University of Groningen

**“Our job is to deliver a good secondary school student, not a good university student.”
Secondary school teachers’ beliefs and practices regarding university preparation**

van Rooij, Els; Jansen, Ellen

Published in:
International Journal of Educational Research

DOI:
[10.1016/j.ijer.2018.01.005](https://doi.org/10.1016/j.ijer.2018.01.005)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2018

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

van Rooij, E., & Jansen, E. (2018). “Our job is to deliver a good secondary school student, not a good university student.” Secondary school teachers’ beliefs and practices regarding university preparation. *International Journal of Educational Research*, 88, 9-19. <https://doi.org/10.1016/j.ijer.2018.01.005>

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the “Taverne” license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

“Our job is to deliver a good secondary school student, not a good university student.” Secondary school teachers’ beliefs and practices regarding university preparation

Els C.M. van Rooij*, Ellen P.W.A. Jansen

Department of Teacher Education, University of Groningen, Grote Kruisstraat 2/1, 9712 TS, Groningen, The Netherlands

ARTICLE INFO

Keywords:

University readiness
Secondary school teachers
Teacher beliefs
Classroom practices
Interviews

ABSTRACT

This study investigated secondary school teachers’ beliefs and practices regarding university preparation by interviewing 50 teachers. Teachers most often mentioned study skills as important aspect of university readiness. Although most teachers believed their role involved contributing to university readiness, few teachers had university preparation as explicit goal; instead, most of them mentioned university preparation practices they performed unintentionally. These preparation practices mainly focused on providing students with information about studying at university. As barriers to university preparation teachers mentioned spending most of their time to preparing their students for national examinations and a lack of knowledge of what universities expected from first-year students. More awareness of the importance of preparation and collaboration between schools and universities offer potentially helpful resolutions.

1. Introduction

High dropout rates in the first year of university education are a global problem. Moreover, in the Netherlands, most students need at least four years to complete a three-year bachelor programme and one out of four students make a wrong choice of degree programme and consequently switch during or after the first year (Inspectie van het Onderwijs, 2017). This is costly for both individual students and the government, which makes improving the success rates in higher education an important point on the political agenda (Onderwijsraad, 2015). As a consequence, plenty of effort goes out to improving student success in universities and it is a well-researched area. International reviews provide overviews of a plethora of factors – e.g., demographic, cognitive, psychological, and institutional – that are related to achievement and retention in higher education (Richardson, Abraham, & Bond, 2012; Robbins et al., 2004) and a substantial number of studies have been published in the research area of postsecondary student success, especially on first-year success, since research showed that how well a student performs in the first year is indicative of success in the continuing years (Hurtado, Han, Sáenz, Espinosa, & Cabrera, 2007; Jansen & Bruinsma, 2005). In contrast, not much attention has been given to the phase before the transition, even though a key reason for dropout and delay is that students are not bridging the gap between secondary and university education effectively (Lowe & Cook, 2003). To increase the likelihood that students will experience a successful transition, efforts to contribute to students’ university readiness, i.e., university preparation, must be an explicit focus of secondary education, especially in countries with differentiated secondary education systems that direct students early into tracks that guarantee access to certain levels of postsecondary education. We focus on the Netherlands for this study, where students in the highest track of secondary education, literally called preparatory university education (short: pre-university education), need to be

* Corresponding author.

E-mail addresses: e.c.m.van.rooij@rug.nl (E.C.M. van Rooij), e.p.w.a.jansen@rug.nl (E.P.W.A. Jansen).

ready for university when they graduate. Teachers in pre-university education are university-educated themselves and can thus be seen as ‘experience experts’. Moreover, they often know their students well, having taught them for several years, which means they potentially play a crucial role in students’ university preparation. We investigate whether and to what extent they pay attention to making their students ready for university. We also consider teachers’ beliefs about the most important aspects of university readiness and their role perception. These beliefs matter, because they act as guides to thought and behaviour (Borg, 2001). By accounting for teacher beliefs, we seek to understand the bases of their practices, which is necessary information if the goal ultimately is to improve their practices (Nespor, 1987) and thereby enhance students’ university readiness. To our knowledge, little research addresses teachers’ beliefs about their role in preparing students for postsecondary education or their preparation practices in the classroom. This study thus can contribute both to research into university transitions and to practice. In the theoretical framework, we will discuss current knowledge about aspects of university readiness and about teachers’ beliefs and practices.

2. Theoretical framework and research questions

2.1. Aspects of university readiness

The transition from secondary school to university is a difficult one for many students. Lowe and Cook (2003) found that in a sample of first-year students at a university in the United Kingdom one out of four to one out of three students faced considerable difficulties in adjusting to postsecondary education. An important reason for adjustment issues concerns the difference between the heavily regulated secondary school learning environment on the one hand and the university environment that makes a strong appeal to a student’s self-regulation capacities on the other hand, in combination with a significant increase in amount and complexity of study content. Much research into first-year success confirmed that a substantial number of students struggle with time management and self-regulation, especially in the first semester (e.g., Haggis, 2006; Van der Meer, Jansen, & Torenbeek, 2010). These adjustment difficulties can cause academic problems, such as underachievement or even dropout, and psychological problems, like depression (Leung, 2017; Lowe & Cook, 2003). What also makes the transition challenging is that many secondary school students do not know what to expect or have unrealistic expectations about university in general (Heublein et al., 2017; Smith & Wertlieb, 2005) or about the specific degree programme they have chosen to pursue (De Buck, 2009), which creates academic and social challenges during the transition, with the accompanying high levels of stress (Friedlander, Reid, Shupak, & Cribbie, 2007).

A better preparation for university during secondary education could make the transition less challenging. To prepare students, teachers need accurate conceptions of what it means to be ready for university. Little research has investigated teachers’ beliefs about college readiness, though Kirst and Bracco (2004) showed that secondary school teachers held different conceptions of college readiness than what college professors expected. Secondary school teachers tended to think graduating from secondary school implied college readiness, whereas professors expected students to master the content knowledge taught in high school but also to possess sufficient learning skills, such as an ability to deal with large amounts of content. These skills are not an explicit part of the high school curriculum, so they are not automatically being mastered during high school. Biology teachers in a qualitative case study by Friedrichsen (2002) saw the following aspects as part of college readiness: being able to think critically and outside the box; having study skills, laboratory skills and confidence; and being able to take tests and read scientific texts. Although these aspects are important, they do not present a complete picture of what is needed to be ready for university.

