Chapter 1

General introduction

1. General introduction

1.1 Introduction

Programmes that aim to involve students in research have become increasingly popular in university education worldwide in recent decades (e.g., Brew & Mantai, 2017 in Australia; Healey, Jordan, Pell, & Short, 2010 in the United Kingdom; van der Rijst, Visser-Wijnveen, Verloop, & van Driel, 2013 in the Netherlands). Since the nineteenth century universities have continued to search for a balance between research and teaching (Esteban, 2016; Simons & Elen, 2007). The tradition of providing education through research is often used to indicate this balance, with von Humboldt being considered its main representative. This contrasts with the philosophy of Newman, who placed teaching at the core of the university system (e.g., Esteban, 2016). In contemporary research-intensive university education, the emphasis is on student engagement in research as integrated into teaching, which is considered to be a valuable means of preparing students to function in an increasingly complex society (Boyer Commission, 1998; Brew, 2003, 2010; Clark, 1997; Hattie & Marsh, 1996). Academics value the role of research in higher education and hence work to integrate research into current teaching practices at both research-intensive and teaching-intensive universities (Griffioen & de Jong, 2015; Hu, van der Rijst, van Veen, & Verloop, 2014; Verburgh, Schouteden, & Elen, 2013). It is expected that the trend towards strengthening the functional connections between research and teaching as a means of promoting student learning in a university setting will continue over the coming years (e.g., Fung, Besters-Dilger, & van der Vaart, 2017).

While policy makers, academics, managers and academic developers all place a high value on student engagement in research, attempts to bring research and teaching closer together in order to benefit student learning may be impeded by a number of factors. These factors include national and international policy issues concerning the status of teaching within universities (Halse, Deane, Hobson, & Jones, 2007; Malcolm, 2014), the characteristics of institutional research cultures (Spronken-Smith, Mirosa, & Darrou, 2014; Turner, Wuetherick, & Healey, 2008), the beliefs, knowledge and practices of teachers (Visser-Wijnveen, van Driel, van der Rijst, Visser, & Verloop, 2012) and students' beliefs regarding the purpose of university education (Robertson & Blackler, 2006). Furthermore, student numbers are increasing, while the student population is becoming more diverse (cf. Scott, 2010), which will influence the distance between students' learning experiences and research activities at universities. It could also affect the value of research for both professional practice and learning. These factors shape how research informs student learning, emphasising how the link between research and teaching is articulated by academics and experienced by students.

1.2 Student engagement in research

Studies investigating student engagement are generally concerned with the relations between the time, effort and other relevant resources invested by both students and their teachers, which are intended to enhance the student experience, learning outcomes and development, as well as the performance and reputation of the institution (Trowler, 2010). The concept of student engagement is based on the assumption that learning is influenced by how students participate in learning activities as well as how staff provides them with opportunities to become involved (Coates, 2005). This means that students' level of engagement can be used to monitor areas of good practice as well as areas that are in need of improvement within institutes (Coates, 2010; Kuh, 2009). The promotion of student engagement in higher education in general has various purposes, including explicating the relevance of the curriculum to students and enhancing student learning outcomes (Trowler, 2010). While there is agreement regarding the relevance of student engagement to student learning, this construct still needs to be carefully framed (Kahu, 2013). The concept of student engagement used in this thesis is based on previous work by Bryson and Hand (2008), which suggests that student engagement encompasses student perceptions and expectations of studying, in this case, occur in a research-rich learning environment. Student engagement in higher education generally focuses on specific aspects of

student learning, for example, student participation, interest and involvement in learning (for an overview see Trowler, 2010). This emphasises the relevance of student perceptions of teaching and their beliefs regarding learning to foster student engagement in research, in addition to ways in which teachers foster student learning. The studies presented in this thesis aim to understand student engagement in research. The term *student engagement in research* was chosen in order to emphasise a desire to actively involve students in disciplinary research in various ways, all of which aim to foster student learning about research, learning from research and learning to conduct research (e.g., Hodson, 1992; Healey & Jenkins, 2009).

