PISA TESTING, SPRING VS AUTUMN 2018: A FEASIBILITY STUDY

Sylvia Denner

Educational Research Centre 2023

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CONTENTS

1 INTRODUCTION

The Programme for International Student Assessment (PISA) is an assessment of the skills and knowledge of 15-year-olds in reading literacy, science and mathematics. It is a study of the Organisation for Economic Cooperation and Development (OECD). PISA has taken place every three years since 2000, with PISA 2018 being the seventh cycle. In each cycle, one domain is the major domain of assessment, and the remaining two areas are assessed as minor domains. Reading literacy was the major assessment domain in 2018 (with science and mathematics assessed as minor domains).

The 2018 cycle of PISA is the second full administration of the study on computer. PISA 2015 saw the transition to computer-based assessment in 57 of 72 participating countries/economies, including all 35 OECD countries. In PISA 2018, this increased to 70 of 79 countries/economies, including all 37 OECD countries. PISA 2018 builds on changes in the design and methodology of earlier cycles, and includes for the first time adaptive testing for reading literacy and machine-supported scoring with automatic coding of exact match student responses in reading literacy, science and mathematics.

The international PISA 2018 consortium, led by the Educational Testing Service (ETS) in the United States, was responsible for the implementation of PISA, under the direction of the OECD Education Secretariat, on behalf of the PISA Governing Board. In Ireland, PISA is implemented by the Educational Research Centre, on behalf of the Department of Education and Skills.

1.1 PURPOSE OF THIS STUDY

PISA is an age-based assessment and therefore students are distributed over different grades. In the most recent cycle of PISA (PISA 2018) approximately 62% of PISA eligible students in Ireland were in Third Year and a further 28% were in Transition Year (TY), while the remainder were distributed over First/Second (2%) and Fifth Years (8%) (McKeown et al., 2019). In Ireland, PISA has traditionally been administered in schools in March. This is the earliest feasible time permitted by the international project timeline. Yet March is a time of the school year when a range of State examinations-related activities are taking place. During the month of February, just prior to PISA spring testing, Third Year students sit in-house exams (mock exams). The completion of the second CBA[1] and Assessment Task could potentially result in added pressure for Third Year students in springtime. For example, in the academic year 2018/2019 the window for completing the Junior Cycle English, Science and Business Studies CBA 2 and Assessment Task was from 12th November 2018 to 15th March 2019 (NCCA, 2019). While March 15th was the end date, it is reasonable to assume that the period from the middle of November to middle of March is a demanding time for Third Year students, their teachers and their schools.

1 CBAs (Classroom-Based Assessments) relate to the students' learning during Second and Third Year of Junior Cycle education. They are similar to the formative assessment that occurs every day in every class. The CBAs are conducted in the Second and Third Year of the Junior Cycle, along with an Assessment Task which is completed after the second CBA, and is marked by the SEC.

Practical tests (in subjects such as Home Economics, Music, and Metalwork) are also typically scheduled during March/April, with the completion of project work in other subjects by April/May.

The other main group of students who participate in PISA are Fourth Year or Transition Year (TY) students. While there is much less of a focus on examinations and assessment in Transition Year compared with Third Year, there are pressures and demands on the staff and management of the school associated with the administration and delivery of TY. For example, as part of the TY programme, students may participate in school exchanges, community service and multi-week placements in the workplace which can create logistical problems when PISA testing is being planned.[2] One or more full weeks of work placement during the PISA testing window also means that there are fewer dates available when a school can schedule testing, potentially contributing to lower response rates. Other issues pose challenges for PISA fieldwork at this time of year. They include the scheduling of some sporting events, the timing of the Easter holidays, closure of schools around St Patrick's Day and the potential for other national/international surveys to be in the field in the springtime. Where a sizeable number of selected students are absent on the date on which PISA testing is scheduled, it may be necessary to run a second day of testing for those who are absent including TY students, to ensure that Ireland's response rates are in line with international standards. This results in an additional burden on the school, and additional test administration costs.

Other challenges that arise during spring testing concern the administration of PISA by the National Centre. Because PISA testing occurs in early spring, Ireland is often one of the first countries to receive the final version of the assessment software, the sampling software (Maple), coding software (OECS) and data management software (DME) and, hence experiences more 'bugs' in the system than countries testing later, for whom bugs will have been substantially reduced. This then adds to the pressures on the ERC to finalise and test materials in a very tight timeline.