In recent decades, college readiness has received substantial attention in research, especially in the United States. The four-part model of college readiness by Conley (2008) provides a useful overview of readiness aspects. It includes four keys a student needs to be successful in college: cognitive strategies, content knowledge, learning skills and techniques, and transition knowledge and skills. This model can also be applied to university readiness in the Netherlands. The first key consists of key cognitive strategies, or ways of thinking and working that are needed and expected in a college environment, such as analytical thinking, identifying research questions, reasoning, evaluating, precision, and accuracy. In higher education, educational content tends to be more complex than that provided in secondary school; hence, in order to master it, students need good cognitive strategies. Moreover, especially in research universities like those in the Netherlands, course content is highly research-based, requiring students to read academic articles or to design their own research proposals. This task demands thinking skills. The second factor Conley (2008) refers to is key content knowledge, or the mastery of knowledge and skills pertaining to the core subjects and an understanding of the structure of knowledge in these subject areas. For English for example, key skills include writing and presentation skills. As a third factor, a prospective university student must possess key learning skills and techniques. These academic behaviours or beliefs include time management skills, study skills, persistence, motivation, and self-efficacy. The importance of this factor becomes particularly clear when considering the difference between the externally regulated secondary school environment and the freer college environment that expects substantial independence from students and covers more content more quickly. Finally, the fourth factor refers to key transition knowledge and skills, or information that students need to get into college and then navigate its environment. In particular, they need financial knowledge, to understand the costs and financial aid available; cultural knowledge, to recognize the prevalent norms and values in college; and procedural knowledge, to perceive how the admission process works. These transitional skills are especially pertinent to a student’s choice of a degree programme.

We chose to use Conley’s model as an overview of university readiness, because in contrast to theories of student success in higher education such as the ones by Tinto (1993) and Astin (1999), or overviews of important correlates of student success such as those by Richardson et al. (2012) and Robbins et al. (2004), this model focuses explicitly on what is needed before a student makes the transition. Related to this, unlike these other models or overviews, Conley’s model includes transition knowledge and skills, which students need these to make an adequate choice of what degree programme they are going to pursue. This aspect is crucial, because in

the Netherlands, many students switch programmes because they have chosen a programme they are not satisfied with (Inspectie van het Onderwijs, 2017). By switching programmes, a student usually loses a year. Thus, we apply this framework of college readiness to investigate which factors secondary school teachers in the Netherlands believe are important for their students to be a successful in university, leading to the first research question:

1. What are teachers' beliefs about aspects of university readiness?

2.2. Teachers' university preparation practices

Little research focuses specifically on how teachers prepare students for postsecondary education (McPhail, 2015), though some research suggests that secondary school teachers play a role. Smith and Zhang (2008) reported that students rated secondary school teachers more helpful than counsellors in preparing them for postsecondary education, which could be a result of the many students that each counsellor advises and the little time for each student. Another reason may be that the counsellors do not know the students as well as the teachers do. Moreover, in a qualitative study, Reid and Moore (2008) found that first-generation urban college students indicated that teachers helped them prepare academically for college and served as trusted sources of information. Last, research has shown that university students' perceptions of their preparation during secondary school, specifically management ability and study skills, relate positively to their subsequent study behaviour and achievement in the first year of university (Jansen & Suhre, 2010). These studies, however, do not provide much detailed information about what teachers exactly do when preparing students for university, which is why this study aims to map these teacher behaviours and categorise them within Conley's framework. By doing so, we can also see to what extent teachers' beliefs about important aspects of university readiness align with their university preparation practices. The second research question is:

2. How do teachers contribute to their students' university readiness?

2.3. The connection between beliefs and practices

Teachers who believe college preparation is part of their role likely pay more attention to it in the classroom, because teachers' beliefs influence their teaching decisions and practices (e.g., Pajares, 1992). For this study, we use Calderhead's (1996) description of beliefs as suppositions, commitments and ideologies. The development of teacher beliefs is a long-term, on-going process that starts during the teacher's time as a student (Lortie, 1975) and continues to be influenced by personal experiences, prior work experiences, and professional development (Ertmer, 2005). Beliefs regarding college preparation in particular might be shaped by the teacher's own college experiences (Friedrichsen, 2002). In the vast research conducted to understand teacher beliefs and their link to teacher behaviour, some research uncovered a strong relationship between teacher beliefs and practices (Kagan, 1992; Nespor, 1987; Pajares, 1992), but studies have also highlighted some inconsistencies (Ertmer, 2005), usually due to contextual factors that prevent teachers from translating their beliefs into practice (Fang, 1996). These contextual factors might include time constraints, curriculum requirements, or external pressures such as having to prepare students for examinations (Ertmer, 2005; Friedrichsen, 2002). To gain insight into the connection between teachers' role perception and their practices regarding university preparation, we ask the following two questions:

3. What are teachers' beliefs about their role in the process of preparing students for university?
4. Do teachers experience barriers that hinder them from attending to university preparation, and if so, what are these barriers, and how might they be overcome?

3. Method

3.1. Research context

In the Dutch education system, secondary school students attend a level of education on the basis of their abilities. About one fifth of secondary school students follow the pre-university track that we focus on in this study (CBS, 2016b). Students who graduate from pre-university (which takes six years) are allowed to enter university. In 2014, 80% of all pre-university graduates directly entered university (CBS, 2016a); many of the remaining 20% entered professional higher education, which means a change in learning environment that is comparable to the transition to university (e.g., more independent study, fewer contact hours). Moreover, some students take a gap year after graduating from secondary school and then attend university. Accordingly, university preparation is in theory a central goal for pre-university education that is relevant for the vast majority of students.