Based on findings from previous studies concerning student engagement in higher education, student engagement in research is conceptualised in this thesis 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 both learning and professional practice. Student perceptions, beliefs and supervision practices are examined in the context of an undergraduate programme in medicine that strives to promote the integration of research into teaching. This thesis focuses on the perceptions of students and their supervisors, since perceptions of teaching influence knowledge acquisition as well as actual learning and teaching behaviour (Pajares, 1992). Perceived differences in the roles of research and learning in the learning environment may thus result in different actions in relation to learning and teaching in research-rich contexts (e.g., Hu, et al., 2014).

The concepts of perceptions, beliefs and practices are complex and should, therefore, be carefully defined (Pajares, 1992). In this thesis, *student perceptions* refer to the ways in which students experience research via teaching activities. Student perceptions are influenced by student beliefs. Such beliefs are generally referred to as a set of (partly implicit) suppositions or a lens through which students perceive the world, which remains relatively stable over time and courses (Pajares, 1992). The notion of *student beliefs* regarding the relevance of research actually refers to two types of beliefs. First, it refers to the extent to which students believe that research stimulates their learning, that is, beliefs regarding the relevance of research to learning. Second, student beliefs refer to the extent to which students believe that research is relevant to their future professional practice. Moreover, *supervision practices* refer to supervisors' teaching practices within students' research projects that aim to foster student learning through research. Furthermore, the word *teachers* is used to refer to academics who hold a teaching role in general, while the word *supervisors* is used to refer specifically to those who perform a teaching role in students' research projects.

This dissertation focuses on a single institute within the medical discipline. Student beliefs and perceptions of the integration of research into teaching depend on discipline-specific characteristics, for example, the ways in which knowledge is structured as well as shared conceptions of research and teaching within disciplines (Brew, 2003; Smeby, 2000). Medicine is an example of a hard-applied discipline (e.g., Biglan, 1973) in which research skills and attitudes, such as knowledge concerning research designs and a critical approach to knowledge (cf. Neumann, 1994), are important in clinical practice. This is especially true for physicians, since they must stay abreast of advances in the field to continuously improve patient care. In this thesis medicine provides the context for the investigation of research integration with the aim of promoting student engagement in research.

1.3 Theoretical background

1.3.1 The role of research in teaching

There are several reasons why research and teaching should be brought closer together in university education. First, a strong connection between research and teaching is reflected in the traditional and influential philosophies that inform higher education, which suggests that research-teaching integration is a key part of the mission of any university (Esteban, 2016; Robertson & Bond, 2005). Second, research is believed to further high quality teaching within universities (Brew & Ginns, 2008; Deem & Lucas, 2007; Hattie & Marsh, 1996). Third, close connections between research and teaching are seen as important in terms

of helping students to develop the ability to think critically, analyse problems and work in a complex knowledge society (Brew, 2003; Simons & Elen, 2007; Verburgh, Francois, Elen, & Janssen, 2013). Similar ideas are reflected in the literature concerning medical education. Medical teachers combine their roles in research and teaching in diverse ways building upon their academic identity (e.g., van Lankveld, et al., 2017). The combination of research and teaching promotes discussion about the quality of teaching in medical education (e.g., Ahmed, Farooq, Storie, Hartling, & Oswald, 2016; Suwanwela, 1995), which has led to investigations into the intended research competencies and student learning outcomes (Chang & Ramnanan, 2015; Ribeiro, Severo, Pereira, & Ferreira, 2015). Unsurprisingly then, the emphasis in the current research literature is on strengthening the role of research in teaching. In addition to the importance placed on the notion of research integration in order to foster a scientific mindset among students, the stronger integration of research into teaching is considered beneficial for improving teaching practices. In line with the emphasis seen in the existing literature, this thesis focuses on strengthening the role of research within teaching as opposed to, for instance, bringing teaching into research to a greater extent. For the sake of clarity, the term 'research integration' is used to refer to all the learning activities within medical teaching units in which the fostering of student engagement in research findings and processes is an essential element (cf. Healey & Jenkins, 2009).