Ireland is not unique in experiencing challenges associated with the administration of PISA in the early spring. For example, two northern hemisphere countries which moved their PISA testing from the spring to the autumn were the United States (US) and the United Kingdom (UK). The US had a poor school response rate in the 2003 cycle of PISA and, with permission from the PISA contractors, they supplemented their sample by conducting a second round of testing in the autumn of that year. An examination of the school average performance at these two time points revealed that performance on PISA in the autumn and the spring was not statistically significantly different (Ferraro, Kali and Williams, 2009). The UK, however, did not conduct any analysis on the impact of moving PISA testing from the spring to the autumn when they changed their testing window in 2006. For the PISA 2021 cycle, the Netherlands is planning to move to the autumn for testing, mainly due to the fact that many 15-year-olds in the lower levels of secondary education sit their final school examinations in May and prepare for them in the weeks before that. Another related issue that may have contributed to the move was that, in 2018, a number of students, parents and schools voiced objections to taking part

2 TY work experience may occur in autumn or spring, though it generally takes place in spring.

in PISA during the springtime (Dr. A.M.L. van Langen, personal communication, March 11, 2020).

In an Irish context, the impact of moving PISA testing from the spring to the autumn has not been examined and hence the need for this study.

Due to the nature of PISA, which is not a curriculum-based assessment and which uses an age-based sample, it may be possible to move the testing period to a different time in the calendar year, and this would not be expected to impact on performance in a negative way. The move would have some potential benefits to the school system, and for teachers and students insofar as a less busy time of year, such as autumn, may be more suitable. It would also be of some benefit to the ERC (the PISA National Centre for Ireland) in allowing more time for survey, test, and test delivery software preparation, finalisation and checking. However, such a move prompts the research question: '*if PISA testing were to be carried out at a different time in the year, what would be the impact, if any, on performance?*'

1.2 STUDY OBJECTIVES AND RESEARCH QUESTIONS

Overall objective of the present study

Holding sampling, procedural and test administration processes constant, the study seeks to assess whether or not there is any impact on PISA outcomes when the assessment is administered in the autumn compared with the spring.

Research questions

1. Are there any differences in response rates of schools and students in the autumn and spring samples?
2. How are PISA-eligible students distributed across grade levels in autumn compared with spring?
3. Are there differences in the overall average performance of students on PISA reading, mathematics and science in autumn compared with spring?[3]
4. Are there differences in the distributions of performance of students on PISA reading, mathematics and science in autumn compared with spring?
5. Are there differences in the performance of key sub-groups of students on PISA reading, mathematics and science in autumn compared with spring?

3 Subscales are produced for the main domain and therefore in 2018 there are only subscales in reading. Given the larger standards errors associated with subscale scores (making it more difficult to detect differences in performance on subscales than on overall scales), performance on subscales was not examined in the current study.

6. Are schools and test administrators more favourably disposed to PISA testing in the autumn?

7. From a national centre perspective, and from the experience of conducting PISA testing in the autumn, are there any administrative, operational or budgetary implications which pose potential risks to the integrity of the study, and if so, can these be mitigated?

1.3 IMPLEMENTATION OF PISA SPRING AND AUTUMN TESTING

The PISA 2018 Main Study (spring testing) was carried out in March and April 2018 and autumn testing was carried out in October and November 2018. This section will provide details of the methodology used in the study, highlighting the similarities and differences between the spring and autumn testing.

1.3.1 School and student sampling

The operational definition of the PISA age population directly depends on the testing dates; therefore, the age definition for the spring and autumn testing will differ in order for the age eligibility to remain constant. The spring testing period in Ireland was form 1st March 2018 - 20th April 2018 and so the eligible students were those with a date of birth between 1st January 2002 to 31st December 2002. The autumn testing period was from 15th October 2018[4] to 23rd November 2018, with the eligible student date of birth adjusted accordingly, i.e. 1st August 2002 to 31st July 2003.

The sampling of schools for both the spring and autumn testing was carried out by Westat, one of the organisations in the international PISA consortium. To manage cost and system burdens, the autumn study was administered as an *adjudicated entity*, additional to the primary adjudicated entity of the PISA 2018 MS study (spring testing). An additional adjudicated entity is a similarly defined population, for which the international contractor fully implements quality assurance and quality control mechanisms (OECD, 2017). The student sample size for the computer-based mode is a minimum of 6300 assessed students, and 2100 for an additional adjudicated entity with the school sample size resulting in a minimum of 150 participating schools for the Main Study, and 50 participating schools for additional adjudicated entities (OECD, 2017). This means that the adjudicated entity sample is representative, while being somewhat less precise than a full national sample.

