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A study on the influence of the level of a student population on Mathematics Education at Primary Teacher Education Schools in the Netherlands.

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Preface

Writing this Master Thesis has been a wonderful process, in which ups and downs alternated each other. At the beginning of this process, when writing my research proposal and thinking about how to set up this study, I would not have thought that it would end up where it did. From having a very ambitious plan, with a large data set – to having trouble collecting the right data and matching these data together – to taking a complete U-turn. This U-turn meant turning my independent variables into dependent variables and complete rearranging the entire study.

At that moment, the end of this study, and the end of writing the thesis seemed so far away. However, here it is. I need to thank a lot of people that have supported me through this process.

I would first of all like to thank Ronald Keijzer (iPabo) and Petra Hendrikse (Katholieke PABO Zwolle) for coming up with the original research idea. Also, for supporting me and helping me wherever they could. If I asked them for feedback, or their opinions and ideas, they were always there to help. Even though my research took a different turn, and their original research idea moved to the background, they were still supportive through all of it.

Secondly, I would like to thank my study-counsellor Dr. J.W. Luyten, for guiding me through the entire process. He was very easily approachable for me during the entire year, was always quick with providing feedback and was available on short-term notice for appointments face-to-face. He helped me figure out how to deal with the sudden turn in my research and saw how important it was for me to finish it, before I start my job coming September.

Lastly, I would also like to thank my second supervisor, Prof. Dr. Theo Eggen, for being involved and making it possible for me to use data from CITO. Without his help and connections to get me the data I needed, this study would not have been possible.

It was a very fulfilling, inspiring, hard, pleasant, and interesting journey of which I am happy that it is over, but which I would not have wanted to miss for the world.

Thank you very much.

Sincerely,

Eva Blokhuis

Contents

Summary

This study focusses on discovering a relationship between the Mathematical level of a student population that enters a Primary Teacher Education School and the type of Mathematics education that is provided at that school. In order to discover that relationship, data was collected through means of two surveys that were presented to all the Primary Teacher Education Schools in the Netherlands. Roughly 45 percent of these schools replied. Additionally, data on the Mathematical level of a student population was measured by using data from CITO. CITO develops the WISCAT: a standardized Mathematics test that all students have to take and pass before or during their first year. Averages were calculated per school and these averages were linked to data on the type of Mathematical education, which was collected through the surveys.

The multiple regression analyses showed results that did not confirm the hypotheses. It seems that both the ‘Average on the WISCAT’ and the ‘Level of teacher expertise’ have a positive relationship with the ‘Amount of teaching to the test’, whereas a negative relationship was hypothesized. The analyses also showed that the ‘Average on the WISCAT’ has no relevant relationship with ‘Amount of ECs’, whereas a negative relationship was hypothesized. The ‘Level of Teacher Expertise’ has a positive relationship with ‘Amount of ECs’ when no relationship was expected. And lastly, only the ‘Average on the WISCAT’ does not have a relationship with the ‘Level of Integration’, whereas ‘The level of Teacher Expertise’, remarkably, has a negative relationship with the ‘Level of Integration’.

This leads to several recommendations for future research, in which the type of measurement may have an important role for eventually finding more conclusive results.

Keywords: Primary Teacher Education, Mathematical Pedagogical Content Knowledge, Teaching to the test, WISCAT, Mathematics Education.

Introduction.

This thesis focusses on Primary Teacher Education Schools in the Netherlands and whether or not these schools (unconsciously) adapt their Mathematics education to the level of the students that enrol. The relevance for this research stems from the fact that Primary Teacher Education Schools attract very different types of students, simply due to the fact that they are located all over the Netherlands. The population in a city differs from the population in a small town. A school with a certain religion may attract different students than a public school. Therefore it is interesting to examine if the average level of the students affects the type of education that is provided at these schools. The type of education that is provided at these schools is divided into three dependent variables; teaching to the test, the level of integration of pedagogical and individual Mathematical skills, and time in terms study-load in European Credits. More information on these variables will be provided in the theoretical framework that scaffolds this research.

In the end, this research might be used as a stepping stone for follow-up research with a focus on determining if it is the type of students that enrol at a school that determine the results on certain standardized Mathematics-tests and to what extent the actual education provided at that school has an influence on these tests.

In order to find out whether or not the type of education is determined by the level of enrolment of students, first, the average level of enrolment needs to be measured per school. The WISCAT-test is used for this. The WISCAT-test is a standardized obligatory test, provided by CITO, that students have to take in advance to, or during their first year. The score on this test shows if a student is supposedly fit to successfully complete the entire program with regards to Mathematics. It tests the individual Mathematical skills of the student, which have to exceed a certain level.

This score, which was provided by CITO to benefit this research, will then be linked to the results of two surveys which are filled out by the Mathematics teachers at the Primary Teacher Education Schools in the Netherlands. These surveys focus on features of the teachers themselves (survey 1), but also on what kind of Mathematics education they provide for their students (survey 2). Both surveys provide information on the dependent variables of this research. As mentioned in the first paragraph the dependent variables are time, level of integration and teaching to the test. Why these variables are considered relevant will be thoroughly explained in the theoretical framework.

Additionally, in order to formulate the problem statement, the research question and hypotheses, an extensive literature study has been conducted. In the next chapter, the theoretical framework is presented in order to create understanding of the research problem, its various facets and how those facets are related to each other.

Theoretical framework.

In this chapter the theoretical framework will be presented. It will start off with a general introduction into the topic of this study. Information will be provided on the effect of teacher expectations on students and on education as well.

After this, the topics that are related to this specific study, will be introduced. Several aspects that are important for formulating the research problem and main research question will be discussed. At the end of this chapter, the research problem will be presented together with the research question and sub-questions.

The effect of teacher expectations.

This study aims to discover a relationship between the level of the students and the type of education provided at Primary Teacher Education Schools. A lot of research has been conducted on the possible effect of teacher expectations and how they come to be. Teacher expectations can be formed by several factors; for example ethnic background, social-economical background, but also previous performance (Workman, 2012). Another, older but very well-known, study by Rosenthal & Jacobson (1968) shows that when teachers were given false information on the intelligence level of students, they actually adjusted their education and the approach towards students based on their perception of the students' intelligence. Both studies indicate the influence previous performance may have on the education that is provided to certain students.

It can be argued whether this is good or bad. A teacher should be able to provide the student with not too difficult, but at the same time not too easy materials in order to make the student improve and in order to challenge the student. A teacher should teach a student in their 'zone of proximal development' (Vygotsky, 1987). Thus previous performance can serve as a way to determine what type of education students need. However, the question then remains that once a teacher makes an estimation on what a student needs to reach a certain level; how does he or she provide that? Are all means allowed to reach a certain goal?

These means are displayed in three types of characteristics that occur in teaching Mathematics at Primary Teacher Education Schools: time, integration and teaching to the test. The choice for these three topics is explained in the corresponding subchapters.

However, it is very important to realize that in the Netherlands, within Primary Teacher Education Schools, no previous research has been conducted on the relationship between the previous performance of the student and the Mathematics education provided at Primary Teacher Education School. Therefore this study will lay the groundwork for further research on this topic. In the next subchapters all the variables relevant to this study will be introduced after which they will be covered in more detail.

In short; all subchapters aim to describe the relevance of the variable in general and in relation to this topic.

An introduction to the main variables

There are five main variables that are important considering this study. One of these variables is the main independent variable, which is the WISCAT-test. Another of these variables is also an independent variable and will be used as a control variable in this research; the level of teacher expertise. The other three variables are the dependent variables (for visualization see the research model in figure 2).

First of all: the WISCAT-test. What is it and why is it used as a tool to measure the students level when they enter the Primary Teacher Education School? In this research the WISCAT-test is used as an independent variable. Why is that and is that sufficient for determining the entrance level of a student? In this theoretical framework the answers to these question will be provided.

The second variable is the level of teacher expertise. Is it important, according to literature, to have teachers with more experience, or teachers with a STEM (Science, Technology, Engineering and Mathematics) background teaching Mathematics? This variable is also independent and will be used as a control variable. In this case that means; if it is to be made sure that that the average level of the student based on the WISCAT-score determines the education that is provided at a certain school, it can be useful to check if the level of teacher expertise determines the education that is provided. In this theoretical framework the influence of teacher expertise on education will be elaborated on to provide the reader with a sense of the amount of relevance teacher expertise could actually have on the education that is provided. This should provide enough of a basis to justify the use of this variable as a control variable.

The first dependent variable is time in terms of European Credits (ECs); is time at all relevant in teaching Mathematics? Does a student population that is relatively bad at Mathematics go to a school where they have to earn more ECs and therefore spend more time on Mathematics? Research shows a lot of difference between Primary Teacher Education Schools and the time they schedule for Mathematics; why is that? All these questions are posed to determine the role of time in teaching Mathematics. In the end, this study will try to discover a relationship between the level of the student population and time in ECs devoted to Mathematics.

This question brings us to the second dependent variable: the level of integration in the Mathematics classes the students are provided with. A teacher should be able to combine his or her individual Mathematical skills and their pedagogical skills and teach students to do the same.. Both types are equally relevant and therefore one can ask themselves: does it make sense for a Primary Teacher Education School to put a lot of time into developing the students' own individual Mathematical skills, rather than integrating both pedagogical and individual Mathematical skills? The goal here is to eventually determine whether or not the average score of the students at a school determines the level of integration at that school, or whether the level of teacher expertise is more important in determining the level of integration.

Finally, taking the above into consideration, a question that arises is; when there is a large focus on developing the individual Mathematical skills in order to understand the Mathematics that is being taught, is there is a risk of teaching to the test? And if yes, what is teaching to the test exactly and why is it frowned upon? Eventually teaching to the test will be related to the level of students at a certain Primary Teacher Education School as well; does the level of the student population correlate with the amount of teaching to the test?

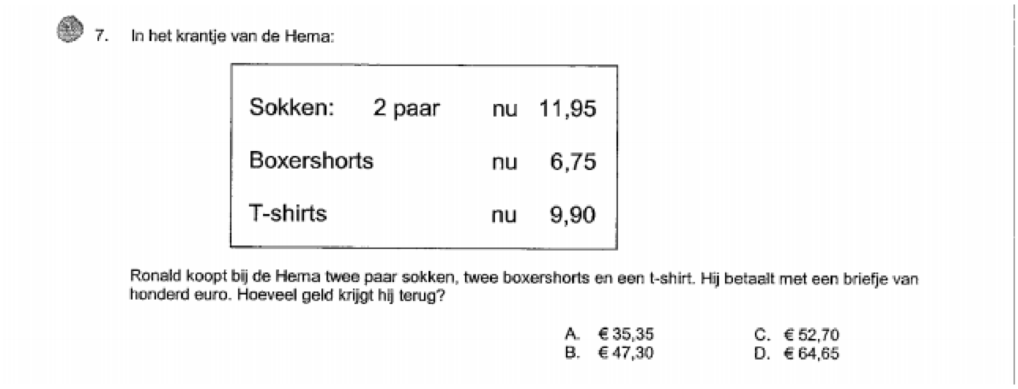
At the end of this chapter, as mentioned before, the main research question will be stated. After this, the sub-questions will posed as well. Logically, some hypotheses will directly flow from these questions which will then lead to presenting the research in a research model to help visualize the research and the relations between the independent variable, the control variable and the dependent variables.

The WISCAT

To provide some indication as to why the WISCAT-score is chosen to determine the average level of a student population, background information on the WISCAT will be provided here. The WISCAT is a test that students that want to complete Primary Teacher Education have to take in order to prove their competence regarding Mathematics. This means that their score on this test has to be above a certain threshold-score that is determined by the Primary Teacher Education School itself. However, this norm has to be at least 103. Most schools use this threshold-score, but there are some schools that actually use a higher threshold-score. Therefore it seems safe to assume that the schools with a higher threshold-score get students with a higher level in Mathematics. This research focusses solely on the given fact that each school has a student population with a certain average (i.e. certain level), which may determine the education that is provided at this school.

The WISCAT can be administered at several moments in time but it has to be administered before a student enters the second year of their education program. This means that some schools provide the test before the first school year starts, others provide it during the year. They can determine the moment themselves. In this research, the moment at which a school administers the test is not used as a control variable. Teacher expertise is already chosen to be a control variable and since the population is not very large, a second control variable would simply be too much. However, most of the school administer this test at the very last in October. Later on in this research possible complications of the two schools that not administered the WISCAT until after the Christmas Holiday will be discussed.

