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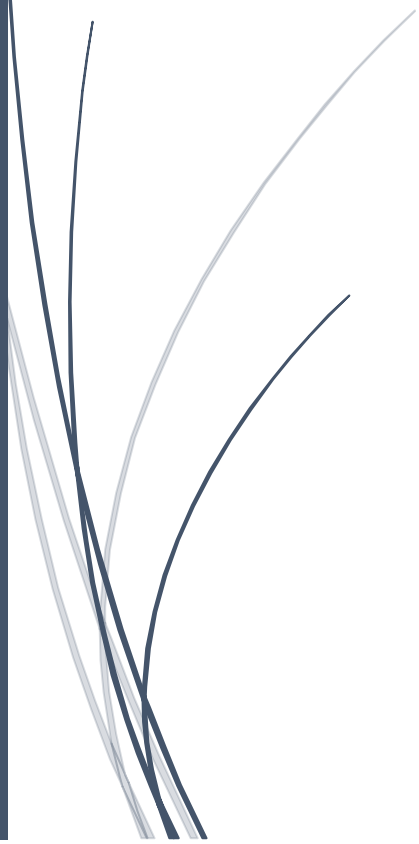
Exploring organizational factors causing Teacher Attrition in Primary schools in the Netherlands: a multiple regression study



''It is better to patch the holes in the bucket before trying to fill it up. The image that comes to mind is of a bucket rapidly losing water because of holes in the bottom. Pouring more water into the bucket will not be the answer if the holes are not first patched.''

- *Ingersoll (2007)*

Masterthesis

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Abstract

INTRODUCTION: Teacher shortage is an acknowledged problem in many countries. The shortage of teachers can be seen as a problem based due to the difference of supply and demand. In the Netherlands, the supply of teachers is a topic which gets a lot of attention, many policies are focused on increasing the supply of teachers. The demand however, gets less attention in overcoming the teacher shortage. A big factor causing increasing demand is the attrition of teachers. Attrition is defined as a teacher who quit their profession voluntarily during their career. Especially beginning teachers are prone to attrition, the numbers differ across the world, in the Netherlands however approximately 12% of the teachers quit their profession every year.

GOAL: The goal of this study is to examine which organizational factors of schools cause greater teacher attrition. Many studies have focused on personal- and job characteristics which increase teacher attrition, however in the Netherlands there is only little empirical evidence about the organizational factors causing teacher attrition. The main research question of this study is therefore: Which organizational school characteristics explain teacher attrition in Dutch primary schools?

METHODS: To answer this main question, a multiple regression analysis has been used. A sample of 1036 schools has been used to build a regression model. District characteristics, financial characteristics and school specific characteristics all have been used as independent variable to gain information about how they influence teacher attrition. This information has been retrieved from multiple sources such as the CBS, DUO and educational administrative offices. A regression model has been build using multiple estimation methods to examine the relationships between the variables.

RESULTS: The analysis showed that seven variables had a significant relationship with teacher attrition. Especially school size, the percentage of immigrants in a district and the class size seemed to have a big influence on the dependent variable ($p<.000$). Other variables, such as student achievement or the denomination of the school did not show a relationship with teacher attrition. Overall, the explained variance of this model is 8% can be seen as small.

CONCLUSION: School size and class size appeared to be the most influential factors concerning teacher attrition. Also, financial characteristics, district characteristics and school quality were explaining factors. These organizational variables however only explained a small portion. This could indicate that other factors suggested by literature, such as workload or stress, are more important in explaining teacher attrition. Future studies could therefore choose to combine organizational factors with more individual characteristics of teacher when trying to analyze teacher attrition. Besides this, future studies could also focus more on cohorts of new teachers. This could overcome several limitations of this study, such as time-lags in effects and teachers who return into the profession after a few years. This study implicates that reducing class size could effectively also reduce teacher attrition. Besides this, another implication is that school management should take into account the characteristics of their district when trying to retain teachers. Especially higher income districts, or districts with a higher percentage of immigrants are related to higher teacher attrition. More empirical research on this topic in the Netherlands is needed to help reducing the teacher shortage caused by teacher attrition.

Preface

I am pleased to introduce the master thesis: 'Exploring organizational factors causing Teacher Attrition in Primary schools in the Netherlands: a multiple regression study'. This thesis has been written in context of my study Business Administration followed at the University of Twente. This study is followed within the track of Digital Business. The thesis has been written with the help and guidance of Infotopics BV, a company providing data visualization, consultancy and prediction.

I have experienced the research I have carried out as very complex. This is due to everyday data challenges that practitioners have to deal with, such as missing data and data management. Besides this, the real world and human behavior is much more complex than can be expressed with numbers. I can therefore rightfully claim that this was the hardest challenge I have had in my student career, luckily it was also the most educationally worthy experience I had. Therefore, I wish to express a special thanks to Igor Wassink from Infotopics for the guidance and the chance to fulfill this assignment at the company he works for. Besides this, I would not be able to finish this assignment without the help from my mentors of the University. Fons Wijnhoven and Jan de Leede have thought with me in such a way, helped me with questions and posed ideas, that I would not be able to carry on without them in moments where I was stuck.

At this moment I would like to thank all my mentors for their excellent guidance and support during this academic trajectory. This has been my second master thesis and also this second time I learned a lot by facing many different challenges. I also thank other 'colleagues' at Infotopics for their welcoming attitude and help when needed (especially Henk ten Caat and Roland van Leeuwen).

My friends, family and girlfriend supported me during the writing of this thesis. In challenging times, they helped me bring this thesis to a good end.

I hope you enjoy reading this thesis.

Pim Gezel

Enschede, 14th august 2020.

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1. Introduction

The shortage of teachers is a substantial problem in the Netherlands (Arbeidsmarktbarometer po, vo, mbo, 2018). Almost 59% of all primary schools has to send their students home because of a lack of teachers (De Staat van het Onderwijs, 2019). Besides this, the research of the Dutch ministry also claims that the shortage of teachers is growing (De Staat van het Onderwijs, 2019). As a result, the quality of schools is dropping, the Onderwijsraad (2009) claims that schools who have to deal with a shortage of teachers, are performing less than schools who don't. This is not only a problem in the Netherlands, but teacher shortage is experienced in many countries over the world (White & Smith, 2005).

In many countries therefore measures have been taken to increase the pool of students who follow an education to become a teacher (in the Netherlands this would be for example the PABO for primary teachers). Besides this also measures have been taken to attract already qualified persons who do not yet teach. These measures mainly consist of making the job more attractive by for example increasing the salary or decreasing the workload. However, it is important to consider how many of these applicants leave after (a few) years of teaching.

An important attribute in the problem of teacher shortage, is the attrition of teachers. Attrition is defined as: teachers who leave the profession before retirement (Cooper & Alvarado, 2006). It might be that schools are attracting a sufficient quantity of excellent teachers, however if those teachers are already leaving after a few years, then this can have several consequences for the school. At first it requires the school to fulfill the gap that the leaving teacher created, this can be hard in areas where the supply of teachers is already insufficient. Besides this it also causes several costs for attracting and selecting new teachers (Mobley, 1982; Ingersoll & Smith, 2003). Attrition is seen as one of the major causes for teacher shortage problems (Lindqvist, Nordänger & Carlsson, 2014; Den Brok, Wubbels & Tartwijk, 2017; Ingersoll, 2001; Ingersoll & Smith, 2003; Ingersoll, Merril & May, 2014; Krieg, 2006; Harris & Adams, 2007).

This study addresses the problem of teacher attrition. Literature has addressed teacher attrition for many years. Most studies have however focused on personal and job-related causes of teacher attrition, which caused individual teachers to make the decision to leave the school and the profession. Less studies have investigated organizational factors causing teacher attrition, this can be for example the financial situation of a school. In the Netherlands, no studies have been found that address these types of causes for teacher attrition.

The goal of this study is to explore the relationship between several organizational factors and the teacher attrition rate of a school. The main question of this study is therefore: Which organizational school characteristics explain teacher attrition in Dutch primary- and secondary schools? This question is answered by examining the relationship of the attrition rate and organizational factors of a sample of 1036 primary schools in the Netherlands. This relationship has been examined by using multiple regression analysis.

Chapter 2 analyzes the context of the problem. At first the problem of teacher shortage and attrition has been quantified in the context of the Netherlands. This study tried to make clear how the shortage of teachers has arisen and how the shortage could develop in the future. In addition to this, also international studies have been addressed to compare the situation in the Netherlands to other countries. After quantifying the problem, this chapter tries to give a deeper insight into the origin of the problem and the difference of this problem compared to other sectors and jobs in a labor market. At the end of this chapter, the consequences of a high teacher attrition rate are discussed.

In chapter 3 the causes of teacher attrition are discussed. A literature review took place to examine the causes researchers have addressed in their studies. At first the personal and job-related causes have been described, most studies have focused on this subject. Afterwards the claimed organizational factors of teacher attrition are shown. The hypotheses that this study investigates are posed after each subsequent topic of organizational factors. This chapter ends with a section summarizing this study and its goals and research question.

In chapter 4 the methodology of this study is covered, starting with an overview of the sample that has been used in the study. The operationalization of this sample is afterwards explained, here the reader can find the definitions and origin of the variables that this study uses. After this section, the data collection process is explained. The data analyses part of this chapter explains thoroughly what has been done in this study to come to the results. The chapter ends with the ethical steps that have been taken to ensure the approval of this study.

In chapter 5, the results section, the outcome of the multiple regression analysis is stated. It starts by giving the coefficients determined in the 75% training set. Afterwards using these coefficients, the holdout 25% test set is predicted. These results are then compared in the final part of this chapter. The chapter ends with an overview of which hypotheses are confirmed and which are rejected.

The final chapter, chapter 6, starts with a conclusion of the results; what has been shown and what are the limitations that the reader should be cautious of. Afterwards results are discussed regarding the findings of other studies in literature, it is discussed why some

results are contrary or in line with other studies. The implication section tries to give more context to the meaning of the results and relates them to practice. What does this study imply for practice, such as school management and policymakers. This chapter ends with recommendations.

2. Problem analysis: What is the size of the problem of teacher shortage and attrition?

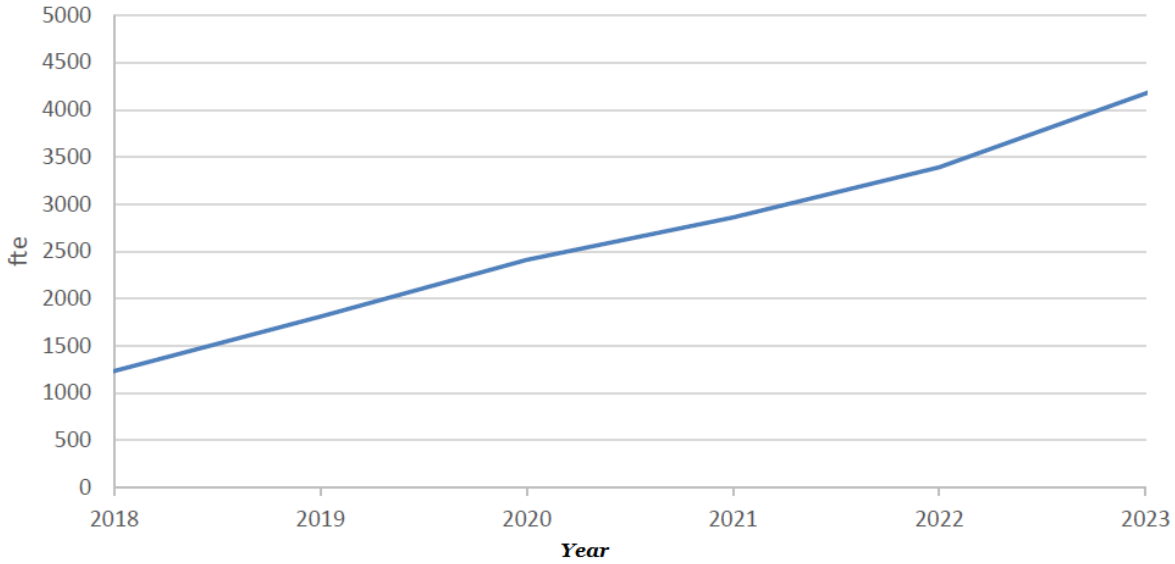
In this chapter, firstly the size and impact of teacher shortage and attrition is described. The shortage is explained through graphs and numbers provided by an analysis performed by Adriaens, Fontein and de Vos (2018) about the future of the labor market of teachers. Besides this, also the impact of this shortage is discussed. In the next paragraph, an overview is given about the context of the teacher labor market in the Netherlands, what are the rules of this market and why does this differ from the ‘’normal’’ labor market and other international situations. Finally, the concept of functional turnover is discussed regarding to the literature.

2.1 Shortage of teachers in the Netherlands and internationally

Adriaens, Fontein and de Vos (2018) claim that the shortage in primary schools has started since 2007. Since 2007 the graduates from the PABO (the education for primary school teachers) are decreasing every year. In 2006 the number of graduates each year was around 7000, that was enough to fill the upcoming vacancies for primary school teachers. However, in 2017 this number had decreased to 3800 graduates a year. The expectation is that this number decreases more. This leads, according to Adriaens et al. (2018) to circa 4150 unfulfilled demanded FTE’s in 2023. This is 4.5% of the total number of FTE’s. In figure 2.1 the predicted unfulfilled FTE’s are displayed for primary schools.

Figure 2.1

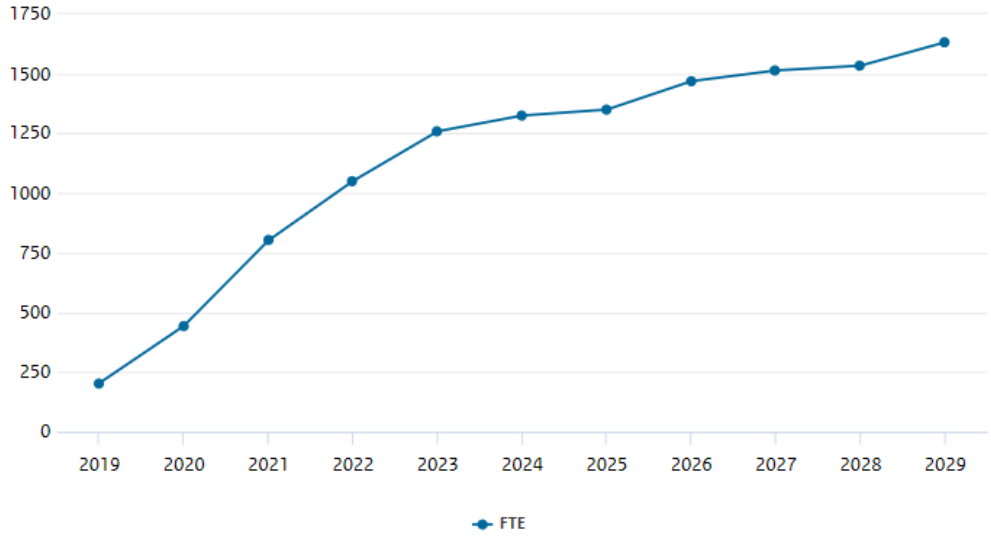
Total shortage of teachers in FTE in primary education (Adriaens et al., 2018)



In secondary education, the problem is slightly smaller compared to primary education (Adriaens et al., 2018). However, the problem in secondary education focusses around certain subjects, something that is not a relevant issue in primary school. The shortage of teachers is expected to be 1259 FTE's in 2023 (see figure 2.2). This shortage seems relatively small, however Adriaens et al. (2018) remarks that this is due to the decrease of the total number of students. Besides this, also the number of unqualified teachers which is high compared to primary education, decreases the total shortage of teachers. Almost 4.8% of total lessons are given by unqualified teachers (Vloet, den Uyl & Fontein, 2017).

Figure 2.2

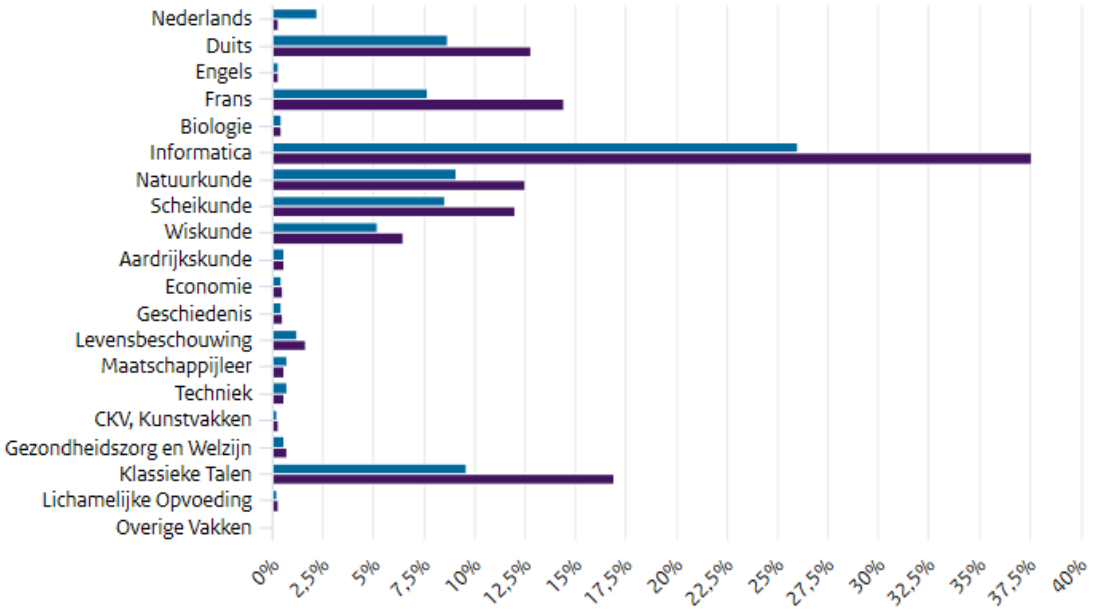
Total shortage of teachers in FTE in secondary education (Adriaens et al., 2018)



As mentioned, the average shortage does not seem to be very problematic. Compared to the total number of FTE's (which is expected by CentERdata to be 56.500 in 2023), the shortage of FTE's is 2%. However, when splitting this data per subject, then there seems to be bigger problems for certain subjects in the future. In figure 2.3 the percentage of shortage per subject is shown for 2024 in blue and 2029 in purple. The figure shows that the shortage for Information science and classical languages is the highest. However, since these subjects only have a small number of total FTE, the percentages seem quite big. When looking at the total number of FTE, then CentERdata (2018) concludes that mathematics has the biggest expected shortage in the future in FTE's.

