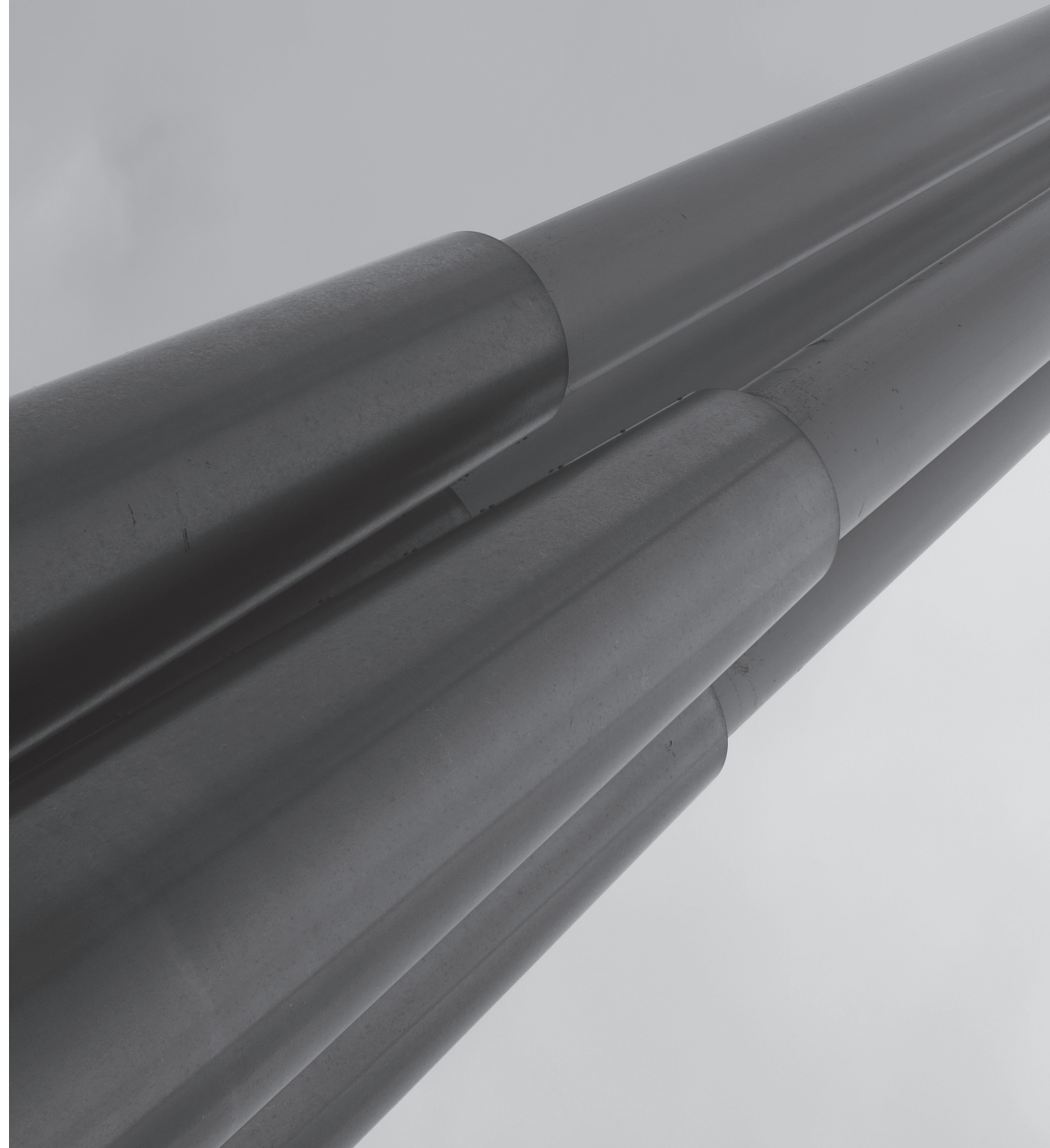Cover Page

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Summary

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Chapter 1: General introduction