In order to obtain nationally representative samples in PISA, stratification (both explicit and implicit) is used in the sampling process. In 2018, schools were grouped by enrolment size on the number of PISA eligible students (large, medium or small[5]) and sector (secondary, ETB/vocational[6], community/ comprehensive). Within each of the resulting nine groups or explicit strata, schools were ordered by the percentage of 15-year old female students in the school, and socioeconomic quartile, based on percentage of students in a school with

4 The PISA technical standards state that testing cannot start within the first six weeks of the academic year (OECD, 2017), September 1st was recorded as the first day of the academic year in Ireland.
5 Small schools had up to 45 PISA-eligible students, medium schools had between 46 and 85, and large schools had over 85.
6 Vocational schools, managed by the ETBs (Education and Training Boards).

a Junior Certificate examination fee waiver (the implicit stratifying variables). To maximise comparability of samples, the same stratification variables were used for both spring and autumn testing.

For the autumn testing, overlap control was required with respect to PISA spring testing, specifically because students in spring testing who were born between 1st August 2002 and 31st December 2002 could potentially be sampled in both studies if their school was selected for both samples. Sampling was carried out using a procedure called sampling Probability Proportional to Size (PPS). A representative sample of 157 schools in Ireland was selected to participate in PISA 2018 spring testing, and 57 schools were subsequently sampled for the autumn testing.

For the autumn testing, five schools initially required replacements[7] because, at the time of inviting schools to participate in the autumn testing, those schools had been selected to take part in the TIMSS Field Trial. It was decided not to overburden them by involving them in both the TIMSS Field Trial (in spring 2018) and the PISA 2018 autumn testing. Four of these five schools were replaced with either the first or second PISA replacement school (these are schools with similar sampling characteristics which are pre-identified in the sampling frame). In the case of the fifth school, both the first and second replacement schools had been in the spring PISA testing[8] and therefore could not take part. It was decided to contact this school when they had finished TIMSS field trial testing and invite them at that stage to take part in the PISA autumn testing, and the school accepted the invitation. In total 57 schools accepted the invitation to participate, including 4 replacement schools.

The second stage of sampling in PISA is the sampling of students within schools. The PISA contractors provided the software (KeyQuest) for individual countries to perform this task. For both the spring and the autumn testing, up to 44 PISA eligible students were selected at random from within each school to participate and were divided into two test sessions of up to 22 students.[9]

1.3.2 Personnel

As was the case in PISA 2015, PISA 2018 was administered solely on laptops hired and transported to schools for the assessment by technical support persons (due to the need for fully reliable and consistent testing conditions), with Department of Education and Skills Inspectors acting as lead test administrators, alongside support test administrators (mainly retired Inspectors and principals). The same company supplied the laptops for both testing periods. It was also the same technical support companies that worked for both testing periods; however, within one of these companies in the autumn testing there was one new technical support person who had never worked on the PISA assessment. To ensure the same standard of technical support was given, the new person's first day was monitored on-site.

7 Each sampled school in the spring and autumn studies was assigned two replacement schools from the school sampling frame. A replacement school is one above and one below the sampled school in the sampling frame. These schools are selected at the same stage as the sampled schools. Their characteristics are very similar to the sampled schools.

8 There was minimal overlap control with the spring testing which meant only overlap control with the sampled school and not the replacement schools.

9 In the spring testing seven schools had fewer than 44 15-year olds enrolled as had seven in the autumn testing; all students in such schools were selected.

The lead test administrators (13 in total) and support test administrators (16 in total) had all worked on the PISA project before, which ensured consistency with the administration of the project. Prior to both the spring and autumn fieldwork, test administrators and technical support personnel received standardised face-to-face training.

1.3.3 PISA assessment

Students in both PISA testing periods sat a 2-hour test session and the test content, design, delivery and administration procedures were the same across spring and autumn. The content of the PISA tests is established in consultation with national representatives and international panels of subject experts. Every student was assessed on reading literacy (the main domain in the 2018 cycle) in both spring and autumn studies, with fewer students receiving mathematics and science items. Students received various combinations of the domains according to a prescribed probability: 46% completed reading and science literacy items; 46% completed reading and mathematical literacy items and a further 8% completed one hour of reading literacy, 30 minutes of mathematical literacy and 30 minutes of science literacy items.