Some background information on the WISCAT: the WISCAT was implemented for the first time in 2006 and focusses mainly on discovering whether a student is as good in Mathematics as the top 20% of children in the final grade of primary school (Straetmans & Eggen, 2011). This can be tested by having students make exercises where their own skill-level is tested, and not necessarily about how to teach Mathematics or justify the Mathematical strategy that is used. This is illustrated by figure 1: an example of an exercise that could appear in the WISCAT.


7. In het krantje van de Hema:

Sokken:	2 paar	nu	11,95
Boxershorts		nu	6,75
T-shirts		nu	9,90

Ronald koopt bij de Hema twee paar sokken, twee boxershorts en een t-shirt. Hij betaalt met een briefje van honderd euro. Hoeveel geld krijgt hij terug?

A. € 35,35
B. € 47,30
C. € 52,70
D. € 64,65

Figure 1. Example of an exercise that could appear in the WISCAT.

It is assumed that some schools have students with a higher level of knowledge and other schools have students with a lower level of knowledge. As mentioned above, schools have the opportunity to decide (within a certain range) what the threshold-score is for students that take this test. This can be from a 103 score upwards. This implies that the higher this threshold is, the higher the level of Mathematical Knowledge of the students is that eventually enter or continue their education at a Primary Teacher Education School. The test is administered at several moments during the year, and students get to do a re-take if they do not pass the first time. In the chapter on data-collection it is explained why only the first attempts of the students in the school-year 2012-2013 are used.

This research is set out to find out whether or not the schools adjust their education (consciously or unconsciously) to the level of the students they teach.

In what ways this ‘adjusting’ can occur will be discussed in the next few subchapters of the theoretical framework. First of all the control variable, the level of teacher expertise, will be discussed. The last three subchapters will deal with the three dependent variables and their relevance to this research.

Teacher expertise

The second independent variable that is used this study, is the level of teacher expertise. This could influence the education at Primary Teacher Education Schools. Several studies show that the expertise of the teacher and the performance of a teacher on the job has an influence on student's performance (Rockoff, 2004; Kane, Rockoff, & Staiger, 2007). This means that teacher expertise could also be relevant for what happens in the classroom (teaching to the test, level of integration), because it is assumed that the actual education that is provided by the teacher and received by the students does something to improve the students performance. So there might be one step in between: teacher expertise determines that a teacher offers which in turn determines the student's outcomes. Figure 2 shows what this relationship would look like.

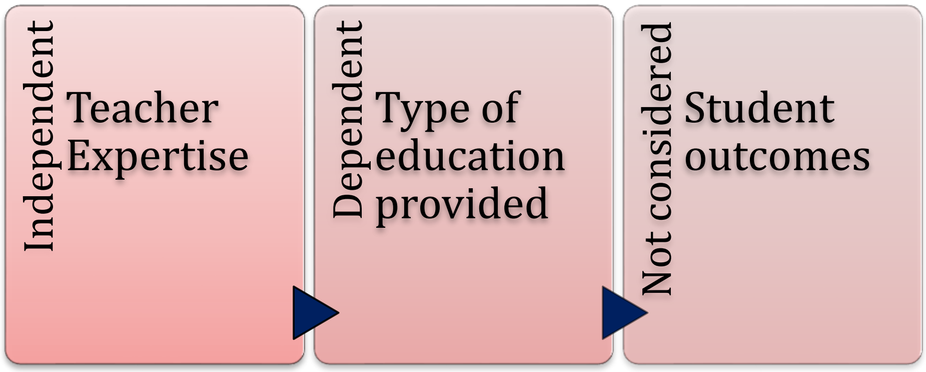


Figure 2. Relationship between teacher expertise and the type of education provided

However, eventual students outcomes are not considered in this study. What teacher expertise and the level of the students actually entails is explained further in the subchapters that are to come. Additionally, the type of education that these two variables are expected to have an influence on, are discussed as well. These are the three dependent variables, the amount of time in ECs, the level of integration and the amount of teaching to the test.

Teacher expertise can be looked at more in detail in relation to this topic as well. As opposed to the level of the student determining the education at a Primary Teacher Education School, the level of expertise of the teacher may also be a determining factor in the education that is provided at a certain school. So, the level of expertise may be of significant influence on one of the three dependent variables; time, level of integration and teaching-to-the test. Therefore, this concept will be further explored in the next paragraphs, in order to get an idea of its relevance in teaching Mathematics.

A major study was conducted in 2012, within 17 different countries to establish differences and determining factors in educating prospective teachers especially with regards to Mathematics: TEDS-M (Tatto, et al., 2012). This is a meta-analysis which focussed on different aspects of teaching and learning to teach Mathematics. The study was conducted because of the differences between countries. The focus was, among other things, on content in the teacher education programs, but also on the level of expertise of the Mathematics teachers at these teacher education programs. This research serves as an important basis for the current study, because it showed the first sign of evidence that there are large differences in between countries with regards to the level of teachers at the end of their teacher education program and differences between the programs as well. This may be reason to believe that there is a difference in between schools within one country (in this case the Netherlands) as well.

One of the main focusses of this meta-analyses was the high level of relevance between having both Mathematical Content Knowledge (MCK) and Mathematical Pedagogical Content Knowledge (MPCK). MCK is knowledge about Mathematics in general. MPCK is knowledge about teaching Mathematics. This relevant and close link between MCK and MPCK is also confirmed in a study by Buchholz & Kaiser (2013). Even though this study focussed on the future primary school teachers and not the teachers at a Primary Teacher Education School, it could be assumed that the relation between those two concepts is important in teaching Mathematics at any level.

Pedagogical Content Knowledge (PCK) is a term that was first used by Shulman (1986). PCK makes sure that a teacher knows how to be able to make content understandable for students.

The citation from Brunner et al. (2006), shows the relevance of both in depth knowledge about the subject (Mathematics) and about teaching as a trade in itself. For a teacher this means that, for example, he or she needs to know what audience they are teaching and what strategies they need to use in order to stimulate their students' learning (Koehler & Mishra, 2009). The most important feature of teaching is whether or not a teacher can justify the choices that are made during classes, especially during instruction (Kyriades, Christoforou & Charalambous, 2013). Teachers should have deeper insights and thoughts about teaching and learning. They have to be able to estimate the level of the student and offer the right teaching strategies to their students (Hattie, 2003).

All these sources point to the importance of MCK and MPCK when teaching at a Primary Teacher Education School. Based on the above it can be argued that teachers that have a degree in Mathematics and in teaching as well are the better teachers. This variable is used as a control variable because it may not only be the score of the students on the WISCAT that determines the type of education that is provided at a Primary Teacher Education School, it could be largely influenced by the level of teacher expertise.

Time and student outcomes.

Intuitively, people may think that the more time that is spent on learning subject matter or the more classes that are attended regarding, in this case, Mathematics, the better the students' skills are. First of all, time is a relevant factor in studying and learning. However, it does matter how this time is spent. Research has actually shown several times that a reduction in contact-hours and more room for self-study will lead to higher student outcomes (Schmidt, et al., 2009; Jansen, 2004; Peeters & Lievens, 2012). Of course, lectures can be relevant to bring about motivation in students (Peeters & Lievens, 2012), but when there is too much lecturing in the curriculum it can lead to less interest of students and less time for self-study (Schmidt, et al., 2009).

Based on these studies it can be concluded that time in itself is not a concept that says something about the quality of education at a certain school. What it actually shows is that the way that this time is spent is way more important. Therefore a connection has to be made between the amount of time a school spends on Mathematics and the way this time is allocated. Research from Keijzer (2015) shows that from 2009 onwards Primary Teacher Education Schools differ a lot in the amount of time they spent on Mathematics. However; what does this actually say? At the very most it says that schools are unsure of how to teach Mathematics to their students. In this study a correlation may be discovered between the level of the students and the time that is spent on Mathematics. Time is measured in ECs. ECs are European Credits and one EC is equal to 25 to 30 hours of learning (European Union, 2009). This includes not only contact-hours, but also time spent by students at home or working in groups. It could be that schools with lower scoring populations reserve more time for their students to learn. However, this does not necessarily mean that more time is better and beneficent for these students. A lot of time provided to students is not enough to make sure they learn well enough. Even though, it is still interesting to see whether or not the Primary Teacher Education Schools see a correlation between the entry level of their students and the time they provide (in ECs). This may indicate that they believe that the more time they provide, the more students learn. As stated before, it matters how this time is actually used. In the next subchapter insight will be provided in the way Mathematics can be taught at Primary Teacher Education Schools and which approaches are assumed to be most effective. Time, in this study, will be measured in terms of study-load and the amount of contact-hours. This study could eventually show that schools with same-levelled populations differ in the time they spent on their Mathematics Education and the type of education they provide to their students. Therefore, it could eventually be interesting to study which of these school perform better on Mathematics tests in later years of the educational program.

Types of Mathematical Education.

As mentioned above, it is clear that not all Primary Teacher Education Schools are offering the same amount of contact-hours and study-load when it comes to Mathematics (Keijzer, 2015). The next question that arises is whether or not Primary Teacher Education Schools with, for example, a low-scoring population provide the contact-hours in a different way to their students than Primary Teacher Education Schools with a high-scoring population? Posing this question assumes that there are different ways to teach Mathematics in Primary Teacher Education. This assumption will be illustrated in this subchapter with the help of several sources.

In the subchapter on teacher expertise a distinction was made between MCK and MPCK. MCK focusses on Mathematical Content Knowledge; knowledge about Mathematics in terms of individual skills. MPCK concerns Mathematical Pedagogical Content Knowledge; knowledge about how to teach Mathematics to others, which can actually be seen as an integration of MCK and PCK. In terms of teacher education it is important to realize that the teachers have to present both to their students. The students need to learn to teach Mathematics (MPCK) and they need to acquire certain mathematical skills and knowledge themselves (MCK) (Buchholz & Kaiser, 2013; Ball, Thames, & Phelps, 2008). These two concepts are referred to in many studies in different ways and with different names. To avoid confusion MCK and MPCK will be the concepts used in this study.

Student teachers should be able to look at Mathematical problems and see more than one way to solve these problems. They should be able to judge a child's problem-solving skills and not merely state whether a child has done an exercise correct or not (Keijzer & Kool, 2012).

Oonk, Verloop, & Gravemeijer (2015) talk about this as well and call it the 'Theory-Enriched Practical Knowledge'. They explain this concept as knowledge about teaching Mathematics and making decisions and judgements about the teaching practice based on theory.

In short, all these sources talk about the same thing in general; the relevance of MPCK. It can be concluded that the Mathematics lessons at a Primary Teacher Education School should give students the possibility to improve their own individual Mathematical Skills and their Mathematical teaching skills. The question is how to provide this to students? Is it useful to integrate when there is a low-scoring student population that does not have sufficient individual Mathematical skills?

Keijzer & Kool (2012) tried to improve the MPCK (which they called Specific Content Knowledge) of preservice teachers by providing them with the opportunity to judge certain exercises made by children and by evaluating the children's problem solving. This led to the conclusion that '… analysing, explaining and comparing several problem approaches led to more flexibility and a better overview of the approaches … Both the children's problem approaches and the input of other student teachers gave the student teachers' reasoning a boost. They often realized that teachers need to do more than solving a problem in only one way and on one level' (Keijzer & Kool, 2012, p. 6). This study indicates that it may be useful to focus on solely on MPCK at certain times, to give students insight in the processes of children's thinking. However, the question remains whether there is room to do this with students that have a hard time to master MCK to begin with. MPCK is a form of Mathematics teaching that integrates both MCK and PCK and therefore requires the students to have sufficient individual Mathematical skills to begin with. It requires the student to be at a certain level.

In this study it will be examined whether or not there is a correlation between student population characteristics (their level) and the way Mathematics is taught to these students. It can be assumed that having a low-scoring population would ask for a higher amount of focus on developing the students' individual Mathematical skills (MCK) rather than focusing on MPCK. The same as with 'Time and Student outcomes', the results on this part of study may be used as a stepping stone to decide in later research if certain teaching methods influence the tests scores of students in their further Mathematics education at Primary Teacher Education Schools. Also, suspicion could rise on whether focusing too much on the student's individual Mathematical skills rather than on the teaching of Mathematics can be seen as a form of teaching to the test. This particular concept will be discussed in the next sub-chapter.