While academics, managers and academic developers generally all highly value close connections between research and teaching due to the perceived benefits for student learning, it is not always evident to students how to become engaged in research through the teaching they receive. The way in which the link between research and teaching is articulated by academics and experienced by students not only depends on the mission statement of a particular study programme, but also on the learning activities that the students participate in. The studies included in this thesis all examine various aspects of student engagement in research within the medical domain. In the medical discipline, the integration of research into teaching is deemed to be highly relevant if students are to learn how to conduct research and incorporate research into their professional, clinical decision making, all of which is intended to improve patient care. The notion of student engagement in higher education emphasises ways in which students participate in learning activities as well as how the academic staff provides opportunities for them to become involved. Student engagement in general is, therefore, considered useful in relation to monitoring both areas that need improvement and good practice within study programmes. In line with this, student engagement in research highlights the relevance of the desire to actively involve students in disciplinary research in various ways, with the aim being to promote student learning about research and from research as well as their understanding of how to conduct research. In this dissertation, student engagement in research is conceptualised as promoting student learning through research practices, which is facilitated by how students perceive research to be integrated into teaching as well as student beliefs regarding the value of research for learning and professional practice. Student perceptions of the learning environment are particularly important in terms of fostering student learning outcomes. They influence student achievement and learning outcomes, for example, skill performance, directly and indirectly via the ways in which students approach learning. More precisely, student perceptions of the learning environment influence both their achievement as reflected in their grades and their research skills as reflected in the work they produce. Student perceptions of research involve: (1) participation in research; (2) critical reflection on research findings; (3) motivation for research; and (4) familiarity with staff research. The term 'research integration' is used in this thesis to refer to all learning activities within teaching units in the medical domain in which the fostering of student engagement in research findings and research processes is an essential element.

The context of a curriculum change at the Leiden University Medical Center (LUMC) was considered particularly appropiate for studying student engagement in research. Indeed, student research practices constituted a key element of a curriculum change that aimed to strengthen research-teaching integration. The first two studies (Chapters 2 and 3) included in this thesis were designed to provide insights into the effect of the study programme (e.g., the sequence of courses) on student learning outcomes. Regarding student engagement in research, Chapters 2 and 3 provide valuable insights into the relevance of the study programme as perceived by the students as well as into the quality of student learning outcomes. Previously, strong correlations have been found between student engagement in learning activities and student achievement. The study presented in Chapter 4 aimed to explore relations between student perceptions of research, their beliefs regarding the relevance of research and student achievement. Chapter 5 reports on a study designed to provide in-depth insights into how supervisors foster student learning during students' research projects. This study relates to student engagement in research through its focus on how supervisors guide student participation in purposeful learning activities in which research is integrated. Students' research projects were chosen as a context for studying research-teaching integration, since research projects, for example, undergraduate's and master's dissertations, are common in university education and both have similar learning goals with regard to promoting research competencies such as critical and scientific thinking. Research supervision offers an example of a teaching activity based on the notion that supervision contributes

to student learning about research findings and processes. Particularly in the context of medical education, students' research projects are supervised by PhD students or immediate postdoctorates. This group may especially benefit from support in terms of exploring approaches to supervision and ways of dealing with challenges. The study presented in Chapter 5 hence aimed to provide in-depth insights into how novice supervisors can foster student engagement in practice as well as how this practice may be shaped by dilemmas they face in student-supervisor interaction.