In the Netherlands, a national curriculum prescribes the learning content for all school subjects that students must master. They graduate if they pass the mandatory national examinations in their final year of secondary school. The Inspectorate of Education keeps a close eye on students' results at each school, and average examination results are publicly available, suggesting the substantial accountability attached to these examinations. In contrast, there are no guidelines for or evaluation of university preparation. Schools must have a career guidance programme, but each school can make its own decisions about what form this programme takes (SLO, 2016). Guidance counsellors in each school coordinate the career guidance programmes and advise individual students about their choices. In some schools, consultations with the counsellor are mandatory, whereas in others, students pursue the consultations on their own initiative. In response to some recent criticisms of career guidance in Dutch schools, starting in August 2017, the Inspectorate of Education also will evaluate schools' career programmes, as part of the basic quality criteria they must meet (Bussemaker & Dekker, 2016).

Table 1

Overview of participants by their secondary school discipline.

	Science	Social science	Humanities	Total
Male	13	4	7	24
Female	4	2	20	26
Total	17	6	27	50

Admission to specific university degree programmes depends on a student's secondary school coursework. For example, to be admitted to a science degree programme, a student must have completed science coursework in secondary school.

3.2. Participants

The study participants were 50 teachers who taught, among other grades, grades 11 and 12 in pre-university schools. This selection criterion is pertinent because university preparation is most relevant in the years immediately before graduation. The teachers were employed by 14 different pre-university schools in the Netherlands. As [Table 1](#) shows, most teachers were teaching humanities subjects. Female teachers were overrepresented in humanities subjects, and male teachers in science subjects, reflective of the Dutch teacher population ([Microsoft, 2017](#)).

3.3. Instrument and procedure

A qualitative methodology is an appropriate way to capture people's cognitions ([King & Horrocks, 2010](#)), so we conducted semi-structured interviews. The interview protocol consisted of an introduction and 13 questions that addressed the research questions, such as 'What are, according to you, important characteristics a student needs in order to be successful in the first year of university?' (university readiness aspects) and 'In your lessons, do you pay attention to preparing students for university? If so, how?' (university preparation practices). We purposefully formulated the questions broadly, so that the interviews would not steer participants in any certain direction. Moreover, participants were free to express what 'university preparation' meant, which also reflected their beliefs about it. When needed, interviewers used prompts and probes.

The interviews were held from September 2015 to May 2016 by one of the authors and graduate students trained to conduct such interviews. In all cases, the interviews took place at the school where the participant was employed, in an office or empty classroom, and they all used the same interview protocol. Before the interview started, participants were asked (and agreed) to permit the interview to be recorded and to acknowledge that everything they said could be used for research purposes. Anonymity was guaranteed. On average, the interviews lasted 35 min and 45 s; the longest interview lasted more than 56 min, and the shortest was about 21 min.

3.4. Analysis

All interviews were transcribed verbatim. With our research questions in mind, the analysis sought to categorise different types of beliefs and behaviours, find associations between them, and seek explanations. Framework analysis — a systematic process of sifting, charting and sorting material according to key themes — suits these goals ([Ritchie & Spencer, 1994](#)). As detailed in [Table 2](#), we followed [Ritchie and Spencer's \(1994\)](#) five data analysis stages: (1) familiarisation, (2) identifying a thematic framework, (3) indexing, (4) charting, and (5) mapping and interpretation. Atlas.ti was used to conduct the analyses.

4. Results

To present the results, we discuss the main themes that emerged from the data related to each research question: teachers' beliefs about university readiness, their university preparation practices, beliefs about the teacher's role in preparation, and possible barriers. We also briefly outline two other themes that arose from the data: teacher background factors and teacher knowledge that influence teachers' practices.

A point of interest was to find links between teacher beliefs about readiness and their preparation practices, so we combine the results for research questions 1 and 2 together in [Table 3](#). The left-hand column summarises aspects of university readiness most often mentioned by teachers and the percentage of teachers who mentioned it. The second column identifies the relevant key category of college readiness according to Conley's model, and then the third column reveals the university preparation practice that corresponds to this readiness aspect, along with what percentage of teachers indicated they attended to this aspect in the classroom. Finally, we highlight the discrepancy between readiness aspects and preparation practices, such that a negative symbol indicates fewer teachers mentioned it as a practice than identified it as a readiness aspect.

4.1. Teachers' beliefs about university readiness

The three aspects most often mentioned as crucial to university readiness all belonged to [Conley's \(2007\)](#) learning skills and

Table 2

Overview of the stages of framework analysis: Description and execution.

Stage	Description by <i>Ritchie and Spencer (1994)</i>	Our practices
1. Familiarisation	Becoming familiar with the data and gaining an overview.	We immersed ourselves with the data by reading and re-reading the 50 transcripts and listing recurrent themes that emerged as important.
2. Identifying a thematic framework	Identifying key issues, concepts, and themes and constructing a framework by drawing on research aims and themes arising from the data.	We linked emergent themes to the research questions. In addition, we categorised those pertaining to beliefs about university readiness and practices of university preparation according to Conley's four keys: cognitive strategies, content knowledge, learning skills and techniques, and transition knowledge and skills.
3. Indexing	Applying the thematic framework systematically to the data.	We coded the passages using the framework with emergent themes developed in stage 2. If a passage did not fit the framework, we assigned a new code and thus expanded the initial framework.
4. Charting	Rearranging the data according to the themes and constructing main 'charts' that consist of headings and subheadings from the research questions and developed framework.	In line with our research questions and the framework derived from stages 1–3, we constructed seven charts: (1) readiness beliefs, (2) preparation practices, (3) role perception, (4) obstacles, (5) wishes, (6) background factors influencing beliefs and practices and (7) knowledge influencing beliefs and practices.
5. Mapping and interpretation	Analysing the range and nature of key themes within the charts, mapping and interpreting the data as a whole and searching for patterns and explanations.	Using Atlas.ti, we generated an overview of how many teachers mentioned each theme to obtain an overall pattern of beliefs and practices. We linked university readiness beliefs to university preparation practices, to determine the extent to which they aligned. Role perception beliefs, background factors, knowledge and barriers were linked to practices and can explain why teachers attend to university preparation or not in their classrooms.

Table 3

Themes in university readiness factors and university preparation practices and the percentage of teachers who mentioned it as important readiness aspect respectively as an aspect they pay attention to.