Teaching to the test

There is little consensus among researchers on what teaching to the test actually entails. Several definitions have been proposed to describe what teaching-to-the-test means and where it begins and ends.

Au (2007) performed a qualitative meta-synthesis and studied how high stakes tests can severely influence the curriculum. It actually shows that the type of high stakes test determines the influence on the curriculum. Au (2007) talks about three types of influences these high stakes tests can have on the curriculum. The influence can be content-centred, knowledge-form centred, and pedagogy centred. The first can described as teaching content that aligns with the test. The second is focused on the way that the content of the lesson is presented to the student; whether it is similar to the way the content in presented in a high-stakes test or not. The third entails having the teacher centre the lesson around him- or herself in order to be able to prepare students for a test. This means that the teacher really controls the thinking and doing of a student in order to steer the student in the right direction. This research shows that in some cases, regarding high-stakes testing, content that was not tested was left out of the content of the lesson as well. It also shows that some high-stake tests have an influence on the way the curriculum is presented to the students (form). And lastly it showed that, in general, the lessons that prepare students for a high-stake test are more centred around the teacher than the student.

A second study by Welsh, Eastwood & D'Agostino (2014) concludes that there are five types of teaching to the test that can be identified: '

1. General instruction on tested objectives
2. Teaching test-taking skills
3. Instruction on tested objectives using examples like the test format
4. Decontextualized practice that mirrors the state test
5. Practice on the operational test.'(p.103-104)

In comparison to the research by Au (2007), Welsh, Eastwood & D'Agostino (2014) seem to have succeeded in a more specified way of describing teaching-to-the-test. Where Au (2007) describes three very general categories, the latter present more concrete examples and 'levels' of teaching to the test (the first being not intrusive on the teaching at all, the last being very determinative in the teaching). Not intrusive means that the way a teacher prepares his or her students for a test is considered to be appropriate; it is okay to provide a student with general instructions on what to expect at a certain test, like for example informing the students about what topics will be tested. Very intrusive means that it is considered to be inappropriate. For example; providing students with exact exercises from the test. It means that the teachers' teaching is very, very much influenced by the test, i.e. the test is very intrusive in the teaching in a classroom.

When looking at these five points, the researchers see the first two points as being appropriate, the last two points as inappropriate. They cannot decide to which of the two, appropriate or inappropriate, the third point belongs. In this research the third point will be viewed as an appropriate way of teaching-to-the-test. This choice has been made because Welsh, Eastwood & D'Agostino (2014) show that only the last two points are certainly inappropriate, and this makes sure that only the forms of teaching to the test that are definitely not useful will be identified and singled out.

Au(2007) also makes no comments about whether or not any of the three forms of teaching to the test are beneficial for learning or maybe the opposite. Welsh, Eastwood & D'Agostino (2014) make a distinction in the severity of teaching-to-the-test. This research eventually shows that there is no gain from item-preparation and it may even be considered a form of fraud.

In addition it seems that high-stake tests are more prone to bring about teaching-to-the-test than low-stake tests (Au, 2007; Pedulla, et al., 2003).

When relating this information to this research it will be quite interesting to test if there is a relationship between the type of student that enters a Primary Teacher Education School and the level in which this school uses Teaching-to-the-test as a means to improve their students skills.

Introduction of the research question, hypotheses and research model

Research questions

In line with the theoretical framework above, the research questions and the matching hypotheses are presented. This will lead to the presentation of the research model at the end of this chapter. The main research question combines all the concepts as treated above by naming them ‘Characteristics of Teaching Mathematics at Primary Teacher Education Schools’:

“**Which characteristics of Teaching Mathematics at Primary Teacher Education Schools in the Netherlands are related to the level of the students on the WISCAT-test when entering the education program?”**

These ‘characteristics’ are specified in the sub questions that are listed below.

- Does a higher average score of students on the WISCAT lead to a lower amount of study-load (in ECs) for Mathematics?
- Does a higher average score of students on the WISCAT result in a higher focus on integration of MCK and PCK (MPCK)?
- Does a lower average score of students on the WISCAT lead to a higher amount of teaching to the test?
- Does a higher level of teacher expertise lead to a higher amount of study-load (in ECs) for Mathematics?
- Does a higher level of teacher expertise lead to a higher focus on integration of MCK and PCK (MPCK)?
- Does a higher level of teacher expertise result in a lower amount of teaching to the test?

Hypotheses.

Each of these questions will be linked to a hypothesis that will follow logically from the theoretical framework as it was presented. A short explanation for the formulation of each hypothesis will be given by providing the literature that support this hypothesis.

The first sub-question is: Does a higher average score of students on the WISCAT lead to a lower amount of study-load (in ECs) for Mathematics?

The fourth sub-question is: Does a higher level of teacher expertise lead to a higher amount of study-load (in ECs) for Mathematics?
Based on Schmidt, et al. (2009); Jansen (2004), Peeters & Lievens (2012) it leads to formulating the first two hypotheses:

H1: The lower the average score of a school on the WISCAT, the higher the study-load (in ECs) will be. In its turn, the higher the average score of a school on the WISCAT, the lower the study-load (in ECs) will be.

H2: The level of teacher expertise has no correlation with the amount of study-load (in ECs)

The second and fifth sub-question are at the basis of the next two hypotheses. The second sub-question is: Does a higher average score of students on the WISCAT result in a higher focus on integration of MCK and PCK (MPCK)?

The fifth sub-question is: Does a higher level of teacher expertise lead to a higher focus on integration of MCK and PCK (MPCK)?
Based on Welsh, Eastwood & D’Agostino (2014), Ball, Thames, & Phelps (2008) and Keijzer & Kool (2012), the third hypothesis is:

H3: The higher the average score of a school on the WISCAT, the higher the level of integration of MCK and PCK (MPCK).

H4: The higher the level of teacher expertise, the higher the level of integration of MCK and PCK (MPCK).

The third and last sub-questions lead to the last two hypotheses. The third sub-question is: Does a lower average score of students on the WISCAT lead to a higher amount of teaching to the test? The sixth and last sub-question is: Does a higher level of teacher expertise result in a lower amount of teaching to the test? Based on Welsh, Eastwood & D'Agostino (2014) and Au (2007), these are the last two hypotheses:

H5: The lower the average score of a school on the WISCAT, the higher the amount of teaching to the test that occurs at a school.

H6: The higher the level of teacher expertise, the lower the level of teaching to the test.

Research model.

Seen below is the research model visualizing the present study. Since there has been no research on this particular subject before, the research model was made from scratch based on the theoretical framework (and the hypotheses that followed from the framework). On the upper-left side the main independent variable is presented: "average score WISCAT per school". Below this independent variable is a black line indicating the distinction between the main independent variable and the control variable which is also independent: "Level of teacher expertise per school". Both independent variables are connected to the dependent variables through arrows to indicate a possible correlation between them. On the upper right side the first dependent variable is presented; " time in terms of ECs and study-load". Below that the second dependent variable: " Level of integration". On the bottom right the third and last variable: " teaching-to-the-test". This is a fairly straightforward model, which indicates there may be correlations between the independent variables and the dependent variables which can be determined by linear regression analyses, which will be further described in the chapter on data-analysis.

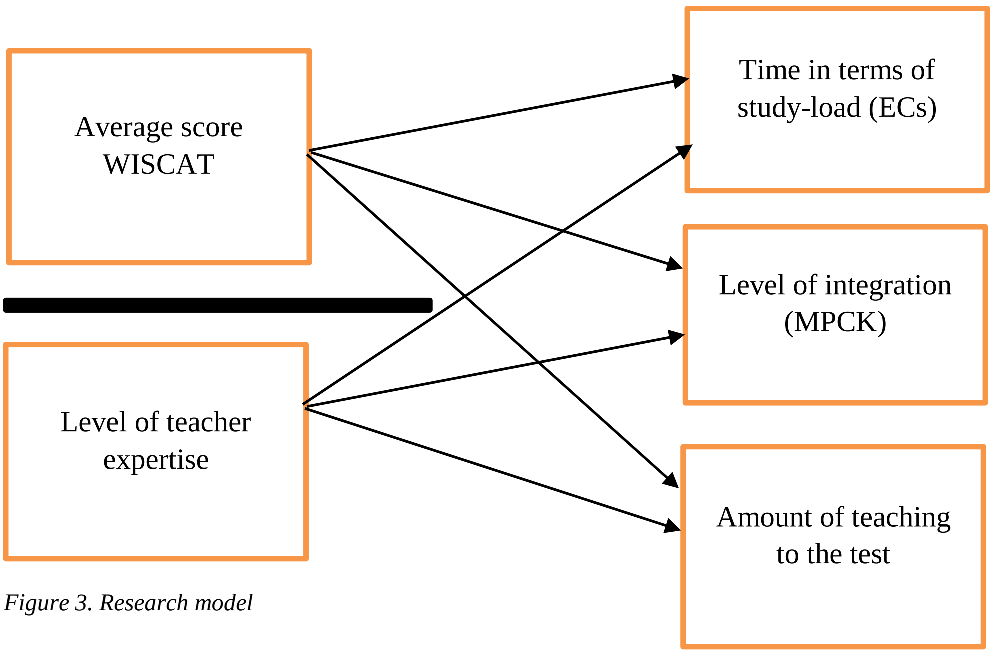


Figure 3. Research model

Method

Research design.

When looking at the model, the research questions and hypotheses it is clear that this research has a correlational design using a cross-sectional method. This is a correlational design because the dependent variable and the control variable are measured and not set on a certain value. This has implications for the conclusions that can be drawn from any relationships that are found between the independent variables and the dependent variables. Because it is not certain whether or not the independent variables actually have a direct influence on the dependent variables, this is not an experimental design. The cross-sectional method relates to the fact that the survey that is included in this research will only be held at one point in time and not at multiple times over a longer period.

This research is a quantitative research. The data concerning the average student score on the WISCAT per school are collected on a large scale; the data concern numbers of all schools of all first year students of the schoolyear 2012-2013. Why this year is chosen will be explained in the subchapter on respondents. More information on the data collection can be found under data collection and procedure. The data concerning the control variable and the dependent variables are also quantitative. However, the population in terms of schools is much smaller then when looking at individual student scores. There are only 38 Primary Teacher Education Schools in the Netherlands, which is a fairly small sample, however, there simply are no more Primary Teacher Education Schools.

Data

There are two distinct sources of information within this research. The first is CITO (Central Institution for Test Development, in Dutch: Centraal Instituut voor Toets Ontwikkeling), which is the organization that developed the WISCAT-test. In case of this research the data requested from CITO concerns schoolyear 2012-2013. Because this research in itself tries to uncover relations between students' average scores and the type of education, it may as well serve as a basis for further research that will focus on discovering whether or not the type of education that is provided actually improves the students' performance on a third-year standardized Mathematics test; the Knowledge-Base Test for Mathematics. This test was first implemented in schoolyear 2014-2015. To make a relevant comparison between the students who first took the third year test, when comparing it to the score on the WISCAT, the data from 2012-2013 is needed. So the choice for the use of the data from 2012-2013 is solely based on possible further research. The CITO has therefore been requested to provide data from students in the schoolyear 2012-2013, which were very kindly provided.

The other source of information are Mathematics teachers at Primary Teacher Education Schools that taught the students whose scores were requested from CITO. These are the teachers that taught these students in the years of 2012-2013 and 2013-2014. In these years the students were in the Major-phase (as it is called in the Netherlands; can also be described as the main-phase of the education) of their studies. Because the teacher that fills out the survey has to be a teacher that taught these students in the year of 2012-2013 and 2013-2014, in some schools only one teacher filled out the survey, whereas other schools had multiple teachers working together on the survey.

Then, through the survey, some data were collected among all the Mathematics teachers at Primary Teacher Education Schools, not necessarily the teachers that taught these particular students. These questions relate to the personal background of the teacher and this survey was accessible to all Mathematics teachers at the Primary Teacher Education Schools.