Chapter 2: Authentic research practices throughout the curriculum

The longitudinal study described in Chapter 2 aimed to assess the influence of authentic research practices on student perceptions of research and their beliefs regarding the relevance of research to both practice and learning. The research question was: *What is the influence of authentic research practices, integrated into the study programme in the context of a curriculum change, on student perceptions of research in teaching and on student beliefs regarding the relevance of research for practice and learning during the course of undergraduate medical education?* The inclusion of authentic research practices within every year of the undergraduate study programme was implemented in the context of a curriculum change. A framework for authentic learning was used to describe authentic aspects of the research practices, including: (1) student engagement with real-world professional practice; (2) the opportunity to practice thinking skills; (3) fostering discourse among learners; and (4) elements of students' choice during learning (Rule, 2006). The description of research practices emphasised student engagement with professional practice within research practices in particular. For the data collection, an adapted version of the Student Perceptions of Research Integration Questionnaire (SPRIQ) was used with three cohorts of undergraduate medical students (n = 941). All the students in these cohorts were invited to complete the SPRIQ towards the end of each academic year, after they had completed their research practices. A comparison was made between two student cohorts

studying the changed curriculum (n = 619) and a cohort who studied the previous curriculum (n = 322). An analysis of the data suggested that the students perceived stronger participation in research, stronger motivation for research and a more critical reflection on research findings, over the years of their study, particularly within the changed curriculum. Furthermore, the data suggested that authentic research practices do not only articulate tangible research aspects to students, but also provide space for teachers to familiarise students with the research activities of staff. Students who followed the previous curriculum found research to be less relevant to their learning over time, while those who followed the changed curriculum exhibited an increased belief in the relevance of research to learning towards the end of the study programme. The findings suggest that student beliefs regarding the value of research to professional practice were less strongly related to the study programme than student perceptions of research in teaching. This implies that the active involvement of students in research through authentic research practices within the study programme does not necessarily demonstrate the practical relevance of research to students. It also suggests that learning outcomes associated with the integration of research, other than beliefs regarding research and a programmatic approach to the implementation of authentic research practices could promote student engagement in research. One way of achieving this would be to focus on learning activities that allow students to relate their perceptions of research within teaching to their beliefs regarding research in practice to promote connections between rather individual pieces of knowledge concerning the use of research in medical professions.

Chapter 3: Research integrated into the first-year curriculum

After assessing the influence of the curriculum on student perceptions of research, as well as their beliefs regarding the relevance of research to both learning and practice, in Chapter 2, the potential influence of the study programme on student learning outcomes was examined in Chapter 3. The first research question of the study presented in Chapter 3 was: *What is the influence of a curriculum change placing*

a strong emphasis on research integration into the first-year medical study programme on student learning outcomes, especially student products and test scores within the domain of research? The second research question was: *What is the influence of a curriculum change placing a strong emphasis on research integration into the first-year medical study programme on student perceptions of research in teaching and on student beliefs regarding the relevance of research for practice and learning?* The first-year study programme was chosen because studying within a research environment at the university is a relatively new experience for first-year students. This makes it challenging for teachers to incorporate research into their teaching in ways that promote student learning outcomes. This study was conducted in the context of a curriculum change that aimed to strengthen research integration. When following the changed curriculum the first-year undergraduates participated as researchers in projects related to an early clinical experience in nursing homes. For both the previous and the changed curriculum, the students also participated in an ECG-practical in which they collected data, conducted statistical analyses and wrote a research report. In order to investigate student learning outcomes, the reports per curriculum were rated blindly and anonymously using a scoring rubric. Data were also collected regarding the scores for research-related items on a national progress test. The differences in the scores for both the reports and the test items suggest that students who followed the changed curriculum wrote better reports and performed better in relation to the test items. The SPRIQ was used to compare the student perceptions of research integration and their beliefs regarding the relevance of research to learning and practice between the curricula. The findings suggest that first-year students who followed the changed curriculum (n = 485) perceived stronger participation as researchers, stronger motivation for research, more critical reflection on research and a stronger familiarity with staff research than students who followed the previous curriculum (n = 261). The findings of this study hence suggest that a curriculum change that aimed to strengthen research integration contributed to both first-year student perceptions of research integration and their learning outcomes within the domain of medical research. The findings add to the knowledge base on the integration of research into medical education by indicating that student learning can benefit from a focus on student perceptions of research in the context of teaching as well as from focusing on specific, research-related learning outcomes.

