Project Report for Data Literacy 2023/24
Grade Inflation in the German School System - Causes and Effects

Jonathan Schwab [*1] **Lars Kasüschke** [*2] **Niklas Munkes** [*3] **Tom Freudenmann** [*4]

Abstract

Introduction

The Abitur grades have constantly increased in the German school system over the past decades. Every year, when the Abitur takes place, the grades and the difficulty of the exercises are extensively discussed in the media and have been part of a fierce research discussion for decades. The central focus of the discourse revolves around the question of whether grade inflation occurs, signifying a rise in grades without a corresponding increase in competence or knowledge.

The discourse has predominantly centred around mathematics, since the difficulty of exercises is easiest to compare. The line is drawn between mathematicians arguing that specific exercises are easier than exercises in the past (Kühnel, 2015) (Jahnke et al., 2014) (Lemmermeyer et al., 2019) and studies claiming that grade inflation cannot be reliably proven since the competence of students has also increased (Schleithoff, 2015). In 2015, a data-driven approach was employed, involving the analysis of comprehensive data on the education system. The analysis was promising, but not yet enough to neglect the claim of a grade inflation (Grözinger & Baillet, 2015).

This paper expands on that work, disproving the claim that grade inflation is the main cause of the observed trend. An explanatory framework for the improvement of Abitur grades is provided by this data analysis, building upon past research. All analysed data is taken from official federal resources such as the German Federal Statistics Office.

The study undertakes an analysis of the quantifiable impacts stemming from the upward trend in Abitur grades within the educational system. Prognostications are offered concerning the trajectory of future grade developments and the implications for the German education system.

Methods

The Pearson correlation coefficient (Rodgers & Nicewander, 1988), denoted as r, is a statistical measure used to assess the linear relationship between two sets of data, X and Y. It is computed as the ratio of the sample covariance of the X and Y to the product of their sample standard deviations:

$$r = \frac{\sum_{i=1}^{n}(X_i - \overline{X})(Y_i - \overline{Y})}{\sqrt{\sum_{i=1}^{n}(X_i - \overline{X})^2 \cdot \sum_{i=1}^{n}(Y_i - \overline{Y})^2}} \quad (1)$$

Datasets: The basis for the analysis of the German school system are the average final Abitur grades. The grades are published every year by the Kultusminister Konferenz. Each file contains the count of children per written grade and federal state. The grades are defined in 0.1 steps, with 4.0 as the worst and 1.0 as the best grade. Furthermore, the amount of children who failed with a grade worse than 4.0 is aggregated in an additional column.

The second dataset is provided in the *Fachreport Schuljahr 2020/21* of the Statistische Bundesamt and contains the number of teachers from 1992 until 2020. The dataset groups them primarily according to their contract type, federal state, and school type. This paper merges the teacher counts with two student datasets, which are published in the *Genesis* database of the Statistische Bundesamt. Both provide the number of students as different groupings and aggregations. The first contains the number of children per grade and school type for the years 1998 to 2022. In contrast, the second table provides the absolute amount of children, leavers, and beginners in each federal state from 1997 to 2022. Therefore, the analysis of the merged dataset can only be conducted separately for school types and federal states.

The dataset *Repeaters*, derived from the *GENESIS* Database of the Statistische Bundesamt, encompasses data spanning

[*]Equal contribution [1]Matrikelnummer 6765897, jonathan.schwab@student.uni-tuebingen.de, MSc Computer Science [2]Matrikelnummer 4247775, lars.kasueschke@student.uni-tuebingen.de, BSc Computer Science [3]Matrikelnummer 4269436, niklas.munkes@student.uni-tuebingen.de, MSc Media Informatics [4]Matrikelnummer 6631101, tom.freudenmann@student.uni-tuebingen.de, MSc Computer Science.

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from the academic year 1998/99 through 2022/23. It includes data on the number of repeaters categorized by federal state, year, school type, grade, and gender.

Figures Figure 1 presents a visualization of the Pearson correlation coefficients, analyzing the relationship between the number of students per teacher and the average number of repeaters, as well as the educational budget per state.

Initially, to compute the relative number of repeaters, the *Number of Repeaters* dataset is merged with the *school-children-by-state* dataset, grouped by *Federal State* and *Year* and the number of repeaters is divided by the total number of students. Subsequently this dataset is merged with the *budget* and the *students by teacher* dataset, using *Federal States* and *Years* as the common attributes for alignment.

Finally, for each state, the Pearson correlation coefficient was calculated across different years to ascertain the correlation between students per teacher and the budget, as well as the average amount of repeaters.

In order to visualize the data over the states a heatmap for the german federal states is created. Therefor the Pearson correlation coefficients are normalized to the used colormap scale. Each state receives the appropriate computed color then.

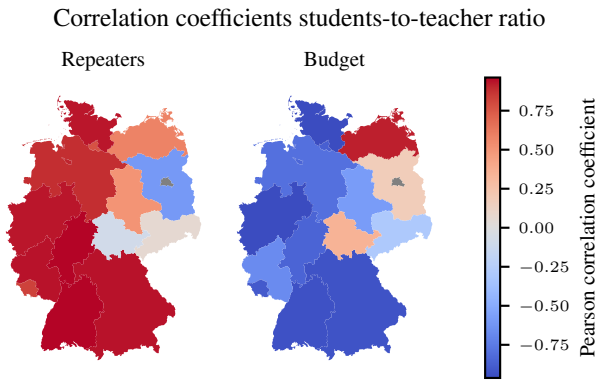

Figure 1. Pearson correlation coefficients between the student-to-teacher ratio and the relative repeater count (left) and the inflation-adjusted average budget per child (right). Red indicates positive, gray neutral, and blue negative correlations between the variables.

Results

Conclusion

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