Figure 2.3

Projected shortage of teacher in FTE per subject in secondary education (by Adriaens et al., 2018) for 2024 (blue) and 2029 (purple)



Adriaens et al. (2018) also tried to assign a meaning to the given percentages of shortage. They claim that shortages up to 1% are non-problematic and the probability that they will solve themselves is very high (this for example due to a coincidental drop of supply or increase of demand). However, when the shortage reaches 5% or more, than the researchers claim that there will be notable effects upon the quality of education. The researchers argue that it takes a long time to overcome this shortage and in between the students will suffer from the absence of a teacher, or are teached by a non-qualified teachers. This is claimed to be harming the quality of education.

But not only schools in the Netherlands are dealing with teacher shortage. Also, internationally this is a common problem. For example, the US is experiencing teacher shortages since 2013 and this shortage is growing every year. Sutcher et al. (2016) expects that the shortage of teachers is growing to 300.000 FTE's in a few years in the USA, this due to the growing differences in the supply and demand of teachers. White and Smith reported already in 2005 in a PISA study that in twenty-five countries there is perceived to have a considerable shortage which is hindering student progress. The precise statistics are shown in table 2.1.

Table 2.1

Headteachers reporting teacher shortage as hindering student progress (White & Smith, 2005)

Country	Number of schools (total)	Initial school response rate (%)	Shortages/inadequacies hindering student progress (%)
Netherlands	93	27.13	79.6
Russian Federation	239	98.84	72.0
Greece	151	83.91	68.9
Germany	197	94.71	68.0
Sweden	154	99.96	65.6
Iceland	126	99.88	65.1
Finland	155	96.82	64.5
UK	**334**	**61.27**	**64.4**
Norway	166	85.95	62.0
Italy	170	97.90	58.8
Australia	230	80.95	57.8
Japan	135	82.05	57.8
Canada	1096	87.91	57.3
New Zealand	145	77.65	54.5
Ireland	136	85.56	52.9
Luxembourg	22	93.04	50.0
Portugal	147	95.27	48.3
Belgium	120	69.12	46.7
US	120	56.42	42.5
Denmark	208	83.66	41.8
Korea	144	100.00	41.0
France	156	94.66	35.9
Switzerland	276	91.81	33.0
Spain	180	95.41	30.0
Austria	212	99.38	25.9

One of the most common measures to overcome a shortage of teachers is to try to increase recruitment into the profession of teachers. Internationally known campaigns such as Teach for America and Teach first (England) represents such measures. Other measures taken are for example the increase of salary, the reduction of tuition for teacher education and signing bonusses. However many studies indicate that teacher attrition is one of the major causes of teacher shortage (Lindqvist, Nordänger & Carlsson, 2014; Den Brok, Wubbels & Tartwijk, 2017; Ingersoll, 2001; Ingersoll & Smith, 2003; Ingersoll, Merril & May, 2014; Krieg, 2006; Harris & Adams, 2007). This even is the case in countries where there is a sufficient supply in teachers (Luekens, Lyter & Fox, 2004; Ingersoll, 2007; Cooper & Alvarado, 2006).

Especially beginning teachers are prone to already leave their job after a few years (Den Brok et al., 2017). Many authors therefore claim that it is more important to focus on the retention and attrition than on the supply of teachers. Ingersoll (2007, p. 6) sketches this as *'' it is better to patch the holes in the bucket before trying to fill it up. The image that comes to mind is of a bucket rapidly losing water because of holes in the bottom. Pouring more water into the bucket will not be the answer if the holes are not first patched.''.*

It is assumed by Borman and Maritza-Dowling (2008) that figures of attrition mainly form a U-shaped curve, where the peaks form in the first five year of a teaching career and at the age of around 50 years old. Attrition rates of teachers are problematic around the world. Studies in the US report that teacher attrition in the first five years of teaching are up to 30-50% (Hong, 2010; Ingersoll, 2001). Also, the United Kingdom and Australia suffer from a comparable attrition rate. However, the situation around the world is quite different, a study in Hong Kong found that the attrition rate in that country is only 4.8% (Mcinerney et al., 2015). In the Netherlands it is estimated that the attrition rate for primary education is around 12% and for secondary education around 13% for beginning (<5 years) teachers (Fontein et al., 2016).

2.2 Understanding teacher turnover, attrition and the teacher labor market in the Netherlands

It is remarkable that teacher turnover is high compared to other sector attrition numbers, why is it that attrition turnover appears to function differently? When following the argument of Guarino et al. (2004), teachers can be seen as normal participants in a labor market. However, while this might be the case in the US, the point of view in the Netherlands is claimed to be different. De Vos and Fontein (2019) claim that this is not the case in the Netherlands, this is due to several reasons:

- The demand of teachers is mainly dependent on the number of students.
- The high demand of teachers would result in better working conditions and a higher salary, which would in turn lower the overall demand, however this is not the case.
- The supply side of teachers knows barriers in the form of legally required certifications.
- School boards are bound by a collective labor agreement which disallows them to give higher salaries to teachers when the demand of teachers is high. Also, the funding of the government for schools is fixed, which restricts schools from increasing salaries.

Overall turnover consist of two components (Ingersoll & Smith, 2003): *attrition* (those who leave the teaching job) and *migration* (those who move to teaching jobs in other schools). In literature, studies can focus on one of these components or both. An important thing to keep in mind when reading this study, is that teacher attrition has consequences for the whole sector, since teacher attrition increases teacher shortage and all the earlier related problems described on teacher shortage. Teacher turnover (attrition and migration) has consequences for the school as the organization, since they might have to replace the leaving teacher. The concept of turnover and attrition (as a component of turnover) are sometimes discussed in literature as one concept, however the reader should keep in mind that attrition has consequences for the whole educational sector and the school, whereas migration has consequences mainly for the school.

In the US context, Ingersoll and Smith (2003) claim that turnover is split fairly between attrition and migration, the two components. However in the Netherlands, the migration rates are around 3% for both primary and secondary education (Staat van het Onderwijs, 2019) compared to the attrition rate of around 12% suggested by den Brok et al. (2017). This can be explained by the fact that US schools have more possibilities to compete for teachers than Dutch schools. In the US there is also a significantly larger number of private schools (CAPE, 2013). Several studies have addressed teacher attrition rates in US private schools and found that these rates are higher for private schools compared to public schools (Bobbit et al., 1994; Ingersoll ,2001; Luekens et al., 2004; Marvel et al., 2007). The main reported reason for leaving the teaching profession was salary (Bobbit et al., 1994; Marvel et al., 2007). Compared to public teachers it is therefore not strange that the private teacher attrition rate is higher, they get on average less paid than their public counterpart (Bryk et al., 1993; National center for education statistics, 2012). This might seem odd, since private schools can appoint more resources to teacher salary than their pre-defined public counterpart, however Orlin (2013) points out that this works the other way around. Orlin (2013) claims that private teachers are paid lower due to several reasons: public teachers have a more powerful lobby in the government, which enables them to negotiate a higher salary, private teachers do not have to obtain all the licenses that a public teacher has and this enables private schools to hire whoever they seem able to do the job. This last mechanism is according to the author the main reason for the big difference in salary, since in the public domain the imbalance between the supply and demand side is bigger. Besides this, better

working conditions make private schools more attractive to teachers despite the lower salary (Orlin, 2013; NCES, 2012).

Other consequences of a high attrition rate, except worsening the earlier mentioned teacher shortage problems are mainly educational quality and financial issues. Ingersoll et al. (1997) and the Staat van het Onderwijs (2019) both warn that when schools suffer a high attrition rate and as a consequence their workforce is not stable, this can harm the quality of education. Several empirical studies bring different arguments for this, however they all come to the conclusion that in general teacher turnover (in the possible form of attrition) harms the quality of education. Reasons stated by studies are for example:

- High turnover is correlated with lower average teacher quality, reduced human capital and disrupted school programs (Ronfeldt, Loeb & Wyckoff, 2013).
- A loss of experience which teachers have gained during their profession (Hanushek, Rivkin & Schiman, 2015).
- Within year teacher turnover will cause replacement problems resulting in students scoring significantly lower on their tests (Henry & Redding, 2018).
- A high number of turnover can have a severe impact on the social resources in a school's working community, affecting climate and trust within the teacher. community (Hanselman, Grigg, Bruch & Gamoran, 2016). This can in turn affect teaching quality. This confirms Ronfeldt et al. (2013) who claims that teacher turnover even affects the quality of teaching for the remaining teachers.
- Teachers hired to replace the teachers who have left do often not have the teaching experience and qualifications of the teachers which they are replacing (Rollefson, 1993).
- It takes new teachers time to get assimilated to the schools' culture, curriculum and community, before reaching their full effectiveness (Boe, Bobbit & Cook, 1997).

There are also financial effects of teacher turnover. Cascio & Boudreau (2010) make a distinct in separation and replacement costs (assuming that a school wants to find a new teacher). The separation costs consist according to them of the costs of the exit interview (average HR salary x time spent on interview by HR x number of turnover in a period) and the administrative functions related to termination (average HR salary x administrative time required x number of turnover in a period). Levy et al. (2012) concludes however that this is only a small portion of the total turnover costs, it is estimated to be 3.6% of the total costs.

When looking at replacement costs of teachers, we are looking at a bigger expense. Defeo et al. (2017) gave an overview of the cost categories for separating and replacing teachers. In figure 2.4 the proposed associated costs with parts of the teacher turnover are shown. Synar and Maiden (2012) and Levy et al. (2012) both conducted a study to estimate the costs of teacher turnover, in figure 2.4 their estimation as a percentage of the total costs is shown. An example of this is the "hiring" costs, for which Synar and Maiden (2012) estimate that this consists of 8.64% of the total costs related to teacher turnover.

Figure 2.4

Associated costs for teacher turnover (based upon Defeo et al., 2017)

Parts of teacher turnover	Associated costs	Estimated cost
Separation	- Administrative tasks - Exit interviews	~ 2.29 - 3.6% (Synar & Maiden, 2012; Levy et al.,2012)
Vacancy	- Overtime of colleagues - Hiring of temporary help	No estimation because of major differences in cases
Recruitment	- Job fairs: travel & registration - Advertisement	No estimation because of major differences in cases
Hiring	- Application, interview, background check - HR processing	~ 8.64% (Synar & Maiden, 2012)
Orientation & Training	- New teacher orientation & mentoring - Professional development	~ 48.15% - 67% (Synar & Maiden, 2012; Levy et al., 2012)
Teacher productivity	- Possible temporary loss of effectiveness in student learning (setback in productivity)	40.92% (Synar & Maiden, 2012)

Recruitment costs are about the activities that are necessary to find suitable replacing teachers to fill up the recently opened position. These costs consist primarily of advertising costs and job fair participation. However Defeo et al. (2017) claims that these costs can be very different among cities and district, since schools which are more selective might spent more

on recruitment than others or schools that are more attractive will have more applicants and thus need to spend less on recruitment.

Hiring includes many costs related to the time that is committed to them such as screening, interviewing, selecting, background checks, contract preparation, school board approval, setting up payroll/benefits and negotiating about them. The amount time that is spent on these categories is highly variable and dependent on the number of applicants on the job, Synar and Maiden (2012) estimate that these activities constitute of 8.64% of the total turnover costs.

Orientation and training costs differ a lot per organization and are therefore very difficult to estimate since every school spends different effort in this category (Levy et al., 2012). Schools can for example do this internally or contract this out to an external party. Besides this, some schools offer professional development to each teacher and some only to beginning teachers, in conclusion this cost can vary a lot. However, Synar and Maiden (2012) estimate that this is 48.15% of the total costs in their model and Levy et al. (2012) estimates this as 67% of the total costs. The professional development of teachers is considered in both models as ‘’sunken costs’’ however this is hard to conclude since the school itself also had advantage of this development. Hiring experienced teachers as replacement can lower these costs (Defeo et al., 2017).

Preparation costs consists of costs to finalize the process and getting the new employee up and running. This consists of HR related costs such as making an account to access or giving a tour around the location. This costs only takes a small proportion of the total costs.

The last cost category is the loss of productivity of teachers. This category is very hard to estimate but is considered as a significant cost of teacher turnover (Karsan, 2007). The effectiveness of the leaving and incoming teachers can be highly variable, since incoming teachers could be more productive than the leavers (Barnes et al., 2007), however studies suggest that this is mainly not the case and most of the times turnover is considered as a setback to productivity (Milanowski & Odden, 2007; Cascio & Boudreau, 2010; Defeo et al., 2017). Different ways have been used to calculate these costs, for example Synar and Maiden (2012) calculated that this consists of 40.92% of the total costs. In their calculation they made the assumption that a teacher gained 20% increased effectiveness a month, thus needing five months to reach their full effectiveness. They then propose that this loss of effectiveness consists of 40.92% of the total costs of turnover. Other studies such as Rosenholtz (1985) and the more recent Pennucci (2012) claim that it takes five years to be fully effective in a new

environment. This lost effectiveness is directly associated with student achievement and studies indicate that student achievement declines significant when taught by new teachers (Alliance excellent education, 2005; Hanushek et al., 2004).

As several studies point out, direct costs such as the above mentioned are possible to quantify however they do not account for all considerations (Synar & Maiden, 2012; Defeo, 2017; Cascio & Boudreau, 2010). The loss of moral of the remaining employees and as a consequence lost productivity of the remaining employees is an indirect cost that many studies mention (Karsan, 2007; Cascio & Boudreau, 2010; Defeo et al., 2017; Watlington et al., 2010). Cascio and Boudreau (2010) also mention the increased chance that employees which liked the leaving employee might have an increased chance to leave as well. Then there are the indirect costs related to a decrease in student achievement and the dropping out of lessons. It might be the case that due to lower achievement and a high drop-out new students (or parents) might choose another school in the future. Other more easily calculated costs which often are forgot are for example the costs of overtime or the cost of replacement to fill the open vacancy (Cascio & Boudreau, 2010).

The total costs estimated differs between studies, Levy et al. (2012) estimates it between the $2500 and $5100 whereas Barnes, Crowe and Schaefer (2007) estimates it to be 25% of a teacher's annual salary. The main conclusion is however that departure of teachers can have a severe financial impact.

Nonetheless not all turnover is seen as negative to an organization. Cascio and Boudreau (2010) name this ''functional turnover''. This is when an employee's departure provides increased value for the organization. In addition to this, several studies claim that some degree of turnover is good for an organization, providing ''new blood'', fresh ideas and prevents the organization to stagnate (Dalton & Todor, 1979; Alexander, Bloom & Beverly, 1991; Muchinsky & Morrow, 1980; Staw, 1980). Since poor teaching competence is related to turnover (Helmz-Lorenz, 2014; Harmsen et al., 2015; Ingersoll, 2001), this can mean that ineffective teachers leave the organization and might be replaced by more effective teachers. However, this statement is rejected by Hanushek, Rivkin and Schiman (2016) who conclude that despite the selection of leavers, teacher turnover still affects achievement negatively.

3. Causes of teacher attrition

In this theoretical framework the types of causes given by the literature for teacher attrition are displayed. At first, the personal and job-related causes for teacher attrition is displayed. This is done by reviewing recent Dutch studies which claim that the major reasons for teacher turnover and attrition are personal related reasons. Afterwards these studies are compared to international studies, which are mainly focused on the US context. A major difference between these studies, is that the US studies found salary as one of the most important reasons, where Dutch studies only give little attention to this factor, salary was in the Dutch context seen as not important regarding teacher attrition. After examining the personal and job-related causes, the next section describes how organizational factors can influence teacher turnover. In literature, no Dutch studies have been found that address these types of factors, in the US and other countries a few studies have taken these organizational factors into account. These studies are however in minority compared to the number of studies that is described in section 3.1. This chapter ends with the explanation, goal and research question of this study.

3.1 Personal and job-related causes of teacher attrition

In general, teachers in the Netherlands are less happy with the conditions of their job than other Dutch professionals. This is claimed by Koppes et al. (2013) who investigated the perception of Dutch professionals of their working conditions through a questionnaire. Teachers for example indicate, compared to other professionals, that they work more hours than they should and that they are less paid for this overtime. The study also points out that they find their work more hectic than other professionals and report more instances of stress and burnout. Den Brok et al. (2017) claims that most of the research that has been done on the topic of teacher attrition, has focused on the individual teachers and their reasons to quit the job. For example, Harmsen et al. (2015) found in a study based on 545 beginning teachers, that important factors causing attrition were: emotional stress, lack of growth and a low level of perceived teaching competence. In a follow-up study which Harmsen et al. (2017) conducted, they again found that high physiological demands were the strongest cause for the emotional stress teachers perceive and were the strongest factor causing attrition. A lot of studies confirm the idea that emotional stress is one of the main reasons for teacher attrition (Fruytier et al., 2013; SBO, 2010; Bakker & Demerouti, 2007). Besides stress, also lack of growth options are often recalled as an important factor explaining teacher attrition (Harmsen et al., 2017; Pillen, 2013; SBO, 2010;). Smith (2014) has categorized the four topics that

gained the most attention in terms of teacher attrition: personal circumstances, characteristics of the teaching job, school characteristics and relationships. Den Brok et al. (2017) summarized the findings of five Dutch studies and categorized them in these four topics as thought of by Smith (2014). In table 3.1 the literature review done by Den Brok et al. (2017) is displayed, they used Smith (2014) as a categorization of their findings.