Chapter 4: Student perceptions, beliefs concerning the value of research and achievement

Chapter 2 explored relations between study programmes, student perceptions of research and student beliefs regarding the relevance of research, while in Chapter 3 this investigation was extended by including specific, research-related learning outcomes. The study presented in Chapter 4 aimed to provide insights into relations between student perceptions of research, beliefs regarding the relevance of research and a generic learning outcome, namely student achievement. This was based on the notion that student perceptions of the learning environment not only influence their research skills as reflected in the work they produce, but also their achievement. The research question addressed in Chapter 4 was: *To what extent are student achievement, specifically grade point average, and student beliefs regarding the importance of research related to ways in which students perceive research in the first year of undergraduate medical education?* The grade point average (GPA) was examined in relation to student perceptions of research in order to determine the extent to which the research intensity of the student programme was reflected in their GPA. The SPRIQ was administered to 261 first-year medical undergraduates in one study programme. The study programme mainly consisted of theoretical classes augmented by small-group work and short patient encounters. As part of the first-year study programme, the students participated in an ECG-practical in which they collected and analysed data and then reported their findings in writing. The findings suggest that student achievement was more strongly related to their beliefs regarding the relevance of research to practice than to student perceptions of research. First-year medical students clearly recognised research as being integrated into their teaching, found research motivating for their learning and considered research to be relevant to their future practice. Student motivation for research correlated strongly with familiarity with staff

research and student beliefs regarding the relevance of research for learning and practice. A moderate correlation was found between student motivation to both research and student achievement. The findings of this study suggest that, in order to promote student achievement, emphasis should be placed on learning activities that aim to foster student beliefs regarding the relevance of research to practice.

Chapter 5: Supervision practices and the dilemmatic space within research supervision

Research supervision during students' research projects, for example, undergraduate's and master's dissertations, can be considered a teaching activity, since it is assumed that students learn from conducting research under supervision, from engaging in research processes and from their supervisor's feedback. Based on the notion that supervisors learn to focus on student understanding in interaction with the students, Chapter 5 reports on a study investigating novice supervisors' practices during student-supervisor meetings. The concept of teacher noticing is explored in this study in the context of research supervision. Furthermore, research supervisors can have multiple goals simultaneously during student-supervisor interaction which may affect their pedagogical decisions and which are negotiated in a dilemmatic space. This study aimed to explore relations between novice supervisors' practices and the dilemmatic space in which they make their pedagogic decisions. The research question was: *How do supervisors foster student learning in students' research projects in medical bachelor and master education and what is the relation between research supervision practices and the dilemmatic space in which novice supervisors negotiate research supervision?* Twelve stimulated recall interviews were conducted with supervisors of students' research projects in the medical and biomedical sciences. The interviews took place immediately after an individual student-supervisor meeting. The results of the analysis of the interview transcripts suggest that novice supervisors use five practices to foster student learning (1) fostering motivation;

(2) giving directions; (3) promoting knowledge construction; (4) thinking along, and (5) creating student awareness. In addition to the identified practices, the supervisors mentioned the actors who are involved in the students' research projects, namely themselves, the student and others. In addition to practices and actors supervisors mentioned the planning of the project with the goal of timely completion and the aims of research supervision. In an additional analysis the transcripts were used to explore the concept of a dilemmatic space within the data. Four kinds of dilemmas were revealed, namely supervisors' questions regarding regulation, student needs, the student-supervisor relationship and the supervisors' professional identity. Promoting knowledge construction as a practice and giving the student directions were described across the four dilemmas. It was found that the supervisors mainly provide directions within the space of fostering student regulation. Fostering student motivation was reflected in relation to dilemmas involving student regulation, difficulties in interpreting student needs and maintaining the student-supervisor relationship. The aims of supervision were mentioned in relation to supervisors' professional identity.

