regarding the value of research. The Student Perception of Research Integration Questionnaire was filled out by 261 students. The answers were related to student beliefs regarding the value of research and student achievement. The findings suggest that student motivation for research is strongly related to the merging of current research into teaching. Students rather recognised an emphasis on research methodologies than research engagement. In particular, student beliefs regarding research are related to achievement. It is suggested that to foster positive beliefs regarding research, teachers should familiarise students with current research and foster enthusiasm for research.

4.1 Introduction

Strengthening research-teaching integration in order to benefit student learning about research in universities remains a challenge that needs to be overcome in higher education (Spronken-Smith, Mirosa & Darrou, 2014; van der Rijst, Visser-Wijnveen, Verloop & van Driel, 2013). Teachers should explicitly express research within their undergraduate teaching in a way that is visible and approachable so that students learning can benefit from research integration, since student perceptions of teaching are known to play an important role in fostering student learning outcomes (e.g., Prosser & Trigwell, 2014). For first-year students in particular it can prove difficult to recognize research integrated into teaching, therefore the promotion of student perceptions of the university as a research-rich learning environment is an essential part of the transition to higher education (e.g., Brew, 2010). Our study adds to the knowledge base by describing relationships between student perceptions of research within teaching, beliefs regarding the value of research and student achievement during the first year of their undergraduate education.

4.1.1 Student beliefs, perceptions and achievement

Within teaching and learning in higher education it is argued that student perceptions of the learning environment and student characteristics influence student learning outcomes (Prosser & Trigwell, 2014; Ramsden, 1991). Findings from an empirical study by Lizzio, Wilson and Simons (2002) support the proposition that student perceptions of teaching influence their learning outcomes, indicating that positive perceptions not only directly influence student achievement but also improve the quality of their learning outcomes (e.g., generic skills). Moreover, the results from this study suggest that perceptions of the university learning environment may contribute to student achievement irrespective of the prior academic success of a particular student. A reason for this is that effective teaching, as perceived by the students, facilitates effective student learning (Ramsden, 1991), including during the first undergraduate year (Prosser & Trigwell, 2014).

In previous studies student perceptions of research were found to be related to undergraduate research experiences and institutional factors. Some such studies revealed that staff needs to be supported in order to immerse students into the research culture (e.g., Brew, 2010; Spronken-Smith, Mirosa, & Darrou, 2014) and to incorporate research into teaching (Hu, van der Rijst, van Veen, & Verloop, 2014). Yet, the integration of research into teaching within courses appears to be one of the most important factors in promoting student learning and student beliefs regarding research (Verburgh & Elen, 2011). A review study suggested that general beliefs about teaching and learning strongly influence perceptions and, further, that student beliefs are well established by the time they begin university (Pajares, 1992). At the same time beliefs and knowledge are intertwined, rendering beliefs a filter through which new information is interpreted (e.g., Abelson, 1979). Thus, previous studies emphasise the reciprocal nature of relationships between student beliefs, perceptions and knowledge that influence student outcomes in terms of their learning goals in higher education.

Few studies have focused on undergraduate student perceptions of research within teaching during the first undergraduate year and the relationship of such perceptions with student learning outcomes (cf. Levy & Petrulis, 2012; Spronken-Smith et al. 2014). Levy and Petrulis (2012) conducted a qualitative study into an undergraduate research course using inquiry-based learning pedagogies from which it can be concluded that there exists a relationship between students' understanding of inquiry, their learning and their knowledge of the topic. A survey study conducted by Spronken-Smith et al. (2014) found that first-year undergraduate students notice fewer elements of the institutional research culture than more senior students. Our study aims to describe the extent to which first-year student perceptions of research-teaching integration are related to student learning outcomes, specifically student beliefs regarding the value of research and student achievement.