Despite the general agreement regarding the relevance of research integration, there is still little agreement in terms of how to strengthen research integration within university education. One suggestion in this regard is to focus on the study programme (i.e., the meso level). The findings from previous studies indicate that research integration is influenced by the time allocated for research and teaching, availability of staff and the identification of the relations between the institutional research policy and the study programme (Hu, van der Rijst, van Veen, & Verloop, 2014; Jenkins, Blackman, Lindsay, & Paton-Saltzberg, 1998). Moreover, findings of studies concerning study programmes in medical education indicate that actively engaging in research can foster student outcomes, including research skills and attitudes, although these practices mostly constitute only a small proportion of the student activities (Bierer, Prayson, & Dannefer, 2015; de Oliveira, Luz, Saraiva, & Alves, 2011; Mullan, Weston, Rich, & McLennan, 2014). Other means of stimulating student learning through research integration focus on teaching and learning (i.e., the micro level), investigating the relations between teachers' practices within the classroom and various aspects of student learning. Previous studies have found that student learning is influenced by, for instance, the nature of the research integration practices and teacher beliefs regarding research and teaching (Schouteden, Verburgh, & Elen, 2014; Visser-Wijnveen, van Driel, van der Rijst, Verloop, & Visser, 2010). A common characteristic of these previous studies, whether at the meso or micro level, is the need to explicitly emphasise research in a way that stimulates student learning in contexts in which teaching, research and learning are connected, as opposed to more implicit ways of promoting student learning. However, engaging students in research practices is rarely that straightforward.

Within research-intensive university education in general, staff involvement in research is considered vital for stimulating student learning, although research integration can depend on the support received by the staff in relation to integrating research into their teaching as well as on the relevance placed on research integration by academics (Coate, Barnett, & Williams, 2001; Durning & Jenkins, 2005). For this reason it is expected that research and teaching will be more closely connected within study programmes than, for instance, at the institutional or departmental level. Furthermore, focusing on the meso and micro levels is of substantial practical relevance, since education managers, programme directors, academic developers and teachers in higher education in general and medical education specifically all strive to promote student engagement in research. The curriculum, which is comprised of the mainly predetermined teaching units that students follow during the study programme, can function as a starting point for dialogue among all stakeholders regarding research integration, by providing a framework for the inclusion of academics' research interests with a strong focus on student learning (Healey & Jenkins, 2009; Jenkins, 2004; Willison, 2012). When initiating a curriculum change, for example, it is not only the programme's mission that should change but also the study programme itself,

with student learning activities following on from this. At the same time, good practices within the programme will be reconsidered. The first studies included in this thesis, therefore, focus on the study programme. It can prove challenging for teachers to render teaching-research relations functional. Teachers' uncertainty regarding the extent to which research fits with students' interests and capabilities represents a reason for this (Brew & Mantai, 2017; Zamorski, 2002).

1.3.2 The role of research in medical education

Fostering learning through research integration places an emphasis on the relations between learning experiences and the characteristics of research and knowledge within academic disciplines (Brew, 2003; Visser-Wijnveen, et al., 2012). In hard disciplines in general, knowledge has a hierarchical cumulative structure that may also be reflected in the structure of curricula (Nederlandse Federatie van Universitair Medische Centra [NFU], 2009; Smeby, 2000). The Dutch national curriculum in medicine, as an example of a hard-applied discipline (e.g., Biglan, 1973), emphasises students' knowledge regarding research and research skills during the undergraduate phase, while, students' ability to conduct a research project is emphasised in the master's phase, and fosters the ability to make professional decisions based on research findings as a desirable learning goal (NFU, 2009). Specifically in medical education, these learning goals are related to societal expectations that future medical professionals should be able to both develop knowledge through conducting research and use research findings to enhance patient care (e.g., de Beaufort & de Goeij, 2013). The desired learning outcomes of undergraduate and postgraduate medical education (i.e., specialist training) in the Netherlands and abroad are framed around the necessary competencies of medical professionals (CanMEDS, 2015; GMC, 2015; NFU, 2009). In this thesis the focus is on medical students' perceptions, beliefs and actual learning outcomes, since these variables closely align with the intended learning outcomes.