University readiness aspect	%	Category in Conley's model ^a	University preparation practice	%	Discrepancy ^b
Study skills	58	LST	Teaching study skills	44	-
Independence	48	LST	Promoting independence	42	0
Perseverance	44	LST	Promoting perseverance	2	-
Curiosity	40	CS	Promoting curiosity	5	-
Adequate choice of programme	38	TKS	Answering students' questions about degree programmes	68	++
			Asking students about their future plans	50	+
Content knowledge	36	CK	Making sure students master content knowledge	5	-
Language skills	36	CK	Teaching language skills	15	-
Research skills and attitude	28	CS	Teaching research skills and an attitude of inquiry	50	+
Thinking skills (e.g., critical thinking)	24	CS	Teaching thinking skills	48	+
^c		TKS	Giving information about studying at university in general	44	+

^a Conley's categories are as follows: CS: cognitive strategies; CK: content knowledge; LST: learning skills and techniques; TKS: transition knowledge and skills.^b In the Discrepancy column, 0 implies virtually no difference in the percentages of teachers who mentioned it as university readiness aspect and as a university preparation practice; - indicates it was more often mentioned as aspect of readiness than as a preparation practice (difference ≥ 10); - means it was substantially more often mentioned as aspect of readiness than as a preparation practice (difference ≥ 30); + implies it was more often mentioned as a preparation practice than as an aspect of readiness (difference ≥ 10); and ++ means it was substantially more often mentioned as a preparation practice than as an aspect of readiness (difference ≥ 30).^c Although providing students with information about studying at university in general was mentioned by many teachers as a university preparation practice, being well-informed about university education in general was not mentioned as a readiness aspect, hence this cell is empty.

techniques category. The most often mentioned aspect was possessing study skills. Teachers often talked about university students needing to be able to plan to master the vast amount of content required, without external regulation. A second notable aspect was independence, which they considered as both being able to live independently, after moving out of their parents' homes, and a capability to study independently. Perseverance emerged as another crucial aspect; the teachers described the learning content as more difficult than that in secondary school, and they recognised that students would have to pass courses that they would find difficult or disliked. Furthermore, more than one-third of the teachers mentioned curiosity, an adequate choice of study programme, content knowledge, and language skills as important readiness aspects. Curiosity constitutes a cognitive strategy in the college readiness framework, an adequate choice of programme reflects the transition knowledge and skills category, and the latter two aspects are forms of content knowledge.

4.2. Teachers' university readiness practices

All 50 teachers described teacher behaviours they performed regularly in the classroom that they saw as contributing to university readiness. Most of them were implicit though: 46% of teachers said at some point in their interviews that they were not consciously occupied with university preparation. When they engaged in it, they were not aware of contributing to readiness; instead, they became aware of it only during the interview, when primed to talk about university preparation. Only 24% mentioned that some of their classroom practices were intentionally designed to contribute to university readiness.

The most frequently mentioned behaviour – by 68% of teachers – consisted of answering questions from students about specific degree programmes in the teacher's field. Compared with asking students about their plans for future study, which half of the teachers did, it seemed that teachers tended to leave the initiative to the students to talk about their future after secondary school and the associated possibilities. For example economics teacher T12 explicitly noted: '[Giving information about degree programmes] is usually demand-driven, so if students come to me with questions I answer them. You don't do it on your own initiative'. A mathematics teacher (T11) explained what this interaction usually looks like: 'Students approach me very often, like "what do you think about this [degree programme], and what do you think about this one?" They ask me mainly about science degree programmes. They ask what I know about them, what they have to do, what the access criteria are, that's mostly it'.

Half of all teachers sought to promote students' research skills and an attitude of inquiry. Some teachers gave examples of relatively minor efforts, such as letting students practice developing good research questions, whereas others mentioned more substantial notions, such as when a chemistry teacher revealed (T50): 'What we are currently doing as a team of teachers – well, we've only been doing it for a year now – is to shape the transition in a better way and to set up a research line through the curriculum from grade 7 up to 12'.

A little less than half tried to promote students' thinking skills, often in relation to analytical and critical thinking skills. Dutch teacher T3 pointed out: 'Especially when you are working with texts, that we don't only pay attention to what does it say and what's it about, but also what does it mean, and do we agree, and is the writer's statement correct?'

Two behaviours were each mentioned by 44% of teachers: promoting study skills and giving information about studying at university in general. To promote study skills, teachers mostly dealt with planning skills and how to study large amounts of text, such as by showing students how to write a good summary, as economics teacher T34 explained: 'Making a good summary is not that easy. It's more than just taking over the structure of the book and copying. So I say: "Later on [in university] you cannot make summaries like these. You will have to ask yourself: what do I know and what not, to which aspects do I have to pay attention, what is the common thread"'. Another common preparation practice was to provide students with information about studying at university in general, to give them an idea of what to expect. Usually, teachers would integrate this kind of information into their everyday teaching. English teacher T24 provided an exemplary quote: 'When students complain about the amount of subject matter they have to study for a test, I tell them: "This is to prepare you for how you have to do it later [in university]". And I also tell them that for a test in university I sometimes had to study five books'.

Teacher behaviours to promote students' independence, as performed by 42% of them, typically were described as follows: 'In grade 12 I don't take them by the hand anymore regarding the subject matter. I do tell them in a timely manner what they have to study, but I'm not going to check it in between. Sometimes this means that they have to study three chapters for one test, and I do not offer these chapters in bite-sized parts anymore' (T24, English teacher).

Finally, the last practice mentioned often enough to appear as a theme (15%) was paying attention to the development of students' language skills, which usually related to requirements that university students would need to read, write, and present in Dutch and English. Thus, 'In grade 10 we have them write a research paper now which has to be linked to their coursework, so that they get acquainted with the vocabulary of the discipline they may study in university, because at university much is in English' (T13, English teacher). Training students in language skills represented the practice that exhibited the largest difference across disciplines: Half of the humanities teachers paid attention to language skills, but only 6% of science and none of the social sciences teachers did so.

4.3. Teachers' beliefs about their role in university preparation

Table 4 outlines four themes that emerged regarding role perceptions. When teachers indicated if they considered preparing students for university as part of their role, two-thirds of our respondents agreed, with comments such as 'I also tell the students: "I have a responsibility towards you guys to prepare you for what's next"' (T20, physics and chemistry teacher) or 'Of course that is a part of the job, you want to deliver them well' (T19, physics and mathematics teacher). The most common elaboration by teachers

Table 4
Role perception themes.