Chapter 6: General conclusions and discussion

In Chapter 6 the main research findings are summarised, general conclusions are offered, the strengths and limitations of the research are described, and suggestions are put forward for both future research and educational practice. The general conclusions integrate the findings of the separate studies and hence they are categorised into conclusions regarding the following themes; (1) study programme; (2) teaching practice; (3) student perceptions and beliefs; and (4) student learning.

Study programme

- The study programme contributed to five aspects of student engagement in research: (1) critical reflection on research findings; (2) familiarity with staff

research; (3) student motivation for research; (4) student participation in research; (5) research-related student learning outcomes (Chapters 2 and 3).

- The study programme was more closely related to student perceptions of research integration than to student beliefs regarding the relevance of research for professional practice (Chapters 2 and 3).

Teaching practice

- Teaching practices that render the relevance of research explicit to students were found to mainly focus on using staff research, reflections on previous research findings and fostering motivation for research (Chapters 4 and 5).
- Teaching practices within medical education emphasised both intangible aspects of research, for example, critical reflection on research findings, motivation for research and familiarity with staff research and tangible aspects of research integration, for example, student participation (Chapters 4 and 5).

Student perceptions and beliefs

- Student perceptions of research as integrated into teaching depended more strongly on their beliefs regarding the relevance of research to learning than on student beliefs regarding the relevance of research to practice (Chapters 2, 3 and 4).
- Student beliefs regarding the relevance of research were mainly fostered via the promotion of student motivation for research through teaching (Chapter 4).

Student learning outcomes

- Context- and discipline-specific student learning outcomes, for example, student research products and research-related test items, were a strong indicator of student engagement in research within a study programme, in contrast to students' generic achievement, such as their GPA (Chapters 3 and 4).

Practical and theoretical implications

Professional practice both in medicine and higher education can benefit from further studies concerning student engagement in research. First, future studies of professional practice in medicine should focus on how engagement in research develops across transitions as well as how it influences patient care. For example, how do novice medical doctors integrate research into their professional role? Second, further studies can deepen our understanding of student engagement in research by exploring relations between the actual time, effort and other resources invested by both students and teachers in research integration activities and student perceptions of research in various disciplines. Third, greater importance should be placed on professional learning in the context of the design and implementation of curriculum changes intended to promote student engagement in research. In most cases, university teachers from various departments need to collaborate and adapt their teaching practices to foster student engagement in research.

The practical implications of the studies in this dissertation are discussed in relation to study programmes and teaching. The results of the studies suggest that research integration practices should be designed to allow students to have ample opportunities to engage in a wide variety of research. This means that educational directors and programme managers should strive to incorporate a variety of research approaches into teaching so as to present a broad representation of the field to students. The next step in the curriculum design should aim to promote coherence with regard to research integration practices within the study programme, which means that study programmes should facilitate students' integrative learning experiences in research in addition to the rather fragmented research practices within courses. Furthermore, the instruments used in the studies presented in Chapters 2 to 4 can be used to gain insights into the research-intensiveness of a study programme from which adaptations to learning activities may follow.

With regards to teaching, it may be helpful to encourage students to make their beliefs regarding the relevance of research explicit. For example, by comparing

their ideas to the experiences of researchers and professionals in the field. When it comes to professional development initiatives in higher education, learning activities that enable both novice and experienced supervisors to connect principles of research supervision to their practices should be implemented. Findings from the study presented in Chapter 5 suggest that the use of video recordings of supervision meetings can be useful in terms of achieving this goal.

In conclusion, the potential of current and future studies into student engagement in research is emphasised in light of trends in both higher and medical education that will continue over the coming years. Further studies of student engagement in research in medicine could deepen our understanding of connections between research and teaching in higher education in general. In medicine in particular, further investigation of student engagement in research could provide insights into how to strengthen connections between research and patient care. Therefore, we encourage researchers who are investigating student engagement in medical education to look beyond disciplinary boundaries.