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The development of student teachers' research knowledge, beliefs and attitude

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This study reports on the development of second-year student teachers' knowledge of research, and the changes in their beliefs and attitude regarding research during an introductory course at an institute for primary teacher education. Questionnaires and concept maps were administered before and after the course. The results showed that student teachers' knowledge about research grew during the introductory course and that their positive beliefs about research became more positive, while their negative beliefs about research decreased. A positive change was found concerning the attractiveness of research to student teachers. Furthermore, student teachers' self-efficacy regarding research appeared related to their beliefs and attitude: the more the student teachers were convinced of their abilities to conduct and use the results of research after the course, the more positive their beliefs and their attitude regarding research were. This study provides guidelines for institutes for teacher education on integrating research activities into their curricula, so that their student teachers develop research knowledge and positive beliefs and attitudes towards research.

Keywords: student teachers' development; research knowledge; beliefs; attitudes

1. Introduction

In the year 2000, the EU countries announced their ambition to grow into the most dynamic knowledge society in the world by signing the Lisbon Declaration. Since then the amount of attention being paid to the contribution of universities of applied sciences in terms of the development, transfer, expansion and circulation of knowledge increased. In Europe, it became compulsory to pay attention to research in the curricula of all universities of applied sciences. This was translated to the educational practice and expressed in terms of the Dublin descriptors (Joint Quality Initiative 2004). Therefore, many countries face the challenge of integrating research in the curricula teacher education.

Although attention to research in the curricula of institutes for teacher education has increased, the results of recent research show that there is no research culture in schools and teachers hardly use the results of (scientific) research to improve their

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own teaching practice at all (Kress 2011; Leeman and Wardekker 2014). Apparently, for stimulating schools to conduct and use research, teaching research skills to student teachers is insufficient. Research into how student teachers should be motivated and taught how to conduct research and use results of research in their future jobs is scarce. Several studies emphasise the importance of (the development of) teachers' positive attitudes regarding research (e.g. Dobber et al. 2012; Hagevik, Aydeniz, and Rowell 2012). Research activities in the curricula of teacher education often consist of restricted courses on basic research knowledge and skills in which student teachers' beliefs and attitudes towards research are rarely included.

If teachers are expected to conduct research and to use the results of research in their practice, more knowledge about the ways in which teacher education can prepare student teachers for these tasks is needed. Specifically, knowledge about how student teachers' development of research knowledge can be stimulated and about how their beliefs and attitudes about research can be influenced positively. This article reports on a study carried out in a Dutch university of applied sciences, in an institute for primary teacher education. The study concerned the impact of an introductory course in research on student teachers' knowledge development and how it changed their beliefs and attitudes towards research.

2. Theoretical background

The importance of teachers researching their own practice has long been acknowledged. Already in 1929, Dewey described teachers as the most important inquirers into the successes and failures of the school. Stenhouse (1975) later emphasised the importance of teacher research in his *teacher as researcher* approach, and Schön (1983) advocated his ideas of teachers as reflective practitioners. More recent studies regarding evidence-based or data-driven teaching have focused on the teachers' role in systematically gathering evidence of what works in their classroom (Ledoux et al. 2009).

Related to the different functionalities of research in teachers' practice, several goals of research in teacher education have been formulated. Firstly, research should enable teachers to realise a critical, reflective attitude towards their own practice (Hall 2009). Secondly, research should contribute to the development of teachers' knowledge, and 'evidence' of what works in practice and why it works (Ponte et al. 2004). Thirdly, when teachers have been educated in conducting and using research, they should be able to translate the results from (scientific) research into improvements in their own practice (Gore and Gitlin 2004). In order to fulfil these aims, student teachers need to develop (1) sufficient research knowledge, (2) positive beliefs regarding research and (3) a positive attitude towards research. These three concepts are addressed below.

2.1. Student teacher research knowledge

Based on findings of several authors (e.g. Lunenberg, Ponte, and van de Ven 2007; Reis-Jorge 2007), it can be stated that in order to develop the ability to conduct and use research, student teachers need to develop knowledge of:

(1) the goals and benefits of research by teachers;
(2) the kind of topics that are suitable for research by teachers;

(3) the process for conducting research, consisting of the translation of relevant topics from problem analyses into research questions, the different phases of research, the different appropriate research designs, and appropriate methods for the collection and analysis of data;
(4) the criteria for research quality and how to apply this knowledge in their own research; and
(5) reporting research results in such a way that colleagues get a clear view of the process, the results and the practical implications of the research.