4.1.2 Student perceptions of research integrated into teaching
Previous studies suggest that students vary in terms of the extent to which they experience research activities within university teaching (Brew & Ginns, 2008;

van der Rijst, et al., 2013). Comparisons of teachers' intentions regarding research integration in their courses with student perceptions of research within those courses suggest that students mainly perceive participation in research and become familiar with the teachers' own research (van der Rijst, et al., 2013). Students also report that an emphasis on teachers' research within teaching can lead to narrow representations of the field (Lindsay, Breen, & Jenkins, 2002). Final-year undergraduate students mainly report the benefits of research within teaching such as research contributing to teachers' credibility, promoting undergraduates' motivation for research and facilitating an increased understanding of subjects (Healey, Jordan, Pell, & Short, 2010; Turner, Wuetherick, & Healey, 2008). These findings from the literature suggest there is no single best strategy for engaging students in research and, further, that the value of research-teaching integration lies in a considered diversity of ways of promoting student learning about research from first-year onwards.

Robertson and Blackler (2006) showed that individual differences between student perceptions of research relate to their understandings of the purpose of university education. An explanation for the variety seen in student perceptions of research within teaching can be found in differences in student motivation for and beliefs regarding academic research. Breen and Lindsay (1999) showed that students' intrinsic motivation and course competency contribute to positive beliefs regarding research, while negative beliefs or indifference to research are associated with externally motivated students. Students' prior experiences of research within teaching may also influence their perceptions of research in university (cf. Prosser & Trigwell, 2014). Thus, these results indicate that student perceptions of research depend on student characteristics and the experiences that they bring into the classroom.

Integrating research into teaching is challenging for teachers, particularly during the earlier years of undergraduate education. First, students do not always recognise research activities, they may not yet be open to them (Turner, et al., 2008) or they may lack the disciplinary framework necessary to engage in research (Robertson & Bond, 2001). Second, undergraduates may feel excluded from direct involvement in research and they may report negative

effects of the integration of research into teaching. Students also perceive staff to overcome their own challenges in terms of dealing with teaching and research responsibilities (Healey, et al., 2010; Lindsay, et al., 2002; Turner, et al., 2008). Moreover, as Brew (2010) and others (e.g., Spronken-Smith, et al., 2014) have argued, one of the critical factors in promoting student learning about research is their perception of the university as a research environment. Undergraduate students report positive impacts of a research culture within their universities on their learning (Spronken-Smith, et al., 2014). Student perceptions of teaching can provide a valid and reliable image of the learning environment and, they are hence commonly used in higher education research (Marsh & Roche, 1997; Spooren, Brockx, & Mortelmans, 2013). Since the focus of this study is on the learning environment from the perspective of student learning, student perceptions of teaching are used to provide insights into research integration (cf. Visser-Wijnveen, van der Rijst, & van Driel, 2016).

4.1.3 Disciplinary differences in student perceptions of research

Several prior studies suggest that student perceptions of research integration depend on discipline-specific characteristics, including organisational factors within departments (Durning & Jenkins, 2005), the ways in which knowledge is structured (Smeby, 2000) and shared conceptions of research and knowledge within disciplines (Brew, 2010). 'Soft' sciences (e.g., social sciences, humanities) tend to use a wide variety of research methodologies within the discipline, which leads to ample opportunities for teachers to articulate research within teaching (Biglan, 1973; Neumann, 1994). Colbeck (1998), for example, found that certain discipline-specific characteristics, such as a low consensus on paradigms within a discipline, may promote the integration of research into teaching. This in turn influences students' perceptions of research-teaching links (Robertson & Blackler, 2006). Within the 'hard' sciences (e.g., physics, medicine), attention has also been paid to enhancing research integration within teaching as well (Robertson & Bond, 2001). In addition to differences between the hard and soft sciences a distinction has been made between applied and pure domains in order to indicate the degree of applicability to practical problems. In applied domains research questions depend heavily upon professional practice (Biglan, 1973). Medicine is an example of an applied discipline in which research skills and attitudes are important for clinical practice, especially for physicians who must stay abreast of advances in the field. In our study medicine provided a content-rich and research-rich context for improving our understanding of the relationship between student perceptions of research in teaching and student learning outcomes.