More details on the content of this survey and the way the data were collected are provided in the next subchapters.

Data collection and procedure.

In order to collect the data, several ways of data collection were used. Each way of data collection and the procedure that goes along with it will be presented in order to clarify the way the data was collected. In the end some general information will be provided on the overall procedure of setting up this research.

Data from CITO

For collecting data from CITO, a formal request was sent to the organization, to see what the possibilities were to get data concerning individual students. Before these data were made available for this study, absolute anonymity had to be guaranteed. In order to achieve this anonymity, a confidentiality agreement had to be signed. This agreement states that in case of a publication of this study no school or individual student is traceable. Therefore, CITO themselves made sure that the data that were provided cannot be traced to a certain individual. And because this study works with average scores per school, there is no eminent danger that any results can be led back to an individual. In reporting the results of this research, the only thing that has to be taken into account is to make sure that none of the results can be connected to a certain school. CITO provided the scores of the students' first, second and third attempt to pass this test for the year 2012-2013.

Data from teachers

The data concerning the teachers were collected through a survey. There are two parts of the survey. The first part concerns the teachers that have taught the students in the schoolyear 2012-2013 and the schoolyear 2013-2014. A survey was developed and digitally distributed among the 38 Primary Teacher Education Schools. For each school one contact-person was available that was found through the network of Primary Teacher Education Schools. These contact persons were requested to find a teacher that met the requirements for filling out this survey, and have them actually filling it out. Some schools had to be contacted a couple of times in order to get through to the right contact person, or because they forgot to fill out the survey.

The second group of teachers are all the Mathematics teachers at all the Primary Teacher Education Schools. Again, an email was sent with a request to all the Mathematics teachers to respond to the survey about their personal background. In this case, most of the schools only needed the one email to let the teachers fill out the survey.

General information regarding the procedure.

In order to collect the data, two surveys were developed. These two surveys are completely based on the theoretical framework as it was presented before. Its contents are aimed at retrieving information on the control variables and the dependent variables: level of teacher expertise, time in study-load and contact-hours, level of integration and teaching-to-the-test. These surveys were distributed in December 2015 and most of the data was collected in February 2015 The final count of surveys collected concerning the teachers that taught the 2012-2013 students is 19 (19 schools filled out the survey, which is 50%). The final count of the other survey, requesting personal information of Mathematics teachers at the Primary Teacher Education Schools is 74. Because there is no information on how many Mathematics teachers there are at Primary Education Schools in the Netherlands in total, it is hard to provide an accurate percentage. Next to that, the schools that filled out the survey on the dependent variables (the first survey) can be used either way. The schools that filled out both surveys can be used in this research as well; this would be the desired situation. However, schools of which only the level of teacher expertise is known, because only the second survey was filled out, cannot be used because if there is no information on the dependent variables.

Instrumentation

In order to explain what the surveys looked like and to get an idea of their contents, all the variables that are included in this research will be presented below. Of each variable an example or some examples will be provided in order to illustrate the content of the two surveys. Additionally, the choice for the type of measurement will be explained as well.

Control variable.

The control variable, as presented below the thick black line in the research model, is the level of teacher expertise. This variable was measured by using the survey that was distributed among all the Mathematics teachers of the Primary Teacher Education Schools to gather information on their background. In the theoretical framework MPCK is considered the most relevant aspect of teacher expertise. As mentioned before, MPCK is a combination of PCK and MCK. That is why those concepts are measured by the survey to determine the level of teacher expertise. There was no time to visit all the Primary Teacher Education Schools in the Netherlands and observe the level of integration of MCK and PCK (MPCK) and therefore the survey was used. In this survey, having a teaching-degree was linked to PCK and having a degree in Mathematics was linked to MCK. Having both a degree in mathematics or STEM and a teaching-degree was related to MPCK. Lastly, the respondents were asked to indicate their years of experience as a teacher at a Primary Teacher Education School. All these concepts together could determine whether or not a teacher has a high or a low level of expertise. The most ideal situation would be a teacher with a teaching degree in STEM who has been teaching at a Primary Teacher Education School for more than 10 years. In table 1 this is clarified:

Table 1. Link between type of knowledge and measurement

Type of knowledge:	**Measured by:**
PCK	Teaching degree
MCK	Degree in STEM
MPCK	Having both a teaching degree and a degree in STEM

An example of a question that was posed to the teachers is: “Do you have a STEM background?’. Followed by: ‘Do you have a degree in Mathematics or some other STEM field?’. These two questions are obviously focused on the level of MCK of a teacher. Another example of a question that measured the level of PCK is: ‘Do you have a degree in teaching?’ In the end, a teacher could score a 1 through 4 on the ‘Level of teacher expertise’. This number is based on the three qualities in Table 1 and the number of years (more than 10 means experienced) they have been a teacher. A ‘1’ means that a teacher possesses none of the qualities described in Table 1. A ‘2’ means a teacher possesses one of the qualities displayed in Table 1, or has more than 10 years of experience. A ‘3’ means that the teacher possesses either two out of three qualities described in Table 1, or 1 of those qualities and more than ten years of experience. And finally, ‘4’ means the teacher possesses all of the qualities from Table 1 and has more than 10 years of teaching experience. The full survey is displayed in Appendix 1.

Dependent variables.

Time in terms of study-load and contact-hours

This variable is measured by the second survey in which the schools were asked to provide insight into their schedules for the school-years 2012-2013 and 2013-2014. Specifically: the schools were asked to provide the amount of contact-hours and ECs in Mathematics. As the theoretical framework pointed out; time is relevant in teaching Mathematics. This question was added to the survey, to see whether or not schools differ in the time they spent on Mathematics and whether or not that is related to the WISCAT scores of the students. Additionally they were asked to fill out the amount of obligated contact-hours. The reason for asking about the amount of obligatory contact-hours and not about the total of contact-hours is to make sure that the students actually attend these hours. See question 13 in the survey. The whole second survey can be seen in Appendix 2.

The amount integration of PCK and MCK (MPCK)

The amount of integration of MCK and PCK in the lessons that are provided to students at a Primary Teacher Education School is the next dependent variable that was measured by means of this survey. This was a more complex variable to translate into a survey question. First of all because in research on the combination of PCK and MCK, little was found on the measurement of the integration of PCK and MCK in Primary Teacher Education. One research was found in which only two schools were involved (Keijzer & Kool, 2012). The measurements used in this research was qualitative, rather than quantitative.

Next to that, the integration of PCK and MCK within Mathematics at Primary Teacher Education Schools is seen as a positive thing. When asking about the amount of integration straight up, this brings the risk of socially desirable answers. Therefore, in this survey, respondents were asked to react to a number of concrete statements (using a Likert-scale) and some indirect questions were asked as well. An example of one of the statement is ‘I provide my students with lessons in which they work on their own personal skills in Mathematics, but in which Pedagogical Content Knowledge is not treated’. The teacher has the opportunity to answer on a scale of ‘Not at all’ to ‘Substantially (more than 50% of the time). This is item 14 which is displayed in full in the survey in Appendix 2. The second way of measuring the amount of integration of Pedagogical Content Knowledge and personal skills within the lessons taught, a question with an image was used. In each of these questions the teacher gets to see three images of what their lessons could look like. They were asked to divide 100% over these three options, accompanied by the question: ‘Which of these options resembles your lessons to what percentage?’. Each of these three images show an example of a lesson in which only Pedagogical Content Knowledge is treated, in which only personal skills are treated and in which both are combined. An example of three of these options are given in figure 4. All the questions concerning this topic can be seen in Appendix 2, item 16 through 19.

Optie 1

Reken uit:

-12 X -10 =

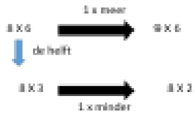
28 X 11 =

6 X 7 =

Aan de hand van een dia, werkblad of opdracht in een boek met opgaven (als boven) bespreekt u met uw studenten hoe je deze sommen kunt uitrekenen. U maakt daarbij geen gebruik van een schema of model.

Optie 2

Welke eigenschap die van toepassing is op vermenigvuldigsommen zie je hieronder?



Aan de hand van een dia, werkblad of opdracht in een boek met opgaven (als boven) bespreekt u met uw studenten aan de hand van een schema of model hoe gegeven opgaven uitgerekend kunnen worden door gebruik te maken van een specifieke eigenschap.

Optie 3

Reken uit en leg uit welke handigheid je gebruikt. Hoe heet die handigheid?

3 X 8 =	14 X 8 =
6 X 8 =	15 X 8 =
7 X 8 =	14 X 16 =

Aan de hand van een dia, werkblad of opdracht in een boek met opgaven (als boven) bespreekt u met uw studenten hoe handige strategieën gelabeld kunnen worden.

Figure 4. Question on the level of integration from the survey

Teaching to the test

The last dependent variable is teaching to the test. As with the level of integration, teaching to the test is a challenge to measure objectively. Several sources and the theoretical framework of this research were used to formulate the questions for the survey as objectively and accurately as possible, avoiding the risk of social desirable responses from teachers. The first source is the Survey of the Extended Curriculum (SEC - Surveys of Enacted Curriculum, 2013). This survey focusses on several aspects of the curriculum. They provide, for example, a survey on instructional methods regarding Mathematics. These questions were initially actually focused on grade 12 teachers in the United States, but the questions were adapted to fit the respondents involved in this research, and also translated in Dutch. Some examples of questions that were derived from this survey are: ‘ During my classes I offer my students with example items from the Knowledge-Base Test for Mathematics’ and ‘ I do not treat certain subjects in my classes because they are not part of the Knowledge-Base Test for Mathematics’. These statements had to be answered on a Likert-Scale from ‘Completely disagree’ through ‘Completely Agree’.

The Knowledge-Base test for Mathematics is chosen to be mentioned here, because this is the only high-stakes, standardized test, which the students take after the first two years of the teacher training. In order to measure the amount of teaching to the test and the relevance of this particular test, it seemed to make sense to ask the 'teaching to the test' questions referring to this test. Furthermore, this research may eventually be the stepping stone for further research in which, for example, the researchers will try to find out why a certain school scores better on the Knowledge-Base test for Mathematics than another school. The items based on the Survey of the Extended Curriculum can be found in Appendix 2, question 20 and 21.

A second set of questions concerning teaching to the test were formulated positively in order to avoid the risk of teachers providing socially desirable answers. Those questions were taken from a research by Jäger, Merki, Oerke, & Holmeier (2012). An example of one of these statements is: 'I took the desires and interests of my students into account in choosing the topics/content of the course' (Jäger, Merki, Oerke, & Holmeier, 2012, p. 457). Again, a Likert scale was provided to let the teacher choose from 'Completely Disagree' through 'Completely Agree'. In Appendix 2 the complete set of items is shown in question 22.

In the next chapter, information will be provided on how the data, once gathered, were analyzed and why. After this the actual results of the research will be provided in the chapter on 'Results'.

Data-analysis.

Average WISCAT-score

First, the independent variable was prepared; the mean scores per school for the WISCAT were calculated. These means were added to the data-set in which the survey of the Primary Teacher Education Schools was coded. The average score of the schools that participated in this research is 118.13. The average of the schools that do not participate in this research is 118.7. Therefore the sample is believed to be representative of the entire population. The average for each school was calculated following the next steps:

1. All students that passed on the first try were included
2. The students that passed on their second or third try were included as well, but the score that was included for these students was their score of their first try (in order to accurately calculate the level of a student when he or she started the education)

In the results section the averages per school (both the ones included and the ones not included) are provided. It is good to keep in mind that the average score of all the students that took the test in the year 2012-2013 is lower than the average that is used here. So the average of all the students of all the schools, whether they passed or not is lower than the 118 used in this research based on the steps above, at an average score of 106.

Teacher expertise

The data which concerned the control variable, 'Teacher Expertise', had to be prepared to fit the rest of the data. Some schools had several teachers fill this information out, others only had one. In the case of a school with more than one teacher, averages were calculated per item in the survey.

Additionally, the average years of experience in teaching at a school were calculated as well. Together it eventually led to a variable with values between 'Extremely experienced'(1) and 'Extremely unexperienced'(4). Extremely experienced means that a school has at least one teacher with a STEM-background, a teaching certificate (together that means having MPCK) and more than ten years of teaching experience at either a Teacher Education School or as a Mathematics teacher in general. Extremely unexperienced means that a school has no teachers with a STEM-background, a teaching certificate and also that none of the teachers has more than ten years of experience.

