On: 17 May 2013, At: 02:46
Publisher: Routledge
Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK

Innovations in Education and Teaching International

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/riie20

Undergraduate science coursework: teachers' goal statements and how students experience research

Roeland M. Van der Rijst [a], Gerda J. Visser-Wijnveen [a], Nico Verloop [a] & Jan H. Van Driel [a]

[a] ICLON - Graduate School of Teaching, Leiden University, Leiden, the Netherlands

Published online: 08 Feb 2013.

To cite this article: Roeland M. Van der Rijst, Gerda J. Visser-Wijnveen, Nico Verloop & Jan H. Van Driel (2013): Undergraduate science coursework: teachers' goal statements and how students experience research, Innovations in Education and Teaching International, 50:2, 178-190

To link to this article: http://dx.doi.org/10.1080/14703297.2012.760872

Innovations in Education and Teaching International, 2013
Vol. 50, No. 2, 178–190, http://dx.doi.org/10.1080/14703297.2012.760872

Undergraduate science coursework: teachers' goal statements and how students experience research

Roeland M. Van der Rijst*, Gerda J. Visser-Wijnveen, Nico Verloop and Jan H. Van Driel

ICLON – Graduate School of Teaching, Leiden University, Leiden, the Netherlands

Understanding the relation between teachers' goal statements and students' experiences about the position of research in undergraduate coursework can give use insight into ways to integrate research and teaching and foster undergraduate research. In this study, we examined to what extent teachers' goal statements agreed with students' experiences of research during undergraduate science coursework. Interviews were held with university science teachers and a questionnaire was presented to their students. The results suggest that teachers' goal statements about the research dispositions of students often tend to disagree with students' experiences, while the emphasis on teachers' own research or explicit participation of students in research activities tends to be in agreement with students' experiences. It is suggested that if students are to appreciate the intangible elements of research, teachers need to emphasise these elements in their communications to their students.

Keywords: research-teaching nexus; science teaching; learning objectives; undergraduate research; student engagement; teaching intentions

Introduction

Undergraduate research and relations between research and teaching are increasingly gaining attention at higher education institutions (Elsen, Visser-Wijnveen, Van der Rijst, & Van Driel, 2009; Spronken-Smith, 2010). More and more institutions incorporate various kinds of connection between research and teaching in their mission statements. However, it is not always obvious how teachers might implement connections between research and teaching in their courses. The relation between teachers' goal statements and students' experiences about the position of research in coursework can give use insight into teaching practices that strengthening the nexus between research, teaching and learning (cf. Alonso, López, Manrique, & Viñes, 2008; Visser-Wijnveen, Van Driel, Van der Rijst, Verloop, & Visser, 2010). In this perspective, both explicit as well as implicit teaching goals are relevant to consider. In order to gain a better understanding of undergraduate science coursework and undergraduate research, we studied relations between teachers' explicit and implicit goal statements and students' experiences about the position of research in undergraduate coursework.

*Corresponding author. Email: rrijst@iclon.leidenuniv.nl

Teachers' goal statements about research

In this study, we define teachers' goal statements as those statements of teachers about their intentions and expectations about what is to be accomplished in a specific course (cf. McAlpine, Weston, Bertjaume, & Fairbank-Roch, 2006). Neumann (1994) made a distinction between the 'tangible' and the 'intangible' connections of teaching and research at universities. Elements of *tangible connections* can be interpreted as those explicit research elements in teaching, such as lectures on advanced knowledge or teaching research skills in a laboratory setting. Elements of *intangible connections* contain the more tacit, not directly observable research elements such as forming an inquisitive research climate, fostering an innovative atmosphere or stimulating the development of suitable research dispositions in students. Teachers and educational researchers have often pointed to these intangible elements as relevant for learning to do research, but few have addressed the relation between these intangible elements of the research-teaching nexus and students' experiences of university coursework (Elen, Lindblom-Ylänne, & Clement, 2007). The study of both explicit as well as implicit teachers' goal statements can provide us with improved insight about strategies for teaching about research in undergraduate courses.