1.3.4 Scoring and Scaling

Scoring of the data for the spring testing was carried out in May-June 2019 and for the autumn testing it was carried out in November and early December 2019. The personnel recruited for scoring were mainly post-graduates from universities and as a result there were different personnel employed across the spring and autumn sessions. However, both sets of scoring personnel received equivalent training, supervision and support materials, and the software used (Open-Ended Coding System, OECS) monitored the reliability throughout the coding (scoring) process. The careful monitoring of coding reliability is important to ensure consistency within (multiple coding) and across (anchor coding) countries and to identify coding inconsistencies or problems early in the coding process so they can be resolved as soon as possible.

The level of agreement between two coders is represented by an index called inter-rater reliability. In PISA, inter-rater reliability represents the extent to which any two coders agree on how a particular response should be coded, and thus the comparability in how the coding rubric is being interpreted and applied. Inter-rater reliability will vary from 0 (no reliability or 0% agreement) to 1 (maximum degree of reliability or 100% agreement). The goal in PISA coding is to reach a within-country inter-rater reliability of at least 0.92 (92% agreement) across all items, with at least 85% agreement for each item. Achieving these levels of reliability for both testing periods in all domains[10] ensures consistency in the scoring process across the spring and autumn testing and justifies comparison of outcomes.

The data collected during both the spring and autumn testing were processed and scaled by the OECD's contractors, with the weights applied to students' responses based on the sampling process. The processing, scaling and weighting procedures were identical across spring and autumn.

10 Inter-rater reliability - spring testing: mathematics=98%, reading=94%, science=93%; autumn testing: mathematics=96%, reading=93%, science=92%.

1.3.5 Analysis

The analysis described in this report comprises descriptive statistics comparing results from the spring and autumn testing using IEA IDB Analyser. The IEA IDB Analyser applies a macro to the analysis and corrects the standard error to account for both measurement error (i.e., each student attempts only a portion of the total test item pool) and sampling error (i.e., in both spring and autumn, achievement estimates are based on samples of post-primary schools rather than the full population of post-primary schools).

Given that, insofar as possible, all procedures and testing conditions have been kept constant across the spring and autumn studies, the main caveat concerning the analyses in this study relates to the differences in the samples sizes (the autumn sample had 57 schools and the spring sample had 157 schools). The smaller autumn sample, although fully representative, is less precise, i.e. will give rise to somewhat larger standard errors in the autumn.

This issue is highlighted as relevant in the discussion of the results, and addressed in both the generation of standard errors[11] and, where relevant, adjustment of the alpha level (risk level/confidence level[12]). The 95% confidence interval (corresponding to an alpha level of .05) is the most commonly used level. Under this scenario, we can say that we are 95% confident that a difference observed is not occurring by chance. However, given the smaller sample size and slightly lower precision of the autumn study, we have expanded the interval in this analysis to 99% confidence (or alpha of .01)[13]. The use of the 99% confidence interval allows us a greater degree of certainty in detecting any differences. However, in interpreting differences, attention should be paid not only to the statistical significance but also to the absolute size of differences and whether these differences are important in substantive terms. To test for significant differences between the autumn and spring testing, the normal independent samples t-test was used.

11 Standard Errors measures the precision of estimates of population parameters by taking sampling error and the clustering of students in schools, into account.

12 Confidence level refers to the percentage of probability, or certainty, that the confidence interval would contain the true population parameter when you draw a random sample many times. Confidence Intervals (CI) indicates the range that's likely to contain the true population parameter, so the CI focuses on the *population*.

13 The 99%CI is used between the testing periods and 95%CI is used within the testing periods.

2 SAMPLE AND RESPONSE RATES

In both spring and autumn, school-level participation rates (once replacement schools were taken into account) were 100%.

Table 2.1 provides details of the student sample and response rates for the spring and autumn testing. In total, 5,577 students (82.5% unweighted) participated in the assessment in the spring testing, with a similar unweighted percentage for the autumn testing (82.0% or 1,988 students).

Similar percentages of students were deemed ineligible to participate (i.e. outside the eligible age definition or had left school; 0.9% for the spring sample and 1.4% for the autumn sample) and exclusion rates due to specified special educational needs were the same across the spring and autumn (3.8% and 3.7% for the spring and autumn samples, respectively). In the spring sample, 12.8% did not participate or were absent on the day on which the test was administered compared to 13.2% in the autumn sample. Of students who didn't participate or were absent on the day, 8.6% were withdrawn from the assessment by their parents in the spring sample compared to 7.0% in the autumn sample. There are no marked gender differences on participation and non-participation rates of students across assessment windows.

