Feminization of education and its effect on student scores

Master thesis

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Abstract

This study examines gender gaps in school performance in relation to the percentage of female teachers across several nations. The results show a positive link between gender differences in math, science, and general academic achievement and the presence of female teachers. As the percentage of female teachers rises, the gender disparity in reading gets wider. Despite being statistically significant, the effects are not very large. Interestingly, the impact of a 10% increase in the percentage of female teachers differ depending on the subject. Conflicting results from the analysis of the overall student scores point to the possibility of additional influences. In addition, there is no obvious correlation between the average scores across all subjects and the percentage of female teachers. In conclusion, more female teachers may unintentionally worsen the gender gap in reading whereas they can help close it in math and science. The lack of a consistent relationship emphasizes how much more research is required to fully comprehend the complex factors influencing gender differences in school performance.

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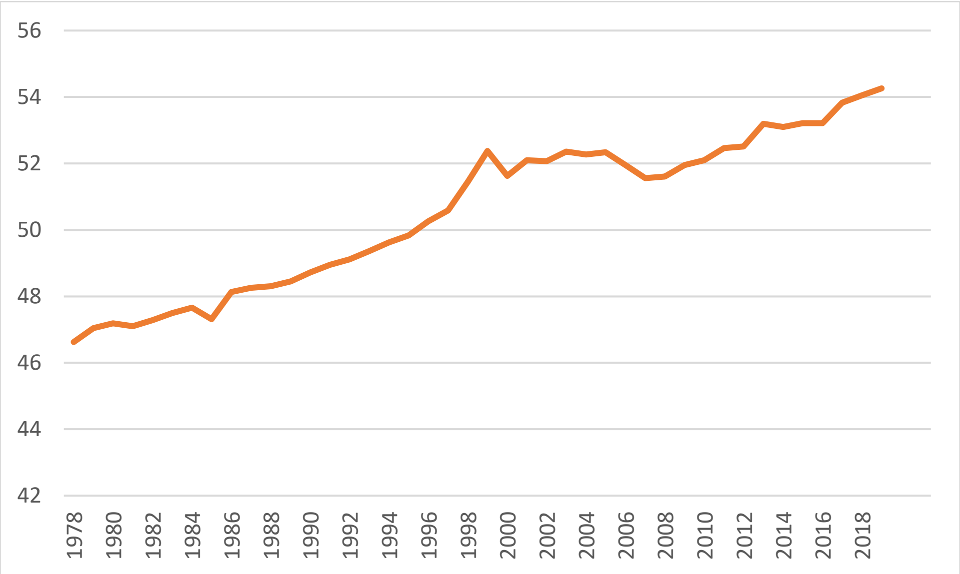
1. Introduction

1.1 Introduction

Education has evolved significantly over time (Avalos, 2011). The majority of the adjustments are well-thought-out decisions to keep up with societal changes and new insights about how our brains process information. These adjustments aim to ensure that students receive optimal education. A major change in education relates to the gender of the teachers (Schmude & Jackisch, 2019). However, the change in the ratio male-to-female teachers was not a conscious decision but rather an autonomous change over time. While secondary school teachers used to be primarily male, since 1996 the international percentage of female teachers has exceeded 50% (OECD, 2019; UNESCO, 2019). That is, there are more women standing in front of a classroom than men. This research will look at student performance in relation to female teacher proportion change, both in general as well as the performance between female and male students.

Figure 1

percentage female teachers worldwide at secondary school



This study addresses the impact of a country's increase in female teachers on student performance by using data from the worldwide PISA (Programme for International Student Assessment) surveys from 2000 to 2018 covering 37 countries. During that period, the percentage female teachers in secondary education increased in nearly every country.

However, there is substantial variation between countries in this respect. PISA scores will be used to compare the performance of male and female students. The PISA survey evaluates fifteen-year-olds' reading, math, and science proficiency in real-world scenarios.

1.2 Scientific and social relevance

This study is scientifically and practically relevant in various ways. There is still a lot unknown on what influences the performance of a high school students. Therefore, a scientific justification for this study is to increase our understanding of the effect of country wide feminization on student learning. As mentioned before, previous research has focused on effects of teacher gender at the classroom level. Therefore a scientific understanding about the effect of feminization of the teaching profession could indicate whether or not feminization is reason for concern.

The added value comes from the fact that this is the first time the impact of growing feminization of education has been studied. Prior studies have examined whether, among other things, female teachers approach boys differently or teach in a different way than their male counterparts. This study actually takes a far more direct approach to examining the impact of feminization within a country. The rising percentage of female teachers is referred to as the "feminization of education." This study is going to ascertain whether feminization is associated with changes in general academic performance and gender differences between boys and girls by comparing several countries where feminization has happened at varying rates over the previous 20 years.

Additionally, this study has a practical application. Since the effect on students' learning is currently unknown, it is also unknown if male students are disadvantaged by the change. If it is found that they are disadvantaged, a discussion could be held on whether (applied) universities should perhaps positively discriminate potential male teachers. If it is found that male students are not disadvantaged, this study will contribute to the discussion of whether women should be allowed to continue ‘mould education and assessment to suit their gender’ (Budge, 1995, p12).

1.3 Research question

The aim of this study is to investigate whether the increase of female teachers influences student performance. As part of the theoretical framework, the following subjects will be discussed.

- Changes in education since 1960
- Gender difference in learning
- Gender difference in teaching
- Effect of educational changes on male and female students.

The main objective of this research is to determine how student performance in overall PISA scores of 15-year-old students, as well as in the subjects of math, science, and reading, relates to the percentage of female teachers in various nations between 2000 and 2018. Moreover, what effect does the ratio of female teachers have on the gender difference in these four subjects on student performance?

2. Theory

2.1 Gender

The definitions of gender and sex are regularly used interchangeably.

For this study, the student gender and sex will be closely linked together. The responding students filled in questionnaires and had to choose the option they identified with. Thus, their gender rather than sex is recorded. However, it is safe to assume that for most students (and also their teachers) gender and sex coincide.

2.1.1 Student Gender and learning

Extensive empirical research has been conducted in the field of education and gender since the mid-1960s (Severiens & Ten Dam, 1994). According to Burton 1990, Chipman et al. 1985, Fennema and Leder 1990, the majority of research on gender and education is focused on mathematics and science combined with school-internal factors, particularly the role of teachers, teaching methods, and the scope of education. Not surprisingly, whether a student is male or female can influence the way a person learns, either from the brain chemistry and/or by society (Weiss, 2001).

The term "gendered perceptions of learning" refers to differences in learning styles as well as anticipated differences between the genders in learning outcomes and learner preferences. One way to examine the differences is to consider the physiological aspects of learning, where the focus is on problems with neuronal connectivity within the brain. The differences between male and female students that could be analyzed include those in how information is processed in various learning situations, the impact of testosterone on risk-taking behaviors in testing situations, or gender-based variations in the anatomy of the eye, with male retina having more cells collecting information about direction and movement while female retina has more cells collecting information about color and texture (Sax, 2005). For example, a male student might place greater emphasis on a real-world example to help him recall the material, whereas a female student could favor a colored graphic.

The common themes of lower self-confidence and more test anxiety for female students and inflated confidence and largely external learning motives for males are the foundation of psychological variations in learning preferences (Koivula et al. 2001). This suggests that female students would benefit from taking fewer graded tests as formative testing would help them with the anxiety an attain better results. Summative testing would be more preferable for male students because they need grading as an external motivator to study.

Last but not least, sociocultural explanations for gendered learning differences center on gender stereotypes that either favor or discourage males and females from studying certain courses (such child care for females or engineering for males), which correspond with supposed interest from a gender. It is frequently asserted that gender labels have an impact on academic achievement and perceived ability, regardless of whether the student conforms to the preconceptions (Steele 1997). The literature on social explanations disagrees not about whether or not there are differences in learning, but rather about whether it is nature or nurture.

Previous studies have shown that women perform slightly better academically, particularly when assessed on subjects where they are able to see how the work would be used in real-life situations (Ghazvini and Khajehpour, 2011). Likewise, research on female students indicate that they are more motivated, exhibit more effective time-management abilities, and use self-testing strategies more frequently (Ghazvini and Khajehpour, 2011). In three-dimensional mathematical modeling and experimental learning, where students learn by doing and experiencing, male students generally score better (Pinker 2002). In addition, according to Ghazvini and Khajehpour (2011), male students do better when it comes to information processing and key concept selection strategies.

Male students would, by using selecting main ideas strategies, be more able to focus on essential information while reading course materials or listening to lectures, while woman are more likely to find everything important. This is also visible in the information processing difference. Males and females employ different information processing strategies. As an alternative for more complex processing, they frequently resort to a range of heuristic methods, such as highlighting cues that are highly visible or accessible in the context or that converge to imply a single conclusion. Male students are typically less perceptive of details. Contrarily, women prefer to absorb in all available information and build on it by making more connections with previously learned material. As a result, women try to carefully consider the material at hand and are more likely to notice and clarify small hints.

2.1.2 Gender and teaching

Teaching can be anything from a mother assisting a child in learning how to ride a bike to a healthcare worker who instructs a patient on how to administer insulin. A teacher is defined as a person who teaches (Smith, 2015), in the example the mother and the healthcare worker. For this study, to keep it focused, the definitions will be focused on teaching and teachers only in a school setting.

One of the possible reasons that a larger percentage of teachers are female could be that teaching at a highschool is seen as a feminine profession since World War 2 (Ullah, 2016). Taking care of and nurturing children is often considered a "natural" job for women (Ullah, 2016). Such stigmas surrounding the teaching profession, are frequently mentioned by men as the reason why they are reluctant to pursue a career in teaching. Especially at primary schools with younger students (Crushman, 2006). While there is a change, little is known about the effect of the increase in female teachers on the performance of secondary school pupils. Especially when comparing female students to male students. Timmerman and van Essen (2004) found that there is no significant difference in performance between primary school classes with a male or female teacher when looking at a specific class. However, Burman (2006) actually concluded that looking at a larger scale it is clear that the education is changing due to the feminization. This change in education might have an influence on student performance, which has not yet been investigated on a large scale. The teaching style of males are different than those of females and due to the feminization, the woman teaching style is becoming the norm in some countries (Fischman, 2007). For example, male teachers have shown to prefer a more authorial style of teaching, a style where the teacher has complete control over the classroom. Female teachers, however, prefer to encourage students to work together and debate (Arnot, 1992). The style of teaching could influence the student performance.