All of the above aspects of knowledge regarding research should enhance the ability of student teachers to evaluate, interpret and reflect on the results of (other) research work and its practical implications.

2.2. Student teacher beliefs about research

Beliefs can be seen as filters through which new knowledge and experiences are screened for meaning (Campbell et al. 2004). Beliefs are more influential than knowledge in discerning how individuals frame and organise problems and tasks, and thus they are strong predictors of behaviour (Pajares 1992). Teacher beliefs are grounded in belief systems, and represent psychologically held understandings, premises or propositions which are felt to be true about teaching practice (Richardson 2003). Student teacher beliefs are considered to be amenable to change as a result of instruction and experience. To facilitate a change in beliefs, student teachers need to be confronted with their own beliefs and have opportunities to discuss these beliefs. Furthermore, the chances of student teachers changing their beliefs increase in an environment where they experience the benefits of new behaviour themselves, while they are encouraged to reflect explicitly on these new and developing beliefs (Clark and Hollingsworth 2002).

2.3. Student teacher attitude towards research

The concept of attitude is often divided into three aspects: affective, cognitive and behavioural aspects (Ajzen and Fishbein 2000). The cognitive aspect is a person's thoughts and knowledge about an object or behaviour, and is based on the overall evaluation of that person's beliefs. The affective aspect of attitude is an emotional response that expresses the person's degree of preference for an object or behaviour. Or in other words, a person's feelings towards an object or behaviour.

Another aspect of attitude that influences behaviour is a person's perceived behavioural control (Ajzen 2001). This is described as whether or not a person believes that he or she has control over performing a certain behaviour. The concept of perceived behavioural control is closely related to the self-efficacy theory. Self-efficacy is the degree of anticipated difficulty and one's judgement of ability to perform a behaviour (Pajares and Urdan 2006). A person's beliefs and the cognitive, affective and self-efficacious aspects of their attitude influence the *intention* to perform certain behaviour (from now on described as 'intended behaviour'). A person's intended behaviour is assumed to be a mediator between beliefs and attitude, on the one hand, and the actual behaviour, on the other.

Gawronski and Bodenhausen (2006) showed that attitudes are (re)constructed when a person is motivated to think about a new object or behaviour, and to report

either positive and/or negative experiences with it. The cognitive aspect of the student teachers' attitude will most likely change when student teachers are 'persuaded' by strong arguments and different kinds of heuristic cues (for example, the expertise of the person that provides the strong arguments). The affective aspect of attitude can be changed through positive personal experiences with an object or behaviour which take place in such a way that it becomes attractive to the student teachers (for example, when they experience the benefits for themselves as prospective teachers). Student teachers' self-efficacy will likely increase through mastery experiences, gained through perseverant effort and accompanied by feedback from others in a non-threatening environment indicating that the student teachers possess certain (levels of) capability (Bandura 2006).

The student teachers' attitude towards research is operationalised in this study by four attitudinal aspects described as follows: (1) *the cognitive aspect*, referring to the fact that student teachers need to understand and perceive the possibilities of conducting and using research as important for them as prospective teachers; (2) *the affective aspect*, concerning the need for student teachers to enjoy conducting and using research and to be attracted to it; (3) *the self-efficacious aspect*, referring to the need for student teachers' positive judgement about being able to conduct and use research as teachers in practice; and (4) *the intended behaviour*, referring to the question whether a student teacher plans to conduct or use the results of research or to learn more about it.

2.4. Research questions

The aim of this study was to investigate the ability of an introductory course in research to simultaneously influence the growth of student teachers' research knowledge and a change their beliefs and attitudes towards research in a more positive direction. This study, therefore, attempted to answer the following research questions:

(1) To what extent do student teachers develop research knowledge during the introductory course in research?
(2) What kind of concepts regarding research do student teachers develop during the introductory course in research?
(3) To what extent do student teachers' beliefs about research change during the introductory course in research?
(4) To what extent do the student teachers' attitudes towards research change during the introductory course in research?