Overall, it can be concluded that the response rates at school and student levels are equivalent across spring and autumn.

Table 2.1. Unweighted numbers of participating, non-participating/absent, ineligible and excluded students in the PISA Spring 2018 and PISA Autumn 2018 samples, by gender.

	Students -Sampled	Students -Participated		Didn't Participate/ Absent		Ineligible		Excluded	
		N	% *	N	%	n	%	n	%
PISA Spring 2018									
All	6,761	5,577	82.5	868	12.8	59	0.9	257	3.8
Gender									
Male	3,413	2,800	41.4	434	6.4	36	0.5	143	2.1
Female	3,348	2,777	41.1	434	6.4	23	0.4	114	1.7
PISA Autumn 2018									
All	2,424	1,988	82.0	314	13.2	33	1.4	89	3.7
Gender									
Male	1,228	987	40.7	173	7.1	14	0.6	49	2.0
Female	1,196	1,001	41.3	141	5.8	19	0.8	40	1.7

The data in the table are unweighted. Percentages are relative to totals (e.g., based on 6,761 students overall in spring; 2,424 in autumn).

PISA is an age-based sample and the PISA eligible students are distributed over a number of the grades in post-primary schools. Table 2.2 presents the distributions of the unweighted numbers of PISA-eligible students and weighted percentages completing the spring and autumn assessments by grade. The PISA-eligible students in the spring sample are spread over five year levels with 2.0% in First/Second Year, 61.6% in Third Year, 27.9% in Transition Year and 8.5% in Fifth Year. This compares to 0.6% in First/Second Year, 26.4% in Third Year, 52.6% in Transition Year, 19.8% in Fifth Year and a further 0.7% in Sixth Year in the sample tested in the autumn. Therefore, in the autumn, a majority of students were in Senior Cycle, while in the spring, a majority were in Junior Cycle. However, most of those in Senior Cycle in the autumn study only had about 6 weeks experience at Senior Cycle. The spring/autumn differences in the distribution of PISA students across grade levels are to be expected, given the age-based sampling definition applied in PISA and is not of concern because PISA's objective is to assess the outcomes of the population of school-going 15-year-olds rather than the outcomes of students at a particular grade level. The overall mean scores for PISA 2018 spring and PISA 2018 autumn testing for the various grades are presented in Section 3.3.2.

Table 2.2. Unweighted numbers of students and weighted percentages in Ireland completing the PISA Spring 2018 and PISA Autumn 2018 assessment by grade.

	PISA Spring 2018		PISA Autumn 2018	
Grade	Unweighted number of students	Weighted percent	Unweighted number of students	Weighted percent
First/Second Year	116	2.0	13	0.6
Third Year	3,533	61.6	526	26.4
Transition Year	1,479	27.9	1,063	52.6
Fifth Year	449	8.5	374	19.8
Sixth Year	0	0.0	12	0.7

Table 2.3 presents the response rate of students within grade for the spring and autumn testing. Slightly higher percentages of sampled Fifth Years completed the assessment in the autumn compared to the spring (80.3% compared to 78.5% respectively). Similarly, of the sampled TY students, 83.2% completed the assessment in the autumn compared to 78.9% in the spring testing. However, examining the response rate for Third Year students, 85.7% of the sampled Third Year in the spring testing completed the assessment compared to 82.4% in the autumn testing.

Table 2.3 Unweighted numbers of participating, non-participating/absent, ineligible and excluded students in the PISA Spring 2018 and PISA Autumn 2018 samples, within grade