Not only the style of teaching could influence the performance. Previous research has claimed that academic performance and social behavior in school are connected (Wentzel, 1993; Lane, et al., 2014). Teachers are potential role models for students, and research has shown that African American male adolescents without male role models often engage in more problem behaviors than their counterparts with role models (Bryant and Zimmerman, 2003). Therefore, having a male teacher could be beneficial for male students on a psychological level. If a student shows problem behavior, they are less likely to bond with a school, which have shown to result in lower academic results. If there is a larger percentage of male teachers at a school, it might hold true that male students show higher test scores

Hutchinson and Beadle (1992) noted that when it came to the preferences of male and female teachers for teaching, the former were more likely to start discussing more subjects and make more contributions to structured discussions. A participative classroom approach, where the teacher is more involved in every phase, was preferred by the female teachers. Women were reported to involve the students more in a coaching process than men, meaning helping students work together to reach a common goal. Also women were more likely to grade individual steps along the way than men. Edres and Schierhorn (1992) reported that men were more likely than women to play the dominant role during activities outside of the classroom for example field trips and recess.

A survey among teachers in higher education showed that fifty-three percent of the females indicated that they favored practices that predicted the Enabler teaching style (Saleh, 1998). An Enabler teaching style is through inquiry-based learning and teamwork, enablers establish an inclusive learning environment that gives students the freedom to discover and hone their skills. Teachers characterized by high inclusion and high sensitivity are called enablers. This teaching approach is centered on establishing a friendly and inclusive learning environment, modifying lesson plans to meet the requirements of a variety of learners, and encouraging students to show empathy and respect for one another. They are learner-centered teachers. Enablers tend to be flexible and responsive to students' needs. Their teaching practices are usually varied according to students interests and needs. They tend to empower learners by involving them in the learning process to the fullest capacity.

Male professors are more likely to apply an expert teaching style. The expert teaching style have teachers who prioritize precision and clarity in their explanations exhibit mastery in material delivery through organized presentations and demonstrations. Sixty-five percent of the male professors believe that they "have the information that the learners need" and they "often know what is best for the learners in the long run even though they may not be aware of that themselves" (Saleh, 1998). The expert style is characterized by low inclusion, and by low sensitivity. The expert teachers tend to be subject-centered and they prefer to use the lecture method or the direct approach in teaching.

Furthermore there is a significant difference in how many hours teachers are teaching during the week. In most countries the amount of female part timers is larger than the male part timers. For example, in the Netherlands the percentage female teachers in secondary school working part time in 2017 is 76 % vs the 46 % of their male colleagues (CBS, 2018). This means that while the number of female teachers is larger than the male teachers, the effect is damped by the actual working hours.

Teaching styles and performance.

Based on the 2018 PISA outcomes, in reading proficiency, China, Singapore, Hong Kong, Estonia and Canada were the top five countries. In mathematics, China led the list followed by Singapore, Hong Kong, Japan and South Korea. For science, the leading countries were China, Singapore, Estonia, Japan and Finland.

China which is the highest scoring country overall has an authoritarian teaching style (Gao 2021). On the other hand; Singapore has been shifting from a dictatorship form of pedagogy to empowerment education model (Zhang et al. 2012). Teaching styles in Hong Kong are less constant as they can change according to different educational settings both internally and externally influenced factors (Wong 2015). Some internal influences may include: teachers' personal learning style preferences as well as their cultural and educational backgrounds that shape their teaching approaches based on their own learning experiences.

Sultan and Hussain's (2012) research brought out distinctions across cultures regarding views of teaching styles. Whereas in collectivist societies such as Pakistan authoritarian instruction would be appreciated by students it contrasts with Western desire for autonomy supportive environment. Also male or female pupils perform better when taught by humanistic educators as per this same study (Sultan & Hussain 2012).

2.2 Feminization of education

It is referred to as "feminization of a profession" when women make up more than 50% of the workforce in a given field. If there are at least 70% female professors in a profession, that profession is considered to be severely feminized by UNESCO (United Nations Educational and Cultural Organization). The degree of feminization in secondary schools in OECD (Organisation for Economic Co-operation and Development) member nations ranges from extremely to moderately feminized.

According to Budge (1994) the teaching profession has become overwhelming more female than ever. As seen in figure 1, this growth has continued at secondary schools since 1994. Budge claims that that the female teachers ‘have been gradually and unknowingly, moulding education and assessment to suit their gender’ (1994, p12). A possible change in education that might be attributed to the influence of women is the shift from an expert-centered teaching style to a more enabling, student-centered approach.

There are a variety of variables that influenced the feminization process in secondary schools, resulting in a rising proportion of female teachers. Possible reasons for this are the low salaries in comparison to other professions (Carroll, 2019) and women simply liking children more (Budge, 1994).

Teachers will experiment with changes in teaching methods during their career, these changers are later adopted by future teachers. Furthermore, universities teaching programs, often with female professors, can serve as another avenue for implementing educational innovations (Hollingsworth, 1989).

One of the examples on how education has changed in the Netherlands is the amount and regulations of testing. Most secondary Dutch schools have limited the amount of summative exams, which also have to be announced at least five schooldays in advance (Erskine, 2014). Previously, students would be subjected to ‘surprise’ exams, as many teachers preferred. As mentioned before, male students benefit from external motivation like summative testing while female students might be hindered, therefore limiting the summative tests might benefit the female students.

Another example is roughhousing. Vaillancourt (2019) claims that roughhousing during recess gives a child and especially boys time to reset. According to her research, roughhousing leads to better concentration for boys after breaks and to less bullying. However, female teachers claim that having students play ‘rough’ makes them feel insecure about their handling of classroom while male teachers are less likely to mind students roughhousing on the playground (Acker, 1995). Most schools have placed rules against roughhousing on school grounds and recess.

2.3 Previous research

Sokal et al.'s (2009) study with 175 struggling young readers examined the effects of teacher gender on schooling and found that while the teachers' gender had no significant effect on reading performance, boys responded more positively to female teachers in terms of their self-perception. Regardless of the gender of the teacher, more expressive teaching style resulted in higher student evaluations and better subject test performance in Basow and Distenfeld's (1985) study with 117 students. Expressive teachers use dynamic and engaging instructional techniques, such as humor and storytelling, to capture students' interest and inspire curiosity while delivering content. Taking into account social learning and cognitive developmental theories, Gold and Reis (1982) explored the idea of increasing the number of male teachers to solve boys' school-related problems but found little empirical and theoretical support for this approach.

During 2001, Duffy, Warren, and Walsh examined the effects of teacher and student interactions. A study involving 597 high school students and 36 teachers demonstrated that both male and female teachers engaged more with male students in math, literature, and language than with female students. If a student engages with the material, they are more likely to perform better (Duffy, Warren, & Walsh, 2001). Therefore it can be assumed that male students perform better. This phenomenon cannot be attributed solely to male students initiating more interactions with their teachers, emphasizing the importance of gender relations in classroom dynamics. The attention female students paid to teachers was not significantly different from that of their male counterparts.

2.4 Hypothesis

The findings on gender differences in learning and teaching styles indicate unique preferences and results for male and female learners. When male students can refer to real-life examples, actively participate in the classroom, and rely on choosing a main idea, it is easier for them since they are not quite as obsessed with details, yet succeed when there is external incentive of summative testing. Conversely, girls benefit from visual aids and methods that reduce anxiety before exams, such as using images or preparatory activities that lower stress. These approaches help them better absorb and retain knowledge, making it easier to connect new information with what they have previously learned.. They also often have more developed self-testing routines than males.

Concerning teaching styles; male educators typically adopt an authoritarian style with emphasis on control and structure which may psychologically benefit males by encouraging more participation whereas female teachers prefer participative and enabler teaching styles cultivating collaboration, compassion and learner-centered environment. They get students involved in learning process of their teachings are tailored towards diverse needs hence grading incremental progress most times.

HYPOTHESIS: When the majority of teachers in a country are female, and prefer teaching in a participative and enabler teaching styles, female students will likely perform better academically because it matches their preferred ways of learning. This is through an inclusive and supportive environment, formative assessments as well as collaborative learning opportunities. Therefore, girls are expected to perform better under women with female teaching style while boys might have an orientation period.

3. Method

3.1 Participants and design

A quantitative study has been conducted to assess whether the rise in female teachers has an impact on student achievement. Student average performance per country on the PISA tests is the dependent variable, while the teacher gender ratio over time is the independent variable. For each country, the cohorts from 2000 till 2018 from the OECD PISA survey were compared to see if there was any potential association.

Every three years, the PISA test's main topic changes. The majority of the test items tested reading literacy in 2000/2002, 2009 and 2018. (OECD, 2019b). The 2003 and 2012 surveys focused on mathematics. In 2006 and 2015 the focus was on science. However, each and every PISA study produces reliable averages for reading, mathematics and science per country. Thus, the development of student achievement can be tracked over nearly two decades.

The data has already been gathered through PISA surveys between 2000 and 2018 as well as UNESCO education studies. Only nations that took part in at least four surveys between 2000 and 2018 will be taken into consideration. This includes 41 nations. Countries made up the main study unit. The samples offer an accurate representation of 15-year-old pupils in each nation and academic year.

Unfortunately, not all of the nations who participated in the PISA testing have provided information on their male to female teacher ratio. The percentages from UNESCO from 2000 to 2019 can be found in the main SPSS file. Some countries like Australia, Switzerland, Hong Kong, and Peru do not have data for each year, as may be seen in the datafile.

3.1.1 PISA

The target population for PISA involves students between the age range of 15 years and three months and 16 years and two months who are enrolled in a school at the time of the survey. The Survey has been held in the first half of the year 2000, 2002, 2003, 2006, 2009, 2012, 2015 and 2018.

The primary sample unit were schools. In a second step, a cluster sample was created by randomly selecting pupils from the target population in each school. The tests administered to the sampled students included reading literacy, mathematics and science. Furthermore student surveys were also used to gather a wide range of background data about the students. This personal data includes, among other things, the student's family history, attitude toward school, learning approach, and self-assessment of reading enjoyment. In order to gather details about the school resources, the number of teachers employed there, the criteria used to admit pupils, etc., the study also conducted interviews with the heads of the individual schools. This also contains the number of male and female teachers.