Dependent variables

Finally, the data concerning the dependent variables had to be prepared as well, in order to be able to perform the analyses. Each of the dependent variables will be discussed below, in order to explain how the data were prepared to make them suitable for analyses.

Time in terms of study load

This variable is measured by one concept that determines the study load for students. This is the amount of ECs (European Credits). The Primary Teacher Education Schools were asked what the amount of ECs were in the school years of 2012-2013 and 2013-2014. The average amount of ECs was calculated over these two years and eventually resulted in the variable named: 'Average amount of ECs". In the survey the schools were asked to fill out the amount of obligated ECs the students had to get and the total amount of ECs they could get. In all of the cases these numbers were similar so there was no distinction made between obligated ECs and non-obligated ECs.

The schools were also asked to fill out the amount of contact hours that they provided their students with, but these will not be used in this research. Because there is no information on how these contact hours are used, it cannot be assumed that more or less hours of contact is either better or worse.

Level of integration (MPCK)

The level of integration was measured by several items in the survey on several scales. This results in different types of measuring.

First there is question 14, which contains 3 items, which measured on a Likert scale whether the amount of integration was high or low.

Item 16 through 19 asked the respondents to award a percentage to a type of lesson they would teach. Per item they divided 100 percent between lessons focussed on MPCK, MCK and PCK. From these items the percentage of the third option that represented MPCK was used. The percentage MPCK was placed on a scale of 1 to 5, similar to the scale of question 14.

Over these 7 items a reliability analysis was conducted. Three items (17 through 19) proved to produce the highest Chronbach's Alpha (.638, see table 2), and were therefore used in the eventual data-analysis.

Table 2. Reliability of Level of Integration items

Cronbach's Alpha	N of Items
.638	3

In the end, one overall score was calculated for the level of MPCK, by calculating the average of the numbers on a Likert-Scale. This variable was named 'Integration'.

Teaching to the test.

The last dependent variable is teaching to the test. This variable was measured by question 20 through 22 in the survey and these questions consisted of several items. All these items were measured on a Likert-Scale. However, some items were formulated positively in order to avoid socially desirable answers. This lead to recoding the answers of question 22. Question 20 was measured on a Likert-scale.

Question 21 contained several items. Each item represents a topic that possibly decides the type of education at a school. The school had to fill out which of these topics were very decisive in the type of education at their school, and which were less. Items 1, 2 4 and 5 represented teaching to the test and had a high level of mutual correlation.

Together, these 3 questions had a total of 22 items that are supposed to represent teaching to the test. In order to make sure they actually did, a reliability analysis was performed. This reliability analysis showed an optimal Chronbach's Alpha (.726) with 13 items still left. This is shown in table 3.

Table 3. Reliability of Teaching to the test items

Cronbach's Alpha	N of Items
.726	13

In the end, one score on teaching to the test per school was calculated by finding the average of these 13 items, again on a Likert-Scale in which 1 represents a very low level of teaching to the test, and in which 5 presents a very high level of teaching to the test.

Analyses.

The actual data-analysis is very straightforward in this study. It is focused on discovering a possible relationship between the independent variables and the dependent variables (in some cases positive, in some cases negative). A regression analysis will be applied to discover a relationship. Important when using this type of analysis is to remember that a regression analysis solely indicates that there is a correlation between the dependent variable and the independent variable(s); however it does not give any certainty as to whether there is causality between the two. More on this will be discussed after the results section in the chapter ‘Discussion’. A multiple regression analysis will be conducted in order to determine which of the independent variables has a significant correlation with the dependent variable.

Results

In this chapter the results of the statistical analyses performed in SPSS will be provided. All schools were included in the analyses, because the schools that administered the WISCAT relatively late, compared to the other schools, were left out but that provided no substantial difference in results. To visualize as clearly as possible the relevant results of this research, tables and graphs will be provided if necessary. Note that no interpretation of the results will be provided in this chapter. This will be provided later on in the conclusion and discussion part of this study.

When tables or graphs are used to visualize the results, a written description will be given each time to clarify what can be seen in the figures and what the coding in these figures means. The results are based on the data-analyses as was explained in the chapter above.

General statistics.

Below some general statistics on each of the variables is provided. First on the frequencies. Underneath each table a short explanation is provided to clarify any remarkable outcomes.

Table 4. Statistics on each variable

		Mean WISCAT	Teacher Expertise	Average amount of ECs	Level of Integration	Amount of TTT
N	Valid	19	19	17	19	19
	Missing	1	1	3	1	1
Mean		118.13	1.58	6.235	4.153	2.905
Median		118.13	1.00	7.500	4.300	2.800
Std. Deviation		5.07524	.769	2.7336	.5641	.3865

In table 4, the mean, median and standard deviation are presented. It shows that the average ‘amount of ECs’ has a relatively high standard deviations, which should be taken into account when interpreting the eventual results. Secondly, the ‘Amount of TTT’, or the amount of teaching to the test has a very small standard deviation.

Table 5. Statistics on Teacher Expertise

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Experienced	11	55.0	57.9	57.9
	Experienced	5	25.0	26.3	84.2
	Inexperienced	3	15.0	15.8	100.0
	Total	19	95.0	100.0	
Missing	System	1	5.0		
Total		20	100.0		

Table 5 shows that the majority of the teachers has a high level of expertise. This may have consequences for the eventual results, because if there is not much variation, it may result in ‘Teacher Expertise’ not being a significant predictor for the dependent variables.

Table 6. Statistics on Amount of ECs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.0	1	5.0	5.9	5.9
	1.5	1	5.0	5.9	11.8
	2.0	1	5.0	5.9	17.6
	4.0	1	5.0	5.9	23.5
	5.0	2	10.0	11.8	35.3
	6.5	1	5.0	5.9	41.2
	7.0	1	5.0	5.9	47.1
	7.5	3	15.0	17.6	64.7
	8.0	4	20.0	23.5	88.2
	9.0	1	5.0	5.9	94.1
	10.5	1	5.0	5.9	100.0
	Total	17	85.0	100.0	
Missing	System	3	15.0		
Total		20	100.0		

Table 6 shows the difference in ECs per school. It is obvious that schools differ a lot in the amount of ECs they present their students with. This was also shown in the large standard deviation as can be seen in table 6 above.

Table 7. Statistics on the Level of Integration

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3.0	1	5.0	5.3	5.3
	3.3	2	10.0	10.5	15.8
	3.7	2	10.0	10.5	26.3
	4.0	3	15.0	15.8	42.1
	4.3	6	30.0	31.6	73.7
	4.7	3	15.0	15.8	89.5
	5.0	2	10.0	10.5	100.0
	Total	19	95.0	100.0	
Missing	System	1	5.0		
Total		20	100.0		

Table 7 clearly indicates that all the values of 'Level of Integration' are close together. There are no schools with a 'Level of Integration' below a value of '3', which represents a medium 'Level of Integration'.

Table 8. Statistics on the amount of Teaching to the test

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2.4	3	15.0	15.8	15.8
	2.5	1	5.0	5.3	21.1
	2.6	1	5.0	5.3	26.3
	2.7	2	10.0	10.5	36.8
	2.8	3	15.0	15.8	52.6
	2.9	1	5.0	5.3	57.9
	3.0	1	5.0	5.3	63.2
	3.1	3	15.0	15.8	78.9
	3.2	1	5.0	5.3	84.2
	3.5	2	10.0	10.5	94.7
	3.7	1	5.0	5.3	100.0
	Total	19	95.0	100.0	
Missing	System	1	5.0		
Total		20	100.0		

As mentioned before, and as the standard deviation of the 'Amount of teaching to the test' clearly shows, the scores on this variable are close together, which is shown by table 8. All scores are between 2,4 and 3,7, which means that there are no schools with an extremely high score on teaching to the test, and no schools with an extremely low score on teaching to the test.

Table 9. Correlations between all the variables

		Mean WISCAT	Teacher Expertise	Average amount of ECs	Level of Integration	Amount of TTT
Mean WISCAT	Pearson Correlation	1	-.173	-.158	.114	.248
	Sig. (2-tailed)		.479	.544	.641	.306
	N	19	19	17	19	19
Teacher Expertise	Pearson Correlation	-.173	1	.390	-.356	.326
	Sig. (2-tailed)	.479		.122	.135	.173
	N	19	19	17	19	19
Average amount of ECs	Pearson Correlation	-.158	.390	1	-.466	.045
	Sig. (2-tailed)	.544	.122		.059	.862
	N	17	17	17	17	17
Level of Integration	Pearson Correlation	.114	-.356	-.466	1	.246
	Sig. (2-tailed)	.641	.135	.059		.310
	N	19	19	17	19	19
Amount of TTT	Pearson Correlation	.248	.326	.045	.246	1
	Sig. (2-tailed)	.306	.173	.862	.310	
	N	19	19	17	19	19

Table 9 on correlations is presented because the analyses that are performed are multiple regression analyses. The values in the rows behind 'Pearson Correlation' show the correlation of one variable with another. For the two independent variables this shows that they are negatively correlated: When the 'Mean WISCAT' of a school is low, the level of 'Teacher Expertise' at that school is high. This could be considered valuable; when students have a lower level, a high level of teacher expertise may help improve the students.

In the next subchapters the results of the multiple regression analysis per dependent variable are presented. Numbers that stand out are explained. No interpretation of the results will be provided in these subchapters, but in the chapter 'Conclusion and Discussion'.

In order to understand these results it is relevant to keep in mind that this particular study is not based on a genuine sample of the entire population. There are only 38 Primary Teacher Education Schools in the Netherlands and all of them were asked to participate in this research. Approximately 45% actually participated eventually, which is a high percentage of the total population. Therefore the value that is considered in these multiple regression analyses is primarily the standardized regression coefficients (Beta)'. The Beta value actually shows the change in the dependent variable in standard deviations when the independent variables increases one standard deviation. The lowest 'Standardized Coefficients (Beta)' is set on .300/-.300. These levels are higher than normally accepted, but that is because the high percentage of the total population that is used in this study. The significance level is not considered relevant in this research, even though these values are shown in the tables; the Standardized Coefficients (Beta) are leading.

Influence of the average WISCAT-score on time in ECs

Table 10 below shows the results on the multiple regression analysis with regards to the influence of the ‘Mean WISCAT’ and the ‘Level of teacher expertise’ as the independent variables, on the amount of ECs provided at a certain school.

Table 10. Coefficients table concerning the influence of 'Mean WISCAT' and 'Teacher Expertise' on the 'Average amount of ECs'

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	10.798	16.019		.674	.511
	Mean WISCAT	-.057	.134	-.105	-.426	.676
	Teacher Expertise	1.305	.859	.375	1.520	.151

a. Dependent Variable: Average amount of ECs
*R Square for this model is .163

Table 10 shows that the R square for this model is .163, which means that 16.3 percent of the variance in the dependent variable ‘Amount of ECs’ is predicted by the ‘Mean WISCAT’ and ‘Teacher Expertise’, the independent variables of the model.

The only relevant beta-values in table 10 relate to the variable ‘Teacher Expertise’. As mentioned in the subchapter on ‘General statistics’, the level of the Standardized Coefficients (Beta) is considered relevant when the value is above .300. This is the case with the variable ‘Teacher Expertise’ which has a Standardized Coefficient (Beta) of .375. This means that when the independent variable increases one standard deviation, the dependent variables increases .375 standard deviations.

Influence of the average WISCAT-score on the level of integration (MPCK)

The tables below show the results on the multiple regression analysis concerning the influence of the mean on the WISCAT and the level of teacher expertise as the independent variables, on the level of integration at a certain school.

Table 11. Coefficients table concerning the influence of 'Mean WISCAT' and 'Teacher Expertise' on the 'Level of Integration'

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
	(Constant)	3.842	3.162		1.215	.242
	Mean WISCAT	.006	.026	.054	.230	.821
	Teacher Expertise	-.254	.174	-.347	-1.464	.162

a. Dependent Variable: Level of Integration
*R Square for this model is .130

Table 11 shows that the R square for this model is .130, which means that 13 percent of the variance in the dependent variable ‘Level of integration’ is predicted by the ‘Mean WISCAT’ and ‘Teacher Expertise’, the independent variables of the model.

