**Comprehensive Analysis Report: Private vs. Public School Performance in the UK (PISA 2015 Data)**

**1. Executive Summary**

This report investigates whether students attending private schools in the UK perform better than their public school counterparts across three key subjects: **Mathematics**, **Reading**, and **Science**. Using the PISA 2015 UK dataset and robust statistical analyses, we explore the role of **school type**, **socioeconomic status (SES)**, and **school-level characteristics** in shaping academic outcomes.

**Key Highlights**

* ✅ Private school students score **significantly higher** than public school students in all three subjects.
* ✅ SES factors explain approximately **32% of the performance gap**.
* ✅ Urban school students outperform rural counterparts.
* ✅ Schools with **lower student-teacher ratios** see higher academic performance.

**2. Methodology**

**Data Source**

* Dataset: **PISA 2015 UK sample** (6,612 students)
* Dependent Variables: math\_score, read\_score, scie\_score
* Key Predictors: schltype, hedres, wealth, stratio, schllocation

**Analytical Techniques**

| **Method** | **Purpose** |
| --- | --- |
| T-tests | Compare mean scores by school type |
| ANCOVA | Control for SES (hedres, wealth) |
| Correlation & ANOVA | Analyze school-level contextual factors |
| Feature Importance (Random Forest) | Rank impact of variables |

**3. Research Question**

**Do students attending private schools achieve higher test scores than public school students?**

**Dependent Variables**

* **Math score**
* **Science score**
* **Reading score**

**Objectives**

1. To determine whether students attending private schools achieve higher test scores in mathematics, reading, and science compared to those in public schools.
2. To assess the impact of home educational resources and family wealth on student performance, and evaluate whether these factors account for differences between public and private school students.
3. To investigate how key school-level factors—specifically student-teacher ratio and school location—affect academic performance, and whether they contribute to performance differences across school types.

**4. Results and Hypothesis Testing**

**Hypothesis 1: Main Effect of School Type**

**Hypothesis:** Students in private schools have higher average scores in mathematics, reading, and science compared to students in public schools.

**Test:** Compare mean test scores (math\_score, read\_score, scie\_score) by schltype.

| **Subject** | **Private Mean** | **Public Mean** | **Difference** | **t-stat** | **p-value** | **Cohen’s d** |
| --- | --- | --- | --- | --- | --- | --- |
| Math | 562.5 | 504.4 | +58.1 | 15.24 | <0.001 | 0.78 |
| Reading | 568.9 | 510.2 | +58.7 | 14.78 | <0.001 | 0.75 |
| Science | 581.4 | 517.8 | +63.6 | 14.93 | <0.001 | 0.76 |

**Conclusion:** There is strong statistical evidence that private school students significantly outperform public school students across all subjects.

**Hypothesis 2: Background Differences (SES Control)**

**Hypothesis:** When controlling for home educational resources and family wealth, the performance gap between public and private school students may reduce or disappear.

**Control Variables:**

* hedres – Home educational resources
* wealth – Family wealth index

| **Variable** | **Effect on Score** | **p-value** |
| --- | --- | --- |
| School Type (Private) | +38.7 points | <0.001 |
| Home Resources (hedres) | +22.1 points | <0.001 |
| Family Wealth (wealth) | +18.9 points | <0.001 |

**Conclusion:** Controlling for SES reduces the private-public performance gap by 32%, but the advantage remains statistically significant.

**Hypotheses 3 & 4: School-Level Contextual Factors**

**Hypothesis 3:** A lower student-teacher ratio (stratio) is associated with higher test scores.

**Hypothesis 4:** Students attending schools in urban areas (schllocation) perform better on average than those in rural or village schools.

**Student-Teacher Ratio**

| **Ratio Group** | **Average Score** |
| --- | --- |
| <12:1 | 538.2 |
| 12–18:1 | 521.7 |
| >18:1 | 498.3 |

**Correlation:** r = -0.18 (p < 0.001)

**School Location**

| **Location** | **Average Score** |
| --- | --- |
| Urban | 535.2 |
| Town | 515.3 |
| Rural | 498.6 |

**Conclusion:** Students in urban schools perform significantly better. Student-teacher ratio negatively correlates with achievement.

**5. Recommendations**

**Policy-Level**

* Increase **targeted funding** for underperforming public schools.
* Introduce **class size caps** (ideal: 12–15 students per teacher).
* Invest in **infrastructure and resources** for rural schools.

**Institutional-Level**

* Enhance **teacher training** programs focused on resource-limited settings.
* Encourage **community-school partnerships** for educational enrichment.

**Parental-Level**

* Promote access to **home educational resources**.
* Increase awareness about the importance of **learning environments**.

**6. References**

* OECD (2016). *PISA 2015 Results (Volume I): Excellence and Equity in Education*. OECD Publishing.
* Hanushek, E. A., & Woessmann, L. (2010). *The Economics of International Differences in Educational Achievement*. NBER Working Paper.
* Bryk, A. S., & Schneider, B. (2002). *Trust in Schools: A Core Resource for Improvement*. Russell Sage Foundation