Table 3.1

Types of causes by Den Brok et al. (2017) in terms of categories by Smith (2014).

Types of causes (after Smith, 2014)	**van der Grift and Helms-Lorenz (2013)**	**Fruytier et al. (2013)**	**Harmsen et al. (2015) (see also: Helms-Lorenz et al. (2016)**	**SBO (2010)**	**Pillen (2013)**
Personal circumstances of individual teachers				- Personal problems	- Personality (perfectionism) - Health problems - Family issues
Characteristics of the teaching job	- Satisfaction with profession - Poor teaching competence	- Stress and burnout	- Work pace - Teaching load - Emotional stress - Unclear expectations of the teaching job - Poor teaching competence	- Teaching load - Low salary - Lower status to society - Lack of variety	- Better career options elsewhere
School characteristics		- Unclear expectations from school	- Lack of communication - Unclear expectations from school - Weak future options - Lack of growth options	- Lack of growth options - Loss of jobs at school	
Poor relationships in school		- Lack of feedback and support	- Poor relations with management - Poor relations with colleagues		- Bad relations management - Bad experience with supervisor - Isolation at school

As can be seen, this table suggest that reasons from all categories are present in the Dutch context, however personal circumstances only came forward in small-scaled qualitative studies (e.g. Pillen, 2013). It becomes clear that it is hardly one factor that drives teachers to leave the profession, but that it is most of the time a combination of reasons. The conclusion by Smith (2014) and Den Brok et al. (2017) after conducting this literature review is that the most common reasons for attrition are the workload, stress, the relations within school and the support/coaching of colleagues.

It catches the eye that international literature suggests other main reasons for teacher attrition than those suggested in the Dutch context. In for example many studies conducted in the US, many studies found that salary was one of the most important causes for teacher attrition (Garcia, Slate & Delgado, 2009; Ingersoll, 2001; Ingersoll & Smith, 2003; Ingersoll, 2003; Alvarado & Cooper, 2006). For example, Garcia et al. (2009) found that in districts where teachers received a low salary, that the teacher turnover rate was twice as high than in districts where teachers had an above average salary. Also, Ingersoll (2001) and Ingersoll (2003) found that in their sample around 61% of teachers that had quit their job, salary was given as a reason. Murnane and Olsen (1990) conducted an experiment and found that a $1000 raise in yearly salary would increase the mean duration of teachers' retention by three years. Especially teachers in fields like mathematics and science are prone to staying due to higher salary (Theobald, 1990; Kain & Rivkin, 1999; Stinebrickner, 1998). This can be explained by the argument that teachers in that subject area have higher wage alternatives than teachers in other subjects (Loeb et al, 2016). This is quite different compared to studies conducted in the Dutch context, only SBO (2010) found among 1405 secondary education respondents that only 5% gave salary as a reason for quitting their job. SBO (2010) made a top-ten for causes of teacher attrition and the primary working conditions were in the tenth place as cause for teacher attrition.

Other Dutch studies did not report salary as a factor for teacher attrition. This could be explained by the amount of salary that teachers earn in the US. Teachers in the Netherlands in primary schools earn 0.95 times and in secondary schools 1.07 times the median salary of employees in the Netherlands (RuimbaanvoorPO, 2019; Intermediair, 2018). For US primary teachers this ratio is 0.93 and for secondary school teachers this is 0.95 (Niche, n.d.; US Census, 2016). However this can be seen as a rather bold statement, it is not empirically tested and the comparison between teachers is hard, since their salary can increase substantially with their experience and age. In conclusion one could say that teachers in the

US seem to find salary a more important factor for leaving their teaching job than teachers in the Netherlands.

Another aspect which comes up in the US studies compared to the Dutch studies is the importance of student motivation and student discipline problems (Ingersoll & Smith, 2003; Ingersoll, 2003; Gonzalez, 1995; Gonzalez, Brown & Slate, 2008). In the Dutch studies these problems are not mentioned, however it could be that these problems contribute to the claimed emotional stress by Dutch teachers and thus are categorized as stress and workload, instead of the lack of student motivation or student discipline problems. Something that international studies and Dutch studies do have in common, is that they mostly mention the lack of support as an important factor causing teacher attrition (Fruytier et al., 2013; Pillen, 2013; Ingersoll, 2003; Cooper & Alvarado, 2006).

3.2 Organizational factors causing teacher attrition

Den Brok et al. (2017) claims, basing themselves upon the literature review of Smith (2014), that most Dutch research towards teacher attrition is focused upon the work conditions or personal characteristics of the teachers. They claim that in the Netherlands a lot of empirical research still lacks on the topic of teacher attrition. Also, many US studies focus on the personal characteristics of teachers or the work conditions of teachers. They mainly focus on the individual level of teachers (such as stress, salary, workload, lack of support). A lot of highly cited studies (e.g. Ingersoll, 2001; Ingersoll, 2003; Ingersoll & Smith, 2003; Cooper & Alvarado, 2006; Garcia et al., 2009; Rumberger, 1987) make use of surveys and/or interviews to investigate the reasons teachers mention for leaving their job, thereby focusing mainly on the individual. However, in these studies the organizational aspects of schools are rarely taken into account. These aspects can also be named, variables at a meso-level (Scheerens, 1990). Meso-level variables can be defined as: variables on an organizational level, from the perspective of the school as one organization (Scheerens, 1990). When looking at studies who investigate the relationship between teacher attrition and school characteristics on a meso-level, no Dutch studies can be found. Bonhomme, Jolivet and Leuven (2016) for example do take these meso-level variables into account but they relate them to teacher preferences. They claim this is very related to turnover, however this is not actual turnover.

3.2.1 District characteristics

Internationally, a decent number of studies focusses on the relationship between meso-school characteristics and teacher attrition. For example, a few studies have looked into district

characteristics and the relationship with the attrition of teachers. The economic status of a district was found to be of predictive value for teacher attrition. Studies all found that teacher attrition was negatively related with the district's economic status, the district economic status was measured as the average income of its inhabitants (Mont & Rees, 1996; Stinebrickner, 1998; Scafidi, Sjoquist, & Stinebrickner, 2005). A possible explanation given for this is that a teacher's salary is related to the district salary and a low salary makes non-teaching opportunities in higher income districts more attractive (Mont & Rees, 1996). Other explanations are for example provided by Ingersoll (2001) and Feng (2005 & 2009) which indicate that a lower income district might provide more challenges for the teachers. Another variable that has been studied which is related to the location of schools, is the racial composition of students. These studies all had comparable results, they found that schools with mainly white students experience a significant smaller teacher attrition rate compared to schools with a mainly black or Latino student population (Boyd et. al., 2005; Hanushek et al., 2004; Kain, & Rivkin, 2004; Scafidi, Sjoquist, & Stinebrickner, 2005; Feng, 2005). The empirical studies which related the district characteristics with teacher turnover were all American studies, in the Dutch context it is only known that the teacher shortage is much bigger in districts with a high ethnic diversity among students (Staat van het Onderwijs, 2019). In conclusion both variables on the district level showed a relationship with the teacher attrition rate in non-Dutch studies. Both variables are claimed to be influencing the teaching challenges and workload and therefore the income in a district is expected to be negatively related to teacher attrition and the percentage of immigrants positively. This study follows the reasoning of the earlier conducted studies since for example Pillen et al. (2013) also claims that a more diverse student population seems to increase the perceived workload of teachers. This study therefore poses the following two hypotheses:

H1a: A higher *average income* in a district results in a lower *teacher attrition* rate
H1b: A higher *percentage of immigrants* in a district results in a higher *teacher attrition* rate

3.2.2 Denomination

It is widely believed that religious schools suffer from more teacher attrition than non-religious schools. For example, Stinebrickner (1998) found that religious schools suffer from a significantly higher teacher attrition rate than non-religious schools. Also, Grace and O'Keefe (2007) find that in over seven different countries the attrition rate of teachers in catholic schools is problematic. It is however not clear how this relates to the difference

between public and private schools. Grace and O'Keefe (2007) mentions that a large majority of private schools is catholic. It could be the case that it is more due to private schools' characteristics, that these schools suffer from a high attrition rate instead of the characteristics of religious schools. This could be supported by the results from Schutloffel (2001), he found that only 12% of 200 US private catholic school teachers claimed to be really connected to the religious identity of their school, while the remaining percentage of teachers claimed that they just wanted to do the teaching job. Again, the context of these studies differ a lot, in the Netherlands for example, for many years there has been a discussion to reduce the amount of religious education and convert those schools to public schools (Banning & Bruins, 2017). This is in line with the earlier trend in the 1960s of secularization, since then it is questioned till what extent it is needed to still have so many schools with a religious background (>70% of primary schools), while the Dutch people become "less religious" (CBS, 2017). Lagerveld (2012) describes for example that Dutch parents base their choice for a primary school primarily for the effectivity or distance of the school, instead of the religious ideas of the school.

Concluding this paragraph, since there has not yet been a study investigating teacher attrition and the denomination of Dutch schools, this study will follow the reasoning by for example Lagerveld (2012) which claims that in the Dutch context, the "religious" identity of a school is becoming less important. This would mean that the denomination of a school would not have an effect of its own with teacher attrition. However, since the empirical studies (which are in another context) claim otherwise, it seems still relevant to test whether the denomination of a school has an effect. This study therefore poses a null hypothesis:

H2: There is no relationship between *teacher attrition* and the presence of a religious *denomination* in *a school*.

3.2.3 Financial characteristics

When looking at school finances, there were no studies which empirically tried to find a relationship with a school's financial situation and teacher attrition. This relationship has for example been found in studies in other contexts. For example Gilson (1989) has found that firms who are in financial distress experience a large number of turnover among management. In addition to this Murphy and Zimmerman (1993) have found the same result in their sample. A more recent study conducted in Germany confirm these findings among their sample of 267 German firms, however this study looked at the voluntary and involuntary turnover rate, it

could be the case that employees were fired because of their financial performance and thus resulting in a higher turnover rate. However in conclusions these findings indicate that organizations which are in financial distress are prone to higher turnover rates, a possible explanation for this is that employees feel the financial burden of the organization which could affect the working environment and therefore making it more attractive to quit their job. Ronfeldt et al. (2013) suggest that school resources can influence the decision of teachers to quit their job, however they do not specifically mention school finances or budget. Schneider (2003) does suggest that teachers are thinking of leaving their job due to a lack of school resources and budget, however he does not empirically test this. Empirical studies which used school budget and financial resources mainly found low financial resources or budget restraints in school causes teachers to be more dissatisfied with their job (Schneider, 2003; Sargent & Hannum, 2005; Woods & Weasmer, 2004). It seems like a logical relationship that teacher satisfaction decreases teacher attrition, Woods and Weasmer (2004) claim this as well. Brum (2007) found a positive relationship between investment in training opportunities and the retention of employees. Schools with a lower budget might have lower a smaller amount of training investment, which would reduce their capabilities of employee retention. Section 4.2.4 clarifies the transformation of financial characteristics to the quick ratio and residual budget. Following this argument and the results of several studies in different contexts than schools have found that the financial situation of firms are of predictive value for employee attrition. The following hypothesis is used for this study:

H3: There is a significant negative relationship between the *financial characteristics of the school and teacher attrition*

3.2.4 School size characteristics

There are only limited studies on school size. School size in these studies are measured by the number of students. Loeb and Reiniger (2004) found that when school size increase, teacher attrition rate increases as well. However other studies such as Falch and Strom (2005) and Adalsteinsdottir (2004) found that the relationship between school size and teacher attrition is quadratic and U shaped. They found that small schools are prone to teacher attrition since the hours they can offer to teachers are relatively low and these schools are threatened by being closed due to the too low number of students. Besides this they claim that large schools are prone to teacher attrition since they bring more bureaucracy and a crowded environment. The Norwegian study of Falch and Strom (2005) propose that the quit probability of schools

consisting of 70-670 pupils (mid-size) are equal. Adelsteinsdottir (2004) also claims that mid-size schools (300 in Iceland) are optimal for retaining teachers. However, Leithwood and Jantzi (2009) remark that it is hard to compare school size measures internationally, since 300 students could be mid-size in Iceland, however in some US districts this is seen as a very small school. They do however suggest that the optimal maximum size of schools is 300-500 for elementary schools and 600-1000 for secondary schools.

School size, often measured in number of students, seems to influence the teacher attrition rate. Studies differ in their findings, some studies find a U-shaped relation between school size and the attrition rate, where others find a linear relationship. However they consistently find the presence of a significant relationship between the two variables. This results in the following hypothesis:

H4: There is a significant relationship between *teacher attrition* and *school size*.

Class size is a variable that has been studied considerably more often. However, research on this topic has not yet come to an agreement. For example, older studies such as Macdonald (1999) and Mont and Rees (1996) found that an increase in average class size also causes an increase in teacher attrition. Also, Isenberg (2010) found that a decrease of one standard deviation of class size could lead to a decrease in attrition rate of 4.2 percentage points. They propose that this is due to a higher workload of teachers who teach bigger classes, and that this workload causes teachers to quit their job. However more recent studies such as Burke et al. (2013) but also Feng (2005) found no relationship between class size and teacher attrition. Feng (2005) claims that the findings of Mont and Rees (1996) are due to a small and too much homogeneous sample and therefore proposes that having a bigger more heterogeneous sample would lead to no relationship between these variables. Ronfeldt et al. (2013) does not find a correlation between these variables, however they do find that the presence of very large classes (>33 students) will higher the teacher attrition rate.

Class size is also frequently measured as the student to teacher ratio. Where class size is measured by dividing the number of students by the number of classes, the student to teacher ratio is calculated by dividing the number of students by the number of teacher FTE's. While OECD (2019) claims that there are differences between class size and student to teacher ratio, many studies use this ratio as an indicator for class size (Hanushek, 1986; Mont & Rees, 1996; Stinebrickner, 1998; Theobald, 1990; Schanzenbach, 2014; Kirby, Berends & Naftel, 1999). Also Henshaw and Henshaw (2006) criticize the use of student to teacher ratio

as a proxy for class size. They and OECD (2019) argue that this ratio does not take into account that not all teachers are mainly busy with teaching and therefore the instruction time for students is not taken into account by this ratio. However it does give information about the number of students each teacher have to teach and the amount of attention a teacher can pay to individual students (Hanushek, 1986). When looking at the relationship between this ratio and the teacher attrition rates, then the studies again disagree upon the results. Theobald (1990) found a significant positive relationship between the student to teacher ratio and the attrition rate, however Stinebrickner (1998) did not manage to find this relationship. Studies do seem to disagree upon the effect of class size on teacher attrition rates. When examining these studies, it seems to be the case that older studies do find an effect of class size on teacher attrition, where more recent studies do not find a relationship between these variables. It is for example argued by Theobald (1990) that class size could increase the workload of teachers, workload is shown in literature to be a very important factor explaining teacher attrition (Den Brok et al., 2017). Combining this view of Theobald (1990) about the increasing workload due to an increased class size and the view of for example Hanushek et al. (2004) and other studies, which claim that an increase of migrant students can also increase workload, results in the inclusion of a possible interaction between these two variables. It could be that class size increases workload and as a result, increases teacher attrition. This study will follow this reasoning and expects that a larger class size would result in higher teacher attrition rates.

H5*:* There is a significant positive relationship between *class size* and *teacher attrition*

3.2.5 School quality characteristics

School quality has often been addressed in teacher attrition studies, however is mainly defined as the student achievement of schools.

Student achievement in these studies is measured as the standardized score on national exams (Boyd et al., 2008; Hanushek et al., 2005). All of the conducted studies agree upon the existence of the relationship between student achievement and teacher attrition; they all find that a low student achievement increases the rate of teacher attrition (Boyd et al., 2005; Boyd et al., 2008; Hanushek et al., 2005; Scafidi et al., 2005). Many studies also find that this relationship works in both ways, they claim that a high rate of attrition causes lower quality education and thus lower student achievement. Allensworth et al. (2009) investigated this

relationship for primary schools. He also found that high average pupil achievement led to lower teacher attrition rates.

Student achievement is often examined in teacher attrition studies. To further investigate the relationship between the quality of education and teacher attrition, also quality assessments by the "Onderwijsinspectie" (educational inspection) has been taken into account. The rationale in the literature behind the predictive value of student achievement, is often that schools with a higher student achievement, provide higher quality education and are thus more attractive for teachers. It could however be that the student cluster of the schools used in this dataset performs significantly better than schools outside the dataset. To overcome this bias, this study also takes the "school quality" (here after: "inspection score") into account. Every four years the educational inspection (''Onderwijsinspectie'') examines the quality of schools and their education on different aspects. Afterwards they report the Inspection score in their openly accessible data and rate the school as: very weak, weak, insufficient, sufficient or good. Schools which are rated as insufficient or lower will be under stricter supervision by the inspection.