Research elements in teaching

Besides the distinction between tangible and intangible elements, Healey and Jenkins (2009) suggest that the integration of research elements in teaching in undergraduate curricula can be described along two dimensions: (1) running from emphasis on research products to emphasis on research process and (2) running from students as audience to students as participants in research activities. Figure 1 shows four teaching modes depicting four substantively distinct ways to describe the emphasis put on research in university courses.

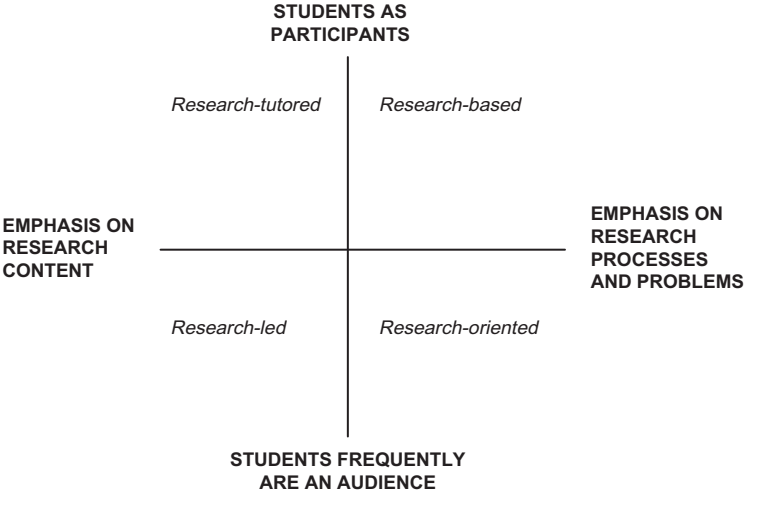

Figure 1. The four modes of the research-teaching nexus (adapted from Healey & Jenkins, 2009).

- *Research-led*: emphasis is on *products* of research, such as understanding theories or models. Students are considered an 'audience' for research activities, for instance, by listening to a lecture by a researcher or observing a simulation of an experiment.
- *Research-oriented*: emphasis is on research *processes*, such as data collection and analysis. Students are considered an 'audience' for research activities, for instance, by repeating well-known experiments in order to develop certain research skills.
- *Research-based*: emphasis is on research *processes*. Students are 'participants' in research activities: they are involved in research, for example, in research internships.
- *Research-tutored*: emphasis is on *products* of research. Students are 'participants' in research activities, for instance, by writing about theories and models or giving presentations about a topic of interest.

Often only parts of a research study can be emphasised in a single course, such as to formulate research questions, to design a study, to gather data, to analyse the data and to report the results. Here, we use the term 'research elements' for all those parts of a research project which can be emphasised in undergraduate science courses. The framework provided by Healey and Jenkins (2009) gives us a window through which we can look at the position of research in undergraduate coursework.

Students' experiences of research and teaching

How students experience the position of research in their courses to some extent determines their conceptions about research. In an overview of research into students' experiences of learning environments in which research and teaching are closely integrated, Healey and Jenkins (2009) show that students are more motivated when they come into contact with staff research at their institution at an early stage in their studies. Students experience courses as up-to-date and intellectually stimulating when teachers bring into play elements of their own research. According to the students, teachers become more enthusiastic when talking about their own studies. The prestige of the staff and institution increases when teachers also have research responsibilities (Jenkins, Blackman, Lindsay, & Paton-Saltzberg, 1998). Furthermore, students perceive a positive relationship between doing research projects and learning (Turner, Wuetherick, & Healey, 2008; Van der Rijst, Visser-Wijnveen, Verstelle, & Van Driel, 2009). Finally, students appreciate being socially and intellectually involved in research groups (Healey, Jordan, Pell, & Short, 2010). In an interview study Robertson and Blackler (2006) have shown that students in a research-intensive learning environment experienced 'pride', and were motivated by the enthusiasm of their teachers. In short, students experience that active involvement in research activities fosters the development of their research skills and their awareness of the research process (Healey et al., 2010).