4.1.4 Research aim

This study describes student perceptions of research-teaching integration in the context of the hard-applied sciences during the first year of their undergraduate education. This exploratory study aimed to determine the extent to which student achievement, specifically grade point average, and student beliefs regarding the importance of research are related to ways in which students perceive research within the first year of their undergraduate medical education. Results of this study will be of importance to teachers and educational directors who aim to strengthen the linkages between research, teaching and student learning.

4.2 Research setting and method

Our study was conducted in the undergraduate programme of the Leiden University Medical Center (LUMC), which is related to the oldest research-intensive university in the Netherlands. Academics at LUMC are responsible for patient care, research and teaching. Further, based on written educational goals all three responsibilities should be interlinked within teaching. The medical undergraduate programme is structured into preclinical and clinical phase. During the three-year preclinical phase students attend patient interviews in addition to predominantly theoretical classes augmented by learning activities conducted in small groups. The clinical phase consists of clinical clerkships and a final-year student research project. In both phases students are taught by academic staff involved in medical scientific research and undergraduate courses. Within this programme, separate disciplines are given great importance.

In order to study first-year student perceptions of research within teaching we administered an adapted version of the SPRIQ as described in section 2.2.3 and Appendices 1 and 2. Its scales include student perceptions of teaching via (1) critical reflection on the way research results are produced; (2) research participation as a student; (3) familiarity with current research done by staff; (4) fostering interest and motivation for research; (5) propositions to measure student beliefs regarding the value of research for learning and (6) propositions to measure student beliefs regarding the value of research for practice and a scale to measure (7) propositions to measure the perceived quality of the learning environment (see Table 4.1 for sample items). All 30 items were answered on a five-point Likert scale ranging from 1 "strongly disagree" to 5 "strongly agree". In addition to recording their scores for the perception and belief scales the students were asked whether they had obtained a previous degree or undertaken research experience. Table 4.1 presents the scales (see section 4.3), the reliability for this particular sample and sample items of the version of the SPRIQ that we used.

All participating first-year students were enrolled in the medical programme in the academic year 2011-2012 (n = 304). We distributed hardcopy questionnaires to all students who attended the first lecture on the cardiovascular system in April 2012. The students were asked to complete the questionnaire for all the subjects they had taken up to that point. They were asked for permission for their unique student identification number to be used, so that we could send the questionnaire to those students who were not present at the lecture. A reminder was sent by e-mail to those students who did not respond to the initial invitation. We also calculated the grade point average over all courses within the period September-April during the academic year 2011/2012, using data retrieved from the LUMC database. Ethical approval for the study was granted by the LUMC Research Ethics Committee.

The respondent group consisted of 261 first-year students, which indicated a response rate of 85.9%; 187 women (71.6%), while the average age of the respondents was 19.7 years (sd = 1.33, range 18 – 30). The vast majority of the respondents had begun studying medicine as their first degree (n = 211). Some of the students had previous or other experiences with research (n = 68), such as attending extracurricular research lectures in Honours Colleges and conducting scientific research at the university while finishing secondary education.

Descriptive analyses were performed for all the scales of the questionnaire and they are expressed as scale means. For the perception scales, we used scale means of 2.65 and higher (range 1 – 5), based on the medians of the scores, in order to indicate that the average was rather high for the perception scales. To interpret the beliefs scales we used means of 3.33 and higher, based on the medians of scores of the beliefs scales. After this, Pearson's correlation coefficients were used to determine relationships between scales and the study results retrieved from the LUMC database (i.e., grade point average; GPA). We applied a confidence interval of 95%. We used the following criteria for interpretation: $r < .30$ = weak correlation, $.30 \leq r < .50$ = moderate correlation, and $r \geq .50$ = strong correlation.