The negative relationship that has been found between the teacher attrition and student achievement has been confirmed by many studies. This results in the following hypotheses:

H6a: There is a significant negative relationship between *student achievement* and *teacher attrition*

H6b: There is a significant negative relationship between *Inspection score* and *teacher attrition*

3.3 This study

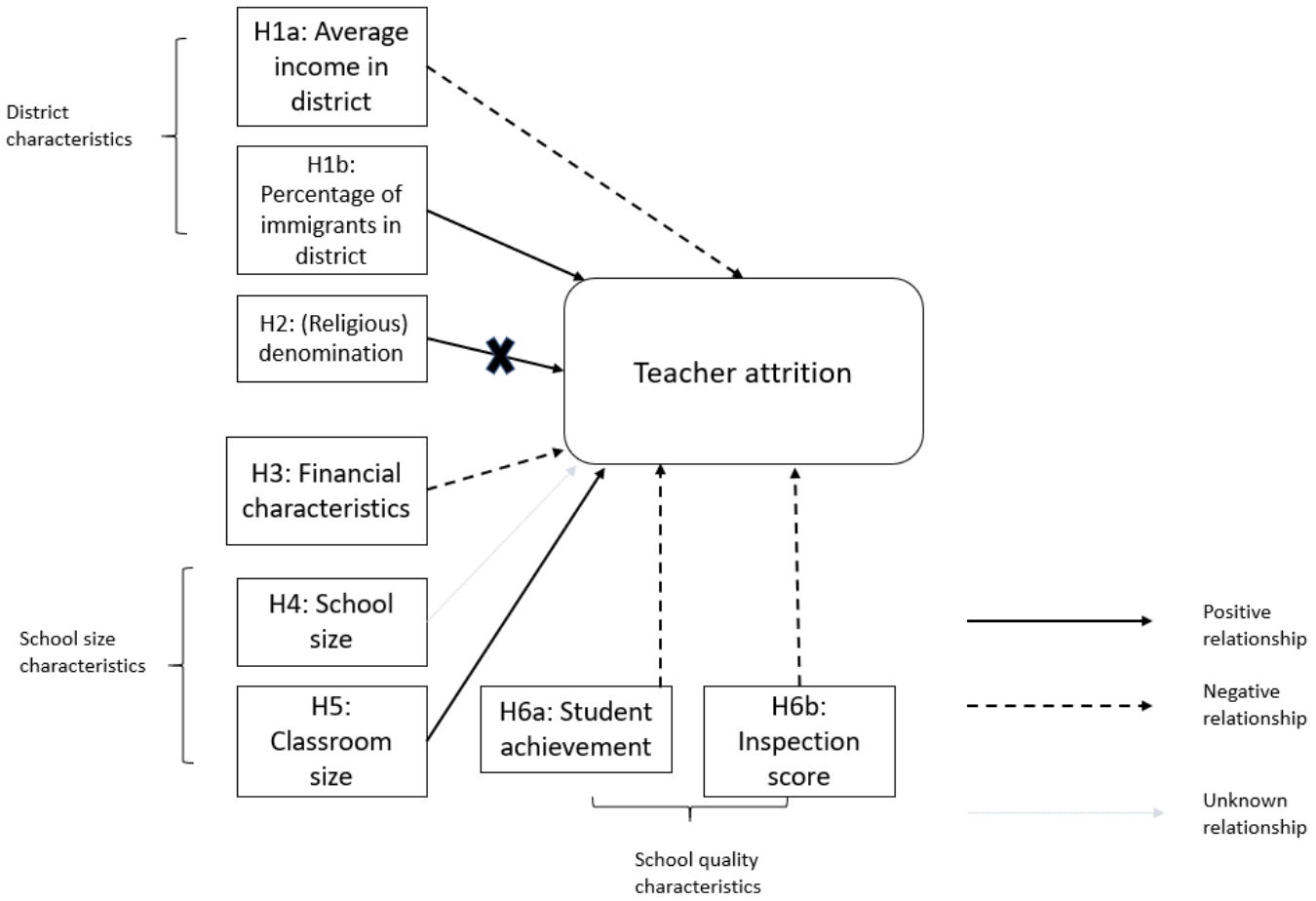
When looking at earlier conducted studies in the literature, it catches the eye that most studies focus on the personal- or job-related characteristics influencing teacher attrition. This is especially the case in the Dutch context, where no studies have yet explored organizational factors causing teacher attrition. This study therefore aims to explore which organizational school factors have a relationship with the teacher attrition rate. The scientific goal of this study is to extend and broaden the literature around teacher attrition in Dutch primary schools, by examining factors that have not yet been addressed by known literature. The study uses teacher attrition rate as a dependent variable and several organizational variables as the

independent variables. The main question of this research is therefore: Which organizational school characteristics explain teacher attrition in Dutch primary schools?

Several hypotheses are tested to establish the relationships between the dependent and independent variables. Multiple regression has been used to examine the relationships between the variables. These hypotheses are based upon the literature review and are tested in this study. The hypotheses can be found in the model in figure 3.1

Figure 3.1

Variables and their relations



4. Methodology

This study is a quantitative study, in which secondary data was used. This data is gathered by three different educational administrative offices and utilized by Infotopics BV for intelligence purposes. This data is combined with open data, coming from DUO (Service execution of Education), the Educational Inspection and the Central Bureau of Statistics (CBS).

4.1 Sample

The sample is an already existing dataset which has been provided by schools to educational administrative offices and distributed by Infotopics. Infotopics is a company focused on making dashboards based on collected data. In the provided sample, these schools are all indirectly a customer of the system provided by Infotopics. This sample consisted originally of 1260 schools, schools which had missing values for the dependent variable were dropped. Schools for which a postal code was not in the original data and could not be received manually, due to an unclear school name, have also been dropped. This resulted in a final sample of 1036 schools. Table 4.1 displays the descriptive statistics of the variables used. The geographical distribution of schools, created by using their postal code, can be found in figure 4.1

Table 4.1

Descriptive statistics

		Mean	Standard Deviation	Count
Turnover in FTE %		16.84%	20.64%	
Number of students		187	116	
Student/teacher ratio		17.20	5.81	
Residual Budget		€39404	€25598	
District: Population density (km²)		2585	3034	
District: Property value		€239,000	€100,000	
DistrIct: Income		€32,000	€8,000	
District: Percentage of migrants		18.71%	16.15%	
Denomination	Public			284
	Catholic			222
	Protestant			235
	Other			58
Inspectionscore	Very weak			4

Weak			11
Insufficient			6
Sufficient			757
Good			3

Figure 4.1

Geographical distribution of sample (each dot represents one case)

4.2 Operationalization

In this section, the definitions and ways of measurement of each variable has been given. At the end of this section, a total overview of all the variables and their way of measurement is displayed.

4.2.1 Teacher attrition

Teacher attrition is defined as: teachers who leave the profession before retirement (Cooper & Alvarado, 2006). This study has examined the teacher attrition rate as the dependent variable, which is the percentage of teacher FTE's that leaves the school voluntarily compared to the total number of teaching FTE's. In the dataset that was provided, teacher which left the school due to other reasons (such as pension, migration or illness) were removed. Teachers who are at the end of their contract were also removed from the dataset. It was not clear if they went to another school or would quit the teaching profession. This led to the remaining teachers in FTE that had quit the profession.

4.2.2 Average income and racial composition of the district

When looking at the independent variables, the first variable taken into account is based on the location of the school. This variable is called the average income of the district (in short: avg. income district). The average income of the district has been collected by the CBS, using tax statements. It is the total income, divided by the number of inhabitants in a district. The racial composition of the area is operationalized as the percentage of immigrants opposed to the total population of a district.

4.2.3 Denomination

The denomination of the school is a categorical variable which consists of four levels: catholic, protestant, public and other. This study has chosen for these categories since the distribution of religious schools is heavily skewed. The catholic and protestant schools make up for almost 50% of the dataset, while the public schools consist of 40% of this dataset. The 10% that is left is scattered around different denominations.

4.2.4 Financial situation

The financial situation of the school has not yet been taken into account in research in this topic. A school's income is mainly provided by the central government and is based on a lump-sum system. Schools get a pre-determined amount of money for each student (€6900 for a primary school student and €8500 for a secondary school student, according to Rijksoverheid (2019). This lumpsum is thus based on the number of students, schools have the freedom to spend this money in the way they wish, however Rijksoverheid (2019) also provides money for each personnel member a school has. A school can also gain income due

to sponsoring activities, however there are strict regulations for sponsoring activities (Rijksoverheid, 2019). These limits restrict schools in the way they gain income and thus restricts the amount of money they can spend. DUO (2018) provides information about the gross residual amount of budget (''residual budget'') that schools have after fulfilling their expenditures required by law (such as personnel costs, overhead costs and special education. This amount can be used for extra-curricular activities such as for example additional lessons, subjects or school trips. To account for school size, this residual budget is divided by the number of students. This information is provided on school-level.

Besides this, DUO (2019) also provides information about the debt-ratios of school boards. This study has also chosen the quick ratio as an indicator for the financial situation of the school since this gives information about the school board's ability to fulfil their short-term debts. The quick ratio is calculated by dividing the cash & equivalents by the current liabilities. A quick ratio of one means that a school can pay its current liabilities with their current assets and is seen as a healthy financial situation (Kenton, 2019). To take into account fluctuations, the mean quick ratio of the last five years has been calculated. Both indicators, the residual budget and the quick ratio have been used to indicate the financial situation of the school.

4.2.5 School Size

School size has been measured by many studies as the number of students that is attending the school (Falch & Strom, 2005; Loeb & Reiniger, 2004; Adelsteindottir, 2004). However Leithwoord and Jantzi (2007) already suggest, the number of students is hard to compare between regions, since a school of 300 students can be a big school in the northern part of the Netherlands compared to the more populated western part. However since these studies mention that it is for example the bureaucracy and crowding that comes from a higher number of students and as a result causes teacher attrition, this is not a relevant problem. Therefore this study also uses the number of students as an indicator for school size.

4.2.6 Class size

To measure average class size, one normally divides the number of students by the number of classes. However studies that used this indicator are rather small studies (Such as Mont & Rees, 1996). This data is most of the times not available for bigger studies and is rather time-intensive to measure, therefore many studies use the student-teacher ratio as an indicator for class size (Hanushek, 1986; Mont & Rees, 1996; Stinebrickner, 1998; Theobald, 1990; Schanzenbach, 2014; Kirby, Berends & Naftel, 1999). The student-teacher ratio is measured by dividing the total number of students by the total number of teacher FTE's. Critic on using

this ratio as an indicator for class size is that it does not take into account that teacher's not spend their full time on teaching, however this critic is mostly relevant for using this indicator on high school level, since teachers there also spend a lot of time on research (OECD, 2019). Besides this, as earlier mentioned, a possible interaction between class size and the percentage of immigrants in a district is also taken into account.

4.2.7 Student achievement and inspection score

In most studies student achievement has been measured by using the result of the final test for a primary school. In the Netherlands, the schools are free to choose any of the by the government approved final tests. In this dataset this means that some schools are using for example the well-known CITO end test, however other schools are using Route8, IEP or the AMN test. To account for the differences in the scaling of scores of the different end-tests, the results on these tests have been standardized, using Zscores. In literature, student achievement is sometimes seen as a proxy for school quality (Boyd et al., 2008; Hanushek et al., 2005) however it could be the case that schools with a higher educational quality, provides a higher student achievement. To test this relationship, also the school quality is taken into account. This is done by using the score of the school that has been given by the educational inspection. This score can have the following values: very weak, weak, insufficient, sufficient and good.

Table 4.2 summarizes dimensions and indicators, measurement levels and their sources.

Table 4.2

Dimensions and their indicators, measurement levels and sources

Dimension	**Indicators**	**Measurement level**	**Source**
Dependent variable			
Teacher attrition rate	$\frac{Teacher\ FTE's\ leaving\ in\ year\ X}{Total\ teacher\ FTE's\ in\ year\ X}$	Scale: 1-100%	Infotopics
Independent variables			
Average income district	- Avg. income per inhabitant of a school's district	Scale	CBS
Racial composition of a district	$\frac{(number\ of\ Western\ immigrants + Number\ of\ non\ Western\ immigrants)}{Total\ inhabitants\ of\ a\ district}$	Scale: 1-100%	CBS
Denomination	Catholic, protestant, public, other	Categorical	DUO
Financial situation	Quick ratio (= $\frac{Cash\ \&\ Equivalents}{Current\ assets}$) Gross residual budget per student	Scale Scale	DUO
School size	Number of students		DUO
Class size	$\frac{Number\ of\ students}{Number\ of\ teacher\ FTE's}$		DUO
School quality	Student achievement Rating of educational inspection (Very weak / weak / insufficient sufficient / good)	Scale: Zscores Ordinal	DUO Educational inspection

4.3 Data collection

The data has been collected from four different sources: Infotopics, Educational Inspection, DUO and the CBS. At first the sample of schools was provided by Infotopics. To form the dependent variable (Attrition in FTE / Total FTE) data about the turnover and total FTE were needed. This data was gathered by extracting this from the data provided by Infotopics. Schools with missing data in one of these variables were dropped. Besides the data needed for the dependent variable, also the postal code of the schools was provided by Infotopics. Missing postal codes were manually searched for and added to the data. The variables that are used are all collected in schoolyear 2017/2018. For district variables, 2018 was used.

After retrieving the postal codes, these were matched with the so called ‘’district codes’’, this is a system which the CBS uses for labeling their district data. Each postal code belongs to a certain district, each district has their own district code. Matching these codes made it possible to match the district data to the schools.

Schools also have their own unique BRIN code. This is a four-digit code which identifies the school. The data from DUO and the educational inspection is also identified with the BRIN codes. The same process as described above was used to match these data, the BRIN codes were matched and the data from DUO was added to the schools. Some schools lacked BRIN codes or the BRIN code was not in the file of Infotopics. In this case the BRIN codes were manually searched for, if a BRIN code could not be found, the school was dropped from the sample. In appendix A a table is provided in which all used files are displayed.

4.4 Data analysis

This section explains how the data cleaning phase has taken place. The data cleaning has been done using Microsoft Excel and SPSS statistics 25. Afterwards the data analysis took place, this has been done using Alteryx designer 2020. The variable names for the variables that have been used and their descriptions are provided in table 4.3.

Table 4.3

Variable names and descriptions

Variable name	**Description**
AttritionFTE	Attrition as a % of FTE

Numberofstudents	Number of students
Studentteacherratio	Student to teacher FTE ratio
Resbudgetstudent	Gross residual budget per student
Denomination	The denomination of a school
Inspectionscore	The score that the educational inspection has given to a school in a period of four years
FinaltestZ	The Z-scores of the final test that schools conduct at the end of a student's primary school time
MeanQR5y	The mean quick ratio of the last 5 years
Percimmi	Percentage of immigrants in a district opposed to the total inhabitants
Distrincome	Avg. income per income receiver in a district

4.4.1 Data cleaning

Data cleaning deals with detecting and removing errors and inconsistencies from data in order to improve the quality of this data (Rahm & Do., 2000). The researcher can identify three basic types of oddities: missing values, outliers, and strange patterns (Van den Broeck et al., 2005).

4.4.1.1 Missing values

At first, the data provided by Infotopics was analyzed for missing values. It appeared that for 27 schools, there was no presence of the dependent variable: teacher attrition in FTE. Besides this, also the presence of the postal code was analyzed, the postal code is necessary to be able to link the schools to data from the CBS. For schools which missed a postal code, which were 114 schools, the researcher manually searched for the postal codes. For schools in which the postal code could not be received, this could be in the case of an unclear school name or in which it is not evident which school is meant (e.g. a school union instead of a single establishment), the case was deleted. This resulted in a working sample of 1039 schools.

Before conducting a missing value analysis, the patterns of the data were checked. It could be for example that missing data was filled in with a "." or a "0" instead of a blank cell. This has been done by displaying tables for each variable (see table 4.4). To gain more insight of the missing value patterns, SPSS produced a pattern analysis. (see figure 4.2) In this figure it can be seen how many number of cases has a number of missing variables, it can for example be seen that 734 cases have no missing variables (top row). This is useful to

investigate specific cases which have a lot of missing variables, such as the one case shown in the last row.

Table 4.4

Frequencies and missing values

		Count	Mean	Missing	Missing%
Denominatio n	Public	356			
	RK	322			
	Protestant	285			
	Other	66			
	Missing	13			1.2%
Inspectionsc ore	Very Weak	0			
	Weak	13			
	Insufficien t	9			
	Sufficient	959			
	Good	2			
	Missing	59			5.6%
AttritionFTE1819		1042	11.56	0	
ResbudgetStudent		1042	206.60	117	11.2%
MeanQR5y		1042	2.93	0	
studentteachratio19		1042	17,60	12	1.1%
Numberofstudents1819		1042	187	12	1.1%
FinaltestZ		1042	-.01222	136	13.1%
DistrIncome19		1042	24.84	176	16.9%
PercImmi		1042	16.31	0	

Figure 4.2

Missing pattern analysis

Tabulated Patterns

	Missing Patterns[a]								
Number of Cases	PercI mmi	Mean QR5y	Attriti onFT E1819	Numb erofst udents 1819	studen tteach ratio1 9	Resbu dget	Finalt estZ	DistrI ncome 19	Comp lete if ...[b]
736									736
37							X		773

54			X	X		861
34			X			770
7			X		X	906
129					X	865
27				X	X	929
8			X	X	X	1032
5	X	X		X	X	939
5	X	X		X		778
16	X	X	X	X		882

a. Variables are sorted on missing patterns.

b. Number of complete cases if variables missing in that pattern (marked with X) are not used.

For categorical variables it was checked if certain text pointed out missing data, in case of some variables the value was “geen actueel oordeel” (no actual judgement). This textual data has also been converted to blank cells which was interpreted as missing data. Especially district income data seems to be missing, for these 176 cases the average income was not provided. Since this is a substantial amount compared to the total number of cases, imputation has been chosen to deal with these missing cases. This missing data is imputed by using simple linear regression, which is according to Zhang (2016) appropriate for single imputation with a highly correlated other variable, this was done using the multiple imputation technique that SPSS offers. The predictor variable that was used was the average housing value (WOZ waarde) in a district, this variable showed an R of .9, indicating a high linear relationship. A linear regression formula was created on the data which had both the average housing value and district income and used to predict the missing district income values (R^2 =.82, p <.000).