Research aim

The aim of this study was to identify associations between teachers' goal statements and students' experiences about the integration of research and teaching. The

rationale behind this was to gain a better understanding of the relation between teachers' goal statements about the position of research in undergraduate coursework on the one hand, and students' experiences on the other, in order to improve teaching practice and student learning regarding the integration of research and teaching in the undergraduate phase.

Methods

Sample and procedure

In this small-scale study, qualitative data from interviews with science teachers were triangulated with quantitative data from students' questionnaires. The participants were university science teachers ($n = 10$) from Leiden University and their undergraduate science students. The term 'course' is used for a series of lectures in an academic subject or practical skill. The instructional formats of the courses varied, and study loads ranged from 40 to 120 h. The contents of the courses were related to research in diverse ways, with formats such as practicals or research internships; others were more focused on lectures by visiting professors or seminars about current research topics. Table 1 shows descriptive details of all courses, using fictitious teacher names in order to preserve anonymity.

Before the courses started, the participating teachers were interviewed about their intentions for, and the planning and design of the courses. The aim of these pre-course semi-structured interviews was to have the teachers articulate their explicit as well as their implicit teaching goals. During the final course sessions, the students were asked to complete a questionnaire about research elements in the learning environment (Van der Rijst et al., 2009). The first part of the questionnaire focused on the attention paid to tangible elements of research in undergraduate coursework and covered four aspects, 'becoming acquainted with recent research', 'participating in research', 'emphasis on research' and 'using teacher's of teacher'. The second part addressed three aspects related to intangible research elements, namely 'motivation for research' and 'development of scientific research disposition'. Answers had to be scored on a five-point Likert scale ranging from 'almost never' to 'almost always'. Table 2 lists the themes included in the questionnaire together with reliabilities and illustrative sample items. In total, 71% of the students who followed the courses completed the questionnaire ($n = 104$).

Table 1. Descriptive details of the courses.

Teacher	Domain	Year	Method of instruction	Number of students
Nathan	Astrophysics	BA 1	Practical	12
Adam	Astrophysics	BA 2	Practical	20
Susan	Biology	BA 1	Practical	10
Tanya	Biology	BA 2	Lecture	10
Simon	Chemistry	BA 1	Seminar	6
Edward	Chemistry	BA 2	Practical	5
Howard	Computer Science	BA 1	Seminar	45
Charles	Computer Science	BA 2	Seminar	15
Carlos	Mathematics	BA 3	Lecture	8
Eliot	Physics	BA 1	Lecture	15
			Total	146

Table 2. Factors of the student questionnaire with Cronbach's α and sample items.

Factor	α	Sample item
A1 – Emphasis on research (11 items) concerns the extent to which research was addressed during the course according to the students	.95	During this course, clear relations were drawn between research and teaching content
A2 – Becoming acquainted with recent research (5 items) concerns the amount of attention for recent research problems and results	.89	During this course, my awareness grew about the problems researchers struggle with at this moment.
A3 – Participating in research (5 items) concerns the extent to which students were involved in and/or contributed to research	.90	During this course, we searched for answers to as yet unresolved scientific questions
A4 – Using research of teacher (4 items) concerns the amount of attention given to research activities of the particular teacher	.91	During this course, I became acquainted with the research of my teacher(s)
B1 – Stimulating a scientific research disposition (7 items) concerns the extent to which students were stimulated to develop a critical, scientific research disposition	.86	During this course, the teacher(s) urged us to ask critical questions about our work
B2 – Motivation for research activities (3 items) concerns the extent to which students were stimulated to develop academically	.85	During this course, I felt stimulated to engage in further study in this research domain