A recent literature review concerning medical students' research activities (Chang & Ramnanan, 2015) indicated that previous studies mainly reported on data regarding the number of students involved in scholarly research, the development of research skills, students' positive perceptions after their research experiences and the research outcomes (i.e., productivity, research success). Taken together, the results suggest that students' research experiences may contribute to their interest in conducting research. Nevertheless, in most cases, medical students will go on to work as practitioners rather than scientists; hence the research practices applied within the study programme are important in terms of fostering student learning about the use of research in clinical practice (e.g., CanMEDS, 2015; GMC, 2015; NFU, 2009). This thesis aims to fill a gap in the literature by investigating students' contextualised perceptions of research, their beliefs regarding the relevance of research to both practice and learning, the learning outcomes within medical education and supervision practices aimed at fostering student engagement in research among large cohorts of students.

1.3.3 Studies into the research-teaching nexus

Previous studies investigating the so-called research-teaching nexus suggest that the relations between research and teaching within universities are complex. Findings from interview studies indicate that both students and teachers have strongly held beliefs regarding the relationship between research and teaching (Robertson & Blackler, 2006; Visser-Wijnveen, et al., 2012). In contrast, the findings from quantitative studies suggest that there are no empirical relations between teachers' research productivity and students' perceptions of the quality of teaching (Hattie & Marsh, 1996; Ramsden & Moses, 1992; Webster, 1985). A new impetus was given to the discussion of research integration by Healey (2005), who introduced a framework for implementing research into curricula that featured two dimensions (Healey & Jenkins, 2009). The first dimension involves the research elements that are integrated into courses. It extends from the research processes, such as data collection and analysis applied in courses, to the research content intended to improve students' understanding of research findings through coursework. The second dimension concerns the role of students in learning activities. It extends from students' involvement as an audience of research to students involved as participants in research. One of the strengths of this model is the intuitive way in which different modes of research integration

can be distinguished, although it could only be partly related to student and teacher perceptions of research in teaching in both qualitative and quantitative studies (e.g., van der Rijst, Visser-Wijnveen, Verloop, & van Driel, 2013; Visser-Wijnveen, et al., 2012; Visser-Wijnveen, et al., 2016).

In higher education it is generally assumed that student perceptions of the learning environment are key to achieving high quality learning outcomes (Biggs, 1985; Prosser & Trigwell, 2014; Ramsden, 1991). Findings from a large-scale study by Lizzio, Wilson, and Simons (2002) support the proposition that student perceptions influence their learning outcomes, indicating that positive perceptions not only directly influence students' level of achievement but also improve the quality of the learning outcomes (e.g., generic skills). Further, the findings from previous studies concerning learning outcomes associated with research integration in particular suggest that student perceptions of research contribute to specific learning outcomes, for example, students' developing research dispositions, research skills and research awareness (Elton, 2001; Turner, et al., 2008; Visser-Wijnveen, et al., 2012). The learning outcomes associated with research integration are investigated in two chapters of this thesis. In line with previous studies concerning student learning outcomes, both the level of students' achievement and specific learning outcomes were chosen in accordance with the aims of the separate studies included in this dissertation.