An individual student's test score does not directly correlate with their percentage of correct answers. Instead, it is calculated using a method from Item Response Theory (Hambleton and Swaminathan, 1989). Calculated scores are weighted averages of all right answers to questions in a particular category, with each question's level of difficulty serving as a separate weight. In a further phase, these individual test results are normalized to produce the PISA 2000 and PISA 2018's unconditional sample means of 500 and unconditional sample standard deviations of 100.

3.1.2 Reading literacy

The main objective of the PISA exams that were administered in 2000/2002, 2009, and 2018 is reading literacy. According to PISA, ("Measuring student knowledge and skills", 1999b) reading literacy includes the capacity to understand and interact with a variety of written materials both inside and outside of the classroom. This is reading, utilizing, and thinking critically about written content in order to fulfill objectives, increase knowledge, and contribute positively to society.

For example, when readers engage with texts, they create meaning by referencing their prior knowledge and experiences. Understanding the text's substance, taking into account its style and organization, and connecting it to cultural settings are all part of this process. In order to improve their understanding, readers use a variety of strategies and techniques, tailoring their approach according to the text's content and the results they hope to achieve (Brunner, 1990; Dole et al., 1991; Binkley & Linnakylä, 1997).

It's crucial to remember that "written texts" in this sense refer to any type of language-based content, including handwritten, print, and digital content. This encompasses not just textual content but also visual components like pictures, charts, diagrams, and drawings. It does not, however, include non-textual formats such as live broadcasts, movies, and cartoons (OECD, 1999b, p. 19).

3.1.3 Mathematical literacy

According to OECD/PISA, mathematical literacy encompasses more than just mathematical knowledge; it also includes real-world applications in daily life. It seeks to develop students' capacity for using arithmetic to solve problems and make decisions, as well as a mentality that supports productivity and positive participation in both current and future pursuits (OECD, 1999b, p. 41).

Four major components make up the framework of mathematical literacy: curricular strands, significant ideas, situational settings, and mathematical competencies. The four major components of the framework of mathematical literacy are designed to structure and enhance the way students learn, understand, and apply mathematics. Skills including mathematical reasoning, argumentation, modeling, problem-solving, and method application are included in these competences (OECD, 1999b, p. 41).

For efficient assessment, these competencies are divided into three classes: higher-order skills (Class 3), which include mathematical thinking, generalization, and insight; integrative problem-solving (Class 2), which emphasizes connections between concepts; and foundational skills (Class 1), which include computation, replication, and definition.

Mathematical literacy, by taking a comprehensive approach, gives students the tools to apply their knowledge of mathematics in practical settings. This approach fosters a culture of critical thinking and problem-solving, which are vital for navigating an increasingly linked world, by bridging the gap between mathematics education and real-world expectations (OECD, 1999b, p. 41).

To illustrate the practical relevance and value of mathematical literacy in daily life, consider how a student who comprehends mathematical concepts like percentages and ratios might apply this knowledge when budgeting for personal finances or analysing data in a scientific study.

3.1.4 Scientific literacy

According to OECD/PISA, scientific literacy gives young people the necessary tools to evaluate facts based on evidence, form trustworthy conclusions, and discern between claims that are opinion-based and those that are supported by evidence (OECD, 1999b, p. 59). It stimulates creativity in scientific pursuits and advances rationality by promoting critical thinking and methodical concept evaluation.

Understanding important scientific concepts including the composition of matter, climate change, energy transformation, and human biology is included in scientific literacy (OECD, 1999b, p. 59). These ideas clarify the universe's order and the effects of scientific knowledge on society.

Literacy in science refers to the mental processes involved in gathering, analyzing, and applying data to gain knowledge and comprehension. This comprises obtaining data, drawing findings that make sense, comprehending scientific ideas, and formulating queries that can be further investigated.

Contextual relevance is an important indicator of measuring scientific literacy in that real-life situations create meaningful context for invoking knowledge gained from science. They include individual and global levels, meant to show how the body of scientific knowledge helps us to make varied decisions throughout our lives. Scientific literacy as assessed by OECD/PISA is based on the integration of knowledge and the ability to apply facts to issues using evidence to make decisions. As such, students can appropriately navigate the science issues in their communities with this kind of science literacy.

One example is how a scientifically literate person might be able to discus and evaluate how human activity is affecting their environment-climate science-and use their derived data to vote for better sustainability practices in their locality. These examples underscore the everyday relevance and significance of scientific literacy in making decisions concerning the intricate issues facing the world today.

3.3 Method of data collection

The PISA test is administered in two 60-minute periods, with a five to ten minutes break between periods. The literacy assessments are followed by a 15-minute break, and then students have 35 minutes to complete the questionnaire. While the test in 2018 was computer-based, the test in 2000 was conducted using paper and pencil.

For this paper, the data for all student responses had been downloaded in SPSS file format from the OECD (http://www.oecd.org/pisa/). Utilizing the Statistical Package for the Social Sciences (SPSS) the entire analysis for this study was conducted. Additionally, the website offers an executive summary of statistics for both the entire world and individual countries as well as details on how the instruments were constructed. Technical reports and research documentation for PISA 2000-2018, and earlier cycles are also available to researchers.

3.3 Data analyses

Quantitative data was collected from OECD and UNESCO databases. Since the data is freely available online, no permission of the ethics committee had been required. The necessary data had already been retrieved and put into an SPSS file. The SPSS file will be added to the report.

The quantitative data collected from PISA and UNESCO was entered into the Statistical Package for the Social Science (SPSS). Data could be downloaded from the PISA website per year. Within the SPSS file for each year, the average of the overall score, the math score, science score and reading score were calculated. From each of the four dependent variables, three separate variables were computed, all students, male students and female students. Therefore each ‘year’ made 13 variables; country, overall, overall female, overall male, math, math female, math male, reading, reading female, reading male, science, science female, science male.

The separate files were combined in one SPSS data file, with six more added variables. The first variable are year and year squared, to search for a linear and non-linear trends. The remaining four variables were calculated by the average of female students minus the male students in the four subjects (overall, math, reading, science) and named female advantage, to search for gender-specific impact.

A multilevel analysis was conducted using the per-country changes in teacher gender ratio as the explanatory variable. This analysis predicts a growth factor for each of the participating countries. The first PISA score relates to 2000. The year variable has been recoded so that a zero score refers to the year 2000. Due to the fact that educational change does not occur over the course of a year but rather over a longer period of time. The dependent variable will be the change in student performance, measured by PISA scores, for each country between 2000 and 2018.

3.3.1 Multilevel analyses

In the multilevel analysis the country averages per year present the lower level. Each country has up to seven scores (2000-2018). The countries present the higher level. The study is aimed at determining to what extent changes across years can be accounted for by variations in female teacher ratios. In addition to the percentages of female teachers, year is included as an explanatory variable. Therefore, the estimated effects of percentage of female teachers are independent of general changes over time. In addition to a linear effect of year, a quadratic effect is estimated. This is done by adding a quadratic term for year in the analysis (i.e. year squared). The linear year effect is modelled as a random effect at the country level. This implies that this effect may vary between countries.

The multilevel analyses are run separately for the different dependent variables; the mean for all scores, math, reading and science as well for the difference between male and female students in the same categories.

3.4 Variables

3.4.1 teacher rates

The percentages of female teachers in secondary education can be found on https://data.worldbank.org/ based on data from UNESCO institute for statistics. The data can be found from 1970 till 2021. The data from 2000 to 2018 has been added to the SPSS file.

Figure 2

Percentage female teachers within the testing time worldwide

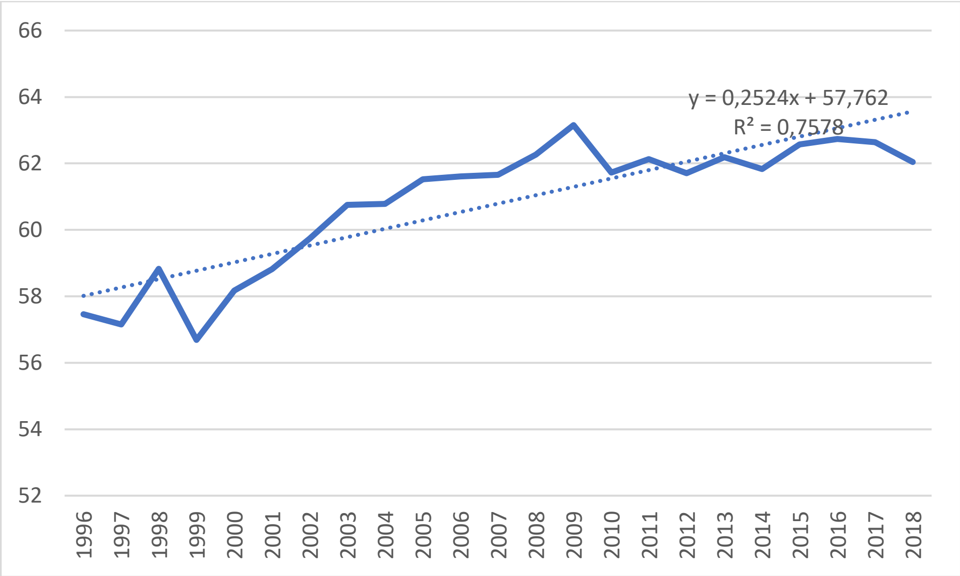
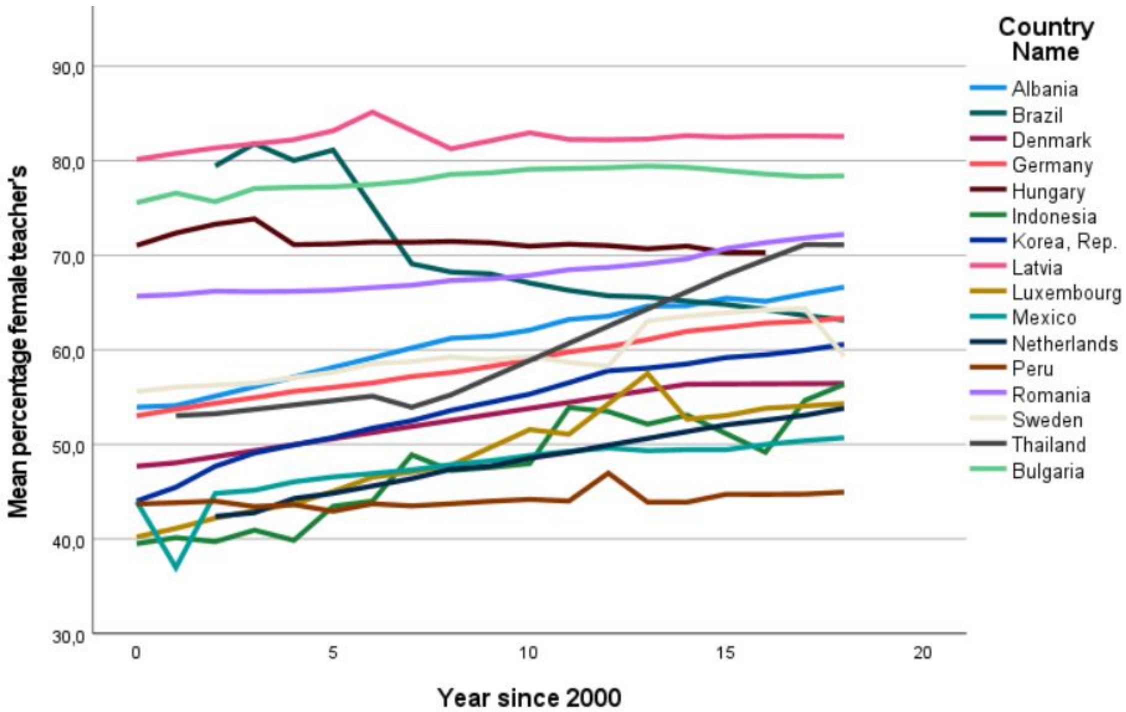