Analysis

In order to identify agreement between teachers' goal statements and students' experiences, the interview data matched with the data from the students' questionnaires. If a goal had been explicitly mentioned by a teacher as intended for the course, and students rated the corresponding items of the questionnaire highly (>3.50), agreement was assumed between goal statement and students' experiences. Similarly, if a goal had explicitly been mentioned as *not* intended in the coursework and students rated the corresponding items low (<2.50), agreement was also assumed. When a specific teaching goal was not mentioned by the teacher, no assumption was made about the coherence between goal statement and students' experiences. This means that agreement could be determined only for those elements which were explicitly articulated during the interviews. The transcripts of the interviews were also analysed to identify those course design elements which could be related to the students' experiences of the courses. In order to identify how research was integrated into undergraduate coursework, the four modes of the research-teaching nexus (Healey & Jenkins, 2009) were used.

Results

To illustrate our findings, we present case descriptions of each mode of integrating research into teaching. These case descriptions can be seen as representative of each mode of teaching. In these descriptions, the codes characterising teachers' goal

statements are highlighted in italics. An overview of the averages of students' experiences can be found in Table 3.

A research-led course

In our sample three academics who taught research-led courses, which differed somewhat as to instructional format and student activities. While Carlos gave a lecture-type course in which students gave presentations on specific topics of interest related to disciplinary research, Eliot designed a lecture-type course in which several scholars, such as Ph.D. candidates and postdoctoral researchers, were invited to present their current research. We will describe the case of Tanya's courses in more detail, because she used an instructional format that is found often in this mode of teaching. In her lecture-type course Tanya focused on *acquainting students with recent research* in her field. She explained that she planned to clarify concepts in current theories and research methods. Student activities consisted of participation in lectures and group sessions. During these group sessions, students were expected to discuss scientific articles provided by the teacher with graduate teaching assistants. Tanya explicitly said that *participation in scientific research activities was not expected* and explained that one of her teaching goals was to *stimulate the development of students' ability* to think critically about literature, hypotheses and research questions. Although the students who followed Tanya's course did not perceive themselves as participants in research (A3; 1.70), they were highly motivated to pursue research (B2; 4.50). The goal statement about acquainting students with current research (A2; 3.60) was moderately well perceived by the students. Furthermore, the students reported a strong encouragement to develop their research dispositions (B1; 3.93) which were one of Tanya's implicit teaching goals.

A research-tutored course

In our sample, Simon was the only academic who taught a research-tutored course. According to Simon, *not much attention would be given to hands-on research* during his course. The students were to discuss *research projects from the institution* and to place it in a broader perspective. Simon explained that he always tries *to integrate research from the institution* into his teaching. During his course, the students *worked in groups to do a literature review*. They did *not participate in empirical or experimental studies*. The students presented their findings to their peers and to staff in a student conference format (paper presentations) which were meant to initiate discussion. Simon considered literature study an essential part of scholarly activity. During his course, Simon planned to focus on argumentation skills. The data from the student questionnaire show that the students felt stimulated to engage in research (B2; 4.00). Students' experiences supported the idea that 'recent research' was part of the course curriculum (A2; 3.90). Although Simon did not intend to 'stimulate students' research disposition', the students perceived the course activities as encouraging the development of their research dispositions (B1; 3.43). As planned by the teacher, the students did not participate in empirical research activities (A3; 2.20).

Table 3. Means and standard deviation of students' experiences of the position of research in undergraduate coursework.