3. Method

3.1. Context

This article reports on a study carried out in a Dutch university of applied sciences, in an institute for primary teacher education. This four-year educational programme offers a bachelor's degree; a follow-up study must be completed to earn a Master's degree. The introductory course for second-year student teachers contained 11 meetings of two hours each in two groups of which one was taught by the first author and the other by another lecturer over a period of five months. The course

development was based on the literature regarding effective course elements and, for example, included promoting elaboration on ideas or new perspectives in order to receive feedback from different participants (Van Swet et al. 2009). The course was evaluated and improved in a pilot study (for more information about the course, see authors 2012).

3.2. Design and participants

This study was based on a pre- and post-test design. The pre-test took place at the beginning of the first course meeting; the post-test at the end of the last meeting. All second-year student teachers of the primary teacher education institute participated in the introductory course ($N = 96$). The average age of the student teachers was between 19 and 20 years old. The number of students completing both questionnaires was 11 male (14%) and 68 (86%) female student teachers. This ratio of males to females is representative of Dutch institutes for primary teacher education.

3.3. Data collection

Student teachers' development of research knowledge was determined by using concept maps. Changes in their beliefs and in their attitudes towards research were determined by using a questionnaire. Seventy-five student teachers completed both concept maps (78%) and 79 student teachers completed the pre-and post-test questionnaire (82%).

3.3.1. Concept maps

Concept maps represent knowledge in terms of the concepts and the relations or links between the concepts (Novak 2002). In developing the instrument, we followed the procedure that was designed by Koopman, Teune, and Beijaard (2011). Each student teacher was instructed to construct a concept map of all their knowledge with respect to the core concept 'research by primary school teachers'. They were asked to:

(1) list 20–40 concepts in response to the question: What do you think of when you consider 'research by primary school teachers?';
(2) think about which concepts were related to each other, in order to cluster them and to indicate the relative importance of the different concepts, students underlined the concepts they found most important;
(3) write down everything in a concept map which they thought logical, starting with the most important concepts closest to the core concept, followed by the remaining ones, clustered around related core concepts; and
(4) connect related concepts with lines and explain, where they thought relevant, the connections between concepts.

The student teachers were given a form to create the concept maps on and got 45 min to complete the task. Students were told that the concept maps were only used for research purposes, not for grading.

3.3.2. Questionnaire

The questionnaire consisted of background variables (gender and age) and four main parts; one 'student teacher beliefs scale regarding research' (fourteen items), and three 'student teacher attitude towards research scales' (cognitive: six items; affective: ten items; intended behaviour: six items). The construction of the belief items and scales was based on results of other research on teacher beliefs (Hermans, van Braak, and Van Keer 2008; Woolley, Benjamin, and Woolley 2004). Student teachers' own descriptions of the concept 'research by primary school teachers' from our previous study (van der Linden et al. 2012) were used to adapt the items to the participants' frame of reference.

The attitude items were constructed after having studied several attitude questionnaires, for example, the Theory of Planned Behaviour questionnaire (Ajzen 2006). The items were again adapted by using the descriptions of the different attitudinal aspects provided by student teachers in our previous study.

The belief and attitude items were all rated by using a five-point Likert scale ranging from 1 = *totally disagree* to 5 = *totally agree*. Exploratory factor analysis on the pre-test data (eigenvalues >1.0) revealed two belief scales – the positive beliefs scale and the negative beliefs scale (explained variance: 39%); one cognitive attitude scale (explained variance: 46%), two affective attitude scales – the positive affective attitude scale and the negative affective attitude scale (explained variance: 61%); and one intended behaviour scale (explained variance: 57%). Items were deleted from the scale, if they did not at least load .30 on a factor and/or if the reliability (Cronbach's alpha) increased strongly when the item was deleted. Table 1 provides more detailed information on the questionnaire.

In the post-test questionnaire, one part was added to measure student teacher research self-efficacy (seven items) in order to determine what changes in student teachers' knowledge, beliefs and attitudes could be explained by the level of research self-efficacy at the end of the introductory course. For constructing the items, general self-efficacy scales as well as Bandura's instructions on constructing self-efficacy scales (Bandura 2006) were used. The same five-point Likert scale was

Table 1. Questionnaire scales, number of items per scale, the reliability rate and item examples.