Recent studies describing the numerous potential of research integration practices have led to multiple typologies reflecting the teaching approaches (e.g., Griffiths, 2004; Healey, 2005; Healey & Jenkins, 2009; Neumann, 1992; Schouteden, et al., 2014; Verburgh, et al., 2013; Visser-Wijnveen, 2013; Zamorski, 2002; Zimbardi & Myatt, 2014) and instruments used to capture student experiences of research (Spronken-Smith, Mirosa, & Darrou, 2014; Turner, et al., 2008; Roseaux , Verachtert, Spooren, van Petegem, & de Schepper, 2016; Visser-Wijnveen, et al., 2016). Furthermore, student perceptions of research can foster various learning outcomes (Elton, 2001; Visser-Wijnveen, et al., 2012; Turner, et al., 2008). Only very few studies have explored the relations between actual research integration practices, student perceptions and student learning outcomes. Student perceptions of research, for example, have been explored in

relation to teacher beliefs regarding research and teaching (e.g., Visser-Wijnveen, et al., 2012). Yet we still lack the appropriate evidence to evaluate the relation between student beliefs, perceptions and learning outcomes and actual research integration practices.

1.3.4 Research integrated into the curriculum

In higher education, the level of a study programme can influence research integration. Teachers, for example, may consider research integration to be more appropriate towards the end of undergraduate and master's programmes than in the earlier years of the study programme (Elen & Verburgh, 2008; Neumann, 1992; Taylor, 2007). The undergraduate curriculum, which consists of the teaching units within the study programme, provides space for strengthening the integration of research (e.g., Fung, 2017). Findings from previous studies suggest that effective integration lies in a considered diversity of approaches based on, for example, students' roles in learning activities, the breadth and depth of attempts to stimulate student understanding of research, the research practices that already exist within institutes, and the desirable student learning outcomes (Healey & Jenkins, 2009; Zimbardi & Myatt, 2014). This adds complexity to the process of determining the effectiveness of curriculum changes within study programmes intended to strengthen research integration.

Statements regarding the effectiveness of curriculum changes are generally made in light of examining the extent to which the goals of the change have been achieved based on relevant data (Kelly, 2004; Marsh & Willis, 2007). In this regard, the data can be considered relevant when multiple data sources are used and the data represents the ideas behind the curriculum development practices (Kelly, 2004; Tawney, 1973). Judgments concerning effectiveness that are solely based on student assessment data, for example, reflect whether the students exhibited the desired response to the curriculum but they do not provide insight into how the curriculum influences learning (Kelly, 2004; van den Akker, 2003). In order to determine the effects of the integration of research into the undergraduate curriculum, an emphasis is usually placed on the perceived as well as the attained curriculum (Fung, 2017; Healey & Jenkins, 2009; Visser-Wijnveen, et al., 2012; Zimbardi & Myatt, 2014).

Two of the studies included in this thesis aimed to provide insights into a curriculum change that was intended to strengthen the integration of research into the study programme. In addition to student perceptions of the integration of research into teaching (i.e., students' perceived curriculum), the studies in this dissertation focus on student learning outcomes and student achievement (i.e., attained curriculum) as well as the perceived practices and challenges in supervising students' research projects (i.e., teachers' perceived curriculum). In order to investigate the extent to which a curriculum change may influence student perceptions, beliefs and learning outcomes, comparisons are made between a previous curriculum and a curriculum intended to strengthen connections between research and teaching. The curricula are referred to in this thesis as the *previous* and *changed curriculum*, respectively. When compared with the previous curriculum, the changed curriculum places a stronger emphasis on research integration.

1.3.5 The relevance of student perceptions of research

Student perceptions of the learning environment and student characteristics can influence student learning outcome, with their perceptions promote both generic (i.e., student achievement) and specific (i.e., skill development) learning outcomes (Lizzio, Wilson, & Simons, 2002; Prosser & Trigwell, 2014; Ramsden, 1991). This notion places an emphasis on student perceptions of research in the teaching context.