In figure 4.2 it can be seen that there is one case with twelve missing variables, this case has been deleted, since it was not able to retrieve the information about this case. Other missing data has been ignored in this phase, they seem to be missing at random and pairwise deletion has been used to conduct analysis with this data.

4.4.1.2 Outlier detection

Besides missing data, also outliers were analyzed, this was done using the descriptives (min, max, range) and the QQplot of the variables (Appendix B). At first the so called “technical” oddities were analyzed, these are oddities which are technically not possible (van den Broeck

et al., 2005). This would mean for example when the percentage of immigrants was greater than 100%. No technical oddities were spotted.

When examining the QQplots further, looking for values which defer a lot from the diagonal line, some variables catch the eye. These variables were examined more thoroughly to gain more insight on these outliers. In the number of students, it strikes out that four schools have the same very high number of 913 students, it seems like there was a mistake in linking this data, since all schools belong to the same schoolboard. After re-examination with the original source files (Infotopics), it was indeed found that the other schools had the same value. To decide which cases had which values, the DUO files were checked, it seemed like only one case existed in the DUO file. This case was kept in this studies dataset, other cases were deleted. For the variable of "amount of teaching FTE" it was also possible to check different sources, since both Infotopics and DUO had this information. This variable is of importance since multiple variables are formed using this information. Outliers were detected using Zscores, where Zscore <3 indicated a very low value and Zscore >3 a very high value (Osborne & Overbay, 2004). The student to teacher ratio was also checked using ''common sense''. This is for example when it indicates that there are more than 100 students for one teaching FTE. Common sense is in this case appropriate to judge a value (Aggerwal, 2015). In the cases where the Zscore indicated an outlier, the case was cross checked. Three different cases where changed during this process, where the DUO file gave a much more plausible value than the Infotopic file. In one case, the teacher to student ratio was exceptionally high, the case could not be cross-checked, so this case was removed (which is justified following Osborne and Overbay (2004)).

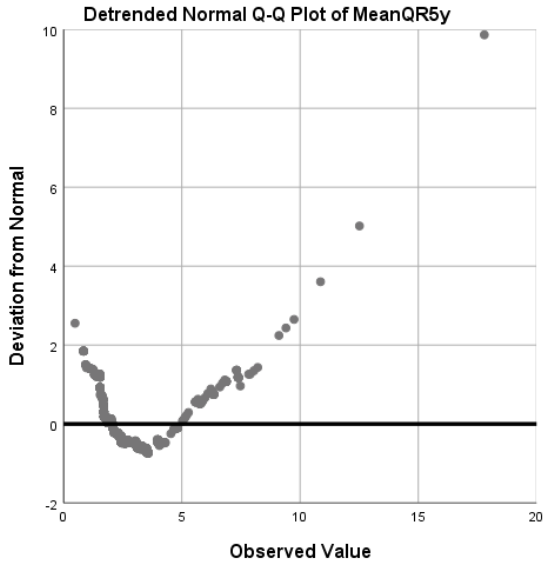
A disadvantage of using Zscores to detect outliers is the underlying assumption of the normal distribution of the dataset. In this case, the data was not normally distributed but right skewed, which led to only high values being detected as an outlier by this method. By looking at the lowest (most negative) Zscores, it catches the eye that all schools with a Zscore of studentteacherratio <-2 all are schools for students with special needs. These schools are known to have much smaller classes, where students get more attention (Smeets, 2007). These data points do therefore not seem anomalous.

Other variables were mainly checked using the detrended QQplots, see figure 4.3 for an example. In this example for the variable MeanQR5y (mean quick ratio for 5 years), it can be seen that some data points defer a lot from the rest of the points. Especially the one in the

top right corner. After examining these data points, the conclusion is that while some values may seem exceptionally high (outliers to the lower side are not found in the other variables), they do seem legit. This was for example also the case for the District income variable, where some districts had a Zscore of >8. After cross-checking these cases with their postal codes to the original source and other online sources, it was found that these cases were located in a town which is known to have a higher average income. For an extensive outlier analysis, see appendix B.

Figure 4.3

Detrended QQ plot example MeanQR5y



4.4.1.3 Data adjustments

Adjustments to the data were also made. As earlier described, the denomination of schools was reduced from twelve categories into four categories. This due to the skewed distribution of schools into each category. To include the denomination of schools in the regression analysis, the variable was transformed into three dummy variables (k-1). Also the variable of final test scores was converted to Zscores, since different final tests were used within schools and the scale of these tests was different. The dependent variable *AttritionFTE* was log transformed, in section 4.4.2 this is explained more thoroughly.

Also the multicollinearity of the data was assessed. This was done, using a cross-correlation matrix. This matrix can be found in figure 4.4. In the matrix it can be seen that there are quite a few variables which are significantly correlated with each other. It could be that there are problems with variables which have a high correlation between each other.. In

the analysis that are conducted, it should be taken into account that this could have a distorting effect on the outcome.

Figure 4.4

Cross-correlation matrix

	Attrition FTE1819	*1.*	*2.*	*3.*	*4.*	*5.*	*6.*	*7.*	*8.*
1. *Numberofstudents1819*	-.131	1							
2. *Studentteachratio19*	-.003	.343**	1						
3. *Distrincome19*	.078*	.173**	.039	1					
4. *Percimmi*	.059	.300**	-.022	.041	1				
5. *MeanQR5y*	.030	-.081**	-.103**	.020	-.197**	1			
6. *Resbudgetstudent*	-.011	-.229**	-.234**	-.152*	-.211**	-.070*	1		
7. *FinaltestZ*	-.059*	.174**	.100**	.241*	-.099**	.099**	-.098**	1	
8. *Inspectionscore*	-.055	.054*	.028	.020	-.019	-.016	-.010	.079*	1

*Note. Above correlations are all Pearson correlations *indicates p<.05, ** indicates p<.001*

4.4.2 Model building

In this study multiple regression analysis has been used to give insight about the relationships between the dependent variable *AttritionFTE* and the independent variables. The final sample after data cleaning consisted of 1036 schools. The method of building this regression model is stepwise regression, this method can be done forward, backward or a combination of both. In forward stepwise regression the model starts empty and the statistical software adds the most significant variables at each step. In backward stepwise regression this is the opposite, the model starts with all variables and the least significant variable is removed during each step. The inclusion or exclusion process is done using the alpha-to-enter (PIN) and alpha-to-remove (POUT) values. The Pin value is the significance level set to decide whether the variable should be included in the model, the POUT value is the level set to decide whether the variable should be excluded from the model. The values chosen for PIN/POUT has been set to 0.05 and 0.15, Pennstate (2017) suggest to use these values, since a lower value makes it too hard for important variables to stay in the model and a higher value would include less important variables in the model.

In most cases, the method of stepwise regression would deliver the same final model (Pennstate, 2017). It could however be that in case of influential outliers or collinearity the final models differ. Therefore, this study has made use of all three methods, to ensure that these would have the same findings and as a result increase the robustness of these findings

The multiple regression model was built using 75% of the data as training set and 25% of the data as the test set. This split percentage was chosen based upon Roy & Roy (2008) which claims that a training/test split of 75/25 is sufficient. The multiple regression was built by using both forward and backward elimination. This technique results in the most predictive variables to build the model. Table 4.4 shows which variables were included in building the model. The regression model has been run twice, to test the possible quadratic relation of *Number of students* (as proposed by Falch and Strom (2005)).

The assumptions for multiple regression, as proposed by for example first Osborne and Waters (2002) and afterwards Williams et al. (2013) have been tested, as stated in appendix C. At first the assumptions of homoscedasticity and normality of the errors were not met. A by literature widely used and advised remedy for this is the log transformation of the dependent variable (Buro, 2014; Keen, 1995; Burbidge, Magee & Robb, 1988). After the log transformation of the dependent variable, the earlier mentioned assumptions all have been tested and this time have been met. Which allowed the study to run the analysis.

Table 4.5

Multiple regression model

Dependent variable	Attrition as a % of total FTE
Independent variables	X1: District avg. income X2: Percentage of immigrants X3: Dummy 1 (Catholic) X4: Dummy 2 (Protestant) X5: Dummy 3 (Other) X6: Residual budget per student X7: Mean quick ratio of 5 previous years X8: Final test score (as Zscore) X9: Number of students / (Number of students^2) X10: Class size X11: Inspection score

	X12: Percentage immigrants * Class size
Tested model	$Log(Attrition\ as\ a\ \%\ of\ FTE) = \beta1 * X1 + \beta2 * X2 + \beta3 * X3 + \beta4 * X4 + \beta5 * X5 + \beta6 * X6 + \beta7 * X7……$

4.5 Ethics

Before presenting the results section of this study, it is a good moment to reflect on the ethical aspects of this study. Before the execution of this study, it was mandatory to sign a contract which prevents the researcher of sharing sensitive information of Infotopics to outsiders. To prevent unwanted data leaks and the consequences of it, the researcher took certain steps. At first all data is stored on the servers of Infotopics, to improve the safety of this digital information. Besides this, all the individual school data provided by Infotopics is anonymized. Most of the data that was used in this study is openly accessible data, however the data that came from Infotopics is not, because of this, the school names were replaced by an ID number to anonymize the cases.

All steps taken by the researcher to safely handle the data that is provided and other ethical aspects of this study, have been judged by the ethics committee of the University of Twente. They approved the ethical aspects of this study (appendix D).

5. Results

Table 5.1 shows the descriptive statistics and the correlations of the used variables in the analysis. The statistics shown in this table are coming from the 75% training set, which has been used to build the regression model. The table also gives the original (untransformed) dependent variable “attritionFTE1819” to indicate how the log transformation possibly changed correlations. The table shows that the number of students is correlated with almost all other variables. It also catches the eye that the district variables are uncorrelated to each other. This chapter first shows the descriptive statistics of the training set, after that it shows how the regression model is formed, in the final part of this chapter the training set is compared to the test set.

Table 5.1

Mean, standard deviations and correlations of variables

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Logattrfte1819	1.15	0.38													
2. AttritionFTE1819	18.76	17.12	.87**												
3. Numberofstudents1819	185.89	127.74	-.21**	-.22**											
4. Studentteachratio19	17.57	5.74	.02	.01	.33**										
5. DistrIncome19	24.99	4.94	.04	.03	.17**	.04									
6. PercImmi	16.47	14.40	.02	.02	.30**	-.03	.02								
7. MeanQR5y	2.90	1.43	.03	.02	-.09*	-.12**	.01	-.19**							
8. ResbudgetStudent	209.79	60.00	.08*	.10*	-.20**	-.23**	-.14**	-.21**	-.05						
9. FinaltestZ	-0.03	0.99	-.04	-.07*	.17**	.12**	.23**	-.11**	.11**	-.09*					
10. Inspectionscore	3.71	1.00	.03	-.01	-.04	-.15**	.02	.06	-.00	.11**	.02				
11. PercimmixStudentteacherratio	289.37	272.39	.01	.02	.41**	.39**	.05	.84**	-.22**	-.24**	-.05	-.02			

12. Denom_3 = Catholic	0.30	0.46	-.10**	-.12**	.21**	.06	.02	.02	-.11**	-.02	.01	-.13**	.04		
13. Denom_4 = Protestant	0.28	0.45	-.01	-.04	-.15**	-.01	-.20**	-.15**	.20**	-.05	.01	.14**	-.13**	-.41**	
14. Denom_5 = other	0.06	0.24	-.03	-.03	.08*	.11**	.06	.22**	-.08*	-.14**	.07	.01	.29**	-.17**	-.16**

*Note. M and SD are used to represent mean and standard deviation, respectively. * indicates p < .05. ** indicates p < .01.*

5.1 Regression analysis

A regression model has been built, using a randomly selected 75% of the data. The result of his regression analysis can be found in table 5.2. The PIN and Pout levels that were used were 0.05 and 0.15 respectively. The dependent variable is the logarithm of attrition, the independent variables are variables 3 till 14 in table 5.1 Variable 12, 13 and 14 are dummy variables to account for the four categories of denomination. Stepwise regression, forward regression and backward regression all produced the same results, they will therefore be described simultaneously in table 5.2. Only variables that have a significant relationship with the dependent variable are displayed, standardized beta values are reported. All implications of the results are discussed in the next chapter.

Table 5.2
Results of regression model

	Logattr1819
Variable	F & B & S
DistrIncome19	.091*
PercImmi	.123**
Denominatie=RK	
Denominatie=Protestant	
Denominatie=other	
ResbudgetStudent	.088*
MeanQR5y	.089*
Numberofstudents1819	-.3**
studentteachratio19	.15**
FinaltestZ	
Inspectionscore	-.076*
Percimmi * Studentteacherratio	
Adj. R Squared	.084
RMSE	.29

*Note: * p < 0.05, ** p < 0.01. For the dependent variable Logattr1819 all three estimation methods (stepwise, forward and backward) find similar results and these are presented in the first column. An empty cell in one of the columns indicates that within the specified PIN and POUT levels, the variable was not included in the model.*

All three methods, stepwise- (S), forward- (F) and backward regression (B) identifies seven statistically significant variables explaining the dependent variable. The adjusted R squared of

the model is 8.4% with an RMSE of .29. The variables “numberofstudents1819” and “studentteachratio19” seem to have the highest correlation with the dependent variable.

5.1.1 District characteristics

The first significant variable is the income of the district (t = 2.530, p = .012). This is not in line with H1a, since the relationship was expected to be in the other direction, where a higher income resulted in a lower teacher attrition. The regression showed that the relationship is a positive relationship.

The second variable which was significant was the percentage of immigrants in the district (t = 2.973, p = 0.003. This finding confirms the expectation of the relationship posed in H1b.

5.1.2 Denomination

All dummy variables regarding the denomination of the school are not deemed significant and are therefore not included in the regression model. This is in line with the expectation stated in H2.

5.1.3 Financial characteristics

The financial situation of the school was measured using two variables, the mean quick ratio of the last five years and the residual budget that a school had divided by the number of students. Both the mean quick ratio (t = 2.304, p = .022) as the residual budget for each student (t = 2.214, p = .027) are significant predictors of the attrition rate, both indicate a statistical positive relationship with the dependent variable. This is a relationship in the other direction than that was posed in H3.

5.1.4 School size characteristics

The number of students showed to be the most influential variable with a beta of .-3, this variable was significant (t = -6.862, p < .000) and was therefore included in the model. H4 indicated the presence of a relationship with no specific direction, this hypothesis is confirmed. The quadratic number of students term has also been tested, but resulted to be producing less explained variance, this term has therefore not been included in the final model.

Also the student to teacher ratio has been included in the model due to its statistical significant positive relationship with the dependent variable (t = 3.621, p < .000). This is in line with the expectation posed in H5. Therefore hypothesis 5 is confirmed. An interaction term between this variable and the district percentage immigrants was also included, this interaction term was rejected by the model.

5.1.5 School quality characteristics

The score on the final test which was transformed to a Zscore due to the differences in the final tests that are used in schools, was not found to be statistically significant (t = .219, p = .827). This is not in line with H6a, which states a negative relationship between the two variables.

The final variable that was included was the score of the educational inspection, this variable showed a significant negative relationship with the dependent variable (t = -2.037, p = .043). This finding confirms H6b.

A summary of results and the confirmation or rejection of all posed hypothesis can be found in figure 5.1 and table 5.3. In table 5.4 a full summary of the regression model is given.