Questionnaire scales (N of items, Cronbach's α)	Examples of items
Positive beliefs scale (10 items, α = .79)	Conducting research is an essential part of the teachers' job
Negative beliefs scale (3 items, α = .65)	When teachers conduct research, this will be done at the expense of important things for pupils' developments
Cognitive attitude scale (6 items, α = .77)	I think it is important for me as a prospective primary school teacher that, through conducting research, I can improve my teaching quality
Positive affective attitude scale (6 items, α = .86)	Conducting research for me is an attractive way of learning
Negative affective attitude scale (3 items, α = .69)	Conducting research makes me insecure, because I do not know what the outcomes/results will be
Intended behaviour scale (4 items, α = .74)	In my later job as a primary school teacher, I will conduct research to gain insight into specific problems in my classroom

used. The exploratory factor analysis confirmed one scale of seven items regarding student teacher self-efficacy about research (explained variance: 58%, $\alpha = .88$). Examples of student teacher research self-efficacy items were: 'I consider myself a prospective teacher who is capable of conducting research in my later teaching practice' and 'I know how I can use results of research to improve my teaching practice'. This part was not measured in the pre-test because it was assumed that, without a realistic and complete view of what research involves, it was not useful to measure their self-efficacy beforehand.

3.4. Analysis

3.4.1. Student teacher research knowledge

The quality of the pre-test and post-test concept maps was determined via an overall examination of the elaborateness and organisation of each of the concept maps. The elaborateness involved the number of concepts, links, layers and clusters, as well as relevance of the concepts. The organisation of the concept maps was evaluated in terms of the relative importance of the concepts included, the types of connections and the clusters of concepts (cf. Koopman, Teune, and Beijaard 2011). Findings regarding the elaborateness and organisation were combined to produce an overall picture of the quality of the concept map; a rating of the concept map using a five-point Likert scale (from 1 = *very poor quality* to 5 = *very good quality*). For example, a concept map was judged to reflect *very poor quality* when a small number of relevant concepts (or a large number of irrelevant concepts) and random links were used, the concepts were arranged in an illogical way (i.e. there was no clear distinction between important and less important concepts) and relevant clusters of concepts could not be distinguished. Cohen's Kappa for rating the quality of the pre-test concept maps was .79 and for the judgement of the quality of the post-test was .86 (based on 16 of the 75 pre- and post-test concept maps).

The development of student teachers' research knowledge was determined by comparing the quality of the pre-test concept map to that of the post-test concept map. This comparison was scored on a five-point Likert scale. *Strong deterioration* (1) or *strong improvement* (5) were scored if the pre- and post-test judgments differed two ratings or more (e.g. from a pre-test concept map of poor quality to a post-test concept map of good quality). *Slight deterioration* (2) or *slight improvement* (4) were scored when the pre- and post-test judgements differed by one rating (e.g. the pre-test was judged neutral and post-test was judged good quality). *No difference* (3) was rated when there were no changes in the quality of the concept maps.

To gain insight into the kinds of concepts student teachers developed during the introductory course, the clusters of concepts used by the student teachers in the concept maps were analysed in-depth. The clusters of concepts of 25 of the post-test concept maps were examined by two researchers and related to the required research knowledge as described in Section 2.1. Four clusters that were similar to the literature could be distinguished: (1) research topics (with concepts such as 'teacher-student relationship' and 'class management'); (2) goals and benefits (with concepts such as 'improving as a teacher' and 'gaining more insight in pupils' developments'); (3) research process (with concepts such as 'problem statement' and 'research questions') and (4) quality of research (with concepts such as 'validity'

and 'objectivity'). In addition, two new clusters emerged: (5) research methods (with concepts such as 'interviews' and 'observations'), and (6) participants in research (with concepts such as 'pupils' and 'parents'). The knowledge anticipated in the literature regarding 'writing research reports' was not reflected in the 25 post-test concept maps. No other clusters of concepts was added after analysis of the remaining 50 concept maps. By using paired *t*-tests, the total number of concepts, the number of relevant concepts and the differences between the number of concepts for all six clusters for the pre- and post-tests were investigated.

3.4.2. Student teacher beliefs and attitudes regarding research

Means and standard deviations for the belief and attitude scales were computed using SPSS 19.0. Changes in student teachers' beliefs about research were determined by conducting paired *t*-tests on the mean scale score(s) of the pre- and post-test. To determine changes in aspects of their attitude, paired *t*-tests were also done regarding the cognitive, affective and intended behavioural scales from the pre- and post-test.