Role perception	Percentage of teachers who mentioned it
University preparation is a teacher's job.	66
Preparation for the examination equals university preparation.	26
Teacher does not play a role in programme choice.	26
Teacher should do more than examination preparation.	22

Table 5
Barrier themes.

Category	Themes	Percentage of teachers who mentioned it
Perceived barriers	Final examination	40
	Lack of time	38
	Not knowing what universities expect	36
	Students' lack of interest or level	34
	Not all students pursue a degree in the teacher's field	24
Wishes	More coordination and collaboration with universities	46
	More attention to university preparation in general	20
	More information on degree programmes	16
	More attention to promoting students' attitude	8

who did not regard university preparation as part of their job was a belief that by preparing students for the final examination, they automatically were preparing them for university education (mentioned by 26% of respondents). As French teacher T28 put it: 'My responsibility is mainly to make sure they start the final examinations well-prepared and these examinations are preparatory for university education, so that's it.' Comparably, mathematics teacher T38 said: 'Our job is to deliver a good secondary school student, not a good university student'. In contrast, 22% of teachers not only considered university preparation part of their task but explicitly mentioned that it entailed more than preparing students for the final examination, which would not give them resources for studying at university, as T19 (physics and mathematics teacher) explained: 'Look, as a teacher you could say you don't really care about the subject, I am only going to practice making the examinations for three years. Then maybe they'll do fantastic on the examinations, but if they've actually learned physics, that's the question. And I think we should be there for all those students who will study aerospace engineering or mathematics or physics or chemistry, or whatever degree.' Finally, role perceptions related to students' study choice too: 26% of teachers explicitly mentioned that the process of choosing a degree was not part of their responsibility. Geography teacher T25 put it like this: 'I think it [providing guidance for the choice of a degree programme] is really a counsellor's task. I am not sufficiently equipped for that as a teacher'.

4.4. Barriers to university preparation

Table 5 presents themes related to barriers that teachers experienced that hindered them from paying more explicit attention to university preparation, as well as their preferences for improving students' university readiness. In particular, 40% of teachers mentioned that the final examinations undermined university preparation efforts. A main line of reasoning stated that passing the examinations was required to even be eligible for higher education, so preparing students to pass them is the priority. According to German teacher T2, 'When they're in the final grade of secondary school, I think as a teacher you should prepare them for the examinations, because these are the entrance ticket to further education. And in this last phase first and foremost we work towards that, because if they don't graduate, they won't make it to university anyway'. An analysis of their words and the emotions expressed made it clear that some teachers found this limitation frustrating: 'Those examinations are sacred, everything's about them and nobody thinks any further. I see them as a means; they see them as the goal. The goal is: What do you want in your life? But secondary school is disabled in the sense that everything is focused on the examinations, and after that there's nothing. Nobody thinks past the examinations' (T36, biology teacher). Furthermore, many teachers cited the influence of the Inspectorate of Education, which keeps track of schools' graduation rates and students' grades on the final examinations, then makes these data publicly available. Schools are accountable for their examination results, but not for how students fare in higher education, so as Dutch teacher T15 says: 'The examination requirements always hold priority. Bad results will be hold against us. So we do focus on them a lot'. Even curricula might be tied to examination requirements, such that teachers have little room for 'extras', but 'If I would have more time, I could do a lot more. But you always have the issue of having to finish the programme. It really has to be finished in six years. So there's not much time for other things then' (T50, chemistry teacher).

In a related finding, 38% of teachers mentioned a lack of time in general as an obstacle to university preparation, as Dutch teacher T4 explained: 'Well, our lessons are 45 min, which means that if you really want to figure something out, or go into depth, you don't have the time for it, because the lessons are too short. I miss that sometimes. Sometimes I think the learning content is very random, while I think that if you want to prepare those children well for university, you need deepening and analysis and whatever, and you need time to achieve that'.

A third obstacle, mentioned by more than one-third of the teachers, was that they did not know what the universities expected, as Dutch teacher T14 indicated: 'But look, if the university would say "hey guys, we miss this or that", then we could see if we could offer that. At the moment I don't know if that is the case, if I have to change something'. Biology teacher T47 shared this doubt and gave an example: 'I thought maybe I have to do certain things differently, or pay more explicit attention to some things, but I also think like "well, what do they [university] expect from me?" So in that sense, yeah, I don't know if it is important to pay more attention to research, because that is more now [in university] than it used to be. What would the university like? I think that is a question that needs to be asked'.

Many teachers affirmed that they had specific wishes regarding university preparation. By far the most frequent wish was more coordination and collaboration with universities, which related directly to the perceived obstacle of not knowing what universities

expect.

4.5. Other influences: background factors and up-to-date knowledge

During the interviews, 58% of the teachers referred to their own experiences at university, which clearly influenced their beliefs and practices. For example, mathematics teacher T11 recounted: ‘During my time at university I learned a lot of research skills and I also transfer them to my students’. Furthermore, 24% of teachers talked about their own children’s university experiences and how they functioned as triggers, making them more aware of the secondary school teacher’s role in university preparation. Thus, teachers’ experiences at university and whether they had children attending university constituted important background factors.

Pertinent knowledge that influenced teacher beliefs and practices was the level of familiarity with the current university environment and the degree programmes in the teacher’s field. Specifically, 48% of teachers mentioned they remained quite familiar with the degree programmes offered in their field. These teachers also talked more often to students about the available programmes and were better able to answer students’ questions. In contrast, the 42% of teachers who explicitly admitted they were not up-to-date on the current programmes referred students to the guidance counsellor with questions about degree programmes.

5. Conclusion and discussion

5.1. Discussion of main findings

Many students have difficulties coping with the transition from secondary to postsecondary education, so to address this concern, the current study investigated teachers’ beliefs and practices regarding university readiness and preparation. First, we considered what teachers perceived as important aspects of university readiness, using Conley’s (2014) four categories to classify these aspects. Teachers referred mostly to learning skills and strategies as necessary attributes to be successful in university, specifically study skills, independence and perseverance.