Apparent in table 11 is the relevance of the variable ‘Teacher Expertise’ in predicting the ‘Level of Integration.’ The value of the Standardized Coefficient (Beta) is -.347, so this relationship is considered relevant in this research. ‘Mean WISCAT’ shows a slight positive relationship with ‘Level of Integration’. However, this is relationship is too small to be considered relevant enough.

Influence of the average WISCAT-score on the amount of teaching to the test

The tables below show the results on the multiple regression analysis with regard to the influence of the ‘Mean WISCAT’ and the ‘Level of teacher expertise’ as the independent variables, on the ‘Amount of teaching to the test(TTT)’ at a certain school.

Table 12. Coefficients table concerning the influence of 'Mean WISCAT' and 'Teacher Expertise' on the 'Amount of TTT' '

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-.211	2.076		-.102	.920
	Mean WISCAT	.024	.017	.314	1.383	.186
	Teacher Expertise	.191	.114	.380	1.676	.113

a. Dependent Variable: Amount of TTT
*R Square for this model is .202

Table 12 shows that the R square for this model is .202, which means that 20.2 percent of the variance in the dependent variable ‘Amount of teaching to the test’ to the test is predicted by the ‘Mean WISCAT’ and ‘Teacher Expertise’, the independent variables of the model.

Table 12 also shows that both variables have a substantial influence on the amount of teaching to the test. The numbers indicate that the chance is just 18.6 percent of finding a sample with a beta of .314 or higher if the relationship between the ‘Mean WISCAT’ and the amount of teaching to the test is actually zero in the entire population . The same goes for ‘Teacher Expertise’, in which case the chance is 11.3 percent of finding a sample with a beta of .380 or higher if the relationship with ‘Amount of Teaching to the Test’ is zero in the entire population. The Standard Coefficient (Beta) with a value of .314 means that when the ‘Mean WISCAT’ changes one standard deviation, the amount of teaching to the test changes .314 deviations. This is quite a big change and therefore considered relevant. The same goes for the variable ‘Teacher Expertise’, which shows practically the same as the variable ‘Mean WISCAT’: this relationship is also considered relevant because the Standard Coefficient (Beta) is .380.

In the next chapter these numbers will be interpreted and possible explanations for these outcomes will be provided. Additionally, in the discussion part of that chapter the conclusions will be thoroughly discussed. This will lead to some recommendations for further research in the last chapter.

Conclusions and discussion

In this chapter the conclusions on the results will be presented and discussed. First of all some general remarks will be made regarding the general statistics of this research and it will be argued how to interpret these general statistics. After this the, main research question will be answered and some general remarks on the conclusions of this study will be made. After this, each research question with the accompanying hypothesis will then be presented at the beginning of each sub chapter. Possible explanations for the results will be provided as well, and questions that may arise will be discussed.

General statistics

One thing that stands out, regarding the general statistics in the chapter on the results, is shown in table 9, the table on correlations among all the variables. There is a strong negative correlation (.-466) between Amount of ECs and Level of Integration. These are the dependent variables in this research, and at the very least, this relationship is remarkable. It suggests that if the Amounts of ECs decrease, the Level of Integration increases. No theoretical research has been done in this study on the relationships among the dependent variables, but table 9 clearly shows there is a negative correlation. It may mean that when a school has less time (in ECs) reserved for Mathematics, a teacher has to integrate MCK and PCK as much as possible in order to get all the work done. The other way around it may indicate that when a school has more ECs reserved for Mathematics, there is more time for MCK and PCK separately, so integration goes down. However, it does not show how the rest of the ECs are spent. The actual level of integration may be as high in a school with a higher amount of ECs.

The rest of table 9 shows correlations that are in line with findings from the multiple regression analyses. The correlations correspond with the values found in the tables on coefficients. Every negative correlation in the correlations table has a negative Standardized Coefficient (Beta), and every positive correlation in table 9 had a positive Standardized Coefficient (Beta), and also the actual values are close to each other.

General remarks and main research question

When interpreting the results of this study, it should be considered that these conclusions have to be drawn very carefully. First of all there is a small number of respondents. This means that even when one respondent is added to or left out of the analyses, the results may differ. Secondly, the sample of the population constitutes a very large part of the entire population, almost 50 percent. There is no guarantee or information on what the other half of the population might have filled out when they had participated. There is no reason to consider that this would lead to completely different results, but it is wise to keep this in mind when reading this study.

Keeping this in mind, the main research question will be answered next.

“Does the level of the student population (based on the average population score on the WISCAT) and the level of teacher experience determine the characteristics of Mathematics Education that is provided at Primary Teacher Education Schools in the Netherlands?”

The answer to this question is partially yes and partially no. There are some relevant relationships found from the regression analyses that were performed. First of all, the average score on the WISCAT has a relevant relationship with the ‘Amount of teaching to the test’, the ‘Level of integration’, but not with the ‘Amount of ECs’. Secondly, the level of teacher expertise was found to have a relevant relationship with the ‘Amount of teaching to the test’ and the ‘Amount of ECs’. These results will be discussed in sub chapters on each dependent variable below.

Influence of the average WISCAT-score on time in ECs

The two research questions that were posed and the two hypotheses that were formulated on Amount of time in ECs, after setting up the theoretical framework, are repeated below. The left column of Table 13 shows the research question. The right column of table 13 shows the hypothesis that accompanies the research question.

Table 13. Research question and hypotheses concerning the 'Amount of ECs'

Research Question	**Hypothesis**
1. Does a higher average score of students on the WISCAT lead to a lower amount of study-load (in ECs) for Mathematics?	The lower the average score of a school on the WISCAT, the higher the study-load (in ECs) will be. In its turn, the higher the average score of a school on the WISCAT, the lower the study-load (in ECs)will be.
2. Does a higher level of teacher expertise lead to a higher amount of study-load (in ECs) for Mathematics?	The level of teacher expertise has no correlation with the amount of study-load (in ECs).

The relationship is visualized below in figure 5, in an adjusted version of the research model. The values that are mentioned in the model are the Standardized Coefficients (Beta):

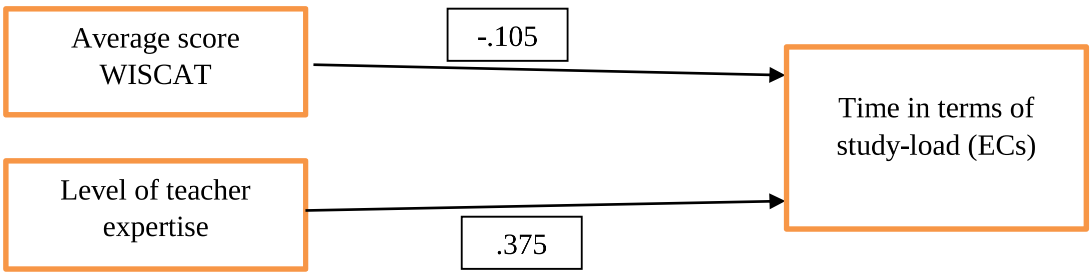


Figure 5. Model on correlation between the two independent variables and the 'Amount of ECs'

When looking at the first hypothesis, H1, it states that a negative relationship is expected between the average score on the WISCAT and the Time in terms of study-load (ECs). A slight negative relationship follows from the analysis. However, the relationship is not considered relevant (too close to zero) . Therefore H1 is not accepted. The results suggest a negative relationship, but it is probably quite weak.

It was stated in the chapter on Results, that the relationship between Level of Teacher Expertise and the study-load in ECs is considered relevant because the Standardized Regression Coefficient (Beta) is higher than .300. H2 states that no relevant relationship was expected to be found between these two variables. Therefore H2 can be rejected and the answer to the accompanying research question is ‘No’. There are several explanations for the positive relationship that is found between the two variables. First of all it may be that when there is a higher level of Teacher Expertise at a certain school, these teachers may make sure that enough ECs of the entire curriculum are dedicated to their subject, because they value their subject as important. However, it could also be argued that when a teacher has more expertise he or she needs less time (i.e. less ECs) to properly teach the contents of their subject. Therefore no firm conclusions can be drawn on the relationship between the two independent variables and the Amount of ECs.

Influence of the average WISCAT-score on the Level of Integration

The two research questions that were posed and the two hypotheses that were formulated on the variable 'Level of Integration' (MPCK), after setting up the theoretical framework, are presented below. The left column of Table 14 shows the research question. The right column of table 16 shows the hypothesis that accompanies the research question.

Table 14. Research questions and hypotheses on the 'Level of Integration'

Research Question	Hypothesis
1. Does a higher average score of students on the WISCAT result in a higher focus on integration of MCK and PCK (MPCK)?	The higher the average score of a school on the WISCAT, the higher the level of integration of MCK and PCK (MPCK).
2. Does a higher level of teacher expertise lead to a higher focus on integration of MCK and PCK (MPCK)?	The higher the level of teacher expertise, the higher the level of integration of MCK and PCK (MPCK).

The relationship is visualized below in figure 6 , in an adjusted version of the research model. The values that are mentioned in the model are the Standardized Coefficients (Beta):

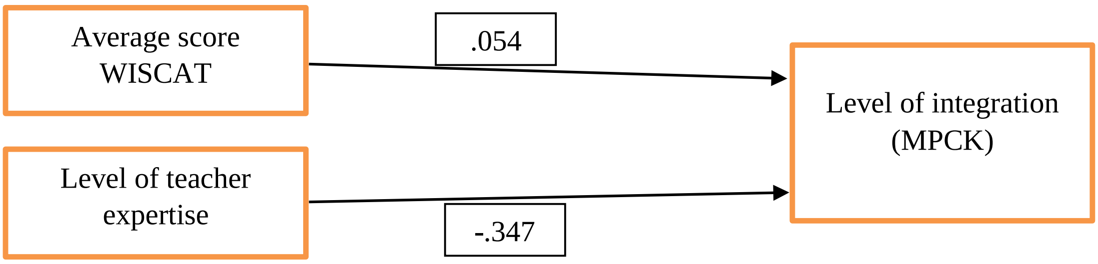


Figure 6. Model on correlation between the two independent variables and the 'Level of Integration'

When looking at the relationship between the 'Average score on the WISCAT and the 'Level of Intergration at a school, the Standardized Coefficient (Beta) is .054, which is below the relevance level of .300 and therefore considered an irrelevant correlation. This is not how it was hypothesized, which can be seen in table 16. Therefore, hypothesis three (H3) is rejected and the answer to the accompanying research question is 'No'. A possible explanation for this relationship will be provided next.

It could mean that the Level of Integration at a school does not depend on the level of the students a school attracts. This is probably a good thing; for an upcoming teacher, it is necessary to know how to integrate MCK and PCK. When the focus is on MCK too much (which was hypothesized to negatively relate to the level of integration), the student may actually not learn how to teach Mathematics (PCK). Therefore the lack of a relationship between the two can actually be considered desirable.

The relationship between the 'Level of teacher Expertise' and the 'Level of integration' (MPCK) is a negative one, which can be considered relevant (-.347). The relationship that is found, is exactly the opposite of the relationship that is hypothesized as can be seen in table 14. The answer to the research question is 'No' and H4 is rejected. It is, at the very least, interesting to see that apparently the higher the level of teacher expertise, the lower the level of integration. A possible explanation for this can be that the more expertise a teacher has and therefore the longer he or she has been working at Primary Teacher Education Schools, the more prone they are to reject the idea of the importance of Integration, instead of embracing the relevance of Integration. However, this is a very tentative conclusion. To figure out how this relationship can be a negative one, some recommendations will be provided for further research.

Influence of the average-WISCAT score on the amount of TTT

The two research questions that were posed and the two hypotheses that were hypothesized on the variable 'Amount of Teaching to the test' after setting up the theoretical framework, are presented below. The left column of Table 15 shows the research question. The right column of table 15 shows die hypothesis that accompanies the research question.

Table 15. Research questions and hypotheses on the 'Level of Integration'

Research Question	Hypothesis
1. Does a lower average score of students on the WISCAT lead to a higher amount of teaching to the test?	The lower the average score of a school on the WISCAT, the higher the amount of teaching to the test that occurs at a school.
2. Does a higher level of teacher expertise result in a lower amount of teaching to the test?	The higher the level of teacher expertise, the lower the level of teaching to the test.