To determine the relationship between student teacher research self-efficacy and their research knowledge and beliefs about research and the other attitudinal aspects, the research self-efficacy mean scale score was correlated (Pearson's *r*) in two ways: first to the mean difference scores of the knowledge, beliefs and attitude scales (post-test minus pre-test), and then to the knowledge, beliefs and attitude mean scale scores of the post-test.

4. Results

4.1. Student teachers' development of research knowledge

For most of the student teachers, the results showed that the quality of their concept maps, reflecting their research knowledge, improved ($N = 63$): 36 of these student teachers had strongly improved concept maps, while the knowledge of 27 student teachers improved slightly. The research knowledge of twelve student teachers remained approximately the same during the introductory course. The results of the paired *t*-test on the pre- and post-test judgements of the quality of the concept maps showed that the quality of the concept maps was significantly better at the post-test compared to the pre-test ($t(74) = 13.86$, $p = .00$; see Table 2).

Figures 1 and 2 present the pre-test and post-test concept maps of one student teacher who developed from a knowledge level of *very poor quality* to a knowledge level of *very good quality.* The core concept is positioned in the middle (black); the bold black lines reflect relations between concepts that the student teacher regarded most important; the remaining concepts are shaded in grey).

Table 2. Quality of concept maps at pre-test and post-test on a five-point scale ($N = 75$).

	–	–	+/–	+	++	Mean	SD
Quality of the pre-test	31	31	10	3	0	1.80	.82
Quality of the post-test	2	10	29	30	4	3.32	.87
Knowledge development	0	0	12	27	36		

Notes: – = very poor quality, ++ = very good quality.

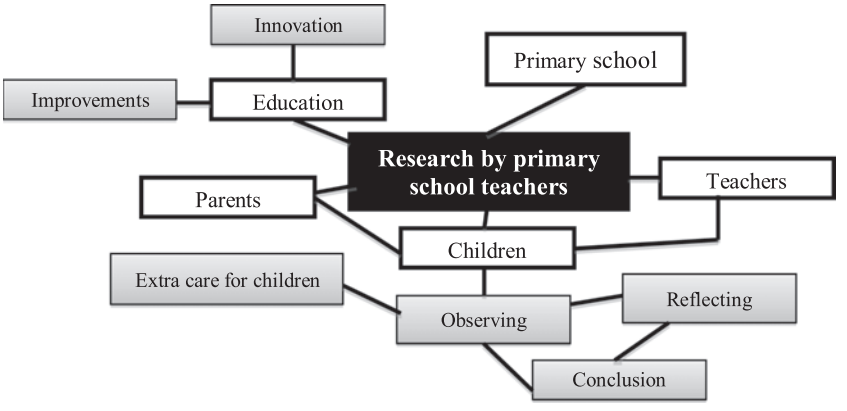

Figure 1. Pre-test concept map of one student teacher, judged as of 'very poor quality'.

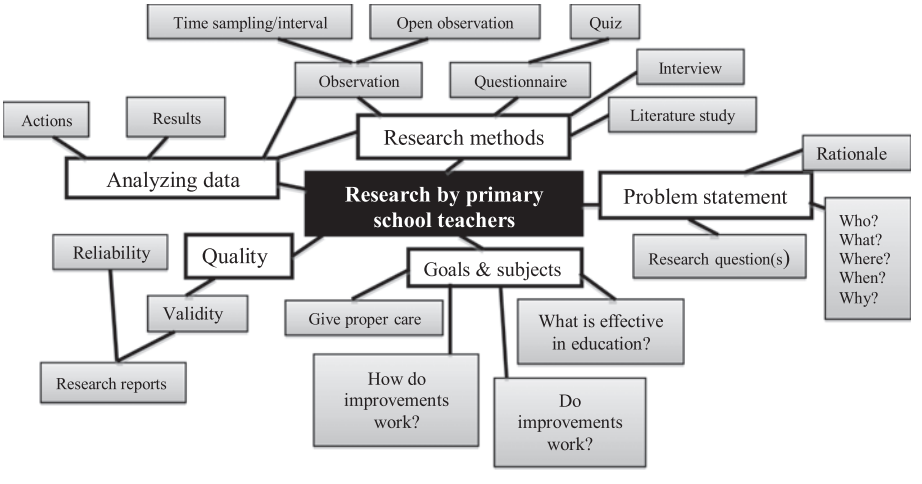

Figure 2. Post-test concept map by the same student, judged as of 'very good quality'.