		Tangible aspects				Intangible aspects	
	Mode of the nexus	Emphasis on research (A1)	Acquaintance with recent research (A2)	Participating in research (A3)	Using teachers' research (A4)	Stimulating research dispositions (B1)	Motivation for research activities (B2)
Carlos	Led	2.95 (1.32)	3.33 (1.27)	2.00 (.87)	2.25 (.50)	3.19 (.73)	3.67 (.58)
Eliot	Led	3.20 (.70)	3.79 (.75)	1.52 (.52)	2.94 (.96)	2.88 (.75)	4.00 (.91)
Tanya	Led	3.09 (.64)	3.60 (1.13)	1.70 (.71)	2.75 (1.41)	3.93 (.30)	4.50 (.24)
Simon	Tutored	3.77 (.84)	3.90 (1.00)	2.20 (1.13)	3.75 (1.06)	3.43 (1.01)	4.00 (.94)
Charles	Oriented	2.57 (.48)	2.10 (.94)	2.83 (.59)	1.53 (.82)	2.76 (.52)	3.04 (.79)
Howard	Oriented	1.95 (.75)	2.10 (.72)	1.43 (.55)	1.35 (.45)	2.02 (.74)	2.32 (1.00)
Nathan	Oriented	3.95 (.47)	3.61 (.51)	2.31 (.92)	2.12 (.60)	3.17 (.67)	3.77 (.70)
Susan	Oriented	3.55 (.88)	3.20 (.73)	2.60 (1.01)	2.90 (.65)	2.87 (.57)	3.50 (.77)
Adam	Based	3.62 (.70)	2.53 (.69)	2.20 (.72)	1.87 (.53)	2.70 (.35)	3.11 (.44)
Edward	Based	3.95 (.24)	3.84 (.43)	3.96 (.57)	4.05 (.74)	3.49 (.60)	3.67 (.33)

A research-oriented course

Among the four academics in our sample who taught a research-oriented course, some remarkable differences in instructional format could be observed. While Charles gave a project-type course in which students embarked on a large project and the lectures were based on relevant questions from the students, Howard and Nathan both gave a seminar-type skill development course in which students were given small written assignments which were more or less based on research in the field. During all these courses, the emphasis was on research processes and problems. We will highlight the case of Susan, who gave a laboratory practical for undergraduate biology students. Susan explained that the emphasis in her course was on development of research skills in hands-on activities. Additional lecture-type activities were also planned, to assist students. In her laboratory practical, Susan intended to pay explicit attention *to bringing fun back into research lab*. She wanted to achieve this by contextualising the assignments, demonstrating novel experiments using materials from current research and describing the links to her own research experiences. Susan paid much attention *to explaining and showing how to do research*. Generally, the two teaching goals Susan articulated in her interview were indeed perceived by her students. Questionnaire data showed that students were motivated to engage in further research (B2; 3.50). Susan focused on research processes and demonstrated several experiments to the students, which meant that the course activities were clearly focused on doing research. Student scores on the scale 'emphasis on research' were therefore relatively high (A1; 3.55).

A research-based course

Two academics in our sample taught a research-based course. While Edward's students embarked on hands-on research from day one at the institute, Adam's students worked on preparing the measures during the first weeks. This difference was inherent in the disciplines. Whereas Edward's chemical laboratory was at the institute and could be used for research activities every day, the observatory where Adam and his students had to do their astronomy observations was miles away and could only be used for a few days during the final week of the course. We will briefly describe the case of Edward. Edward explicitly planned *to make research an essential part* of this course, so that his course would *bring together many elements of research*. Students participated in the study of a Ph.D. candidate studying under Edward's supervision, and therefore were *working on recent issues*. He aimed to give students the chance to practise with all kinds of experimental research practices. He emphasised the relevance of the experiments to the students, explicitly stating his teaching goal *to increase student motivation for research*. Student's experiences about 'teacher's own research' (A4; 4.05) and 'participating in research' (A3; 3.96), reflect their active engagement in institutional research. All activities during this course were related to doing research. This is reflected in the students' responses about 'emphasis on research' (A1; 3.95).

Agreement between teachers' goals statements and students' experiences

Table 3 shows the average scores of students' experiences. Those elements to which the participating teachers explicitly referred in their interviews as a teaching goal

for their courses, and the elements the teachers explicitly identified as not intended in the course, are presented in Table 4.