Second, we sought to know whether teachers paid attention to university preparation and how. Many teachers admitted during the interviews that university preparation was not something they thought about consciously, even though all of them could – when asked – identify specific practices that might be seen as university preparation. The preparation practices most often described by teachers involved the category of transition knowledge and skills: Teachers answered students’ questions about studying at university and specific degree programmes, and they asked students about their future plans. Furthermore, teaching research skills and instilling an attitude of inquiry were mentioned by half of the teachers. The sense that teachers did not consciously pay attention to university preparation is in line with our finding that the most frequently mentioned practice resulted from the initiative of the students (i.e., answering their questions). Thus, it appears that university preparation is not high on the agenda in secondary schools or consciously in the minds of teachers. Furthermore, the combined results regarding the first two research questions reveal that the aspects that teachers mentioned most often as important aspects of readiness were not necessarily the same as the preparation practices they mentioned most frequently. In contrast to research about teacher beliefs (Borg, 2001; Nespor, 1987), teachers’ beliefs about aspects of university readiness did not act as guides to their university preparation practices in the classroom. The biggest discrepancy emerged for perseverance: 44% of teachers mentioned it as an important aspect of readiness, but only 2% tried to encourage its development. We also uncovered notable discrepancies for curiosity, which 40% found necessary but only 5% addressed it in the classroom. A reason for this might be that these teachers regard perseverance and curiosity as stable student characteristics that they cannot influence, as suggested by a perceived obstacle for university preparation that 34% of teachers mentioned: students’ lack of interest or ability.

Our third research question asked about teachers’ beliefs regarding their role in preparing students for university. Two-thirds of the respondents believed university preparation was their job, when asked explicitly. However, we also found vast differences among teachers regarding their role perceptions. Some teachers held strong opinions that university preparation was a crucial goal of secondary school, beyond preparing students for the national examinations; a handful of teachers even referred to the examinations as a burden that they would rather eliminate. However, other teachers did not regard university preparation as one of their tasks, because they thought it was equivalent to examination preparation: They assumed that graduation from secondary school implied the student was equipped for university success.

Finally, we investigated if teachers experienced barriers to preparing students for university and how such barriers might be overcome. At least one-third of teachers cited final examinations, lack of time, not knowing what universities expect, and students’ lack of interest or ability. Their solutions matched the barriers: They sought more coordination and collaboration with universities and more information on current degree programmes. Moreover, they wanted more time in general for university preparation, which related to the barriers of both a lack of time in general and the need to devote substantial time to preparing for the final examinations. The desire to pay attention to developing a more positive attitude in students matches the issue of students’ lack of interest. Previous research has also shown that teachers’ beliefs about a lack of student ability and motivation can prevent those teachers from implementing certain learning or instructional approaches. Roehrig and Luft (2004) and Wallace and Kang (2004) cited this point as the most common constraint to uses of inquiry instruction and complex laboratory assignments. Final examinations and students’ lack of interest and ability were barriers that the science teachers in Friedrichsen’s (2002) study also mentioned when talking about college preparation.

Two other themes emerged from the data as influences on college preparation: background factors and knowledge. Relevant background factors were the teacher’s own experiences with the transition to university and/or having children that attended

university. The influence of these factors on whether and how teachers attend to university preparation likely reflects the absence of specific guidelines for university preparation, as well as its absence from the national curriculum and from teacher education programmes. Thus, teacher preparation practices vary with their idiosyncratic experiences. Teachers who suffered through a difficult transition themselves devoted more attention to university readiness than teachers who did not remember having had any issues. Teachers' own experiences are subjective, and among older teachers, they also may be out-dated, which imply the possibility that teachers give their students biased images. For example, many teachers referred to large lecture halls and professors who did not know their students, but the current university climate is shifting toward small-group teaching and methods that increase student participation and engagement (Brouwer, 2017). Inaccurate or out-dated descriptions of the university environment might not contribute to students' development of realistic expectations. In essence, this issue relates to teachers' lack of knowledge about what universities expect from students and insufficient information about current degree programmes, leaving them with no other option than to draw on their own experiences. Hence, teachers may be 'experience experts' because they have attended university themselves, but this does not necessarily provide them with sufficient knowledge and skills to prepare students for university.

The overall picture makes clear that there are notable differences among teachers in their university preparation practices, and that most practices are not explicit or conscious. Moreover, the link between the aspects that each teacher found important for university readiness on the one hand and the aspects that were part of his or her university preparation practices on the other hand was not always direct or one-to-one. Teachers' university preparation practices are thus not clearly guided by beliefs about which aspects make students ready for university. However, a connection between role perception and university preparation was evident. Teachers who strongly believed university preparation was part of their job more often consciously and explicitly paid attention to it in their classrooms. These teachers often had more up-to-date knowledge about the university environment and degree programmes in their field. Moreover, they were more likely to circumvent barriers, such as by devoting time to it, despite the pressure of having to prepare students for their final examinations.

5.2. Limitations and recommendations for further research

We interviewed teachers about their practices, which represents a limitation in two main ways. First, what teachers say they do may not match what they actually do in the classroom. A more reliable sense of teacher practices would require observations. Second, teachers' university readiness behaviours might not be perceived as such by students, due to the discrepancy between the curriculum delivered and that received. Such a gap is especially likely for implicit practices mentioned by teachers, such as having students engage in their own planning to contribute to the development of study skills they will need in university. If this goal is left implicit, students may not see the connection to their university preparation, in which case it may not contribute to their university readiness. Further research might ask students about their perceptions of teachers' university preparation practices. If by such triangulation a more reliable picture about university preparation is obtained, the next step should be to investigate whether these practices ease the transition, and, if so, what practices are the most helpful. This requires a longitudinal study design that follows a cohort of students from the upper grades of secondary school to the first year of university.

The sample in this study also had its limitations. Teacher participation was voluntary, so any teachers who agreed to participate already may have been more interested in the topic of university preparation, with clearer conceptions about what university readiness entails, and more attentiveness to it in their classroom. This selection bias may have influenced our results, although we also encountered many teachers in our sample who said they were not consciously preparing students for university and others who did not believe it was their job to prepare students for university. Another limitation of this convenience sample was that the distribution of teachers across disciplines was not representative: There were many humanities teachers and few social sciences teachers. We thus cannot draw firm conclusions about possible differences across the disciplines, despite some indications of the presence of such differences. For example, a relatively high percentage of science teachers mentioned developing research skills as a university preparation practice, but language teachers were substantially more likely to spend time developing students' language skills (e.g., writing skills). It would be interesting to pursue a more evenly divided teacher sample, to systematically investigate the possible discipline differences in university preparation.