Figure 3

Percentage female teachers within the testing time per country



3.4.2 Year

The year 2000 has been taken as value 0. The first year PISA has taken place.

3.4.3 PISA Scoring

PISA results from the different years were recovered from the PISA databank. For every year four different country averages were calculated: Math (the plausible values related to subject Math), Reading (the plausible values related to the subject Reading), Science (the plausible values related to the subject Science) and Overall (all the plausible values). For each country, an overall average, an average for female students and an average for male students was computed. This has been done for PISA year 2000, 2003, 2006, 2009, 2012, 2015 and 2018. Nine countries have also held a PISA test in the year 2002.

An additional value was calculated by taking the average for female students and subtracting the average for male students. This values indicates to what extent female students score higher than male students. Negative values indicate a male advantage and positive values indicate a female advantage.

In the accompanying SPSS file the combined data can be found with the PISA scoring, countries, year and percentage of female teachers.

4. Results

An overview of the feminization trends in education from 2000 to 2018 is provided in this section. The value of presenting descriptive data or graphic depictions to show how feminization in education has progressed throughout nations or among subsets of related nations, is recognized. Even if Figure 2 shows a flattening trend toward the end and a minor overall gain of 2-3% in feminization, it is crucial to thoroughly assess the feminization assessment. In light of this, feminization is defined as the proportion of women working in the education industry. The UNESCO statistics were used to quantify feminization in secondary education.

It's important to remember, too, that this study focuses on the differences across countries rather than just the average growth in the proportion of female instructors. A graph with data for every one of the forty countries could become unduly complicated. Rather, figure 3 shows nations where feminization has increased dramatically and those where the increase has been mostly steady. Furthermore, Figure 1 shows that the feminization of education has been a long-term, continuous process, highlighting the necessity for a careful analysis of its effects.

4.1 SPSS file

The SPSS file used in the study incorporates a rich set of variables that are necessary for investigating education performance between countries (this can also be found in 3.4 variables). Included among these variables are the name of each country, the year and the square of its year as essential for temporal analysis. Moreover, it gives percentage on the fraction of female teachers of that specific year in that country which is important to understand within what extent females are represented in teaching staff. A data set contains average score for all PISA questions together with separate means for Math, Reading and Science enabling subject-based performance evaluation. Furthermore, it also reports an overall female advantage based on all questions and separately: math, reading and science giving much insight into sex disparities found in students' achievements.

4.2 SPSS output

In appendix A the tables from each dependent variable can be found. In table 1 and 2, a summarization of the output is given. Only the intercept and fixed effects of year, year squared and percentage of female teachers are reported. With regard to the total difference between female and male students the initial analysis did not reach convergence. Convergence was reached when the correlation between intercept and random year effect was set to zero. The covariance structure was changed from unstructured (UNR) to variance components (VC). This also goes for the reading difference between female and male students. In this case, the random year effect was removed completely. Only the fixed year effect was maintained.

Table 1

Estimated of fixed effects between female teacher rate and the female advantage

		Estimate	Sig.
Total	Intercept	7,169	,475
	Year_squared	,008	,530
	Year	-,281	,283
	MeanTotal	-,031	,101
	%female teacher	,290	,001
Math	Intercept	12,954	,172
	Yearsquared	,123	<,001
	Year	-2,442	<,001
	MeanMath	-,047	,007
	%female teacher	,162	,062
Reading	Intercept	6,119	,668
	Year_squared	-,115	<,001
	Year	1.777	<,001
	MeanRead	-,004	,870
	%female teacher	,443	<,001
Science	Intercept	4,606	,677
	Year_squared	,017	,240
	Year	-,209	,476
	MeanScience	-,048	,024
	%female teacher	,290	,004

Table 2

Estimated of fixed effects between female teacher rate and student results

		Estimate	Sig.
Total	Intercept	465, 125	<,001
	Year_ squared	-,056	,019
	Year	1,181	,030
	%female teacher	,078	,833
Math	Intercept	458,759	<,001
	Year_ squared	-,033	,181
	Year	,874	,145
	%female teacher	,165	,691
Reading	Intercept	481,051	<,001
	Year_ squared	-,048	,115
	Year	1,104	,085
	%female teacher	-,213	,590
Science	Intercept	463,490	<,001
	Year_ squared	-,088	<,001
	Year	1,630	,005
	%female teacher	,145	,708

4.3 Output analyses

4.3.1 Data analyses for *overall score and the female advantage*

Analysis 4.3.1 examines the overall performance gap between female and male students. The findings reveal a significant relationship between the proportion of female teachers and the gender gap in student scores. The practical applications of intercepts in this analysis are few. The intercept represents the point where there is no independent variable on the x-axis. In other words, at year 0 (corresponding to 2000), a score of zero is expected when female teachers constitute no percentage and average performance score is also zero. Although this is mathematically required, it does not make sense practically and limits the interpretation of the intercept. For the overall score and female advantage the estimated coefficient of 0.290, along with a narrow 95% confidence interval (0.120 to 0.460) and a high t-statistic (3.475, $p = 0.001$), strongly support this relationship. These results suggest that as the percentage of female teachers increases, so does the relative advantage of female students.

4.3.2 Data analyses for *math score and the female advantage*

The analysis focusing on math scores demonstrates a positive correlation between the percentage of female teachers and the difference in math achievement between male and female students. The initial model however only accounted for a small proportion of the variance, but incorporating both fixed and random effects enhanced the explanatory power significantly. However, convergence issues prevented using a model with year-intercept correllation. The estimated coefficient of 0.162, supported by a t-value of 1,917 ($p = 0.062$) and a 95% confidence interval (-0.008 to 0.332).While this is not statistically significant in a two-tailed test, it is significant at the $p < 0.05$ level in a one-tailed test. A one-tailed test is appropriate in this context, as the hypothesis assumes that a higher percentage of female teachers is expected to positively influence female student performance. This directional expectation justifies the use of a one-tailed test to more accurately assess the significance of the observed effect. This result shows a pattern that may need more scrutiny, although it cannot be said with certainty that there is a strong relationship between them based on this analysis alone.

4.3.3 Data analyses for *reading score and the female advantage*

The analysis of reading scores indicates a strong relationship between the percentage of female teachers and the gender gap in reading proficiency. The highly significant predictor is supported by a low standard error (0.117) and a high estimated coefficient of 0.443, with a narrow 95% confidence interval (0.207 to 0.679) and a large t-statistic (3.775, $p < 0.001$). These findings suggest that as the percentage of female teachers increases, the gap in reading skills between male and female students widens.

4.3.4 Data analyses for *science score and the female advantage*

The analysis of science scores reveals that higher percentages of female teachers contributes to a higher relative advantages for female students in science achievement. The estimated coefficient of 0.290, along with a constrained 95% confidence interval (0.099 to

0.480) and a significant t-statistic (3.091, p = 0.004), suggests that increasing the number of female teachers can improve the science scores of female students in comparison to that of boys.

4.3.5 Data analyses for *overall score.*

This analysis revisits the overall score, indicating a less significant relationship between the percentage of female teachers and student scores. The wide 95% confidence interval (-0.657 to 0.814) and non-significant t-statistic (0.211) suggest that the impact of female teachers on overall scores is not statistically significant at conventional levels.

4.3.6 Data analyses for *math score*

In this revisit, the analysis fails to establish a reliable relationship between the percentage of female teachers and mean math test scores. Despite a positive estimated coefficient, the non-significant t-statistic (0.398) and wide confidence interval (-0.656 to 0.987), advise caution in interpreting these results.

4.3.7 Data analyses for *reading score*

This analysis also fails to establish a significant relationship between the percentage of female teachers and reading proficiency. The non-significant coefficient (-0.213, p = 0.590), wide confidence interval (-0.994 to 0.569), and insignificant t-statistic (-0.590) highlight the need for further investigation to understand the factors influencing reading scores.

4.3.8 Data analyses for *science score*

Finally, the analysis of science scores similarly fails to provide sufficient evidence for a strong relationship between the percentage of female teachers and science test results. The non-significant coefficient (0.145), wide confidence interval (-0.619 to 0.909), and insignificant t-statistic (0.376, p = 0.708) underscore the importance of cautious interpretation and further research to elucidate the determinants of science student scores.

4.3.9 Conclusion

In conclusion, while some analyses show significant relationships between the presence of female teachers and gender disparities in student performance, others require further investigation and consideration of additional factors to draw conclusive interpretations.