4.3 Results

The students were asked about the extent to which they had experienced research in the courses taught during their first year. In comparison to the other perception scales the students most commonly identified 'critical reflection on research' within teaching, although 'motivation for research' and perceptions of 'familiarity with current research' within the discipline both scored relatively highly as well (Table 4.1). During their first academic year, the students reported 'participation in research' the least when compared to other ways of perceiving research-teaching integration. In general, the students held relatively strong beliefs about the value of research for their professional practice when compared with their beliefs about the potential of research to enhance their learning. The mean score regarding the quality of the learning environment was relatively high (mean = 3.80). Overall, the reliability rates indicated high internal consistency between the items within the scales.

All the correlations between the variables are presented in Table 4.2. The correlation between student beliefs regarding the value of research for learning and their beliefs regarding the value of research for future practice stood out (*r*

=.68). This suggests a relatively strong relationship between the extent to which students believe the elements of research elements to stimulate their learning and the value placed by students on research for their future practice. The motivation for research scale correlated relatively highly with student beliefs regarding the value of research for future practice (i.e., $r = .54$) and their beliefs regarding the value of research for current learning ($r = .59$). Further, critical reflection and familiarity with current research correlated significantly, albeit weakly, with student beliefs regarding relevance of research for clinical practice. The data shows somewhat

similar results for the correlations between student beliefs regarding the value of research for learning and their perceptions of research within teaching (i.e., scale 1-4), although participation also correlated significantly and weakly with their beliefs regarding learning. Of all the scales, the student beliefs regarding the value of research for clinical practice showed the highest, albeit moderate, correlation with GPA.

The perception scales correlated significantly with each other at the 0.05 level, while all the scales correlated the highest with 'familiarity with current research' (see Table 4.2). Moreover, relatively strong correlations were found between current research on the one hand and critical reflection, participation and motivation on the other (.57, .61, and .66 respectively).

Table 4.1. Scales, reliability, means and sample items of the Student Perception of Research Integration Questionnaire (Likert scale 1–5) for first-year students following the previous curriculum

Scale	N items	Cron-bach's alpha	Mean (sd)	Sample items *During this academic year…*
Student perceptions				
Critical reflection on research	4	.75	2.98 (.66)	…I learned to pay attention to the way research is carried out.
Participation in research	5	.85	1.94 (.69)	…as a student I felt involved in research.
Familiarity with current research	5	.79	2.65 (.68)	…I became familiar with the research carried out by my teachers.
Motivation for research	4	.81	2.71 (.78)	…I became enthusiastic about research in medicine.
Other				
Beliefs regarding the value of research for practice	6	.84	3.64 (.67)	Scientific skills are important for being a doctor.
Beliefs regarding the value of research for learning	3	.80	2.99 (.81)	…my learning is stimulated when education is grounded in research.
Quality of learning environment	3	.69	3.80 (.51)	…the teachers carried out their instruction adequately.

Table 4.2. Correlations between the scales of the Student Perceptions of Research Integration Questionnaire and the GPA for first-year students following the previous curriculum

Scales	Partici-pation	Familiarity current research	Motiva-tion	Beliefs value for practice	Beliefs value for learning	GPA
Student perceptions						
Critical reflection on research	.36*	.57*	.49*	.18*	.20*	.06
Participation in research		.61*	.46*	.11	.23*	-.06
Familiarity with current research			.66*	.23*	.31*	.17*
Motivation for research				.54*	.59*	.22*
Other						
Beliefs regarding value of research for practice					.68*	.33*
Beliefs regarding value of research for current learning						.22*