The relationship is visualized below in figure 7, in an adjusted version of the research model. The values that are mentioned in the model are the Standardized Coefficients (Beta):

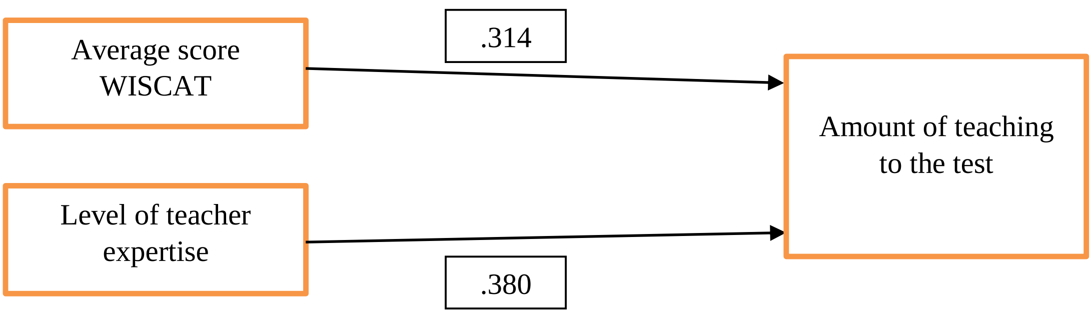


Figure 7. Model on correlation between the two independent variables and the 'Amount of teaching to the test'

Figure 7 shows two clearly relevant relationships between the two independent variables and the dependent variable 'Amount of teaching to the test'. The two hypotheses that were formulated on this particular dependent variable (H5 and H6), both formulate a relationship in completely the other direction. Where the results of the analyses say that there are two positive relationships, H5 and H6 hypothesise two negative relationships. Therefore H5 and H6 are rejected and both research questions can be answered with 'No'.

A possible explanation for the positive relationship between the average score on the WISCAT and the 'Amount of teaching to the test' can be that when a student population has a higher level, they are more teachable. Because there is no need for explanation on simple Mathematical procedures, the education can focus on preparing for tests and how to succeed on tests. On the other hand, it seems more logical to assume that there is a negative relationship between the two, because when a student population has a low average score on the WISCAT it may be harder to teach them the actual skills and a teacher may rather just prepare them for important tests than develop their general Mathematical skills. A firm conclusion cannot be provided on why there is a positive relationship between the two. In the chapter on 'Recommendations' this will be further discussed.

A possible explanation for the positive relationship between the 'Level of teacher expertise' and the 'Amount of teaching to the test' may be quite a serious one. It could mean that teachers that have a high level of expertise, see no other way than using teaching to the test to prepare their students for important tests. However, as described in the theoretical framework, there are different levels of teaching to the test, some of which are considered appropriate, and some of which are considered inappropriate. In short, it can be stated that teachers with a lot of expertise will prepare their students very well for the tests they have to take, regardless whether the students already have a high level of Mathematical knowledge or not. In future research it may be interesting to actually observe what types of teaching to the test occur and whether or not they are inappropriate; more on this in the next chapter.

Recommendations for future research

In this chapter some recommendations will be provided for future research. First of all, the measurement in this research was very quantitative, which may be considered as not suitable for a population and sample this small. Qualitative research through for example observation at Primary Teacher Education Schools might provide more insight in the type of Mathematics Education that is provided. Especially to discover why certain relationships were opposite of what they were expected to be.

Since there has never been any research conducted on this particular subject in the Netherlands, it was hard to construct the surveys and ask schools about the three dependent variables. In future research, the instruments that were used now, could be adjusted to measure for example teaching to the test in more detail. Future research may focus on what this teaching to the test actually entails in the classroom. However, because teaching to the test is a sensitive subject, and because the level of integration is hard to measure through means of a survey, observation could be the answer to getting a more objective view on what actually happens in the classrooms during the Mathematics lessons. Another way of measuring teaching to the test could be to interview the students, or ask them to fill out a survey. By doing this, the risk of socially desirable answers of teachers is minimized.

Additionally, it would be an ideal situation to include all the Primary Teacher Education Schools in the Netherlands in future research. The population is quite small, and the results that will be found will be much more valuable. Therefore it is important to show these schools the relevance of the research being conducted. Secondly, it would take time, much more time, than this research has taken, to visit all of these schools and observe all of these classes.

However, this may be the only way to get a clear image on what the level of the students actually does the type of education provided at a school, or how teacher expertise(experience and qualification) could mainly determine the type of education provided.

In the end, this study can be considered a first insight into the type of Mathematical education provided at Primary Teacher Education schools, and what characteristics may determine this education. Future research could investigate how the type of education actually influences the results of students on important tests they have to take in order to complete their education, and make the dependent variables into independent ones. However, the type of measurement and the involvement of the population will determine the success of future research, and this study can be used as an example for these future studies.

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Appendices

Appendix 1. Survey on teacher's personal background

Personal data PABO-teacher

Beste opleider rekenen en wiskunde, Bedankt dat u de tijd neemt deze vragenlijst in te vullen. Het betreft een onderzoek voor het schrijven van mijn Master-thesis aan de Universiteit Twente, betreffende de studie Educational Science and Technology (Toegepaste Onderwijskunde). In dit onderzoek tracht ik op zoek te gaan naar eventuele voorspellers van de prestatie van studenten op de Kennisbasis Rekenen en Wiskunde. Naast het vergelijken van de WISCAT-score en Kennisbasis-score van een student wordt er ook gekeken naar mogelijke andere voorspellers binnen het onderwijs dat PABOs bieden op het gebied van Rekenen en Wiskunde.   Antwoorden die u verstrekt zullen op geen enkele manier in presentaties, publicaties en overige communicatie over het onderzoek kunnen worden herleid naar u, uw studenten of uw opleiding. Voor het onderzoek is het evenwel noodzakelijk om gegevens van opleidingen en opleiders te koppelen aan die van studenten. Daarom verzoeken wij u in het onderzoek aan te geven bij welke opleiding u werkzaam bent. Het gedeelte dat u nu in gaat vullen kost waarschijnlijk niet meer dan 5 minuten van uw tijd en gaat om uw persoonlijke gegevens. Het meer uitgebreide gedeelte van de vragenlijst wordt beantwoord door u of 1 van uw collega's. Uitleg over wie hiervoor geschikt is staat in de begeleidende brief in de email die u of één van uw collega's heeft ontvangen.   Bedankt voor het invullen.

Q1 Naam PABO waar u werkzaam bent en welke vestiging het betreft (wanneer van toepassing):

Q2 Heeft u een bèta vooropleiding genoten?

- ❍ Ja (1)
- ❍ Nee (2)

Q3 Wat was het opleidingsniveau van deze bèta-vooropleiding

- ❍ HBO-bachelor (1)
- ❍ HBO-Master (2)
- ❍ WO-Bachelor (3)
- ❍ WO-Master (4)
- ❍ PhD (5)

Q4 Heeft u wiskunde gestudeerd tijdens uw vooropleiding?

- ❍ Ja (1)
- ❍ Nee (2)

Q5 Heeft u een niet-bèta vooropleiding genoten?

- ❍ Ja (1)
- ❍ Nee (2)

Q6 Wat was het opleidingsniveau van deze niet-bèta vooropleiding?

- ❍ HBO-Bachelor (1)
- ❍ HBO-Master (2)
- ❍ WO-Bachelor (3)
- ❍ WO-Master (4)
- ❍ PhD (5)

Q7 Heeft u een onderwijsbevoegdheid gehaald in één van uw vooropleidingen?

- ❍ Ja (1)
- ❍ Nee (2)

Q8 Voor welk vak heeft u een onderwijsbevoegdheid gehaald?

Q9 Hoe lang bent u al docent aan de PABO (in aantal jaar)?

Q10 Hoe lang bent u al docent rekenen en/of wiskunde (op de PABO of elders, in aantal jaar)?

Bedankt voor het invullen van uw gegevens. Dit is het einde van de vragenlijst.

Appendix 2. Survey on school-level

Some information on items that are in the survey, but were not used in the analysis. Concerning the level on integration: first there is question 14, which contains 3 items, which measured on a Likert scale whether the amount of integration was high or low.

Question 15 was left out of the analyses because it did not provide enough information on the level of integration at a school, but only provided information on the amount of hours spent on PCK and MCK. However, this does not exclude an overlap within these two; when 20 hours are spent on developing PCK and 10 hours are spent on developing MCK, then it may be that 10 hours are integrated (MPCK) but this is not necessarily the case. Because of this doubt, the question was not further included.

Item 16 through 19 asked the respondents to award a percentage to a type of lesson they would teach. Per item they divided 100 percent between lessons focussed on MPCK, MCK and PCK. From these items the percentage of the third option that represented MPCK was used. The percentage MPCK was placed on a scale of 1 to 5, similar to the scale of question 14.
Concerning Teaching to the test: There were 26 initial items, which were reduced to 13 with a sufficient Chronbach's Alpha. From each of the questions 20 through 22, some items were used. And finally concerning time: only the amount of ECs was used. This is explained in de study as well: the number of contact hours alone does not say enough about how this time was used, as well as whether or not students were studying on their own. The average amount of ECs was chosen because ECs represent the total number of hours students are required to put into that subject, whether these are contact hours or self-study.

Survey Kennisbasis Rekenen en Wiskunde

Beste opleider rekenen en wiskunde, Bedankt dat u de tijd neemt deze vragenlijst in te vullen. Het betreft een onderzoek voor het schrijven van mijn Master-thesis aan de Universiteit Twente, betreffende de studie Educational Science and Technology (Toegepaste Onderwijskunde). In dit onderzoek tracht ik op zoek te gaan naar eventuele voorspellers van de prestatie van studenten op de Kennisbasis Rekenen en Wiskunde. Naast het vergelijken van de WISCAT-score en Kennisbasis-score van een student wordt er ook gekeken naar mogelijke andere voorspellers binnen het onderwijs dat PABOs bieden op het gebied van Rekenen en Wiskunde. Antwoorden die u verstrekt zullen op geen enkele manier in presentaties, publicaties en overige communicatie over het onderzoek kunnen worden herleid naar u, uw studenten of uw opleiding. Voor het onderzoek is het evenwel noodzakelijk om gegevens van opleidingen en opleiders te koppelen aan die van studenten. Daarom verzoeken wij u in het onderzoek aan te geven bij welke opleiding u werkzaam bent. De nummering van de vragen zal wellicht opvallen; de eerste vraag is vraag 11. Dit is omdat deze vragenlijst een soort van 'vervolg' is op de vragenlijst waarin de persoonlijke gegevens van alle opleiders rekenen en wiskunde bij u op de PABO komen te staan. Deze vragenlijst wordt in principe maar door ÉÉN van deze collega's ingevuld. Dat is een collega die voldoet aan de voorwaarden zoals beschreven in het document in de begeleidende email. Wanneer het handiger is om de vragen over studielast en lesuren door bijvoorbeeld een opleidingsmanager in te laten vullen, is dat ook een optie. Geef in het volgende scherm dan aan door hoeveel personen de vragenlijst in totaal wordt ingevuld. Bij iedere vraag vindt u een korte uitleg, waarin is aangegeven wat de bedoeling van de vraag is. Het invullen van deze vragenlijst zal ongeveer dertig minuten in beslag nemen. Bedankt voor het invullen.

Info 1. Door hoeveel personen wordt de vragenlijst ingevuld?

- 1 (1)
- 2 (2)
- 3 (3)

Info 2. Vul hieronder de PABO in waar u werkzaam bent. Als het van toepassing is: ook graag de vestiging vermelden.

Intro.

De volgende vragen gaan over het eerste studiejaar van het cohort 2012, dus het eerste studiejaar voor de studenten die in september 2012 begonnen met hun studie.

Q11 Op welk moment in het jaar werd de WISCAT voor de eerste keer in 2012-2013 afgenomen bij studenten?