5.3. Implications

The implications for practice that we draw from this study reflect the resolutions and wishes mentioned by teachers. First, more coordination and collaboration between secondary schools and universities is needed. Both these parties are involved in the transition, and they need each other. At a minimum level, the coordination should consist of mutual information provision, such that teachers receive up-to-date knowledge about university learning in general, what universities expect from first-year students in terms of general knowledge and skills, and degree programmes in their field, because we saw that having attended university themselves is not sufficient for teachers to prepare students adequately. With such realistic, adequate, and up-to-date information, teachers can help their students set realistic expectations about studying and the degree programmes. This latter, subject-specific role is highly relevant for teachers, who, more so than guidance counsellors, can act as 'ambassadors' for their field. This role is in demand and expected from teachers, as shown by our finding that two-thirds of teachers mentioned students coming to them with questions about degree programmes related to the teacher's school subject. Moreover, many teachers expressed positive feelings toward having conversations with students who were considering a degree programme in their field. On the other side, for university lecturers, counsellors, and programme coordinators, it could be useful to obtain a better view of what happens in the final years of secondary education, so that they have a clearer sense of the transition challenges students are likely to encounter and can take measures to

resolve them, such as by developing a transition pedagogy in their first-year programme (Kift, Nelson, & Clarke, 2010).

Coordination and collaboration between schools and universities also should entail providing schools with feedback about how their students are doing. If information about students' progress in university were to flow back, secondary schools could pinpoint and address possible problems. For example, if many students are switching degree programmes, the school would know that it needs to improve the guidance it provides in the study choice process. Some schools already collect these data and keep track of their alumni's progress, but it is not yet a nation-wide habit.

Second, to address the lack of time, it would be helpful to find ways to integrate university preparation into regular lessons. Here, the issue of examinations and national curricula comes into play, because regular lessons focus heavily on this curriculum and preparing for the examinations. Noting the many critiques we heard of these examinations and how they fail to reflect what is needed to be successful in university, we perceive a need for a national discussion to think critically about the goal of these examinations and whether they could be better aligned with what students need to be ready for university. This issue is not exclusive to the Netherlands; in the United States, scholars have noted deep concerns that state-level and national learning standards do not align with college curricula or professor expectations (Smith & Wertlieb, 2005).

Third, many teachers were not consciously aware of their role in university preparation; much of what they did was unconscious and implicit. It can be seen as positive that teachers could easily mention classroom practices that in their eyes would contribute to university readiness, although they did not consciously plan these practices in the light of university preparation. This means that things are happening in secondary school classrooms that contribute to students' readiness for the transition. However, a more conscious approach, i.e., planning and designing activities with the explicit goal of university preparation, would likely improve these practices and students' readiness. Moreover, many teachers believed that completing secondary school courses implied a student's readiness for further education, a conception that also is common in the United States (Kirst & Bracco, 2004). The topic of university preparation thus needs to become more explicit and prominent, so that all teachers are clearly aware that it takes more than completing secondary school courses to be successful in university and that they could play a role in preparing their students for the transition.

Acknowledgements

We thank the master students of the Teacher Education programme for their assistance in data collection and transcription during the spring of 2016 and all teachers who participated in the interviews.

References

- Astin, A. (1999). Student involvement: A developmental theory for higher education. *Journal of College Student Development*, 40(5), 518–529.
- Borg, M. (2001). Teachers' beliefs. *ELT Journal*, 55(2), 186–188.
- Brouwer, J. (2017). *Connecting, interacting, and supporting. Social capital, peer network and cognitive perspectives on small group teaching. Doctoral dissertation*. Enschede: Ipskamp Printing.
- Bussemaker, J., & Dekker, S. (2016). *Loopbaanoriëntatie en –begeleiding [Career orientation and guidance] [Letter of government]*. [28 September, Retrieved from <https://www.rijksoverheid.nl/documenten/kamerstukken/2016/09/28/kamerbrief-over-loopbaanoriëntatie-en-loopbaanbegeleiding>].
- CBS (Centraal Bureau voor de Statistiek [Statistics Netherlands]) (2016a, January 12). *Meer vwo'ers direct naar de universiteit* [More pre-university students directly to university]. Retrieved from <https://www.cbs.nl/nl-nl/nieuws/2016/02/meer-vwo-ers-direct-naar-de-universiteit>.
- CBS (Centraal Bureau voor de Statistiek [Statistics Netherlands]). (2016b, November 21). <https://www.cbs.nl/nl-nl/achtergrond/2016/47/onderwijs>.
- Calderhead, J. (1996). Teachers: Beliefs and knowledge. In D. C. Berliner, & R. C. Calfee (Eds.). *Handbook of educational psychology* (pp. 709–725). New York: MacMillan.
- Conley, D. T. (2007). *Redefining college readiness*. Eugene, OR: Educational Policy Improvement Center.
- Conley, D. T. (2008). Rethinking college readiness. In B. Barefoot (Ed.). *The first year and beyond: Rethinking the challenge of collegiate transition* (pp. 3–13). San Francisco, CA: Jossey-Bass.
- Conley, D. T. (2014). *Getting ready for college, careers, and the Common Core: What every educator needs to know*. San Francisco, CA: Jossey-Bass.
- De Buck, W. (2009). Studiekeuze, informatiegebruik en studie-uitval in het hoger onderwijs [Study choice, information use and drop-out in higher education]. *Tijdschrift voor Hoger Onderwijs*, 27(3), 147–156.
- Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research and Development*, 53(4), 25–39.
- Fang, Z. (1996). A review of research on teacher beliefs and practices. *Educational Research*, 38, 47–65.
- Friedlander, L. J., Reid, G. J., Shupak, N., & Cribbie, R. (2007). Social support, self-esteem, and stress as predictors of adjustment to university among first-year undergraduates. *Journal of College Student Development*, 48(3), 259–274.
- Friedrichsen, P. J. (2002). *A substantive-level theory of highly-regarded secondary biology teachers' science teaching orientations. Doctoral dissertation*. [Retrieved from https://etda.libraries.psu.edu/files/final_submissions/4870].
- Haggis, T. (2006). Pedagogies for diversity: Retaining critical challenge amidst fears of 'dumbing down'. *Studies in Higher Education*, 31(5), 521–535.
- Heublein, U., Ebert, J., Hutzsch, C., Isleib, S., König, R., Richter, J., & Woisch, A. (2017). Zwischen Studienerwartungen und Studienwirklichkeit. Ursachen des Studienabbruchs, beruflicher Verbleib der Studienabbrecherinnen und Studienabbrecher und Entwicklung der Studienabbruchquote an deutschen Hochschulen [Between expectations and reality. Causes of dropout, careers of dropouts, and developments of the dropout rate in German higher education]. Hannover: Deutsches Zentrum für Hochschul- und Wissenschaftsforschung. Retrieved from http://www.dzhw.eu/pdf/pub_fh/fh-201701.pdf.
- Hurtado, S., Han, J. C., Sáenz, V. B., Espinosa, L. L., Cabrera, N. L., & Cerna, O. S. (2007). Predicting transition and adjustment to college: Biomedical and behavioral science aspirants' and minority students' first year of college. *Research in Higher Education*, 48(7), 841–887.
- Inspectie van het Onderwijs [Inspectorate of Education] (2017). *De staat van het onderwijs: Onderwijsverslag 2015/2016* [The current state of education. Educational report 2015/2016]. Retrieved from <https://www.onderwijsinspectie.nl/onderwerpen/staat-van-het-onderwijs/documenten/rapporten/2017/04/12/staat-van-het-onderwijs-2015-2016>.
- Jansen, E. P. W. A., & Bruinsma, M. (2005). Explaining achievement in higher education. *Educational Research and Evaluation*, 11(3), 235–252.
- Jansen, E. P. W. A., & Suhre, C. J. M. (2010). The effect of secondary school study skills preparation on first-year university achievement. *Educational Studies*, 36(5), 569–580.
- Kagan, D. M. (1992). Implications of research on teacher belief. *Educational Psychologist*, 27, 65–90.
- Kift, S. M., Nelson, K. J., & Clarke, J. A. (2010). Transition pedagogy: A third generation approach to FYE: A case study of policy and practice for the higher education