In this table, aspects which are formulated as a goal for the course are accompanied with a + sign and aspects which are explicitly formulated as not a goal for the course are accompanied with a – sign. Furthermore, aspects which show an agreement between teachers' goal statements and students' experiences are presented in bold, while aspects which show a disagreement between teachers' goal statements and students' experiences are presented in italic. For example, Carlos explicitly stated in his interview that students participating in research activities (A3, **2.00**–) were not a teaching goal (minus-sign); students also did not experience it as an element of their coursework (bold). On the other hand, student research dispositions (B1, *3.19*+) were a teaching goal (plus-sign); however, students did not perceive this as a major emphasis (cut-off condition: <3.50) in the course (italic).

On two aspects, teachers' goal statements and students' experiences often show agreement, namely 'participating in research' (A3; 3 out of 4) and 'using teacher's research' (A4; 4 out of 6). On 'becoming acquainted with recent research' (A2; 2 out of 4) and 'stimulation of research dispositions' (B1; 1 out of 4), goal statements and students' experiences are often not in agreement. The results on 'participating in research' (A3) are also notable because for all research-led courses, students' experiences were lower than average, whereas research-based courses show experiences higher than average. This is in line with the 'student involvement' dimension described by Healey and Jenkins (2009), according to which research-based teaching scores high on student participation in research activities, whereas research-led courses score high on students being less involved in research activities.

Discussion

Our central research aim was to identify associations between teachers' goal statements and students' experiences of the integration of research activities in university science coursework. The results indicate that goal statements about tangible elements, such as 'participation in research' and 'using teacher's research' are often in agreement with students' experiences of research. Teachers' goal statements regarding the participation of students in research activities (A3) and using their own research during the course (A4) showed the greatest correspondence with students' experiences, whereas the development of research dispositions (B1) reflected students' experiences least often. The data also showed an agreement between students' experiences and goal statements about 'motivating students for research activities'. Participation in research activities and using the teacher's own research during a course can both be categorised as tangible elements of the research-teaching nexus; stimulating the development of students' research dispositions is an intangible element of the nexus. Items relating to tangible elements (A-scales) tend to show high agreement, while items about the development of students' research dispositions (B1), intangible elements, often was in disagreement. This is in line with findings presented by Neumann (1994), and can be understood in at least two ways. First, intangible elements of research are often more difficult for students to perceive than tangible elements. Second, intangible elements might be more difficult for teachers to emphasise in undergraduate education. Therefore, goal statements such as 'the development of research dispositions' or 'creating an inquisitive atmosphere' are less likely to be in agreement with students' experiences than

Table 4. Agreement between teachers' goal statements and students' experiences of research in university coursework.

		Tangible aspects				Intangible aspects	
	Mode of the nexus	Emphasis on research (A1)	Acquaintance with recent research (A2)	Participating in research (A3)	Using teachers' research (A3)	Stimulating research dispositions (B1)	Motivation for research activities (B2)
Carlos	Led	–	–	**2.00**–	–	*3.19*+	–
Eliot	Led	*3.20*+	**3.79**+	–	*2.94*+	–	**4.00**+
Tanya	Led	–	**3.60**+	**1.70**–	–	**3.93**	–
Simon	Tutored	*3.77*–	–	–	**3.75**+	–	–
Charles	Oriented	–	*2.10*+	–	**1.53**–	–	**3.04**+
Howard	Oriented	**1.95**–	–	–	–	–	–
Nathan	Oriented	**3.95**+	*3.61*–	–	–	*3.17*+	–
Susan	Oriented	**3.55**+	–	–	–	–	**3.50**+
Adam	Based	–	–	*2.20*+	–	*2.70*+	–
Edward	Based	**3.95**+	–	**3.96**+	**4.0**5	–	**3.67**+

Notes: (i) Aspects which are formulated as a goal for the course are accompanied with a + sign; aspects which are explicitly formulated as not a goal for the course are accompanied with a − sign;
(ii) Cut-off condition for intended goals is above 3.50; cut-off condition for goals not intended in the courses is below 2.50;
(iii) Aspects which show an agreement between teachers' goal statements and student experiences are presented in bold; aspects which show a disagreement between teachers' goal statements and student experiences are presented in italic.

teachers' goal statements such as 'participation in research' or 'using the teacher's own research'. On the other hand, teachers' goal statements about the motivation of students for research activities (B2), which were characterised as intangible elements, are in our sample often in agreement with students' experiences. These tendencies are in line with the study by Turner et al. (2008) about students' experiences of research at different institutes. Among other issues they found that the number of students who reported experiencing the development of research skills was 'less than a third of those surveyed'. Explicit communication with students about the role of research for their learning is crucial when teachers want to foster the development of authentic research dispositions.