Figure 5.1
Relationships summarized

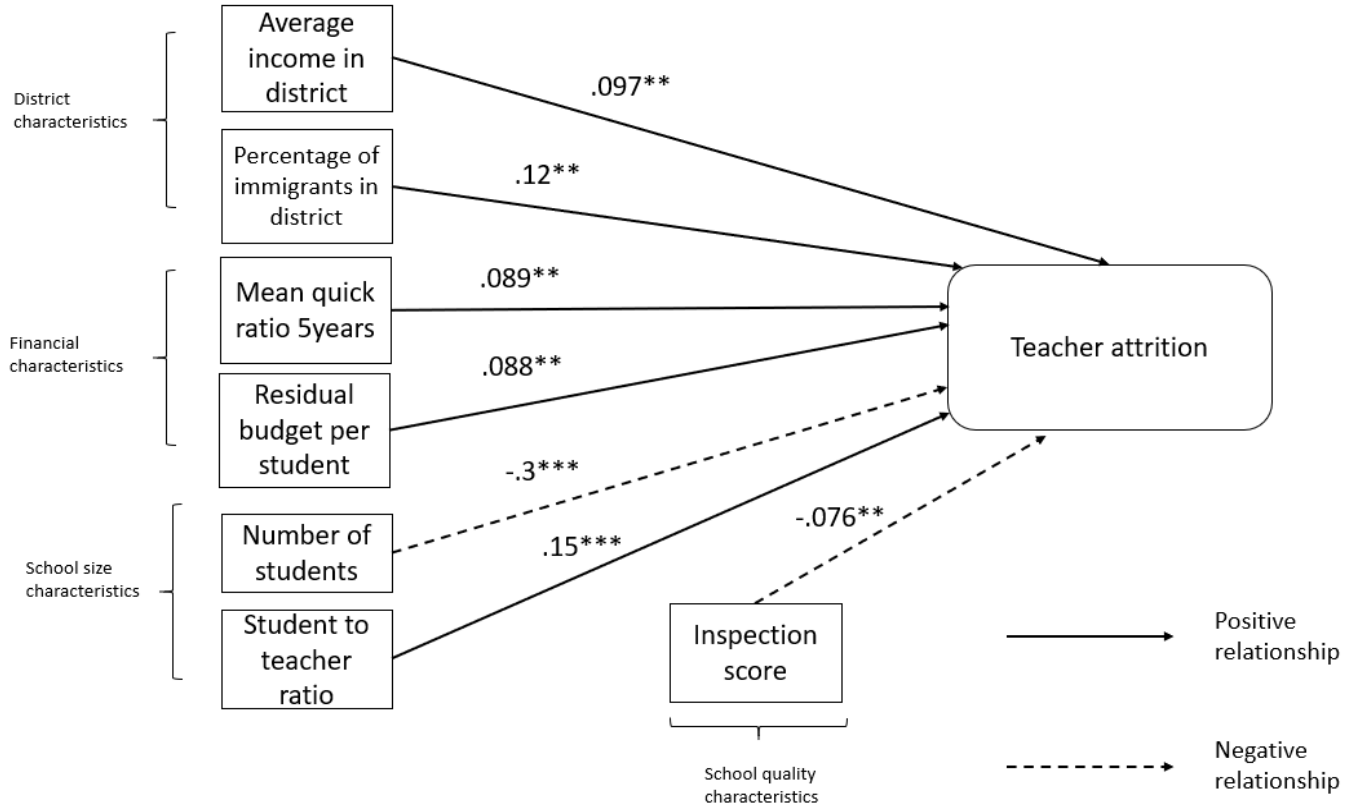


Table 5.3

Hypotheses confirmed and rejected

Hypotheses	Confirmed	Rejected
1a: A higher *average income* in a district results in a lower *teacher attrition* rate		X*

1b: A higher *percentage of immigrants* in a district will result in a higher *teacher attrition* rate	X	
2: There is no relationship between the *presence of a religious denomination* and *teacher attrition*	X	
3: There is a significant negative relationship of *teacher attrition* and the *financial situation of the teacher's school*		X*
4: There is a significant relationship between *teacher attrition* and *school size*.	X	
5: *Class size* has a significant positive relationship with *teacher attrition*	X	
6a: There is a significant negative relationship between *student achievement* and *teacher attrition*		X
6b: There is be a significant negative relationship between inspection score and teacher attrition	X	

*Note: In the two cases marked by a *, a significant relationship has been found but in the other direction than expected.*

Table 5.4

Model summary training set

Model Summary[h]

Model	*R*	*R Square*	*Adjusted R Square*	*Std. Error of the Estimate*	*Durbin-Watson*
1	*.307[g]*	*.094*	*.084*	*.34966222554*	*1.960*

1. Predictors: (Constant), Numberofstudents1819, studentteachratio19, PercImmi, DistrIncome19, Inspectionscore, MeanQR5y, ResbudgetStudent

2. Dependent Variable: Logattrfte1819

5.2 Assessing training and test model fit

To prevent the overfitting of the regression model, the data has been randomly split into a training set of 75% and a test set containing 25% of the cases in the data. To evaluate the training and test set a prediction variable was constructed. This was done using the significant regression model discussed in section 5.1. The variable "Prediction Logattr" was constructed using the following formula:

$$PredictionLogAttr = 1.170 - .001 * Numberofstudents1819 + 0.01 * studentteachratio19 + 0.003 * Percimmi + .007 * Distrincome19 - .11 * Inspectionscore + .022 * MeanQR5y + .001 * Resbudgetstudent$$

This computed variable is then used to predict the attrition values for the test set. After this process, a linear regression was built for the test set, using *PredictionLogAttr* as the independent variable and the original log of attrition as the dependent variable. This process reveals how the training set prediction performs on the test set and reveals possible overfitting of the model. The results of this regression can be found in table 5.5. The predictions show a significant relationship with the actual attrition values of the test set ($r = .244$, $R^2 = .06$, $p<.000$). The RMSE is .29.

Table 5.5

Results of regression between predictions and test set.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.244[a]	.060	.058	.35458865331	1.750

a. Predictors: (Constant), PredictAttr1819

b. Dependent Variable: Logattrfte1819

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			95,0% Confidence Interval for B	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	.538	.088		6.148	.000	.366	.710
	PredictAttr1819	.503	.071	.244	7.097	.000	.364	.642

a. Dependent Variable: Logattrfte1819

6. Conclusion, discussion and implications

The goal of this study was to explore which organizational factors had a relationship with teacher attrition. Teacher attrition is found to be an important factor contributing to the international problem acknowledged problem of teacher shortage. Teacher attrition and possible explaining factors have been analyzed using a multiple regression analysis on a sample consisting of 1036 primary schools in the Netherlands. The main research question of this study was: "Which organizational school characteristics explain teacher attrition in Dutch primary schools?". Organizational factors that have been found to influence teacher attrition in Dutch primary schools were: district income (H1a), Percentage of immigrants (H1b), Financial situation (H3), School size (H4), Class size (H5) and Inspection score (H7). Two variables showed no relationship with teacher attrition: denomination (H2) and student achievement (H6).

The results showed that the used factors in this study only explain a small amount of variance in the attrition rates (Adj. R^2 = .084) and have therefore little predictive power on their own. However as Ozli (2012) for example indicates, a low R^2 (.05-.1) is for a study which goal it is to explain factors (concerning human behavior) sufficient. To evaluate the possible overfit of the training model, 25% of the data was holdout and used as a test model. The predictions of the training model produced only a slightly smaller adjusted R^2 of .058 ($p<.000$) and both models produce a RMSE of .29, this indicates that the possible overfit of the training model is limited.

6.1 Limitations

Before discussing the findings of this study in detail, it might be necessary to shed light on methodological limitations. A first limitation is the geographical distribution of the sample (see figure 4.1). Most of the sample comes from the regions: Friesland, Groningen, Drenthe, Overijssel and Zuid-Holland. This is mainly the North-East part and a small part of Western Netherlands. For example Adriaens et al. (2018) claims that teacher shortages are quite different across regions in the Netherlands and it might be that the teacher attrition rates which result in teacher shortages are also different. As a consequence, the generalization of these results are to be done with caution.

The second limitation concerns the possibility of time-lags in cause-and-effect relationships. This study looks at variables which mostly are formed in one year (except the mean quick ratio of 5 years). This may result in some issues concerning the internal validity of the results. It could be for example that in one year some variables on schools have an exceptionally low or high level. This study tries to counter this by having a large sample size of over thousand schools. It could however be that a nation-wide event such as the status of the economic cycle and as a result the greater alternatives to teaching distort the teacher attrition rates. It could also be that schools with consistently larger classes over the years, are prone to higher teacher attrition. This study measures class size for one year, however it could be that due to the presence of big classes for over three years resulted in a teacher quitting the job, instead of the presence of (a possible coincidental) big class in one year.

At last, this study did not have insight in teachers who returned back into the profession. For example Murnane et al. (2013) showed that between 25% and 33% of teachers return into the profession in subsequent years after leaving. This study is not longitudinal and therefore does not have information about what happens after leaving the teaching job.

6.2 Discussion

The analysis confirms the presence of a relationship between district characteristics and the teacher attrition rate of schools, this is contrary to findings in other studies such as Mont and Rees (1996). They argue that low district income is related to the teacher's income and would made non-teaching, higher paying jobs more attractive. In the Dutch context, teachers' income is only slightly different between regions. Other studies as Feng (2005) argue that lower income districts provide more challenging students, this argument seems more likely in the Dutch context. Possible explanations for differences in findings between this study and most US studies could be found within a difference in the US school funding system. Biddle and Berliner (2002) show that schools in the US are for around half of their budget funded by local property taxes. This system creates great differences (up to 100%) in budgets received per student. In the Netherlands, school funding is based mainly upon the number of students and the student composition. It could therefore be that poor districts in the USA show higher teacher attrition rates due to differences in budget spend for hiring, information and onboarding of new teachers (Johnson et al., 2004). However it still does not explain why this study finds a positive relationship between district income and teacher attrition.

A possible, but not empirically funded thought could be that in higher income districts, the salary of the teacher (which was shown to be 0.95 of the median of all professions) was not sufficient enough for the cost of living. CBS (2019b) shows for example that the cost of living opposed to the salary is much higher in big Dutch cities, it could therefore be that teachers in high income districts decide to switch to better paying alternatives and therefore quit the profession.

This study seems in line with the findings of other studies regarding the racial composition of students, the literature all seem to agree that the higher the percentage of minority (or immigrant) students, the higher the attrition rates (Boyd et. al., 2005; Smith & Ingersoll, 2004; Kain, & Rivkin, 2004; Scafidi, Sjoquist, & Stinebrickner, 2005; Feng, 2005). They claim that a more diverse student composition comes with more challenges and therefore higher workload. This study supports this argument by a positive relationship between the percentage of immigrant students and teacher attrition. Additional evidence can be found in the multicollinearity between this variable and the outcome of the final test score ($r = -.099^*$), which indicates that a more diverse racial composition of students indicate a lower final test score and as a result a possibly more challenging teaching job.

This study did not find a relationship between denomination and teacher attrition. Other studies (Stinebrickner in the USA; Grace and O'Keefe in multiple continents) did find a relationship, this could be due to differences in the religious culture of the country. The Netherlands has shown a decline of interest in religion since the secularization and "ontzuiling" (a term which indicates that people are becoming more individualistic instead of identified by groups) since the 1960's (de Jong, 2007). A recent example of this is the CBS who found for the first time in history in 2017 that a majority of the people claims to be atheistic, also de Jong (2007) finds that parents base their choice for a (religious) primary school upon non-religious characteristics of the school. This could be the same for teachers, indicating that their attrition has no relationship with the religious characteristics of the school.

The financial situation of schools in relation to the teacher attrition rate has not yet empirically been tested in literature, however in other sectors (Gilson, 1989; Murphy & Zimmerman, 1993) financial distress was related to higher turnover. Besides this, it is widely found that budget constraints and a lack of resources causes teacher to be less satisfied about their jobs (Schneider, 2003; Sargent & Hannum, 2005; Woods & Weasmer, 2004). This could

be since schools with a lack of budget could refrain from investing in training (such as Brum (2007) found) or in coaching and the support of teachers. This study however found a relationship which indicated a positive relationship, indicating that more resources and a smaller debt-ratio led to higher attrition rates, this contrasts the proposed claims by literature.

A possible explanation for the non-confirmation of these theories it that only 0.15% of schools in the dataset was in financial distress (a Quick ratio of <1 according to PO Raad (2014) or 0.01% in the case of Onderwijsinspectie (2007) <0.75). It might be that schools refrain from spending money, which could result in a lack of resources for teachers. This claim is supported by for example Steenbeeke (2019) and research by RTL Nieuws (2018). They claim that a portion of schools have saved too much money over time. This study did not have full insight in the finances of the school and therefore future research is needed to indicate how the spending of schools influences the teacher attrition, a possible topic could be the relationship between the amount of money spent on coaching and training and teacher attrition. This relationship seems important, Den Brok et al. (2017) and many other sources claim that coaching is one of the most important factors for retainment.

School size resulted to be the most explaining factor of teacher attrition. However the relationship that was found turned out to be opposing all of the literature that was named in this study. Studies suggested a U-shaped relationship (Falch & Strom, 2005) or a positive relationship (Loeb & Reiniger, 2004). This is contrary to the negative relationship that was found in this study. It could be, following the reasoning of Falch and Strom (2005) that larger schools enables teachers more easily to move between classes and as a consequence find a better fit between their preferred class and themselves. However this needs to be tested to claim this causal relationship.

Furthermore, this study provides significant support for the claims done by Macdonald (1999) and the more recent Isenberg (2010) about the relationship between class size and teacher attrition. This study suggests that for each standard deviation decrease of class size, the attrition rate decreases with approximately 15 percent. This result seems contrary to the findings of Burke et al. (2013) which propose that class size is one of the least important factors causing teacher attrition. This study asked teachers to rank thirty factors of importance for staying in the classroom and indicated that class size was ranked 25th in this list. However to claim that this seems like a less important factor explaining teacher attrition is a rather bold statement. At first this study was conducted on teachers who did not (yet) have left the classroom and the question in this study was to indicate important factors for staying. This is

a different method than actually studying teachers that already left the classroom. Besides this, teachers indicated workload as an important factor to stay. The theory about class size influencing the attrition rate is based upon the increase of workload in bigger classes (Isenberg, 2010; Theobald, 1990). These two arguments seem to indicate the difference between the findings of Burke et al. (2013) and other studies, including this one.

School quality in literature is mainly defined as the student achievement of schools. All conducted studies agreed upon a positive relationship between student achievement and teacher attrition (Boyd et al., 2005; Boyd et al., 2008; Hanushek et al., 2005; Scafidi et al., 2005). It is therefore quite remarkable that this study did not find a relationship. Boyd et al. (2005) presents possible explanations for this finding, they suggest that teachers highly differ in their reaction to low achieving students. Also they indicate that the relationship with student achievement could possibly be more explained by the student composition instead of actual achievement. It might be that this study did not find an effect due to the above-mentioned arguments.

It is hard to relate the findings about school quality in this study, to the general literature. This is due to the measurement of school quality in this study, school quality was measured using the score given by the Educational Inspection. This score is a composite measurement containing multiple school aspects which are judged. Therefore a one-on-one comparison with other studies is not possible, since this variable has not been taken up into other studies (Dutch and non-Dutch). It however seems plausible that schools which perform better are able to retain teachers better, however a major limitation is that the direction of causality for this variable is hard to determine. It could be that ‘better’ schools are able to retain teachers better, however it could also be that schools who retain more teachers are seen as ‘better’ schools.

6.3 Implications

The results show seven antecedents (from four categories) that come forward in all of the performed regression analysis. These seven antecedents explain around eight percent of the variance of teacher attrition across schools. These results show that teacher attrition, as in almost all human behavior studies, is a complex multi-faceted problem. The current study took factors on an organizational level into account. These factors are mainly determined by choices of the school board and management, as opposed to individual teachers. Individual teachers for example only have limited decision-making influence when looking at a variable

as school size. Besides this the variables on a district level (such as income) can be seen as rather static, they can be influenced by the government, however this power is limited.

As earlier discussed, teacher attrition has consequences for the whole educational sector, this is because it is an important factor in teacher shortage (Adriaens et al., 2018; Ingersoll, 2001). However teacher attrition also has consequences for the school as an organization, by for example the cost of replacing the teacher (as discussed in section 2.2). These differences in interests should be taken into account when reading the implications of this study.

The district variables taken up into this study show that they influence teacher attrition. These variables cannot be influenced directly, since it is hard to for example change the racial composition of a district. The finding of this study however implicates that the district characteristics do have a role in teacher attrition and thus it is important for school boards and policy makers to address them. Currently schools are already financially supported based upon their student composition (which is heavily related to the district characteristics). This is called the "Gewichtenregeling" and means that schools with students that are hindered in achieving their full potential due to their background, are given more budget per student (Fettelaar & Smeets, 2013). This policy is currently under re-development since many scholars criticize the use and foundation of this instrument (Driessen, 2013, 2015 and 2017; IBO, 2017 & Mulder, 1996). Driesen (2017) already suggest taking the ethnic composition of students into account when giving more budget. The findings of this study suggest that when re-designing this policy, it could be worthwhile to take into account that the student composition also influences teacher attrition rates. As a consequence schools could therefore receive extra budget in this policy and use this budget for teacher coaching, with the goal of improving teacher retainment (since coaching is seen as important for retention).

Earlier in the discussion it is suggested that schools spend too little money, which results in a (too) good financial situation. Following this reasoning, giving extra budget alone to schools would not necessarily be helpful in reducing teacher attrition. This suggest that it might be helpful to designate specific budget in the reduction of teacher attrition, instead of giving it lump-sum, such as "the Gewichtenregeling". Extra budget can be spent on for example programs that reduce stress, reduction of workload and increasing teacher satisfaction. These are all factors that are considered very important for Dutch teachers (Fruytier et al., 2013; Harmsen et al., 2015; Den Brok et al., 2017).

Class size is a topic that has been a topic of study considerably more often than the other variables in this study, with mixed findings. In the Dutch context, class size has not yet been related to teacher attrition, however it has been a subject in studies in other topics. Many schools invest in decreasing their class size, while there is no empiric evidence that smaller classes have better performing students (Claassen & Mulder, 2011; Driesen, 2013). This study does however suggest that it might be worthwhile to invest in decreasing the class size. While class size might not influence student performance, this and other studies seem to indicate that class size does influence the teacher attrition rate. This can for example be explained by the higher workload teachers perceive in bigger classes (Isenberg, 2010). This implicates that a school board should also take the workload on teachers and the economic consequence of their departure into account when deciding (not) to reduce class size.

Finally, what can schools do more than the above-mentioned parts? As earlier discussed many policies, also on a school level, focus on attracting more teachers and increasing the supply of teachers. This is done with salary, attractive secondary working conditions or other bonuses. These financial incentives can be costly to schools, besides this, studies including this one show that solving only this part of staffing problems will not help in the end. Schools need to invest in retention of teachers as well to overcome their staffing problems. This can be done by for example the very practical framework “”The decade + the teaching career”, this framework builds upon scientific evidence and gives practical advice on how to design mentoring programs to retain teachers (it can be found in appendix E).

In the end, the overall goal should be the best education for children in the Netherlands, the educational system is in danger due to the increasing teacher shortage. Overcoming this challenge is shown to be very complex, not only the supply of teachers should be increased, but retainment seems like a very important topic as well. The retainment of teachers can not only be accomplished by the government, also schools themselves have an important role to play, not only to benefit their own position, but to ensure the future of good education.