- sector. *International Journal of the First Year in Higher Education*, 1(1), 1–20.
- King, N., & Horrocks, C. (2010). *Interviews in qualitative research*. London: Sage.
- Kirst, M. W., & Bracco, K. R. (2004). Bridging the great divide: How the K-12 and postsecondary split hurts students, and what can be done about it. In M. E. Kirst, & A. Venezia (Eds.). *From high school to college: Improving opportunities for success in postsecondary education* (pp. 1–30). San Francisco, CA: Jossey-Bass.
- Leung, C. H. (2017). University support, adjustment, and mental health in tertiary education students in Hong Kong. *Asia Pacific Education Review*, 18(1), 115–122.
- Lortie, D. (1975). *Schoolteacher: A sociological study*. Chicago: University of Chicago Press.
- Lowe, H., & Cook, A. (2003). Mind the gap: Are students prepared for higher education? *Journal of Further and Higher Education*, 27(1), 53–76.
- McPhail, R. (2015). Pre-university prepared students: A programme for facilitating the transition from secondary to tertiary education. *Teaching in Higher Education*, 20(6), 652–665.
- Microsoft (2017). STEM-vaardigheden onderzoek onder meisjes [STEM skills research among girls]. Retrieved from: <https://blogs.microsoft.nl/technologieenmaatschappij/wp-content/uploads/sites/261/2017/03/STEM-vaardigheden-onderzoek-onder-meisjes.pdf?fromblog=629307>.
- Nespor, J. (1987). The role of beliefs in the practice of teaching. *Journal of Curriculum Studies*, 19(4), 317–328.
- Onderwijsraad [Council of Education] (2015). Kwaliteit in het hoger onderwijs [Quality in higher education]. Retrieved from <https://www.onderwijsraad.nl/publicaties/2015/kwaliteit-in-het-hoger-onderwijs/volledig/item7277>.
- Pajares, M. F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research*, 62(3), 307–332.
- Reid, M. J., & Moore, J. L., III (2008). College readiness and academic preparation for postsecondary education. Oral histories of first-generation urban college students. *Urban Education*, 43(2).
- Richardson, M., Abraham, C., & Bond, R. (2012). Psychological correlates of university students' academic performance: A systematic review and meta-analysis. *Psychological Bulletin*, 138(2), 353–387.
- Ritchie, J., & Spencer, L. (1994). Qualitative data analysis for applied policy research. In A. Bryman, & R. G. Burgess (Eds.). *Analyzing qualitative data* (pp. 173–194). London: Routledge.
- Robbins, S., Lauver, K., Le, H., Davis, D., Langley, R., & Carlstrom, A. (2004). Do psychosocial and study skill factors predict college outcomes? A meta-analysis. *Psychological Bulletin*, 130(2), 261.
- Roehrig, G. H., & Luft, J. A. (2004). Constraints experienced by beginning secondary science teachers in implementing scientific inquiry lessons. *International Journal of Science Education*, 26, 3–24.
- SLO (Stichting Leerplan Ontwikkeling [Foundation for Curriculum Development]) (2016, May 12). LOB in het PTA [Career orientation and guidance in the testing and completion plan]. Retrieved from <http://handreikingschoolexamen.slo.nl/beroepsgerichte-vakken/lob/pta>.
- Smith, J. S., & Wertlieb, E. C. (2005). Do first-year college students' expectations align with their first-year experiences? *NASPA Journal*, 42(2), 153–174.
- Smith, W. L., & Zhang, P. (2008). Perceived factors facilitating students' transition from high school to college. *Michigan Sociological Review*, 22, 19–40.
- Tinto, V. (1993). *Leaving college: Rethinking the causes and cures of student attrition* (2nd ed.). Chicago, Illinois: The University of Chicago Press.
- Van der Meer, J., Jansen, E., & Torenbeek, M. (2010). 'It's almost a mindset that teachers need to change': First-year students' need to be inducted into time management. *Studies in Higher Education*, 35(7), 777–791.
- Wallace, C. W., & Kang, N. (2004). An investigation of experienced secondary science teachers' beliefs about inquiry: An examination of competing belief sets. *Journal of Research in Science Teaching*, 41, 936–960.