In the descriptions of the cases, several cues can be found for understanding differences in students' experiences of the position of research in undergraduate course work. We noted in the result section that Eliot designed a course in which several scholars, such as Ph.D. candidates and postdoctoral researchers, were invited to present their current research. The agreement between goal statements of Eliot and the students' experiences of 'motivation for research' (B2, intangible) and 'acquainting with recent research' (A2, tangible), could be explained by the fact that staff members gave a lecture about a recent study. The disagreement between Eliots' goal statement and students' experiences about 'using research of teacher' (A4, tangible) can be understood from the fact that Eliot himself did not explain his research interests. Another cue can be found in the case description of research-oriented courses. While Charles gave a project-type course in which students embarked on a large project, Nathan both gave a seminar-type skill development course in which students were given small written assignments which were based on disciplinary research. Remarkable difference in students' experience is that Charles' students scored high on motivation for research, while Nathans' students experience a stimulation of their research dispositions. This might suggest that projects more often stimulate the motivation of students, while small written assignments based on disciplinary research might more often stimulate the development of research dispositions.

On the basis of the results presented in Table 4, we suggest that students generally perceive the development of their research dispositions (B1) less clearly in research-oriented courses than in courses following other modes of the nexus. A possible explanation is that when students follow a course that aims at improving research skills, it is more difficult for them to reflect on intangible elements of research, such as the development of research dispositions. Reflection on research processes and dispositions might be stimulated best by observation of others, such as peers and experts, or conducting authentic research in which the focus lies on the development of new knowledge, such as in research-based courses. Both Elton (2001) and Healey and Jenkins (2009) provide arguments for inquiry-based learning as a powerful way of strengthening the links between research, teaching and learning. In research-oriented courses, the development of students' research dispositions might be stimulated by the creation of a critical and innovative atmosphere. Attention should be paid to the fact that when students are actively involved in doing research, they themselves may not clearly perceive the development of their research dispositions, although the teacher is working on it constantly. Students' reflection on aspects of their own research dispositions can help them to focus on tacit elements of research, and in research-oriented courses can probably best be done outside the actual assignments. Thus, reflection on undergraduate research and

inquiry activities seems relevant to students developing an authentic conception of research. Several authors have pointed to the value of focusing on the construction of knowledge through inquiry in undergraduate curricula (cf. Brew, 2006; Healey & Jenkins, 2009).

The differences in students' experiences reflected in the data can often be understood by considering the differences between the instructional formats. For example, in the case of Elliot, students perceived a stronger 'motivation for research activities' than in other research-led courses. The students may have been motivated by the variety of different lectures on current research projects by academics from their institute.

Conclusion and implications for teachers' professional development

Putting the results in the broader perspective of the debate on undergraduate research and the research-teaching nexus, we conclude that teachers' goal statements about the research dispositions of students often tend to disagree with students' experiences, while the emphasis on teachers' own research or explicit participation of students in research activities tends to be in agreement with students' experiences. Although the data seem to indicate that goal statements about tangible elements are more often coherent with students' experiences than statements about intangible elements, goal statements about motivating students for research is an exception to this rule of thumb. Based on the results, we suggest that explicit communication with students about the role of research for their learning is crucial when teachers want to foster the development of authentic research dispositions.

It is possible that the participating teachers were more likely to articulate goal statements about tangible elements of research than about intangible elements. This could have caused a bias in the data because of the design of this study, specifically the structure of the interviews. Therefore, we note that in future studies tendencies in the data should be confirmed and validated.