Among the factors that influence student perceptions of research integration are the nature of the discipline, the course type and the opportunity to interact with academic staff (Lindsay, Breen, & Jenkins, 2002; Neumann, 1994). Students can experience both disadvantages (i.e., staff research takes priority over teaching, academics' specific interest narrow down the curriculum; Healey, et al., 2010; Lindsay, et al., 2002) and advantages of research integration (i.e., teachers' enthusiasm for research, increased interest in subjects, improvement of research skills; Neumann, 1994; Turner, et al., 2008). Importantly, student beliefs regarding, for example, the purpose of university education may mediate their perceptions. In the context of research integration, this is illustrated by

findings from a study by Robertson and Blacker (2006) which suggests that students who conceptualise the university being about teaching may experience research as being rather removed from their undergraduate learning activities. For these reasons, it is interesting to investigate student engagement in research by means of student perceptions regarding research in teaching within relation to their beliefs regarding the relevance of research.

1.3.6 The relevance of supervision practices

Student engagement in research is likely to be influenced by how their teachers articulate the links between teaching and research (e.g., Visser-Wijnveen, et al., 2012). Research supervision is an example of a teaching activity, since students are considered to be learners and it is assumed that their capabilities will develop during supervision (Boud & Lee, 2005; Brew, 2001; Hu, van der Rijst, van Veen, & Verloop, 2016; Manathunga, Lant, & Mellick, 2006). In recent years, there has been a trend towards studying research supervision (e.g., Anderson, Day, & McLaughlin, 2008; Harwood & Petrić, 2017; Maxwell & Smyth, 2011; Wichmann-Hansen, Thomsen, & Nordentoft, 2015). Previous studies concerning experienced supervisors have identified factors involved in the practice of research supervision that contribute to student learning, including responsiveness to students' needs and ways in which supervisor-student relationships are maintained (e.g., de Kleijn, Meijer, Pilot, & Brekelmans, 2014; Lee, 2008; Mainhard, van der Rijst, van Tartwijk, & Wubbels, 2009). These factors are useful for stimulating supervisors' reflections on their practices in direct relation to professional academic development activities as well as for the study of research supervision in general. However, students' research projects whether undertaken towards the end of their undergraduate education or during their postgraduate education are mainly supervised by PhD-students or immediate postdoctorates, especially in the medical discipline. This group of supervisors, in particular, may benefit from support in terms of exploring approaches to supervision, overcoming challenges and adapting pedagogies (e.g., Turner, 2015). It would hence be interesting to analyse how novice supervisors foster student engagement in practice as well as how this practice may be shaped by the dilemmas faced during actual research integration activities.

1.4 Outline of the dissertation

To sum up, findings from previous studies have emphasised the relevance of student perceptions of research within teaching. They have also indicated that student learning can benefit from the connections between research and teaching at several levels in higher education. Previous studies into higher education have focused, for example, on overcoming the disadvantages of research integration by means of higher education policy (e.g., Jenkins, et al., 1998) as well as on the visibility of research cultures within higher education institutes (e.g., Spronken-Smith, et al., 2014). Further, previous studies within the health sciences have emphasised the programme level as being particularly relevant to promoting students' research competencies (e.g., Bierer, et al., 2015; Mullan, et al., 2014). Other studies have focused on research integration at the teaching and learning level (Levy & Petrulis, 2012; Visser-Wijnveen et al. 2012). Taken together, the findings of all these previous studies suggest that research can stimulate student engagement by creating a challenging learning environment when research is made explicit to students (Rowe & Okell, 2009; Malcolm, 2014). The main interest of this thesis concerns the promotion of student engagement in research, with a focus on student perceptions of research within teaching activities, student beliefs regarding the relevance of research, student learning outcomes, and research supervision practices. The studies reported on in this dissertation involve components of student engagement in research as a concept, which is in line with the aims of fostering student engagement in research seen per study in this thesis. For this reason, importance is placed on student engagement in the introduction and discussion chapter rather than in the individual studies. The integration of research into medical university education is emphasised within the study programme in the context of a curriculum change as well as within teaching and learning in students' research projects.