5. Conclusion

The study examined the relationship between the percentage of female teachers and various aspects of student performance across multiple countries.It sought to examine three different subjects (reading, math and science) and the three combined in an overall score that are indicative of gender disparities in education and overall student performance.

A recurring theme in this study is the issue of gender inequality.Significantly positive relationships between the presence of female teachers and these outcomes (mathematic, reading, science and the average across these three subjects) were found to be strong and statistically significant. These results imply that raising the share of female teachers is consistent with increasing the female advantage concerning overall scholastic achievement, mathematics, science and the female students' advantage in reading tests. Interestingly, a slight change in the total score gender gap is observed when one more percent of female teachers is introduced, increasing it by 0.290. For math, reading and sciences these figures are respectively 0.162, 0.443 and 0.290. However, it deserves pointing out that such difference, despite being statistically meaningful, is rather small in PISA scale where the results are scaled to fit approximately normal distributions, with means around 500 score points and standard deviations around 100 score points. This implies that a ten percent change in the percentage of female teachers amounts to only a 2.90 change in the female advantage of the total score. The largest effect was found for reading (.443). Even in this case an increase of 20% would imply an 8.86 change. This would still be less than on tenth of standard deviation in the individual scores on the reading test.

However, when looking at the female and male grades combined, the analysis did not yield any conclusions. Statistical significance was not achieved consistently. Therefore, other contributing elements would need to be considered while interpreting student test results obtained in the countries under study. It is possible that the effects observed among boys and girls may offset each other. Conducting a stratified analysis, with separate evaluations for boys and girls, would be beneficial in this context.

In summary, the data indicates that the presence of female teachers can contribute to closing the gender gap in specific academic domains, particularly for the overall scoring, mathematics and science. However, with regard to reading performance an increasing percentage of female teachers may widen the gender gap.

6. Discussion

Analyzing the data, it appears that there is no significant relationship between the overall mean score and the percentage of female teachers. Specifically, when comparing male and female pupils in particular areas like reading, math and science, there are obvious differences. However, more females are increasingly becoming teachers. Still, the stereotypes in sciences and mathematics remain associated with males (Dersch, Heyder and Eitel, 2022). The above observation makes us wonder on what contributes to gender differences in the mentioned subjects. Qing Li (1999) investigated gender-related issues and teachers' beliefs in mathematics education and suggested that teacher perceptions with respect to males and females vary. Male students are usually expected to perform well in mathematics and the attitude toward them is more favorable compared to female. Interestingly, while there are some nuances in which there are no significant gender differences in the teachers' beliefs, it appears that such connections in teachers' beliefs and gender issues in math-education are quite complex and subtle (Li, 2006).

It's important to take into account broader sociological and political events rather than just attributing the observed association between the feminization of education and student performance to a shift in teaching style towards more coaching-oriented approaches. It's possible that the association represents broader cultural changes, such as the continued feminization of education. Nevertheless, it would be better to investigate the ways in which this feminization interacts with other sociological and political processes rather than drawing a straight connection between this and a shift in teaching methods toward a more coach-like approach (Yuval-Davis, 2006). This shift can also be attributed to younger teachers, who usually are more conversant with viable instructional methods because they are likely to have been more recently trained, and, as such, they tend to be more frequent females.

As an example, educational practices may be impacted by the concurrent trends of individualization and initiatives to address inequality (Geven, Batruch, & van de Werfhorst, 2018). Differentiated education is becoming more and more important as educational institutions work to address inequalities and meet the requirements of a wide range of students. This calls for teaching strategies that are flexible and sensitive to each student's unique learning preferences and skill levels.

Additionally, variations in the PISA assessment's stakes among nations could possibly be a factor in student performance differences. Students may approach PISA with less pressure and anxiety in nations where it is seen as a low-stakes exam, which could have a good effect on their performance. On the other hand, pupils may face more stress in nations where PISA is high-stakes, such as those where test results impact financing or school rankings, which could either have a positive or negative effect on their performance. This can't be used as a control variable because it remains unclear to which countries it applies.

In this situation, the feminization of education may interact in complex ways with other societal issues, such as initiatives to alleviate inequality and support individualized learning, as well as the stakes involved in standardized examinations like PISA, to shape the educational landscape. In order to appropriately grasp the relationship between teacher gender, teaching techniques, and student outcomes, it is necessary to investigate the complex nature of these relationships.

For the covariance parameters, the analysis shows substantial variation, most prominently through the estimation of the residual and other covariances. The high level of variability implies that perhaps other variables besides the percentage of female teachers influence these variations in student scores. This would be a topic for further research.

It is crucial to acknowledge that when analyzing the difference between female and male students, their difference is considered as female score minus male score. Positive values of the difference indicate higher scores for female students compared to male students and negative values indicate lower scores of female students compared to male students. However, further analyses should be done in order to comprehend the actual trends and outcomes of these discrepancies in scores based on genders.

Conclusively, the examination of the presented information shows nothing with regards to the relation between the percentages for female teachers and the average mean scores when the female and male students are combined. However, there was no connection as to whether or not the uniform average score relies on the percentage of female teachers. There are several explanations for this phenomenon. First, gender-specific teaching dynamics may play a part in this. Female teachers might use certain strategies that favor girls more than boys like promoting collaborative learning and providing tailor-made support. These strategies could be neutral or even detrimental to males hence do not affect combined scores significantly. In addition, aggregation of data might mask gender effects in schools thereby leading to mixed impacts on female learners while negatively affecting boys' performance making it difficult to detect overall trends. Also, socio-cultural and role model effects likely contribute with a bias toward women who benefit more from women mentors (Bowers et al., 2008). Finally, we can infer that another possible explanation is that there are subjects where females usually perform very well leading to an observable variation between genders yet still having no change in combined scores as many female teachers tend to occupy such positions (Fransson & Frelin, 2016). Another reason would be that statistical sensitivity may exist so that methods or sample sizes used are better adjusted for distinctions linked with males' performance than total results.

However, they emphasize on the need for more research and consideration of diverse determinants as they explore the complicated relationship on gender and academic achievement in math, reading and science.

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Appendix

Appendix A: Output

Frequencies

Notes

Syntax	FREQUENCIES VARIABLES=Name_Country /ORDER=ANALYSIS.

Statistics

Country Name

N	Valid	722
	Missing	0

Country Name

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Albania	19	2,6	2,6	2,6
	Argentina	19	2,6	2,6	5,3
	Austria	19	2,6	2,6	7,9
	Belgium	19	2,6	2,6	10,5
	Brazil	19	2,6	2,6	13,2
	Bulgaria	19	2,6	2,6	15,8
	Chile	19	2,6	2,6	18,4
	Czech Republic	19	2,6	2,6	21,1
	Denmark	19	2,6	2,6	23,7
	Finland	19	2,6	2,6	26,3
	France	19	2,6	2,6	28,9
	Germany	19	2,6	2,6	31,6
	Greece	19	2,6	2,6	34,2
	Hong Kong	19	2,6	2,6	36,8
	Hungary	19	2,6	2,6	39,5
	Indonesia	19	2,6	2,6	42,1
	Israel	19	2,6	2,6	44,7
	Italy	19	2,6	2,6	47,4
	Korea, Rep.	19	2,6	2,6	50,0
	Latvia	19	2,6	2,6	52,6
	Luxembourg	19	2,6	2,6	55,3
	Mexico	19	2,6	2,6	57,9
	Netherlands	19	2,6	2,6	60,5
	New Zealand	19	2,6	2,6	63,2
	Norway	19	2,6	2,6	65,8

	Peru	19	2,6	2,6	68,4
	Poland	19	2,6	2,6	71,1
	Portugal	19	2,6	2,6	73,7
	Romania	19	2,6	2,6	76,3
	Russian Federation	19	2,6	2,6	78,9
	Slovenia	19	2,6	2,6	81,6
	Spain	19	2,6	2,6	84,2
	Sweden	19	2,6	2,6	86,8
	Switzerland	19	2,6	2,6	89,5
	Thailand	19	2,6	2,6	92,1
	Turkey	19	2,6	2,6	94,7
	United Kingdom	19	2,6	2,6	97,4
	United States	19	2,6	2,6	100,0
	Total	722	100,0	100,0	

Mixed Model Analysis

Notes

Output Created	13-AUG-2024 11:04:46
Syntax	MIXED MeanTotal_FemAdv WITH Year Year_kwadraat PercFemTeachersSecEd MeanTotal /CRITERIA=DFMETHOD(SATTERTHWAITE) CIN(95) MXITER(100) MXSTEP(10) SCORING(1) SINGULAR(0.000000000001) HCONVERGE(0.00000001, RELATIVE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0, ABSOLUTE) /FIXED=Year Year_kwadraat PercFemTeachersSecEd MeanTotal | SSTYPE(3) /METHOD=REML /PRINT=SOLUTION TESTCOV /RANDOM=INTERCEPT Year | SUBJECT(Name_Country) COVTYPE(UNR).

Model Dimension[a]

		Number of Levels	Covariance Structure	Number of Parameters
Fixed Effects	Intercept	1		1
	Year	1		1
	Year_kwadraat	1		1
	PercFemTeachersSecEd	1		1
	MeanTotal	1		1
Random Effects	Intercept + Year	2	Unstructured Correlations	3
Residual				1
Total		7		9

Model Dimension[a]

		Subject Variables
Fixed Effects	Intercept	
	Year	
	Year_kwadraat	
	PercFemTeachersSecEd	
	MeanTotal	
Random Effects	Intercept + Year	Name_Country
Residual		
Total		

a. Dependent Variable: MeanTotal_FemAdv.

Information Criteria[a]

-2 Restricted Log Likelihood	1217,42733906
Akaike's Information Criterion (AIC)	1225,42733906
Hurvich and Tsai's Criterion (AICC)	1225,65591049
Bozdogan's Criterion (CAIC)	1242,19916646
Schwarz's Bayesian Criterion (BIC)	1238,19916646

The information criteria are displayed in smaller-is-better form.[a]

a. Dependent Variable: MeanTotal_FemAdv.