The evaluation of students' experiences of the position of research in undergraduate coursework can be an effective tool to stimulate teachers to reflect on their teaching practices. The questionnaire used in this study might serve as an evaluation tool for teachers to become aware of students' experiences related to their teaching goals, and specifically to become aware of students' experience of the position of research in their courses. The results of this study indicate that teachers' goal statements relating to tangible elements of research are likely to agree with students' experiences, whereas teacher's goals about research dispositions tend to be less in agreement with students' experiences. This invites academics to be more explicit to students about how they foster the development of students' research dispositions such as a critical attitude or a desire towards deep understanding.

Notes on contributors

Roeland van der Rijst is an assistant professor at the department of higher education at Leiden University, ICLON – Graduate School of Teaching.

Gerda Visser-Wijnveen is an educational researcher at Leiden University, ICLON – Graduate School of Teaching.

Nico Verloop and Jan van Driel are professors at Leiden University, ICLON – Graduate School of Teaching.

References

Alonso, F., López, G., Manrique, D., & Viñes, J.M. (2008). Learning objects, learning objectives and learning design. *Innovations in Education and Teaching International, 45*, 389–400.

Brew, A. (2006). *Research and teaching: Beyond the divide*. New York, NY: Palgrave MacMillan.

Elen, J., Lindblom-Ylänne, S., & Clement, M. (2007). Faculty development in research-intensive universities: The role of academics' conceptions on the relationship between research and teaching. *International Journal for Academic Development, 12*, 123–139.

Elsen, G.M.F., Visser-Wijnveen, G.J., Van der Rijst, R.M., & Van Driel, J.H. (2009). How to strengthen the connection between research and teaching in undergraduate university education. *Higher Education Quarterly, 36*, 64–85.

Elton, L. (2001). Research and teaching: What are the real relationships? *Teaching in Higher Education, 6*, 43–56.

Healey, M., & Jenkins, A. (2009). *Developing undergraduate research*. York: The Higher Education Academy.

Healey, M., Jordan, F., Pell, B., & Short, C. (2010). The research-teaching nexus: A case study of students' awareness, experiences and perceptions of research. *Innovations in Education and Teaching International, 47*, 235–264.

Jenkins, A., Blackman, T., Lindsay, R., & Paton-Saltzberg, R. (1998). Teaching and research: Student perspectives and policy implications. *Studies in Higher Education, 23*, 127–141.

McAlpine, L., Weston, C., Bertiaume, D., & Fairbank-Roch, G. (2006). How do instructors explain their thinking when planning and teaching? *Higher Education, 51*, 125–155.

Neumann, R. (1994). The teaching-research nexus: Applying a framework to university students' learning experiences. *European Journal of Education, 29*, 323–338.

Robertson, J., & Blackler, G. (2006). Students' experiences of learning in a research environment. *Higher Education Research and Development, 25*, 215–229.

Spronken-Smith, R. (2010). Undergraduate research and inquiry-based learning: Is there a difference? Insights from research in New Zealand. *Council on Undergraduate Research Quarterly, 30*, 28–35.

Turner, N., Wuetherick, B., & Healey, M. (2008). International perspectives on student awareness, experience and perceptions of research: Implications for academic developers in implementing research-based teaching and learning. *International Journal for Academic Development, 13*, 199–211.

Van der Rijst, R.M., Visser-Wijnveen, G.J., Verstelle, T., & Van Driel, J.H. (2009). Studentbeleving van de onderzoeksintensiviteit van universitaire onderwijsomgevingen [in Dutch: Student experience of the research intensiveness of learning environments at universities]. *Pedagogische Studiën, 86*, 214–229.

Visser-Wijnveen, G.J., Van Driel, J.H., Van der Rijst, R.M., Verloop, N., & Visser, A. (2010). The ideal research-teaching nexus in the eyes of academics: Building profiles. *Higher Education Research & Development, 29*, 195–210.