6.4 Future research

This study adds to the limited body of studies on teacher attrition in the Netherlands. Especially large-scale empirical studies are very limited in the Dutch context of teacher attrition (Den Brok et al., 2017). Organizational factors have not yet been examined regarding this topic, most studies focused on personal- or job characteristics of teaching explaining

teacher attrition. The results of this study imply that organizational factors can explain a part of teacher attrition as well, however this is quite limited. Future studies could therefore combine for example the used variables in this study, such as district with more job-related characteristics. Besides this they may also explore possible interactions or mediating relationships between variables from this study and variables such as workload. An interesting insight would for example be if the class size is a factor in workload which results in teacher attrition.

Financial aspects of schools, variables that have not earlier been taken into account, provided to be of predictive value for teacher attrition. Following the earlier reasoning of these aspects, future studies could take into account the specific financial spending of schools. They could for example focus on the amount of budget invested in support, training or coaching of new teachers and examine this relationship with teacher attrition.

The relationship between the income in a district and the teacher attrition appeared to be, quite surprisingly, positive. This contrasts every earlier finding in literature. More research is needed to determine how this relationship is formed and why higher-income districts suffer from a higher teacher attrition rate.

A longitudinal study could overcome several limitations of this study. As earlier mentioned, this study has no information about teachers who return into the profession after a few years. Besides this, longitudinal studies could also take into account the time-lag of certain variables, where data of earlier years and cohorts provide more explanatory power than data of the same year. A possible research design would be to follow a certain number of teachers after they graduate from the PABO, after a certain number of years, the teachers who already left the job could be further examined. As a result this would mean that the focus of the study is more individual based than school based, with the possibility of explaining more of the teacher's behavior. This study could potentially combine quantitative and qualitative measures, determining besides the correlation also causation of results, another limitation that some parts of this study has.

At last, this study used multiple regression to explain the relationships between the variables. While most of these relationships were based upon literature and also tested if otherwise, the parametric regression model might not be the best way to explain and even more predict the attrition rate. When the primary aim is to predict attrition rates, it might be

the case that nonparametric models have a higher predictive value. Further research could focus more upon prediction, and thereby also testing nonparametric models.

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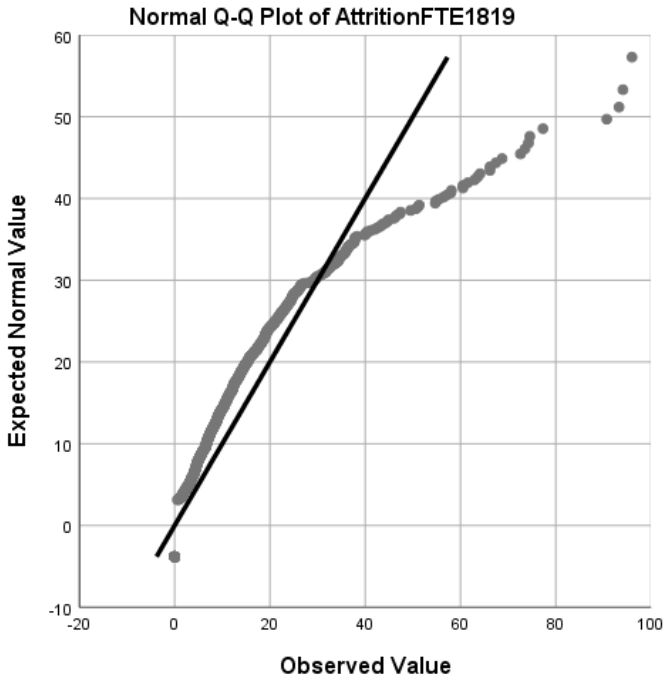
Appendices

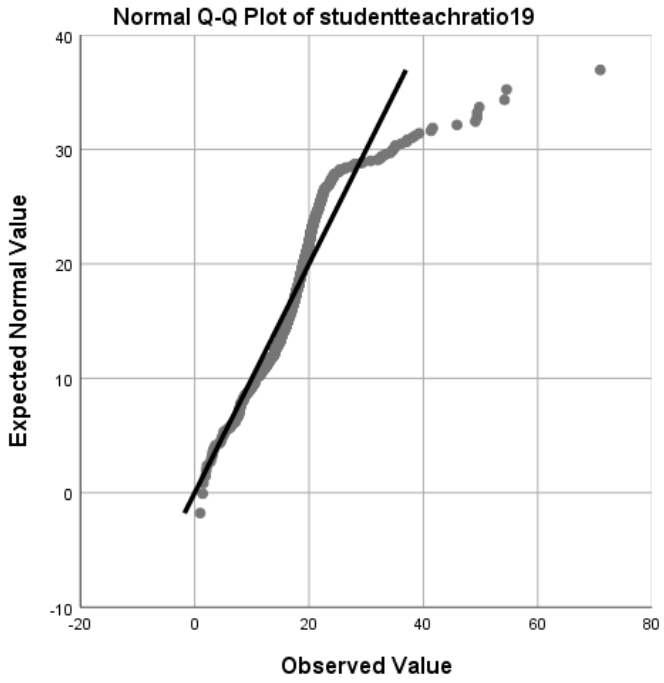
Appendix A: Used files as source for data

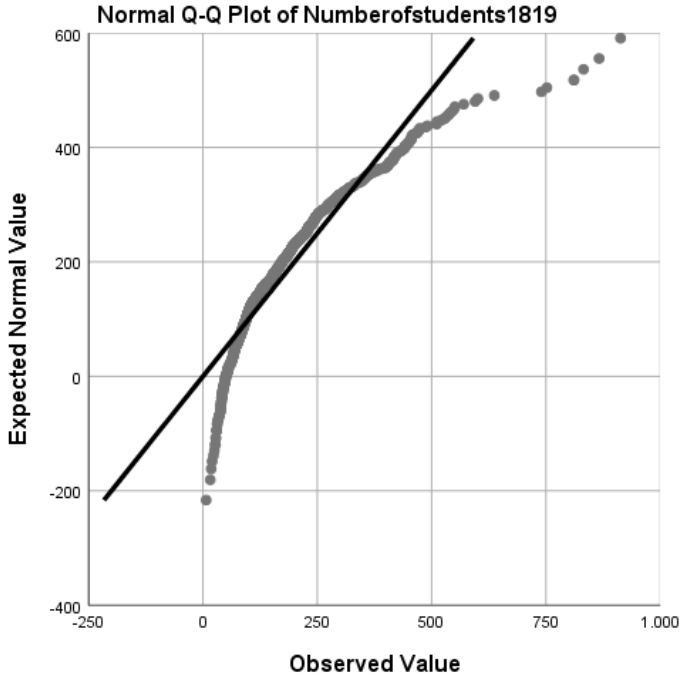
Source	Variables	File
Infotopics	Attrition data FTE data School adress	Combination of turnover of customers: OBM, OHM, OBT
CBS	District income data and percentage of immigrants in district	CBS Wijken en Buurten 2018: https://www.cbs.nl/-/media/cbs/dossiers/nederland-regionaal/wijk-en-buurtstatistieken/_exel/kwb-2018.xls
DUO	Number of students	https://duo.nl/open_onderwijsdata/databestanden/po/leerlingen-po/po-totaal/po-bron.jsp
	Financial information	https://duo.nl/open_onderwijsdata/databestanden/po/bekostiging/rest-swv-po.jsp https://duo.nl/open_onderwijsdata/images/financile-gegevens-per-bestuur-po-2014-2018.pdf
	Student achievement	https://duo.nl/open_onderwijsdata/databestanden/po/leerlingen-po/bo-sbo/bo-sbo-eindscores.jsp
Educational inspection	School quality scores	https://www.onderwijsinspectie.nl/trends-en-ontwikkelingen/documenten/data-bestanden/2019/10/15/oordelen-primair-speciaal-en-voortgezet-onderwijs-1-april-2019-versie-2

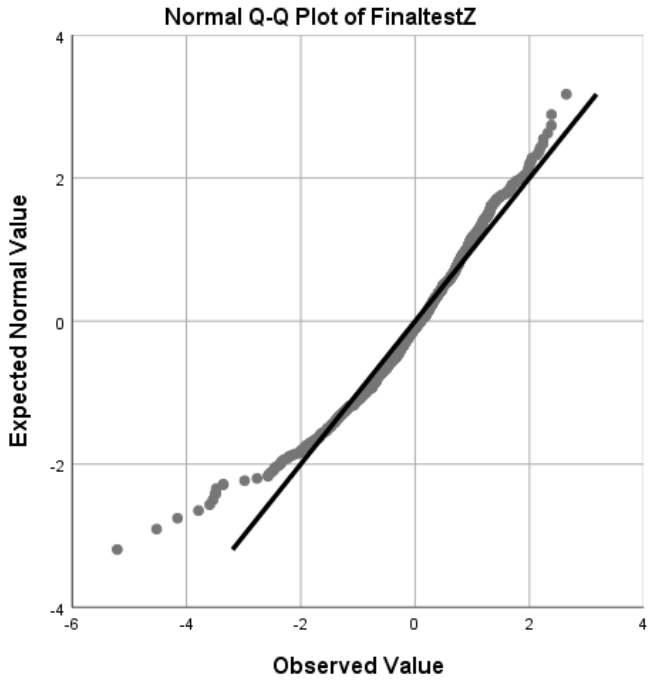
Appendix B: Outlier detection

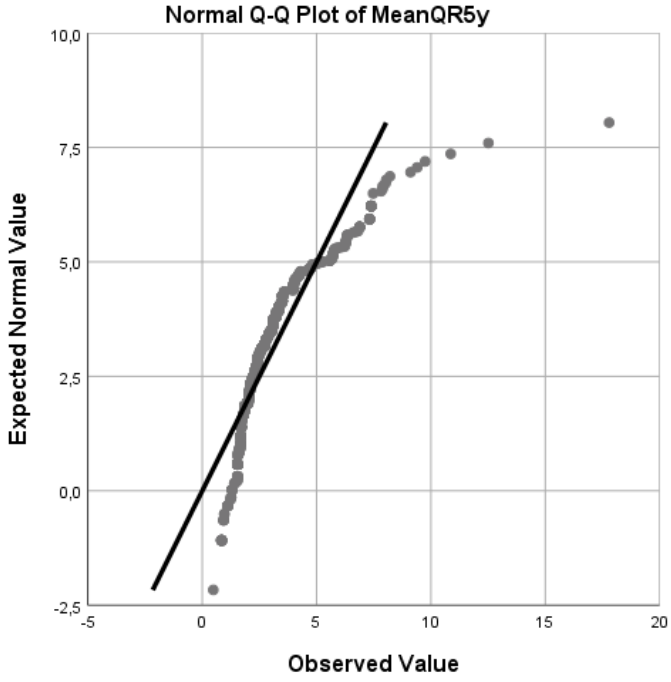
	Count	Mean	Minimum	Maximum	Standard Deviation
AttritionFTE1819	1043	11.57	.00	95.99	14.13
DistrIncome19	1043	24.84	15.60	68.80	5.15
PercImmi	1043	16.29	.92	92.62	14.21
Numberofstudents1819	1043	187	7	913	125
studentteachratio19	1043	17.60	.95	70.95	5.96
FinaltestZ	1043	-.01069	-5.21032	2.64494	.99458
ResbudgetStudent	1043	206.67	55.13	828.18	57.66
MeanQR5y	1043	2.93	.48	17.79	1.54

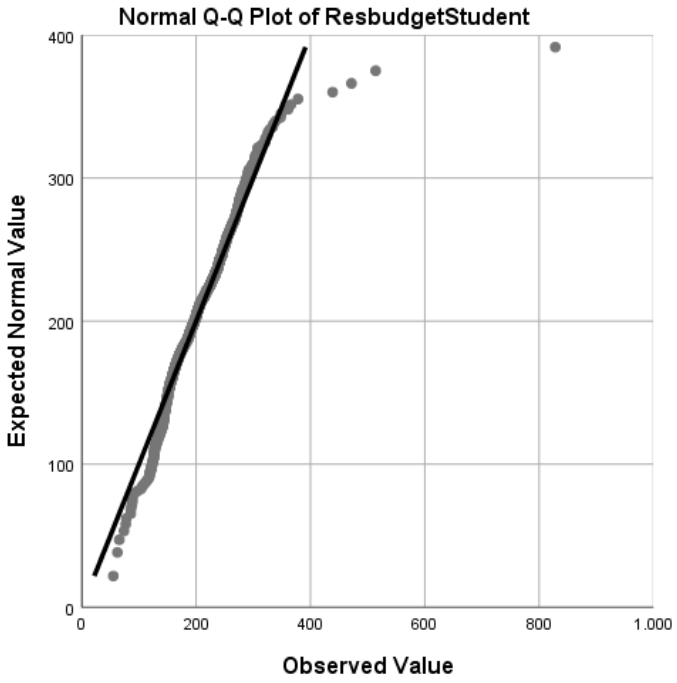


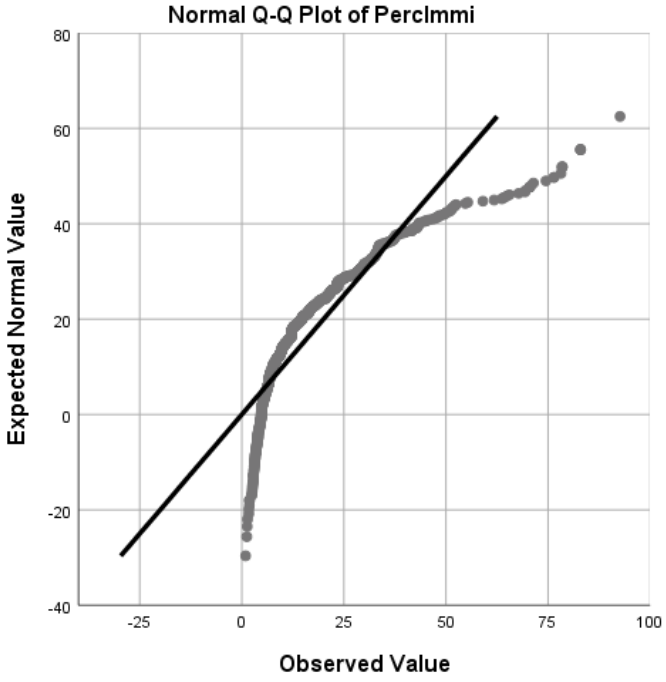

Normal Q-Q Plot of studentteachratio19
Expected Normal Value
Observed Value
40
30
20
10
0
-10
-20
0
20
40
60
80

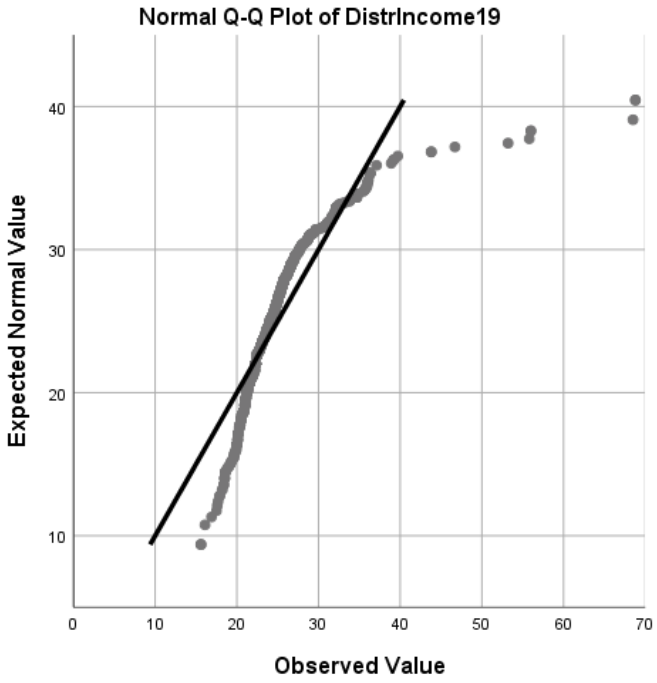

Normal Q-Q Plot of Numberofstudents1819
Expected Normal Value
Observed Value
600
400
200
0
-200
-400
-250
0
250
500
750
1.000


Normal Q-Q Plot of FinaltestZ
Expected Normal Value
Observed Value
4
2
0
-2
-4
-6
-4
-2
0
2
4


Normal Q-Q Plot of MeanQR5y
Expected Normal Value
Observed Value
10,0
7,5
5,0
2,5
0,0
-2,5
-5
0
5
10
15
20

