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## Fostering first-year student learning through research integration into teaching: Student perceptions, beliefs about the value of research and student achievement

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### ABSTRACT

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

### KEYWORDS

Research-teaching nexus; student beliefs; student perceptions; undergraduate research; first-year experience

### Introduction

Strengthening research-teaching integration to benefit student learning about research in universities can still be identified as a challenge that needs to be met in higher education (Spronken-Smith, Miroso, & Darrou, 2014; van der Rijst, Visser-Wijnveen, Verloop, & Van Driel, 2013). Teachers should explicitly express research in their undergraduate teaching in a way that is visible and approachable for students in order for student learning to benefit research integration, since student perceptions of teaching play an important role in fostering student learning outcomes (e.g. Prosser & Trigwell, 2014). Especially for first-year students it can be difficult to recognise research integrated into teaching, therefore promoting 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 in teaching, beliefs about the value of research and student achievement within the first year of undergraduate education.

### *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 academic achievement but also improve the quality of learning outcomes (e.g. generic skills). Moreover, results from this study suggest that perceptions of the university learning environment may contribute to academic achievement irrespective of the prior academic success of a student. A reason for this is that effective teaching, as perceived by the students, facilitates effective student learning (Ramsden, 1991) also in the first undergraduate year (Prosser & Trigwell, 2014).

In previous studies student perceptions of research were related to undergraduate research experiences and related to institutional factors. Some studies revealed that staff needs to be supported in order to immerse students into the research culture (e.g. Brew, 2010; Spronken-Smith et al., 2014), and to incorporate research into teaching (Hu, van der Rijst, van Veen, & Verloop, 2014). Yet research integrated into teaching within courses appears to be one of the most important factors in promoting student learning and student beliefs about research (Verburch & Elen, 2011). A review study suggested that in general beliefs strongly influence perceptions and that student beliefs are well established by the time they get to university (Pajares, 1992). At the same time beliefs and knowledge are intertwined, making 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 which influences student outcomes regarding the learning goals in higher education.

Few studies have focused on undergraduate student perceptions of research in teaching during the first undergraduate year and its relationship with student learning outcomes (cf. Levy & Petrulis, 2012; Spronken-Smith et al., 2014). Levy and Petrulis (2012) conducted a qualitative study into a student research course with inquiry-based learning pedagogies from which can be concluded that there is a relationship between students' understanding of inquiry, 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 an institutional research culture than 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, such as students' beliefs about the value of research and student achievement.

### *Student perceptions of research integrated into teaching*

Studies suggest that students vary in the extent to which they experience research activities in university teaching (Brew & Ginns, 2008; van der Rijst et al., 2013). Comparisons of teachers' intentions about 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' research (van der Rijst et al., 2013). Students also report that emphasis on teachers' research in teaching can lead to narrow representations of the field (Lindsay, Breen, & Jenkins, 2002). Final year undergraduate students mainly report benefits of research in teaching such as research contributing to teachers' credibility, promoting undergraduates' motivation for research and increased understanding of subjects (Healey, Jordan, Pell, & Short, 2010; Turner, Wuetherick, & Healey, 2008). These findings from the literature suggest there is not a single best strategy to engage students in research and that the value of research-teaching integration lies in a considered diversity of ways to promote 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 in student perceptions of research in teaching can be found in differences in student motivation

and beliefs about academic research. Breen and Lindsay (1999) showed that intrinsic student motivation and course competency contribute to positive beliefs about research, while negative beliefs or indifference to research are associated with externally motivated students. Students' prior experiences with research in 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 experiences that are brought into the classroom.

Integrating research in teaching is challenging for teachers, particularly in the earlier years of undergraduate education. First, students do not always recognise research activities or are not yet open to it (Turner et al., 2008) or lack the disciplinary framework to engage in research (Robertson & Bond, 2001). Second, undergraduates may feel excluded from direct involvement in research and also report negative effects on integration of research in teaching. Students also perceive staff overcoming their own challenges in 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 are 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 a student learning perspective, student perceptions of teaching are used to provide insight into research integration (cf. Visser-Wijnveen, van der Rijst, & van Driel, 2016).

### ***Disciplinary differences in student perceptions of research***

Several studies suggest that student perceptions of research integration depend on discipline-specific characteristics, such as organisational factors within departments (Durning & Jenkins, 2005), 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 creates ample possibilities for teachers to articulate research in 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 research integration in teaching. This influences students' perceptions of research-teaching links (Robertson & Blackler, 2006). Within the 'hard' sciences (e.g. physics, medicine) attention has been paid to enhancing research integration in teaching as well (Robertson & Bond, 2001). In addition to differences between hard and soft sciences a distinction has been made between applied and pure domains to indicate a 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 in clinical practice, especially for physicians to stay abreast of advances in the field. In our study medicine provided a content-rich and research-rich context to improve our understanding of the relationship between student perceptions of research in teaching and student learning outcomes.

### ***Research aim***

This paper describes student perceptions of research-teaching integration in the context of the hard-applied sciences in the first year of undergraduate education. This exploratory study aimed to determine the extent to which first-year undergraduate students recognise research in teaching and to what extent students' perceptions of research-teaching integration are related to student learning outcomes, in particular: student achievement and student beliefs about the value of research-teaching integration for learning and for future practice. Results from this study will inform teachers and educational directors who aim to strengthen linkages between research, teaching and student learning.

## Research setting and method

Our study was conducted in the undergraduate programme of the medical centre of Leiden University (LUMC), the oldest research-intensive university in the Netherlands. Academics at LUMC have responsibilities in patient care, research and teaching. According to written educational goals all three responsibilities should be interlinked in teaching. The medical undergraduate programme is structured in a preclinical and clinical phase. In the three-year preclinical phase students attend patient interviews in addition to predominantly theoretical classes augmented by learning activities 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 were given great importance.