Coefficients of Determination

Pseudo-R Square Measures	Marginal	,134
	Conditional	,639

Fixed Effects

Type III Tests of Fixed Effects[a]

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	34,583	,522	,475
Year	1	150,426	1,161	,283
Year_kwadraat	1	127,542	,396	,530
PercFemTeachersSecEd	1	32,389	12,078	,001
MeanTotal	1	35,442	2,827	,101

a. Dependent Variable: MeanTotal_FemAdv.

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval Lower Bound
Intercept	7,169	9,925	34,583	,722	,475	-12,987
Year	-,281	,261	150,426	-1,078	,283	-,796
Year_kwadraat	,008	,013	127,542	,629	,530	-,018
PercFemTeachersSecEd	,290	,083	32,389	3,475	,001	,120
MeanTotal	-,031	,018	35,442	-1,681	,101	-,067

Estimates of Fixed Effects[a]

Parameter	95% Confidence Interval Upper Bound
Intercept	27,326
Year	,234
Year_kwadraat	,034
PercFemTeachersSecEd	,460
MeanTotal	,006

a. Dependent Variable: MeanTotal_FemAdv.

Covariance Parameters

Estimates of Covariance Parameters[a]

Parameter		Estimate	Std. Error	Wald Z	Sig.	95% Confidence Interval Lower Bound
Residual		25,474	3,492	7,294	<,001	19,471
Intercept + Year [subject = Name_Country]	Var(1)	21,906	12,621	1,736	,083	7,082
	Var(2)	,052	,054	,968	,333	,007
	Corr(2,1)	,356	,753	,473	,636	-,866

Estimates of Covariance Parameters[a]

Parameter		95% Confidence Interval Upper Bound
Residual		33,327
Intercept + Year [subject = Name_Country]	Var(1)	67,760
	Var(2)	,395
	Corr(2,1)	,968

a. Dependent Variable: MeanTotal_FemAdv.

Mixed Model Analysis

Notes

Output Created	13-AUG-2024 11:04:46
Syntax	MIXED MeanTotal WITH Year Year_kwadraat PercFemTeachersSecEd /CRITERIA=DFMETHOD(SATTERTHWAITE) CIN(95) MXITER(100) MXSTEP(10) SCORING(1) SINGULAR(0.000000000001) HCONVERGE(0.00000001, RELATIVE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0, ABSOLUTE) /FIXED=Year Year_kwadraat PercFemTeachersSecEd | SSTYPE(3) /METHOD=REML /PRINT=SOLUTION TESTCOV /RANDOM=INTERCEPT Year | SUBJECT(Name_Country) COVTYPE(UNR).

Model Dimension[a]

		Number of Levels	Covariance Structure	Number of Parameters
Fixed Effects	Intercept	1		1
	Year	1		1
	Year_kwadraat	1		1
	PercFemTeachersSecEd	1		1
Random Effects	Intercept + Year	2	Unstructured Correlations	3
Residual				1
Total		6		8

Model Dimension[a]

		Subject Variables
Fixed Effects	Intercept	
	Year	
	Year_kwadraat	
	PercFemTeachersSecEd	
Random Effects	Intercept + Year	Name_Country
Residual		
Total		

a. Dependent Variable: MeanTotal.

Information Criteria[a]

-2 Restricted Log Likelihood	1534,40707021
Akaike's Information Criterion (AIC)	1542,40707021
Hurvich and Tsai's Criterion (AICC)	1542,63434294
Bozdogan's Criterion (CAIC)	1559,20105834
Schwarz's Bayesian Criterion (BIC)	1555,20105834

The information criteria are displayed in smaller-is-better form.[a]

a. Dependent Variable: MeanTotal.

Coefficients of Determination

Pseudo-R Square Measures	Marginal	,002
	Conditional	,965

Fixed Effects

Type III Tests of Fixed Effects[a]

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	106,250	391,982	<,001
Year	1	147,871	4,786	,030
Year_kwadraat	1	126,863	5,663	,019
PercFemTeachersSecEd	1	103,103	,045	,833

a. Dependent Variable: MeanTotal.

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval Lower Bound
Intercept	465,125	23,493	106,250	19,799	<,001	418,549
Year	1,181	,540	147,871	2,188	,030	,114
Year_kwadraat	-,056	,023	126,863	-2,380	,019	-,102
PercFemTeachersSecEd	,078	,371	103,103	,211	,833	-,657

Estimates of Fixed Effects[a]

Parameter	95% Confidence Interval Upper Bound
Intercept	511,701
Year	2,248
Year_kwadraat	-,009
PercFemTeachersSecEd	,814

a. Dependent Variable: MeanTotal.

Covariance Parameters

Estimates of Covariance Parameters[a]

Parameter		Estimate	Std. Error	Wald Z	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Residual		75,416	9,978	7,558	<,001	58,189	97,743
Intercept + Year [subject = Name_Country]	Var(1)	3058,382	736,383	4,153	<,001	1907,846	4902,755
	Var(2)	1,791	,589	3,041	,002	,940	3,412
	Corr(2,1)	-,849	,063	-13,465	<,001	-,935	-,670

a. Dependent Variable: MeanTotal.

Mixed Model Analysis

Notes

Syntax	MIXED MeanMath_FemAdv WITH Year Year_kwadraat PercFemTeachersSecEd MeanMath /CRITERIA=DFMETHOD(SATTERTHWAITE) CIN(95) MXITER(100) MXSTEP(10) SCORING(1) SINGULAR(0.000000000001) HCONVERGE(0.00000001, RELATIVE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0, ABSOLUTE) /FIXED=Year Year_kwadraat PercFemTeachersSecEd MeanMath | SSTYPE(3) /METHOD=REML /PRINT=SOLUTION TESTCOV /RANDOM=INTERCEPT Year | SUBJECT(Name_Country) COVTYPE(UNR).

Warnings

Iteration was terminated but convergence has not been achieved. The MIXED procedure continues despite this warning. Subsequent results produced are based on the last iteration. Validity of the model fit is uncertain.

Model Dimension[a]

		Number of Levels	Covariance Structure	Number of Parameters
Fixed Effects	Intercept	1		1
	Year	1		1
	Year_kwadraat	1		1
	PercFemTeachersSecEd	1		1
	MeanMath	1		1
Random Effects	Intercept + Year	2	Unstructured Correlations	3
Residual				1
Total		7		9

Model Dimension[a]

		Subject Variables
Fixed Effects	Intercept	
	Year	
	Year_kwadraat	
	PercFemTeachersSecEd	
	MeanMath	
Random Effects	Intercept + Year	Name_Country

Residual	
Total	

a. Dependent Variable: MeanMath_FemAdv.

Information Criteria[a]

-2 Restricted Log Likelihood	1224,26778494
Akaike's Information Criterion (AIC)	1232,26778494
Hurvich and Tsai's Criterion (AICC)	1232,49635637
Bozdogan's Criterion (CAIC)	1249,03961234
Schwarz's Bayesian Criterion (BIC)	1245,03961234

The information criteria are displayed in smaller-is-better form.[a]

a. Dependent Variable: MeanMath_FemAdv.

Coefficients of Determination

Pseudo-R Square Measures	Marginal	,245
	Conditional	,718

Fixed Effects

Type III Tests of Fixed Effects[a]

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	29,550	2,625	,116
Year	1	167,582	90,383	<,001
Year_kwadraat	1	164,057	87,195	<,001
PercFemTeachersSecEd	1	31,334	4,318	,046
MeanMath	1	29,317	10,123	,003

a. Dependent Variable: MeanMath_FemAdv.

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval Lower Bound
Intercept	16,084	9,928	29,550	1,620	,116	-4,204
Year	-2,472	,260	167,582	-9,507	<,001	-2,985
Year_kwadraat	,123	,013	164,057	9,338	<,001	,097
PercFemTeachersSecEd	,184	,088	31,334	2,078	,046	,003
MeanMath	-,056	,018	29,317	-3,182	,003	-,092

Estimates of Fixed Effects[a]

Parameter	95% Confidence Interval Upper Bound
Intercept	36,372
Year	-1,958
Year_kwadraat	,150
PercFemTeachersSecEd	,364
MeanMath	-,020

a. Dependent Variable: MeanMath_FemAdv.

Covariance Parameters

Estimates of Covariance Parameters[a]

Parameter		Estimate	Std. Error	Wald Z	Sig.	95% Confidence Interval Lower Bound
Residual		25,977	2,907	8,937	<,001	20,861
Intercept + Year [subject = Name_Country]	Var(1)	29,535	16,478	1,792	,073	9,895
	Var(2)	,014	,022	,659	,510	,001
	Corr(2,1)	,990[b]	,000	.	.	.

Estimates of Covariance Parameters[a]

Parameter		95% Confidence Interval Upper Bound
Residual		32,347
Intercept + Year [subject = Name_Country]	Var(1)	88,153
	Var(2)	,283
	Corr(2,1)	.

a. Dependent Variable: MeanMath_FemAdv.

b. This covariance parameter is redundant. The test statistic and confidence interval cannot be computed.

Mixed Model Analysis

Notes

Syntax	MIXED MeanMath_FemAdv WITH Year Year_kwadraat PercFemTeachersSecEd MeanMath /CRITERIA=DFMETHOD(SATTERTHWAITE) CIN(95) MXITER(100) MXSTEP(10) SCORING(1) SINGULAR(0.000000000001) HCONVERGE(0.00000001, RELATIVE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0, ABSOLUTE) /FIXED=Year Year_kwadraat PercFemTeachersSecEd MeanMath | SSTYPE(3) /METHOD=REML

```
/PRINT=SOLUTION TESTCOV
/RANDOM=INTERCEPT Year | SUBJECT(Name_Country) COVTYPE(VC).
```

Model Dimension[a]

		Number of Levels	Covariance Structure	Number of Parameters
Fixed Effects	Intercept	1		1
	Year	1		1
	Year_kwadraat	1		1
	PercFemTeachersSecEd	1		1
	MeanMath	1		1
Random Effects	Intercept + Year[b]	2	Variance Components	2
Residual				1
Total		7		8

Model Dimension[a]

		Subject Variables
Fixed Effects	Intercept	
	Year	
	Year_kwadraat	
	PercFemTeachersSecEd	
	MeanMath	
Random Effects	Intercept + Year[b]	Name_Country
Residual		
Total		

a. Dependent Variable: MeanMath_FemAdv.

b. As of version 11.5, the syntax rules for the RANDOM subcommand have changed. Your command syntax may yield results that differ from those produced by prior versions. If you are using version 11 syntax, please consult the current syntax reference guide for more information.