Note: *p<.05

4.4 Discussion and conclusions

Our central aim was to determine the extent to which first-year undergraduate students' perceptions of research within teaching relate to their achievement and their beliefs. Although students recognise research throughout their courses and, find it both stimulating for their learning and important for future clinical practice, only a few correlations between perceptions, beliefs and student achievement were found. The data indicates that student beliefs regarding the value of research for future practice are more strongly related to student achievement than their perceptions of research in teaching and beliefs regarding research promoting current learning. This relationship can be explained by the reciprocal relationship between beliefs and knowledge in general as well as the relatively fixed nature of beliefs (Abelson, 1979). If that is indeed the case, and students' positive beliefs regarding the value of research for future clinical practice influence their interpretation of new knowledge regarding research within their learning environment, then students' development of knowledge about research can serve to strengthen their belief that research is highly valuable. We hence conclude that, within a hard-applied science context, student motivation for research within teaching is strongly related to their familiarity with current research and their beliefs regarding the value of research for learning as well as future practice.

In terms of student learning outcomes, we found a moderate relationship between student achievement and their motivation for research. An explanation for this is the existence of a relationship between motivation for learning and motivation for research. According to Breen and Lindsay (1999) students' intrinsic motivation for learning promotes their positive beliefs about the value of research. Student beliefs regarding the value of research for future clinical practice were most strongly related to student achievement. The motivation for learning again provides an explanation for this. Students who already hold strong beliefs regarding the value of research for their future careers are driven to obtain high grades, for example, in order to create future career opportunities rather than to enrich their current learning experiences (Breen & Lindsay, 1999).

Students clearly recognise research in several ways as well as to different degrees. Student perceptions of current research within teaching were strongly related to student motivation for research. The strong correlations between the scales might influence the reliability of the instrument, although the internal consistency is high. Furthermore, the results indicate that students recognise an emphasis on research methodologies, as well as the creation of enthusiasm for research and learning during their courses, rather than being engaged in research activities during their first year.

Our results add to those of earlier work concerning hard-pure and soft-pure sciences, which concluded that students mainly familiarise themselves with the teachers' research through their courses (van der Rijst, et al., 2013; Visser-Wijnveen, van Driel, van der Rijst, Verloop & Visser, 2010). This can be interpreted in several ways. On the one hand, the perceived emphasis on familiarity with current research indicates that, early in their undergraduate education, students mainly focus on deepening their understanding of the discipline (Neumann, 1994; Turner, et al., 2008). On the other hand, the perceived focus on current research can be explained by the teaching content, for instance, if an emphasis is placed on the evaluation of research papers during work group sessions, it can cause students to feel engaged in current advances in the discipline. In addition, our findings suggest that research can inspire first-year undergraduate students through the teaching they receive. This could also be explained by student conceptions of the discipline and the teaching content. Previous studies have found that more senior undergraduates mainly become motivated for research through teaching and research activities (Healey, et al., 2010; Turner, et al., 2008).

According to our data, student perceptions of the integration of research into teaching correlate most strongly with their beliefs regarding research enhancing student learning. In particular, student motivation for research is closely related to the belief that research stimulates both learning and future practice. Again this can be explained by the correlations between student beliefs about learning in general and motivation for learning. However, it must be recognized that our data collection was specifically tailored to evoke beliefs about the integration of teaching, research and learning in order to reduce the possibility that certain

beliefs regarding the value of research for learning affect perceptions of research integration (cf. Visser-Wijnveen, et al., 2016).

Although care should be taken when drawing causal conclusions about the concepts within our data, based on our theoretical framework and our data we suggest the following implications for practice. First, we suggest that teachers should explicitly increase enthusiasm for research among junior undergraduates. Students consider research to be valuable for their future practice and they believe that involvement in research promotes their achievement. Second, our findings indicate that teachers' focus on explaining current disciplinary research in the classroom can foster student motivation for research which in turn stimulates student learning. Although our study reflects student perceptions of several courses within one programme we suggest that, based on both our results and previous findings (Brew, 2010; Healey, et al., 2010), there is scope for the development of innovative students' research projects aiming to actively engage junior undergraduates in research. Future longitudinal research on the development of student perceptions of research within teaching would be helpful in determining whether research-teaching integration will increase over courses. It will also provide further insights into the nature of student characteristics and the experiences that contribute to student learning and achievement.