Chapters 2 and 3 report on studies at the programme level and they are designed to provide insight into the role of research practices within the undergraduate study programme in the context of a curriculum change. Chapters 4 and 5 report on studies promoting student learning at the level of teaching and learning. The study in Chapter 4 is designed to explore relations between student perceptions, beliefs and student achievement. The interview study in Chapter 5 is designed to provide in-depth insights into how supervisors stimulate student learning during the conducting of students' research projects. To this end, an example of the complete integration of research, teaching and learning is chosen, namely research supervision during students' research projects. Figure 1.1 provides an overview of the four empirical studies presented in this dissertation.

In Chapters 2, 3 and 4, a questionnaire was used to gain insights into how as well as the extent to which students perceive research within undergraduate medical education. More specifically, insights were sought into students' familiarity with research conducted by teachers, their critical reflection on research in the medical discipline, their participation in research and their motivation for research. Three other factors were also considered in relation to student perceptions of research, namely the quality of the learning environment in general, the importance placed by students on research for learning and the value of research for professional practice.

Chapter 2 reports on a longitudinal, comparative study in which a group of students (n = 941) participated in data collection over the three years of their undergraduate medical education. The study presented in this chapter focuses on student engagement in research through its aim of providing insights into the relevance of the study programme as perceived by students and by describing the authentic elements of research integration practices. The research question addressed in this chapter is:

- 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?

Chapter 3 reports on a comparative study of student perceptions of research and student learning outcomes. Student learning outcomes were chosen, since one

aim of fostering student engagement in in general is to improve student learning outcomes (Pascarella, Seifert, & Blaich, 2010). A comparison is made between a curriculum with a stronger emphasis on research integration and a previous curriculum with less emphasis on research within teaching. This chapter furthers our understanding of the findings presented in Chapter 2 by comparing student learning outcomes within the same domain of research. Specific research-related learning outcomes were compared before and after a curriculum change. The learning outcomes reflect student knowledge about research and the quality of student products (i.e., test items and student research reports) and they were similar in both curricula. Chapter 3 focuses on first-year students (n = 746) for two reasons. First, the transition from a secondary education learning environment to a research environment within a university has been identified as one of the critical factors in promoting student learning during their university education (Brew, 2010; Spronken-Smith, Mirosa, & Darrou, 2014). Second, it can be difficult to integrate research into subjects. Teachers and students may have different ideas about the need to address research during the first year of undergraduate education in order to foster a scientific frame of mind on the part of the students (e.g., Zamorski, 2002). This means that, particularly during the first year, there is space for innovative teaching methods that aim to engage students in research. Chapter 3 reports on a comparative study conducted before and after a curriculum change that aimed to strengthen the integration of research into the first year of undergraduate medical education. The following research questions are addressed:

- 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?

- 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?

Chapter 4 reports on relations between first-year student perceptions of research (n = 304) and student achievement, in this case their grade point average (GPA) during the first year of university education. The findings detailed in this chapter complement the findings presented in Chapters 2 and 3 by exploring relations between student perceptions and student achievement within one study programme. It has previously been found that students' perceptions of the learning environment generally influence both their learning outcomes and achievement (e.g., Lizzio, Wilson, & Simons, 2002; Prosser & Trigwell, 2014; Ramsden, 1991). Findings from previous studies concerning relations between student perceptions of the learning environment and learning outcomes in higher education indicate that this relationship is reciprocal (e.g., Prosser & Trigwell, 2014). Furthermore, it has been argued that student perceptions of the learning environment in general provide a valid and adequate image of that learning environment (Marsh & Roche, 1997; Spooren, Brockx, & Mortelmans, 2013). Moreover, findings from previous studies suggest that there is a strong relation between student engagement in learning activities and student achievement (Kuh, Kinzie, Schuh, & Whitt, 2005; Pascarella & Terenzini, 2005). Chapter 4 aims to provide insight into the extent to which students' GPA reflects the research intensiveness of the learning environment using student perceptions of research within teaching. The research question is:

- 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?