The pre-test concept map of this student teacher was judged as being of a 'very poor quality' for the following reasons:

- only a small number of concepts were identified and many of these were judged irrelevant (e.g. 'parents', 'teachers' and 'primary schools' were stated as core concepts with no other concepts clustered around them; these concepts were judged 'unexplained/chosen randomly' and in that way irrelevant);
- random and inexplicable links were used (e.g. it was unclear why the research method 'observing' was linked to the research goal 'extra care for children');
and
- the concepts were arranged in an illogical way (there was no clear distinction between important and less important concepts).

The post-test concept map of the same student teacher was judged as being of a 'very good quality', because the student teacher constructed a concept map where a

Table 3. Paired *t*-test results for the (clusters of) concepts from the concept maps.

(Clusters of) Concepts	Pre-test		Post-test				
	M	SD	*M*	SD	*t*	d*f*	*p*
Total concepts	13.91	5.66	18.83	6.56	6.20	74	.00
Relevant concepts	8.98	3.77	15.31	5.54	9.85	74	.00
Research topics	2.57	3.44	2.15	3.57	0.85	74	.40
Goals & benefits	1.67	2.00	1.91	2.13	0.80	73	.43
Research process	1.60	1.74	4.45	3.15	6.86	74	.00
Quality of research	0.14	0.45	1.30	1.21	7.61	73	.00
Research methods	1.93	1.91	3.85	1.73	6.48	74	.00
Participants	1.00	1.40	1.42	1.72	1.77	73	.08

large number of relevant concepts were divided into a network of relevant clusters by using logical connections/links. Three of the concepts closest to the core concept corresponded to the 'clusters of concepts' distinguished by the analyses of the concept maps.

The results of the analyses regarding the overall numbers of concepts used by the student teachers in their concept maps (Table 3) show that the average number of concepts increased significantly (from almost 14 per pre-test concept map to nearly 19 concepts per post-test map). Also the number of *relevant* concepts increased significantly (from almost 9 relevant concepts per pre-test concept map to more than 15 in the post-test map). So, after the introductory course student teachers were able to provide more concepts and also more relevant concepts.

In the average post-test concept map, the greatest number of concepts concerned the 'research process' ($M = 4.45$) and 'the research method' ($M = 3.85$). For the clusters of concepts regarding the 'research process', 'quality of research' and 'research methods', the results of the paired *t*-tests showed a significant increase in the number of relevant concepts (see Table 3). The clusters 'research topics', 'goals & benefits' and 'participants' did not increase significantly.

Table 4. Beliefs scales with means, standard deviations and paired *t*-test results.

Scales	Pre-test		Post-test				
	M	SD	*M*	SD	*t*	d*f*	*p*
Positive beliefs	3.85	.42	4.03	.42	3.70	74	.00
Negative beliefs	2.44	.68	2.18	.72	2.90	77	.01

Table 5. Means, standard deviations and paired *t*-test results of the scores on the attitude scales.

Attitude scales	Pre-test		Post-test				
	M	SD	M	SD	*t*	d*f*	*p**
Cognitive	3.92	.45	3.95	.50	.524	77	.30
Positive affective	3.51	.57	3.66	.68	1.94	77	.02
Negative affective	2.49	.75	2.48	.79	.104	78	.46
Intended behaviour	3.83	.39	3.93	.59	1.59	78	.06

*One sided.

Table 6. Correlations between research self-efficacy and knowledge development, beliefs and attitude (1) change and (2) mean post-test scale scores.

Scales		Knowledge	Positive beliefs	Negative beliefs	Cognitive	Positive affective	Negative affective	Intended behaviour
Self-efficacy	*r* (1)	.08	.16	−.17	.11	.35**	−.11	.15
Self-efficacy	*r* (2)	.12	.36**	−.21	.28**	.51**	−.46**	.25*

*$p < .05$; **$p < .01$.

4.2. Student teacher beliefs about research

The mean scale score of the positive beliefs scale from the pre-test was rather high ($M = 3.85$) and increased during the introductory course significantly (M post-test = 4.03). Student teachers negative beliefs at the start of the course were rather low ($M = 2.44$) and significantly decreased during the introductory course (see Table 4).

4.3. Student teacher attitude towards research

The mean scores for the cognitive attitude scale and the intended behaviour scale were high for both pre- and post-test (see Table 5). The paired *t*-tests on the pre-test and post-test mean scale scores for the cognitive, (positive and negative) affective and intended behaviour scales showed a significant increase only for the positive affective attitude scale (see Table 5). So, regarding their attitude towards research, student teachers developed more positive feelings towards conducting and using research during the introductory course.