Information Criteria[a]

-2 Restricted Log Likelihood	1222,42696980

Akaike's Information Criterion (AIC)	1228,42696980
Hurvich and Tsai's Criterion (AICC)	1228,56333344
Bozdogan's Criterion (CAIC)	1241,00584036
Schwarz's Bayesian Criterion (BIC)	1238,00584036

The information criteria are displayed in smaller-is-better form.[a]

a. Dependent Variable: MeanMath_FemAdv.

Coefficients of Determination

Pseudo-R Square Measures	Marginal	,248
	Conditional	,674

Fixed Effects

Type III Tests of Fixed Effects[a]

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	42,253	1,931	,172
Year	1	151,916	84,034	<,001
Year_kwadraat	1	136,927	85,028	<,001
PercFemTeachersSecEd	1	43,267	3,673	,062
MeanMath	1	42,060	8,047	,007

a. Dependent Variable: MeanMath_FemAdv.

Estimates of Fixed Effects[a]

						95% Confidence Interval
Parameter	Estimate	Std. Error	df	t	Sig.	Lower Bound
Intercept	12,954	9,322	42,253	1,390	,172	-5,856
Year	-2,442	,266	151,916	-9,167	<,001	-2,968
Year_kwadraat	,123	,013	136,927	9,221	<,001	,096
PercFemTeachersSecEd	,162	,084	43,267	1,917	,062	-,008
MeanMath	-,047	,016	42,060	-2,837	,007	-,080

Estimates of Fixed Effects[a]

	95% Confidence Interval
Parameter	Upper Bound
Intercept	31,764
Year	-1,916
Year_kwadraat	,149
PercFemTeachersSecEd	,332

MeanMath	-,013

a. Dependent Variable: MeanMath_FemAdv.

Covariance Parameters

Estimates of Covariance Parameters[a]

Parameter		Estimate	Std. Error	Wald Z	Sig.	95% Confidence Interval Lower Bound
Residual		25,898	3,276	7,905	<,001	20,211
Intercept [subject = Name_Country]	Variance	23,355	9,750	2,395	,017	10,305
Year [subject = Name_Country]	Variance	,083	,050	1,664	,096	,026

Estimates of Covariance Parameters[a]

Parameter		95% Confidence Interval Upper Bound
Residual		33,185
Intercept [subject = Name_Country]	Variance	52,933
Year [subject = Name_Country]	Variance	,270

a. Dependent Variable: MeanMath_FemAdv.

Mixed Model Analysis

Notes

Syntax	MIXED MeanMath WITH Year Year_kwadraat PercFemTeachersSecEd /CRITERIA=DFMETHOD(SATTERTHWAITE) CIN(95) MXITER(100) MXSTEP(10) SCORING(1) SINGULAR(0.000000000001) HCONVERGE(0.00000001, RELATIVE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0, ABSOLUTE) /FIXED=Year Year_kwadraat PercFemTeachersSecEd | SSTYPE(3) /METHOD=REML /PRINT=SOLUTION TESTCOV /RANDOM=INTERCEPT Year | SUBJECT(Name_Country) COVTYPE(UNR).

Model Dimension[a]

		Number of Levels	Covariance Structure	Number of Parameters
Fixed Effects	Intercept	1		1
	Year	1		1
	Year_kwadraat	1		1
	PercFemTeachersSecEd	1		1
Random Effects	Intercept + Year	2	Unstructured Correlations	3
Residual				1
Total		6		8

Model Dimension[a]

		Subject Variables
Fixed Effects	Intercept	
	Year	
	Year_kwadraat	
	PercFemTeachersSecEd	
Random Effects	Intercept + Year	Name_Country
Residual		
Total		

a. Dependent Variable: MeanMath.

Information Criteria[a]

-2 Restricted Log Likelihood	1561,64226543
Akaike's Information Criterion (AIC)	1569,64226543

Hurvich and Tsai's Criterion (AICC)	1569,86953816
Bozdogan's Criterion (CAIC)	1586,43625356
Schwarz's Bayesian Criterion (BIC)	1582,43625356

The information criteria are displayed in smaller-is-better form.[a]

a. Dependent Variable: MeanMath.

Coefficients of Determination

Pseudo-R Square Measures	Marginal	,002
	Conditional	,969

Fixed Effects

Type III Tests of Fixed Effects[a]

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	115,891	303,724	<,001
Year	1	140,881	2,152	,145
Year_kwadraat	1	125,621	1,807	,181
PercFemTeachersSecEd	1	115,108	,159	,691

a. Dependent Variable: MeanMath.

Estimates of Fixed Effects[a]

						95% Confidence Interval
Parameter	Estimate	Std. Error	df	t	Sig.	Lower Bound
Intercept	458,759	26,324	115,891	17,428	<,001	406,621
Year	,874	,596	140,881	1,467	,145	-,304
Year_kwadraat	-,033	,025	125,621	-1,344	,181	-,082
PercFemTeachersSecEd	,165	,415	115,108	,398	,691	-,656

Estimates of Fixed Effects[a]

	95% Confidence Interval
Parameter	Upper Bound
Intercept	510,897
Year	2,052
Year_kwadraat	,016
PercFemTeachersSecEd	,987

a. Dependent Variable: MeanMath.

Covariance Parameters

Estimates of Covariance Parameters[a]

Parameter	Estimate	Std. Error	Wald Z	Sig.	95% Confidence Interval

						Lower Bound
Residual		82,258	10,938	7,520	<,001	63,386
Intercept + Year [subject = Name_Country]	Var(1)	3963,741	954,369	4,153	<,001	2472,620
	Var(2)	2,914	,891	3,272	,001	1,601
	Corr(2,1)	-,862	,054	-15,835	<,001	-,937

Estimates of Covariance Parameters[a]

Parameter		95% Confidence Interval Upper Bound
Residual		106,750
Intercept + Year [subject = Name_Country]	Var(1)	6354,087
	Var(2)	5,305
	Corr(2,1)	-,709

a. Dependent Variable: MeanMath.

Mixed Model Analysis

Notes

Syntax	MIXED MeanRead_FemAdv WITH Year Year_kwadraat PercFemTeachersSecEd MeanRead /CRITERIA=DFMETHOD(SATTERTHWAITE) CIN(95) MXITER(100) MXSTEP(10) SCORING(1) SINGULAR(0.000000000001) HCONVERGE(0.00000001, RELATIVE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0, ABSOLUTE) /FIXED=Year Year_kwadraat PercFemTeachersSecEd MeanRead | SSTYPE(3) /METHOD=REML /PRINT=SOLUTION TESTCOV /RANDOM=INTERCEPT Year | SUBJECT(Name_Country) COVTYPE(UNR).

Model Dimension[a]

		Number of Levels	Covariance Structure	Number of Parameters
Fixed Effects	Intercept	1		1
	Year	1		1
	Year_kwadraat	1		1
	PercFemTeachersSecEd	1		1
	MeanRead	1		1
Random Effects	Intercept + Year	2	Unstructured Correlations	3
Residual				1
Total		7		9

Model Dimension[a]

		Subject Variables
Fixed Effects	Intercept	
	Year	
	Year_kwadraat	
	PercFemTeachersSecEd	
	MeanRead	
Random Effects	Intercept + Year	Name_Country
Residual		
Total		

a. Dependent Variable: MeanRead_FemAdv.

Information Criteria[a]

-2 Restricted Log Likelihood	1338,70301568

Akaike's Information Criterion (AIC)	1346,70301568
Hurvich and Tsai's Criterion (AICC)	1346,93158711
Bozdogan's Criterion (CAIC)	1363,47484308
Schwarz's Bayesian Criterion (BIC)	1359,47484308

The information criteria are displayed in smaller-is-better form.[a]

a. Dependent Variable: MeanRead_FemAdv.

Coefficients of Determination

Pseudo-R Square Measures	Marginal	,257
	Conditional	,613

Fixed Effects

Type III Tests of Fixed Effects[a]

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	48,563	,186	,668
Year	1	151,754	22,173	<,001
Year_kwadraat	1	149,587	35,691	<,001
PercFemTeachersSecEd	1	46,089	14,251	<,001
MeanRead	1	52,505	,027	,870

a. Dependent Variable: MeanRead_FemAdv.

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval Lower Bound
Intercept	6,119	14,200	48,563	,431	,668	-22,424
Year	1,777	,377	151,754	4,709	<,001	1,031
Year_kwadraat	-,115	,019	149,587	-5,974	<,001	-,153
PercFemTeachersSecEd	,443	,117	46,089	3,775	<,001	,207
MeanRead	-,004	,026	52,505	-,164	,870	-,057

Estimates of Fixed Effects[a]

Parameter	95% Confidence Interval Upper Bound
Intercept	34,662
Year	2,523
Year_kwadraat	-,077
PercFemTeachersSecEd	,679

MeanRead	,048

a. Dependent Variable: MeanRead_FemAdv.

Covariance Parameters

Estimates of Covariance Parameters[a]

Parameter		Estimate	Std. Error	Wald Z	Sig.	95% Confidence Interval Lower Bound
Residual		55,140	6,551	8,418	<,001	43,686
Intercept + Year [subject = Name_Country]	Var(1)	50,393	24,495	2,057	,040	19,437
	Var(2)	1,176E-5	,002	,005	,996	4,792E-175
	Corr(2,1)	,939	95,901	,010	,992	-1,000

Estimates of Covariance Parameters[a]

Parameter		95% Confidence Interval Upper Bound
Residual		69,596
Intercept + Year [subject = Name_Country]	Var(1)	130,653
	Var(2)	2,888E+164
	Corr(2,1)	1,000

a. Dependent Variable: MeanRead_FemAdv.

Mixed Model Analysis

Notes

Syntax	MIXED MeanRead WITH Year Year_kwadraat PercFemTeachersSecEd /CRITERIA=DFMETHOD(SATTERTHWAITE) CIN(95) MXITER(100) MXSTEP(10) SCORING(1) SINGULAR(0.000000000001) HCONVERGE(0.00000001, RELATIVE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0, ABSOLUTE) /FIXED=Year Year_kwadraat PercFemTeachersSecEd | SSTYPE(3) /METHOD=REML /PRINT=SOLUTION TESTCOV /RANDOM=INTERCEPT Year | SUBJECT(Name_Country) COVTYPE(UNR).