Finally, an interview study was conducted in order to provide in-depth insights into how supervisors promote student learning in students' research projects conducted in the bachelor and master phase. This study relates to student engagement based on its focus on how supervisors guide student participation in purposeful learning activities in which research is integrated (e.g., Coates, 2005). Stimulated recall interviews were used to elicit supervisors' reflections on

their supervision practices ($n_{supervisors}$ = 11). In these interviews, the supervisors expressed difficulties they had experienced during research supervision. Chapter 5 aims to conceptualise these practices and difficulties within a dilemmatic space in which specific teaching situations will bring certain considerations regarding student learning more to the fore while leaving others in the background. The insights derived from this study can be used as input for development initiatives targeted at novice supervisors.

Students' research projects are particularly suitable for studying the integration of research in teaching for three reasons. First, students' research projects are a common practice in research-intensive university education in the Netherlands indicating that all students participate in research. Research is fully and explicitly integrated into students' research projects, as most students will individually conduct research under supervision. This is not necessarily the case with other types of research integration in teaching (van der Rijst, Visser-Wijnveen, Verloop, & van Driel, 2013; Verburgh, et al., 2013). Second, students within the health sciences may be supervised by PhD students or immediate postdoctorates. This provides opportunities for studying the practices and dilemmas of novice supervisors, which should eventually support supervisors in attempts to deliberately enhance student learning. Third, the research projects conducted by students in the bachelor and master phase have similar learning goals, namely to promote student research competencies, for example, their critical and scientific thinking. The duration of research projects conducted during the two phases of medical education may differ, although all students individually undertake similar research activities (e.g., conducting a literature search, formulating research questions, writing and conducting a research plan and writing a research report). Chapter 5 aims to answer the following research questions:

- 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?

In Chapter 6, the main findings and conclusions of the four studies are summarised, discussed and related to each other. Moreover, suggestions are made for further studies and the practical implications for teaching in higher education in general and medical education specifically, are described.

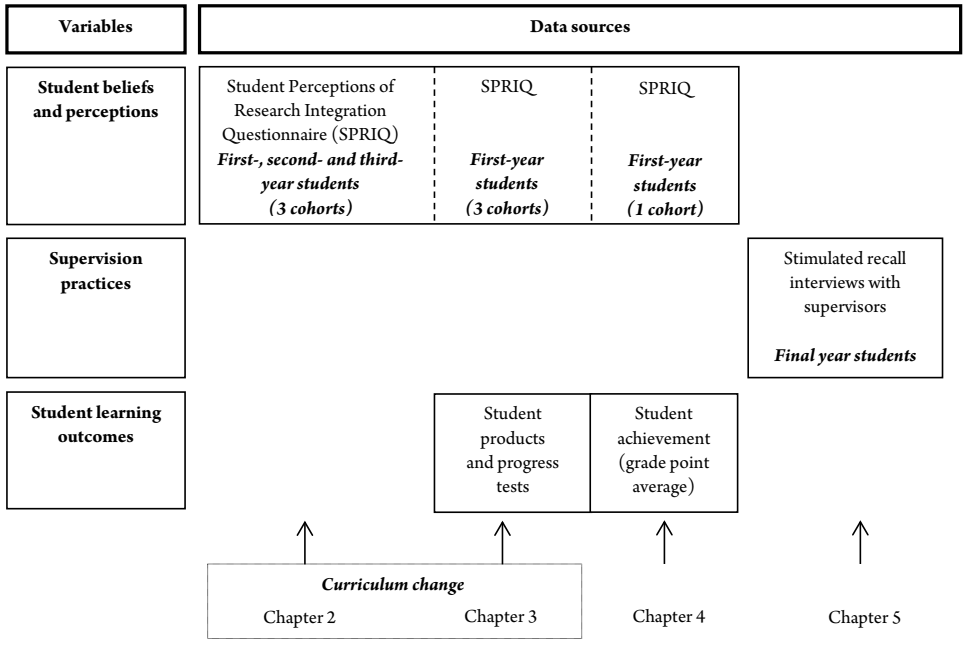

Figure 1.1. Overview of the studies at the programme level (Chapters 2 and 3) and the level of teaching and learning (Chapters 4 and 5).