To study first-year student perceptions of research in teaching we administered the Student Perception of Research Integration Questionnaire (SPRIQ) (Visser-Wijnveen et al., 2016). Its scales include student perceptions of teaching through (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 and propositions to measure (5) student beliefs about the value of research for learning and (6) perceived quality of the learning environment (see Table 1 for sample items). Since the SPRIQ has been validated for the sciences, humanities and medicine, we slightly adjusted items to fit the medical context only and we added a scale about beliefs about the value of research for clinical practice. All 30 items were answered on a 5-point Likert-scale from 1 to 5. The 'quality' scale was included because students' opinions on the general quality of teaching during the first academic year could influence their scores on the other scales. In addition to recording their scores on the perception and belief scales students were asked whether they had obtained a previous degree or research experience. Table 1 shows the scales (see Results), reliability and sample items of the version of SPRIQ that we used.

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

**Table 1.** Scales, reliability, means and sample items of the Student Perception of Research Integration Questionnaire (Likert scale 1–5).

Scale	N items	Cronbach's $\alpha$	Mean (sd)	Sample items
				<i>During this academic year...</i>
<i>Student perceptions</i>				
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
<i>Other</i>				
Beliefs about the value of research for practice	6	.84	3.64 (.67)	Scientific skills are important for being a doctor
Beliefs about 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

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

Descriptive analyses were performed on all scales of the questionnaire and are expressed as scale means. For the perception scales we used scale means of 2.65 and higher (range 1–5), based on medians of scores to indicate that the average was rather high for 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 study results retrieved from the LUMC database (grade point averages (GPA)). We applied a confidence interval of 95%. For interpretation we used the following criteria:  $r < .30$  = weak correlation,  $.30 \leq r < .50$  = moderate correlation, and  $r \geq .50$  = strong correlation.

## Results

The students were asked to what extent they had experienced research in the courses taught during their first year. In comparison to other perception scales students identified most 'critical reflection on research' within teaching, although 'motivation for research' and perceptions of 'familiarity with current research' in the discipline scored relatively highly as well (Table 1). During their first academic year students reported least 'participation in research' compared to other ways of perceiving research-teaching integration. In general, students held relatively strong beliefs about the value of research for their provisional practice compared with their beliefs about research enhancing their learning. The mean score regarding quality of the learning environment was relatively high (mean = 3.80). Overall, the reliability rates indicated high internal consistency between items within scales.

All correlations between variables are presented in Table 2. The correlation between student beliefs about the value of research for learning and beliefs about the value of research for future practice stood out ( $r = .68$ ). This suggests a relatively strong relationship between the extent to which students believe that research elements stimulate their learning and the value placed by students on research for future practice. The motivation for research scale correlated relatively highly with beliefs about the value of research for future practice (i.e.  $r = .54$ ) and with beliefs about the value of research for current learning ( $r = .59$ ). Critical reflection and familiarity with current research correlated significantly, although weakly, with beliefs about relevance of research for clinical practice. The data shows somewhat similar results

**Table 2.** Correlations between scales of the Student Perceptions of Research Integration Questionnaire and GPA.

Scales	Participation	Familiarity current research	Motivation	Beliefs value for practice	Beliefs value for learning	GPA
<i>Student perceptions</i>						
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*
<i>Other</i>						
Beliefs about value of research for practice					.68*	.33*
Beliefs about value of research for current learning						.22*

\* $p < .05$ .

for correlations between beliefs about the value of research for learning and perceptions of research in teaching (i.e. scale 1–4), although participation also correlated significantly and weakly with beliefs about learning. Of all scales, beliefs about the value of research for clinical practice showed the highest though moderate correlation with GPA.

The student perception scales correlated significantly with each other at the 0.05 level and all scales correlated highest with 'familiarity with current research' (see Table 2). 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).

## Discussion and conclusions

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

Regarding student learning outcomes we found a moderate relationship between student achievement and motivation for research. An explanation for this is a relationship between motivation for learning and motivation for research. As follows from Breen and Lindsay (1999) intrinsic student motivation for learning promotes positive student beliefs about the value of research. Student beliefs about the value of research for future clinical practice were most strongly related to student achievement. Motivation for learning provides again an explanation for this. Students who already have strong beliefs about the value of research for their future careers are driven to obtain high grades, for example to create future career opportunities rather than to enrich their current learning experiences (Breen & Lindsay, 1999).

Students clearly recognise research in several ways and to different degrees. Perceptions of current research in teaching were strongly related to student motivation for research. These findings suggest that the SPRIQ measures several aspects of perceived research integration as a concept. Strong correlations between 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, and the creation of enthusiasm for research and learning during their courses rather than being engaged in research activities during their first year.

The results add to earlier work in 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, a reason for 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, a perceived focus on current research can be explained by the teaching content, for instance if there is an emphasis put on evaluation of research papers in work group sessions causing 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 through student conceptions of the discipline and the teaching content. Previous studies have found that mainly senior years undergraduates



become motivated for research through teaching and student research activities (Healey et al., 2010; Turner et al., 2008).

According to our data, student perceptions of research integrated into teaching correlate most strongly with their beliefs about research enhancing student learning. In particular, student motivation for research is closely related to the belief that research stimulates learning and future practice. Again this can be explained by correlations between beliefs about learning in general and motivation for learning. However, our data collection was specifically tailored to evoke beliefs about integration of teaching, research and learning to reduce a possibility that certain beliefs about the value of research for learning affects perceived research integration (cf. Visser-Wijnveen et al., 2016).

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

## Disclosure statement

No potential conflict of interest was reported by the authors.

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