Model Dimension[a]

		Number of Levels	Covariance Structure	Number of Parameters
Fixed Effects	Intercept	1		1
	Year	1		1
	Year_kwadraat	1		1
	PercFemTeachersSecEd	1		1
Random Effects	Intercept + Year	2	Unstructured Correlations	3
Residual				1
Total		6		8

Model Dimension[a]

		Subject Variables
Fixed Effects	Intercept	
	Year	
	Year_kwadraat	
	PercFemTeachersSecEd	
Random Effects	Intercept + Year	Name_Country
Residual		
Total		

a. Dependent Variable: MeanRead.

Information Criteria[a]

-2 Restricted Log Likelihood	1590,89433928
Akaike's Information Criterion (AIC)	1598,89433928

Hurvich and Tsai's Criterion (AICC)	1599,12161200
Bozdogan's Criterion (CAIC)	1615,68832740
Schwarz's Bayesian Criterion (BIC)	1611,68832740

The information criteria are displayed in smaller-is-better form.[a]

a. Dependent Variable: MeanRead.

Coefficients of Determination

Pseudo-R Square Measures	Marginal	,003
	Conditional	,936

Fixed Effects

Type III Tests of Fixed Effects[a]

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	89,012	386,941	<,001
Year	1	152,655	3,010	,085
Year_kwadraat	1	128,148	2,521	,115
PercFemTeachersSecEd	1	87,181	,292	,590

a. Dependent Variable: MeanRead.

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval Lower Bound
Intercept	481,051	24,455	89,012	19,671	<,001	432,460
Year	1,104	,636	152,655	1,735	,085	-,153
Year_kwadraat	-,048	,030	128,148	-1,588	,115	-,107
PercFemTeachersSecEd	-,213	,393	87,181	-,540	,590	-,994

Estimates of Fixed Effects[a]

Parameter	95% Confidence Interval Upper Bound
Intercept	529,643
Year	2,361
Year_kwadraat	,012
PercFemTeachersSecEd	,569

a. Dependent Variable: MeanRead.

Covariance Parameters

Estimates of Covariance Parameters[a]

Parameter	Estimate	Std. Error	Wald Z	Sig.	95% Confidence Interval

						Lower Bound
Residual		126,134	16,687	7,559	<,001	97,324
Intercept + Year [subject = Name_Country]	Var(1)	2510,628	618,814	4,057	<,001	1548,746
	Var(2)	1,098	,494	2,223	,026	,455
	Corr(2,1)	-,817	,103	-7,943	<,001	-,942

Estimates of Covariance Parameters[a]

Parameter		95% Confidence Interval Upper Bound
Residual		163,473
Intercept + Year [subject = Name_Country]	Var(1)	4069,907
	Var(2)	2,652
	Corr(2,1)	-,494

a. Dependent Variable: MeanRead.

Mixed Model Analysis

Notes

Syntax	MIXED MeanScience_FemAdv WITH Year Year_kwadraat PercFemTeachersSecEd MeanScience /CRITERIA=DFMETHOD(SATTERTHWAITE) CIN(95) MXITER(100) MXSTEP(10) SCORING(1) SINGULAR(0.000000000001) HCONVERGE(0.00000001, RELATIVE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0, ABSOLUTE) /FIXED=Year Year_kwadraat PercFemTeachersSecEd MeanScience | SSTYPE(3) /METHOD=REML /PRINT=SOLUTION TESTCOV /RANDOM=INTERCEPT Year | SUBJECT(Name_Country) COVTYPE(UNR).

Model Dimension[a]

		Number of Levels	Covariance Structure	Number of Parameters
Fixed Effects	Intercept	1		1
	Year	1		1
	Year_kwadraat	1		1
	PercFemTeachersSecEd	1		1
	MeanScience	1		1
Random Effects	Intercept + Year	2	Unstructured Correlations	3
Residual				1
Total		7		9

Model Dimension[a]

		Subject Variables
Fixed Effects	Intercept	
	Year	
	Year_kwadraat	
	PercFemTeachersSecEd	
	MeanScience	
Random Effects	Intercept + Year	Name_Country
Residual		
Total		

a. Dependent Variable: MeanScience_FemAdv.

Information Criteria[a]

-2 Restricted Log Likelihood	1254,19226233

Akaike's Information Criterion (AIC)	1262,19226233
Hurvich and Tsai's Criterion (AICC)	1262,42083375
Bozdogan's Criterion (CAIC)	1278,96408973
Schwarz's Bayesian Criterion (BIC)	1274,96408973

The information criteria are displayed in smaller-is-better form.[a]

a. Dependent Variable: MeanScience_FemAdv.

Coefficients of Determination

Pseudo-R Square Measures	Marginal	,151
	Conditional	,626

Fixed Effects

Type III Tests of Fixed Effects[a]

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	38,792	,176	,677
Year	1	152,236	,511	,476
Year_kwadraat	1	129,748	1,396	,240
PercFemTeachersSecEd	1	34,713	9,556	,004
MeanScience	1	40,084	5,469	,024

a. Dependent Variable: MeanScience_FemAdv.

Estimates of Fixed Effects[a]

						95% Confidence Interval
Parameter	Estimate	Std. Error	df	t	Sig.	Lower Bound
Intercept	4,606	10,983	38,792	,419	,677	-17,612
Year	-,209	,292	152,236	-,715	,476	-,785
Year_kwadraat	,017	,015	129,748	1,181	,240	-,012
PercFemTeachersSecEd	,290	,094	34,713	3,091	,004	,099
MeanScience	-,048	,020	40,084	-2,339	,024	-,089

Estimates of Fixed Effects[a]

	95% Confidence Interval
Parameter	Upper Bound
Intercept	26,824
Year	,368
Year_kwadraat	,046
PercFemTeachersSecEd	,480
MeanScience	-,006

a. Dependent Variable:
MeanScience_FemAdv.

Covariance Parameters

Estimates of Covariance Parameters[a]

Parameter		Estimate	Std. Error	Wald Z	Sig.	95% Confidence Interval Lower Bound
Residual		31,565	4,340	7,273	<,001	24,109
Intercept + Year [subject = Name_Country]	Var(1)	29,579	16,468	1,796	,072	9,934
	Var(2)	,063	,069	,908	,364	,007
	Corr(2,1)	,103	,680	,151	,880	-,847

Estimates of Covariance Parameters[a]

Parameter		95% Confidence Interval Upper Bound
Residual		41,327
Intercept + Year [subject = Name_Country]	Var(1)	88,079
	Var(2)	,543
	Corr(2,1)	,896

a. Dependent Variable: MeanScience_FemAdv.

Mixed Model Analysis

Notes

Syntax	MIXED MeanScience WITH Year Year_kwadraat PercFemTeachersSecEd /CRITERIA=DFMETHOD(SATTERTHWAITE) CIN(95) MXITER(100) MXSTEP(10) SCORING(1) SINGULAR(0.000000000001) HCONVERGE(0.00000001, RELATIVE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0, ABSOLUTE) /FIXED=Year Year_kwadraat PercFemTeachersSecEd | SSTYPE(3) /METHOD=REML /PRINT=SOLUTION TESTCOV /RANDOM=INTERCEPT Year | SUBJECT(Name_Country) COVTYPE(UNR).

Model Dimension[a]

		Number of Levels	Covariance Structure	Number of Parameters
Fixed Effects	Intercept	1		1
	Year	1		1
	Year_kwadraat	1		1
	PercFemTeachersSecEd	1		1
Random Effects	Intercept + Year	2	Unstructured Correlations	3
Residual				1
Total		6		8

Model Dimension[a]

		Subject Variables
Fixed Effects	Intercept	
	Year	
	Year_kwadraat	
	PercFemTeachersSecEd	
Random Effects	Intercept + Year	Name_Country
Residual		
Total		

a. Dependent Variable: MeanScience.

Information Criteria[a]

-2 Restricted Log Likelihood	1556,46301346
Akaike's Information Criterion (AIC)	1564,46301346
Hurvich and Tsai's Criterion (AICC)	1564,69028619

Bozdogan's Criterion (CAIC)	1581,25700159
Schwarz's Bayesian Criterion (BIC)	1577,25700159

The information criteria are displayed in smaller-is-better form.[a]

a. Dependent Variable: MeanScience.

Coefficients of Determination

Pseudo-R Square Measures	Marginal	,005
	Conditional	,957

Fixed Effects

Type III Tests of Fixed Effects[a]

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	102,623	366,986	<,001
Year	1	150,026	7,977	,005
Year_kwadraat	1	127,954	11,619	<,001
PercFemTeachersSecEd	1	100,988	,141	,708

a. Dependent Variable: MeanScience.

Estimates of Fixed Effects[a]

						95% Confidence Interval
Parameter	Estimate	Std. Error	df	t	Sig.	Lower Bound
Intercept	463,490	24,194	102,623	19,157	<,001	415,504
Year	1,630	,577	150,026	2,824	,005	,490
Year_kwadraat	-,088	,026	127,954	-3,409	<,001	-,139
PercFemTeachersSecEd	,145	,385	100,988	,376	,708	-,619

Estimates of Fixed Effects[a]

	95% Confidence Interval
Parameter	Upper Bound
Intercept	511,476
Year	2,770
Year_kwadraat	-,037
PercFemTeachersSecEd	,909

a. Dependent Variable: MeanScience.

Covariance Parameters

Estimates of Covariance Parameters[a]

					95% Confidence Interval
Parameter	Estimate	Std. Error	Wald Z	Sig.	Lower Bound
Residual	90,975	11,982	7,592	<,001	70,277

Intercept + Year [subject = Name_Country]	Var(1)	2924,277	708,315	4,128	<,001	1819,037
	Var(2)	1,715	,601	2,855	,004	,863
	Corr(2,1)	-,844	,068	-12,499	<,001	-,935

Estimates of Covariance Parameters[a]

Parameter		95% Confidence Interval Upper Bound
Residual		117,770
Intercept + Year [subject = Name_Country]	Var(1)	4701,057
	Var(2)	3,407
	Corr(2,1)	-,650

a. Dependent Variable: MeanScience.