4.4. Student teacher research self-efficacy

The mean scale score for student teacher research self-efficacy was rather high 3.54 (SD = .57), indicating that they feel they are able to conduct and use research after the introductory course. The mean scale score for student teacher research self-efficacy correlated significantly with the change in the positive affective aspect of their attitude (Table 6). This indicates that the more the student teachers were convinced of their ability to conduct and use the results of research, the more their feelings about research changed positively. Examination of the relation between research self-efficacy and all the beliefs and attitude mean scale post-test scores showed that research self-efficacy correlated positively with the scales for positive beliefs and the cognitive and positive affective aspects of student teacher attitude and with intended behaviour (see Table 6). Research self-efficacy correlated negatively with the student teachers' negative affective aspect of their attitude. These results indicate that the more student teachers were convinced of their ability to conduct and use the results of research after the course, the more positive their beliefs and attitudes regarding research were, and the more they intended to conduct and use the results of research.

5. Conclusions and discussion

The present study investigated the development of second-year student teachers' research knowledge and changes in their beliefs and attitude towards research during an introductory research course at an institute for primary teacher education. Although there is no research culture in Dutch schools yet, for their continuing professional development as a teacher and for making grounded choices in their teaching, it is important that teachers develop a positive attitude towards research and research skills and knowledge (e.g. Hagevik, Aydeniz, and Rowell 2012; Kress 2011). From the present study, it could be concluded that it appeared possible to positively change student teachers' beliefs and attitudes towards research, while developing their research knowledge in the second year of their education.

Remarkably the student teachers' initial beliefs towards research were already quite positive. Also their initial scores on cognitive attitude and even on intended behaviour towards conducting research were quite high, though conducting research is not at all common practice in primary schools. An explanation could be that the student teachers were already influenced by their teachers, who emphasised the importance of research for their future job as teachers. Nevertheless, the introductory course affected their beliefs and positive affective attitude even more. The effect on the other attitude scales was not significant, possibly because conducting research in their future job as a teacher is still too far away for these second-year students. Regarding student teachers' development of research knowledge, they already reported some research concepts before they attended the introductory course, especially on research topics. The students reported significantly more research concepts in their concept map after the introductory course, compared with their concept maps in the pre-test. Only the number of concepts in the clusters 'research topics' and 'goals and benefits' of research by primary school teachers did not increase significantly during the introductory course. This was a remarkable result since the course specifically focused on encouraging student teachers to view research *more* as a part of their teaching job. A possible explanation for this finding is that the student teachers who constructed the post-test concept maps particularly focused on the 'technical' concepts of conducting research, because the last meetings of the course were dominated by preparations for their own research projects in the next semester.

A limitation of this study was the lack of insight in how the course elements contributed to the specific developments and changes in student teachers' knowledge, beliefs and attitudes. As mentioned above, some clusters of research knowledge and some attitudinal aspects did not develop or change during the course, while other clusters and aspects did. In future research, it would be valuable to study the effects of the different elements of the course in more detail. Another limitation was the fact that the first author also taught and evaluated the course in one group of students. Comparisons with the other group that was taught by another lecturer, who was not involved in the research, did not reveal any significant differences between the outcomes in the two groups. Objectivity in the data analysis was warranted by involving a second researcher for establishing sufficient inter-rater agreement. Finally, although this study is important for curricula in institutes for primary teacher education, we do not know whether student teachers will actually use the knowledge and beliefs they developed in practice and whether they put their intended behaviour into practice. An interesting follow-up study would therefore be an examination of the relations between students' research knowledge, beliefs and their intended behaviours and their behaviour during the research projects they carry out in the following semester of their study. Furthermore, it would be interesting to examine longitudinally to what extent these positive findings lead student teachers to actually conduct and use research in the classroom when they are working as a teacher. Leeman and Wardekker (2014) showed that a course for experienced teachers that combined learning to do research and reflecting on aims was not enough to make teachers into critical research-minded professionals, although the course was positively evaluated by the participants. They therefore advocate a context-aware view of teachers' learning process (Leeman and Wardekker 2014). Maybe the combination of research courses within and after initial teacher education will help teachers to integrate research into their job.

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