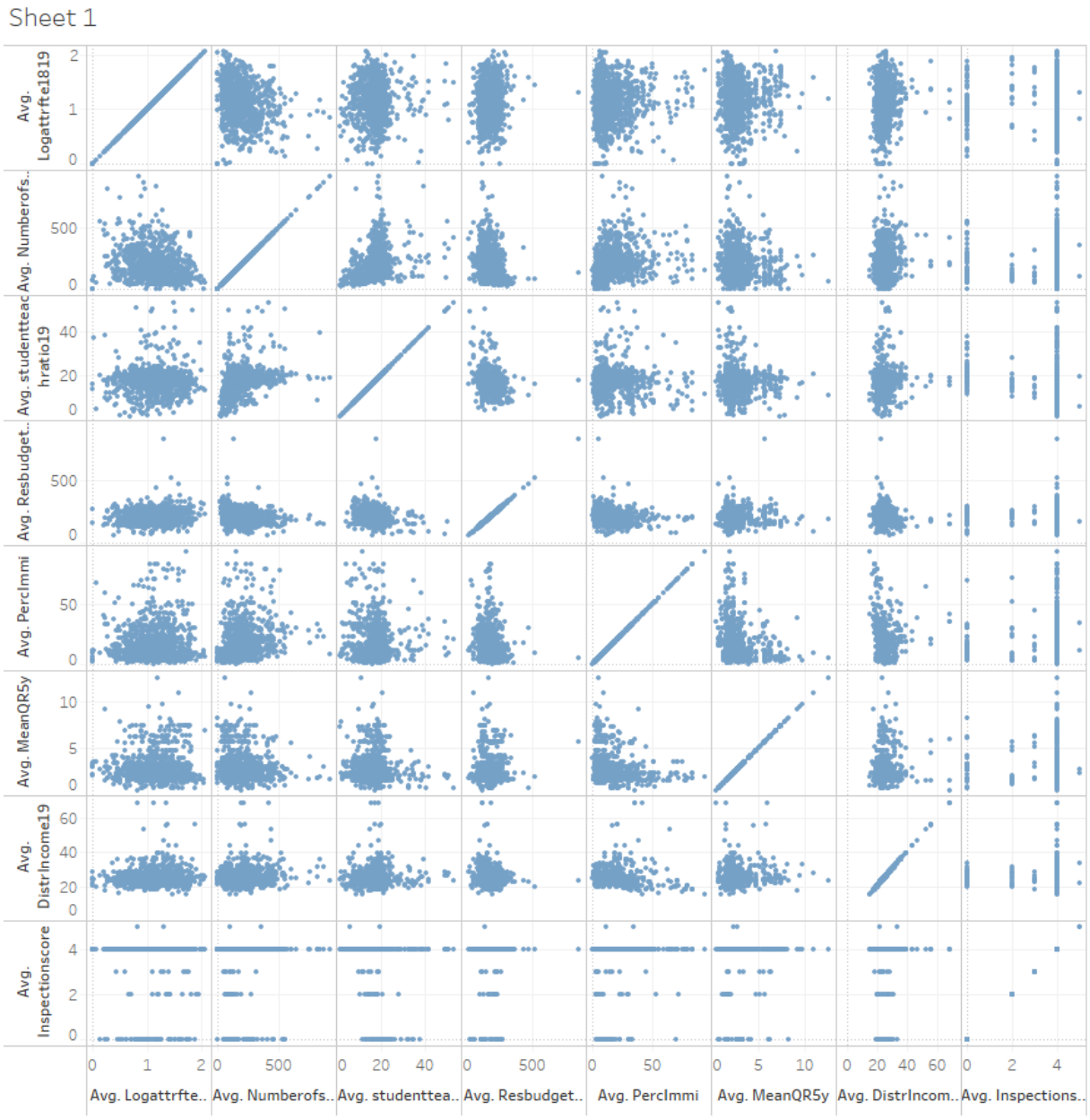

Normal Q-Q Plot of ResbudgetStudent
Expected Normal Value
Observed Value
400
300
200
100
0
0
200
400
600
800
1.000


Normal Q-Q Plot of PercImmi
Expected Normal Value
Observed Value
80
60
40
20
0
-20
-40
-25
0
25
50
75
100


Normal Q-Q Plot of DistrIncome19
Expected Normal Value
Observed Value
40
30
20
10
0
10
20
30
40
50
60
70

Appendix C: Assumptions multiple regression

- Assumption #1: The relationship between the IVs and the DV is linear.



- Assumption #2: There is no multicollinearity in your data. Analysis of collinearity statistics show this assumption has been met, as VIF scores were well below 10, and tolerance scores above 0.2.

Model	Collinearity Statistics

			Tolerance	VIF
1	Numberofstudents1819		,733	1,365
	studentteachratio19		,838	1,194
	DistrIncome19		,924	1,082
	PercImmi	,838	1,193	
	MeanQR5y	,941	1,062	
	FinaltestZ	,895	1,118	
	Inspectionscore		,979	1,021

- Assumption #3: The values of the residuals are independent.

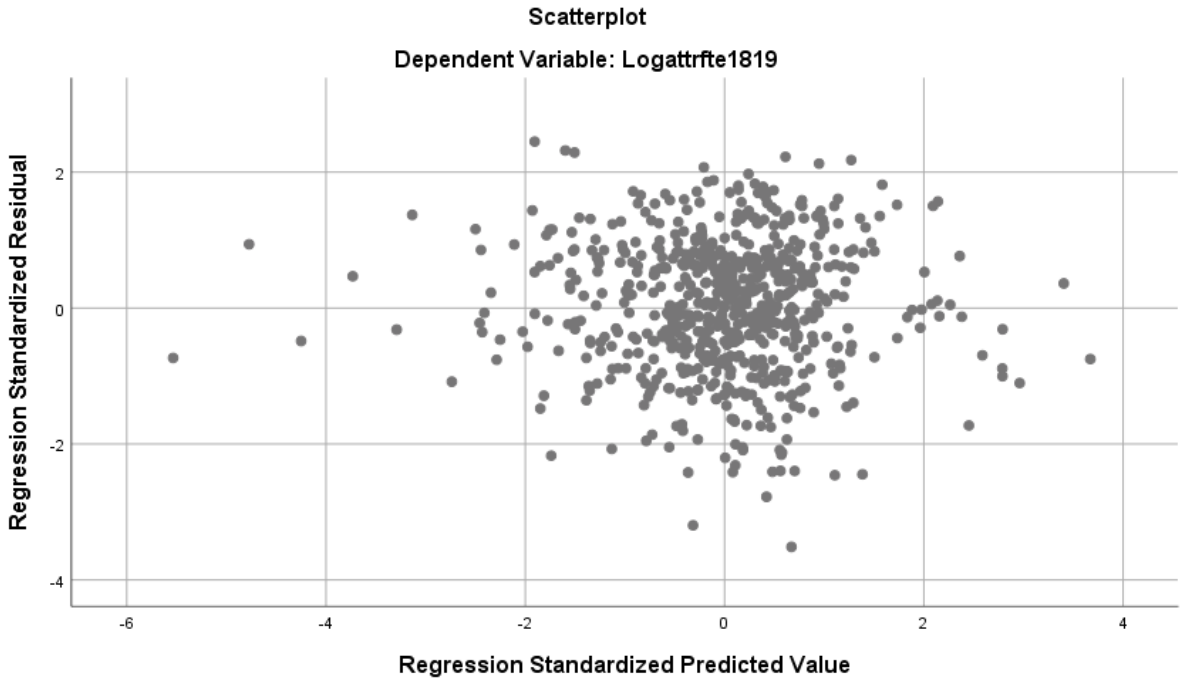
The Durbin-Watson statistic showed that this assumption had been met, as the obtained value was close to 2 (Durbin Watson = 1.**960**).

Statistics

Cook's Distance

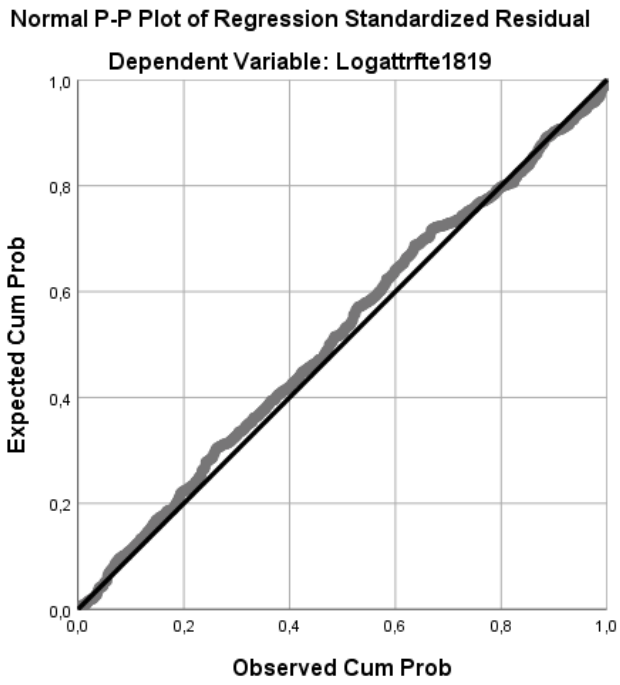
N	Valid	655
	Missing	141
Mean		,0014265
Median		,0003854
Std. Deviation		,00396070
Range		,06677
Minimum		,00000
Maximum		,06677

- Assumption #4: The variance of the residuals is constant.



They no sign of a linearity or whatsoever.

- <u>Assumption #5: The values of the residuals are normally distributed.</u>



The values are very close to the diagonal, thus suggesting that the residuals are normally distributed.

- <u>Assumption #6: There are no influential cases biasing your model.</u>

Cooks distances are all low, showing no influential cases

Statistics

Cook's Distance

N	Valid	655
	Missing	141
Mean		,0014265
Median		,0003854
Std. Deviation		,00396070
Range		,06677
Minimum		,00000
Maximum		,06677

Appendix D: Ethical declaration

APPROVED BMS EC RESEARCH PROJECT REQUEST

Dear researcher,

This is a notification from the BMS Ethics Committee concerning the web application form for the ethical review of research projects.

Requestnr. :	200084
Title :	Predicting Teacher Attrition in Primary and Secondary schools in the Netherlands
Date of application :	2020-01-30
Researcher :	Gezel, P.
Supervisor :	Wijnhoven, A.B.J.M.
Commission :	Junger, M.
Usage of SONA :	-

Your research has been approved by the Ethics Committee.

The ethical committee has assessed the ethical aspects of your research project. On the basis of the information you provided, the committee does not have any ethical concerns regarding this research project.

It is your responsibility to ensure that the research is carried out in line with the information provided in the application you submitted for ethical review. If you make changes to the proposal that affect the approach to research on humans, you must resubmit the changed project or grant agreement to the ethical committee with these changes highlighted.

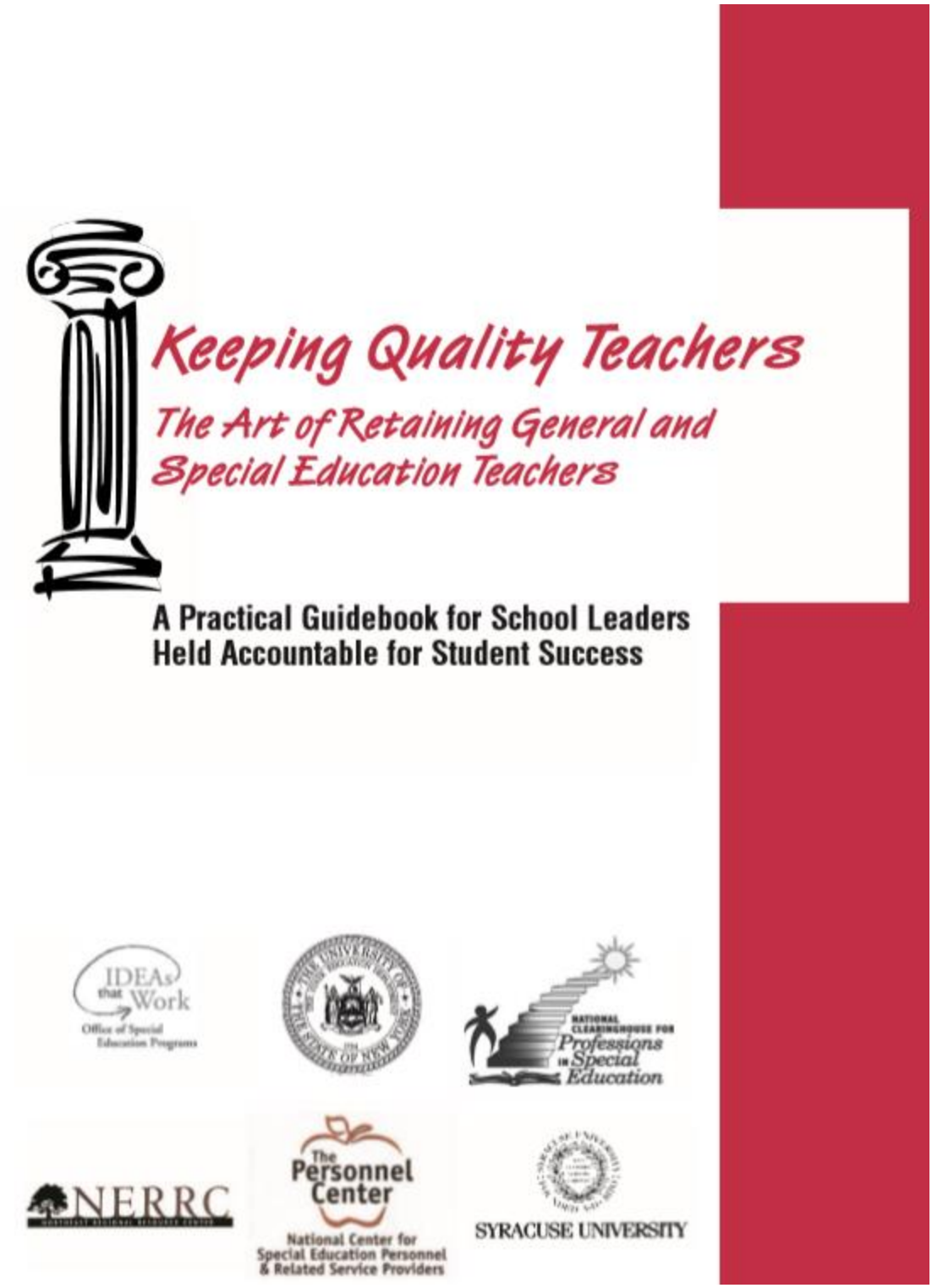
Moreover, novel ethical issues may emerge while carrying out your research. It is important that you re-consider and discuss the ethical aspects and implications of your research regularly, and that you proceed as a responsible scientist.

Finally, your research is subject to regulations such as the EU General Data Protection Regulation (GDPR), the Code of Conduct for the use of personal data in Scientific Research by VSNU (the Association of Universities in the Netherlands), further codes of conduct that are applicable in your field, and the obligation to report a security incident (data breach or otherwise) at the UT.

-

Appendix E: Practical resources for teacher retention

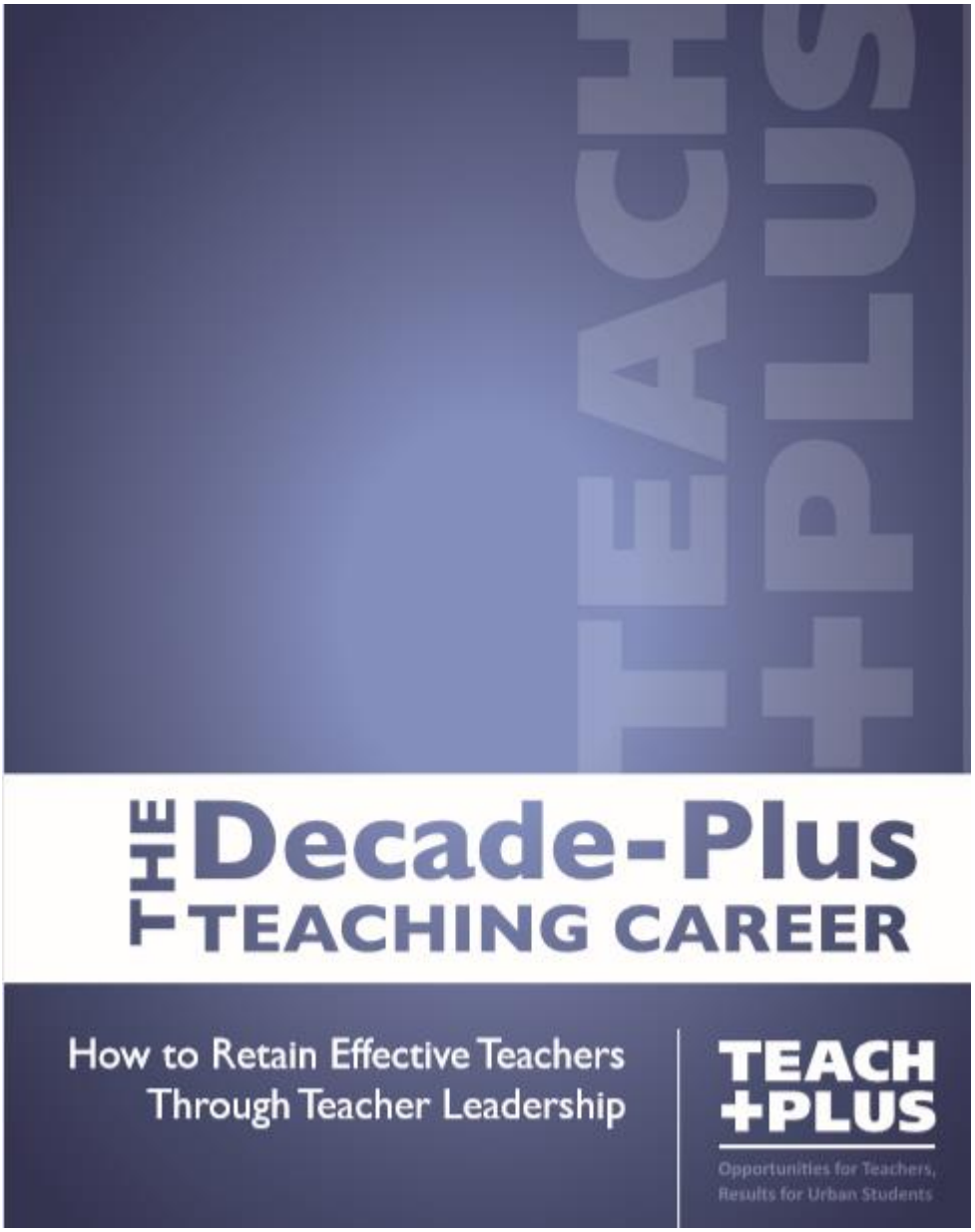
Keeping quality teachers guide:



Access link:

https://www.wested.org/online_pubs/li-05-01.pdf

The decade + teaching career:



Access link: http://www.teachplus.org/sites/default/files/publication/pdf/decade-plus_final.pdf