- Juli 2012 (1)
- Augustus 2012 (2)
- September 2012 (3)
- Oktober 2012 (4)
- November 2012 (5)
- December 2012 (6)
- Januari 2013 (7)
- Februari 2013 (8)
- Maart 2013 (9)
- April 2013 (10)
- Mei 2013 (11)
- Juni 2013 (12)

Q12 Wat was de cesuur (WISCATscore, geen omgerekend cijfer) die uw school hanteerde wat betreft de WISCAT in het studiejaar 2012-2013 (dit gaat dus om studenten die nu (veelal) vierdejaars zijn)?

Intro.

Tijd besteed aan rekenonderwijs De volgende vragen gaan over de tijd die wordt besteed aan het rekenonderwijs. Het gaat dan om het aantal contacturen en ECs met betrekking tot rekenen en wiskunde.

LET OP: het gaat hier om het aantal ECs en contacturen in jaar 1 én 2 in schooljaren 2012-2013 en 2013-2014.lick to write the question text

Q13. Vul onderstaande tabellen in. De eerste twee gaan over contacttijd in klokkuren in respectievelijk 2013-2013 en 2013-2014. De laatste twee gaan over het aantal ECs in 2012-2013 en 2013-2014.

______ Contacttijd in klokuren 2012-2013 (1)
______ Waarvan verplicht in 2012-2013 (2)
______ Contacttijd in klokuren 2013-2014 (3)
______ Waarvan verplicht in 2013-2014 (4)
______ Studielast in EC in 2012-2013 (5)
______ Waarvan verplicht in 2012-2013 (6)
______ Studielast in EC in 2013-2014 (7)
______ Waarvan verplicht in 2013-2014 (8)

Intro.

Rekenonderwijs in opleidingsjaar 1 en 2De volgende vragen gaan over het rekenonderwijs dat bij u op de PABO en door u wordt gegeven aan de PABO-studenten in hun eerste en tweede jaar van de opleiding. U heeft elke keer 5 antwoordmogelijkheden: 1 = niets, 2 = weinig (minder dan 10%), 3 = iets (10-25%), 4 = gemiddeld(26-50%), 5 = behoorlijk(meer dan 50% van de tijd). Na deze vragen wordt u nogmaals gevraagd een tabel in te vullen met betrekking tot de verdeling van de uren voor didactiek en eigen vaardigheid. Deze uren mogen slechts eenmaal worden opgevoerd.

Q14. Vul onderstaande tabel in. Het opgetelde percentage van de 3 stellingen hieronder moet rond de 100% liggen.

	Niets (1)	Weinig(minder dan 10%) (2)	Iets (10-25%) (3)	Gemiddeld (26-50%) (4)	Behoorlijk (meer dan 50% van de tijd) (5)
1. Ik geef lessen aan mijn studenten waarin ze werken aan hun eigen wiskundige vaardigheid, maar waarin didactiek NIET aan bod komt. (1)	❍	❍	❍	❍	❍
2. Ik geef lessen aan mijn studenten waarin puur aandacht wordt besteed aan didactiek, en waarin eigen vaardigheid NIET aan bod komt (2)	❍	❍	❍	❍	❍
3. De lessen die ik geef zijn een mengeling van didactiek en eigen vaardigheid van de studenten. (3)	❍	❍	❍	❍	❍

Q15. Vul in:

______ Contacttijd in klokuren voor didactische vaardigheid eerstejaars in 2012-2013 (1)
______ Contacttijd in klokuren voor eigen vaardigheid eerstejaars in 2012-2013 (2)
______ Contacttijd in klokuren voor didactische vaardigheid tweedejaars in 2013-2014 (3)
______ Contacttijd in klokuren voor eigen vaardigheid tweedejaars in 2013-2014 (4)
______ Studielast in ECs voor didactische vaardigheid eerstejaars in 2012-2013 (5)
______ Studielast in ECs voor eigen vaardigheid eerstejaars in 2012-2013 (6)
______ Studielast in ECs voor didactische vaardigheid tweedejaars in 2013-2014 (7)
______ Studielast in ECs voor eigen vaardigheid tweedejaars in 2013-2014 (8)

Intro.

Inrichting opleidingsonderwijs Hieronder staat een aantal voorbeelden die representeren hoe u uw aanbod voor het vak rekenen-wiskunde in jaar 1 en 2 kunt inrichten. We vragen u bij iedere representatie het deel aan te geven dat u op de aangegeven wijze inricht. U doet dit door een percentage in te vullen. Bijvoorbeeld als u bij optie 1 het getal 15 invult, geeft u daarmee aan dat 15 procent van uw lessen door deze optie gerepresenteerd worden. Wanneer de samenhang van uw lessen evenredig verdeeld is komt er dus bij iedere optie 33 procent te staan. Op die manier kunt u 100 procent verdelen over de gegeven opties. Houdt u er rekening mee dat dit slechts een zeer vereenvoudigde weergave is van hoe uw lessen er hoogstwaarschijnlijk uitzien. Probeer een zo realistisch mogelijk beeld te schetsen.

Q16.

Deze vraag gaat over de laatste keer dat u in uw opleidingsonderwijs in een module of studieonderdeel aandacht besteedde aan het vermenigvuldigen. Klik op de link: Graphic question 1 correct1. Een pdf-document opent. In dit document zie je drie opties. Verdeel 100 procent over deze opties.

______ Optie 1 (1)
______ Optie 2 (2)
______ Optie 3 (3)

Q17. Deze vraag gaat over de laatste keer dat u in uw opleidingsonderwijs in een module of studieonderdeel aandacht besteedde aan de relatie tussen procenten en breuken. Klik op de link: Graphic question 2 .Een pdf-document opent. In dit document zie je drie opties. Verdeel 100 procent over deze opties.

______ Optie 1 (1)
______ Optie 2 (2)
______ Optie 3 (3)

Q18 Deze vraag gaat over de laatste keer dat u in uw opleidingsonderwijs in een module of studieonderdeel aandacht besteedde aan het metriek stelsel. Klik op de link: Graphic question 3 .Een pdf-document opent. In dit document zie je drie opties. Verdeel 100 procent over deze opties.

______ Optie 1 (1)
______ Optie 2 (2)
______ Optie 3 (3)

Q19 Deze vraag gaat over de laatste keer dat u in uw opleidingsonderwijs in een module of studieonderdeel aandacht besteedde aan grafieken en tabellen . Klik op de link: Graphic question 4 .Een pdf-document opent. In dit document zie je drie opties. Verdeel 100 procent over deze opties.

______ Optie 1 (1)
______ Optie 2 (2)
______ Optie 3 (3)

Intro.

Invloed Kennisbasis Rekenen en Wiskunde Nu volgen er een aantal stellingen die gaan over de invloed die de Kennisbasis Rekenen en Wiskunde heeft (gehad) op het onderwijs dat u geeft. U kunt antwoorden op een schaal van 1 tot en met 5. 1 = helemaal niet mee eens, 2 = niet mee eens, 3 = niet mee oneens/niet mee eens, 4 = mee eens, 5 = helemaal mee eens.

Q20. Geeft antwoord op een schaal van 1 tot en met 5 waarbij: 1 = helemaal niet mee eens, 2 = niet mee eens, 3 = niet mee oneens/niet mee eens, 4 = mee eens, 5 = helemaal mee eens.

(question is found one page down)

	1. Helemaal niet mee eens (1)	2. Niet mee eens (2)	3. Niet mee oneens/niet mee eens (3)	4. Mee eens (4)	5. Helemaal mee eens (5)
1. Tijdens mijn lessen bied ik mijn studenten voorbeelditems van de Kennisbasis aan. (1)	❍	❍	❍	❍	❍
2. Tijdens mijn lessen behandel ik strategieën om bepaalde vraagsoorten op een effectieve manier aan te pakken. (2)	❍	❍	❍	❍	❍
3. Ik laat bepaalde onderwerpen in mijn lessen achterwege na invoering van de Kennisbasis, die ik daarvoor wel behandelde, omdat deze onderwerpen niet voorkomen in de Kennisbasis. (3)	❍	❍	❍	❍	❍
4. De kennisbasis bepaalt in grote lijnen het onderwijs dat ik aanbied. (4)	❍	❍	❍	❍	❍
5. Ik pas de vraagstelling in mijn eigen toetsen aan, aan de soort vraagstelling die wordt gehanteerd in de Kennisbasis Rekenen en Wiskunde. (5)	❍	❍	❍	❍	❍

6. Doordat items in de Kennisbasis Rekenen en Wiskunde ieder jaar op elkaar lijken, is het voor mij eenvoudig na te gaan wat voor soort vragen studenten krijgen. (6)	❍	❍	❍	❍	❍
7. Wanneer een bepaalde strategie (bijvoorbeeld koloms-gewijs delen) als enige wordt gebruikt in de kennisbasis is dat voor mij reden om andere strategieën achterwege te laten (bijvoorbeeld staartdelingen). (7)	❍	❍	❍	❍	❍
8. Mijn lesinhoud stem ik af op de inhoud van de Kennisbasis. (8)	❍	❍	❍	❍	❍
9. Ik neem studenten vaak bij de hand op problemen stap voor stap op te lossen. (9)	❍	❍	❍	❍	❍
10. Meer dan de helft van de tijd binnen één les besteed ik aan het uitleggen van de theorie. (10)	❍	❍	❍	❍	❍
11. Doordat een bepaald onderwerp in de kennisbasis voorgaand jaar veel voorkwam, besteed ik daar nu meer aandacht aan in mijn lessen. (11)	❍	❍	❍	❍	❍

12. Doordat studenten in een voorgaand jaar met een bepaald onderwerp in de Kennisbasis Rekenen en Wiskunde veel moeite hadden, besteed ik aan dat onderwerp nu meer tijd tijdens mijn lessen. (12)	❍	❍	❍	❍	❍
13. Doordat items in de Kennisbasis Rekenen en Wiskunde ieder jaar op elkaar lijken, is het voor mij eenvoudig na te gaan wat voor soort vragen studenten krijgen. (13)	❍	❍	❍	❍	❍

Q21. Wat bepaalt uw onderwijs in de klas? U kunt antwoorden op een schaal van 1 tot en met 5. 1 = helemaal niet bepalend, 2 = niet bepalend, 3 = weinig bepalend, 4 = bepalend, 5 = heel sterk bepalend.

	1. Helemaal niet bepalend (1)	2. Niet bepalend (2)	3. Weinig bepalend (3)	4. Bepalend (4)	5. Heel sterk bepalend. (5)
1. Het curriculum/de standaard van de overheid. (1)	❍	❍	❍	❍	❍
2. Het curriculum van de school. (2)	❍	❍	❍	❍	❍
3. Tekstboek/ andere instructiemethoden. (3)	❍	❍	❍	❍	❍
4. Gestandaardiseerde testen en de resultaten daarvan. (4)	❍	❍	❍	❍	❍
5. Eigen toetsen en de resultaten daarvan. (5)	❍	❍	❍	❍	❍
6. Onderwijs dat u tijdens uw eigen opleiding hebt genoten. (6)	❍	❍	❍	❍	❍
7. Speciale behoeften van studenten. (7)	❍	❍	❍	❍	❍
8. Persoonlijke ervaringen als docent. (8)	❍	❍	❍	❍	❍

Q22. In hoeverre bent u het eens met de volgende stellingen? U kunt antwoorden op een schaal van 1 tot en met 5. 1 = helemaal niet mee eens, 2 = niet mee eens, 3 = niet mee oneens/niet mee eens, 4 = mee eens, 5 = helemaal mee eens.

	1. Helemaal niet mee eens (1)	2. Niet mee eens (2)	3. Niet mee oneens/niet mee eens (3)	4. Mee eens (4)	5. Helemaal mee eens (5)
1. Ik neem de interesses van mijn studenten in acht voor de invulling van mijn lessen. (1)	❍	❍	❍	❍	❍
2. Ik neem er de tijd voor om actuele onderwerpen te zoeken en te gebruiken in mijn lessen. (2)	❍	❍	❍	❍	❍
3. Ik neem mijn eigen interesses in acht voor de invulling van mijn lessen. (3)	❍	❍	❍	❍	❍
4. Ondanks de vastgestelde onderwerpen in de Kennisbasis heb ik tijd onderwerpen te behandelen die ik belangrijk vind. (4)	❍	❍	❍	❍	❍
5. Ik behandel regelmatig onderwerpen die niet voorkomen in de Kennisbasis. (5)	❍	❍	❍	❍	❍