	Assessed		Absent		Excluded		Ineligible		Total Sampled	
	N	%	N	%	N	%	N	%	N	%
PISA Spring 2018										
All	5,577	82.5	868	12.8	59	0.9	257	3.8	6,761	100.0
Grade										
1st/2nd Year	116	59.8	33	17.0	37	19.1	8	4.1	194	100.0
Third Year	3,533	85.7	414	10.0	151	3.7	23	0.6	4,121	100.0
TY	1,479	78.9	321	17.1	56	3.0	18	1.0	1,874	100.0
Fifth Year	449	78.5	100	17.5	13	2.3	10	1.7	572	100.0
Sixth Year	0		0		0		0		0	
PISA Autumn 2018										
All	1,988	82.0	314	13.2	33	1.4	89	3.7	2,424	100.0
Grade										
1st/2nd Year	13	52.0	2	8.0	7	28.0	3	12.0	25	100.0
Third Year	526	82.4	67	10.5	38	6.0	7	1.1	638	100.0
TY	1,063	83.2	180	14.1	27	2.1	7	0.5	1,277	100.0
Fifth Year	374	80.3	61	13.1	17	3.6	14	3.0	466	100.0
Sixth Year	12	66.7	4	22.2	0	0.0	2	11.1	18	100.0

3 RESULTS

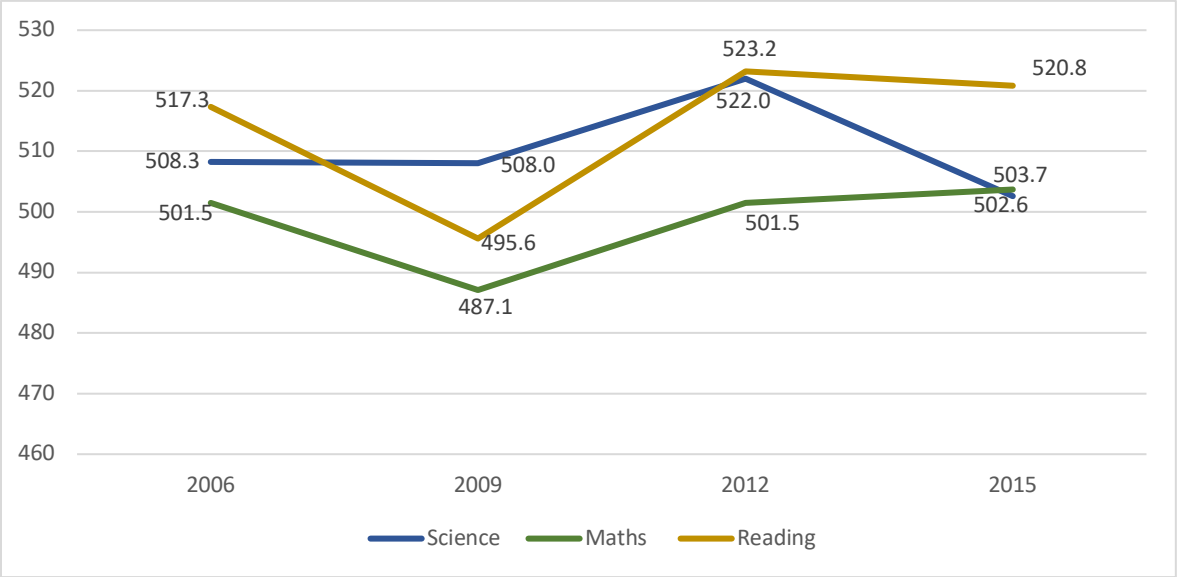
3.1 PAST PERFORMANCE IN PISA

From the 2006 cycle of PISA, all three domains had been scaled to the year when they were first a major domain (reading literacy was a main domain in 2000, mathematics in 2003 and science in 2006). Figure 3.1 presents the overall scores in reading, mathematics and science from 2006 to 2015. Excluding the 2009 cycle, Ireland's performance has been relatively stable. In Ireland, achievement in mathematics had a mean score of 501.5 in the 2006 cycle and a mean score of 503.7 in the 2015 cycle. Similarly, there is no significant difference between the mean score in reading literacy in 2006 and the mean score in the 2015 cycle (517.3 and 520.8 respectively). The mean score for science in the 2006 cycle was 508.3, with an increase to 522.0 in 2012, before falling to 502.6 in the 2015 cycle.

It is important to note that the 2009 results for Ireland saw substantial declines for reading and mathematics performance (Perkins, Cosgrove, Moran, & Shiel, 2012; LaRoche & Cartwright, 2010), with various reasons suggested for the declines including issues with the test design and scaling models used (e.g., Cosgrove & Cartwright, 2014; Sachse, Mahler & Pohl, 2019). However, in the sixth cycle of PISA (2015), the number of link items was increased. This allowed for greater construct coverage and reduced uncertainty in linking scales from cycle to cycle (OECD, 2017), helping to ensure that if fluctuations occur between cycle, they are more like to occur because of differences in performance rather than because of the design of PISA.[14] Results for reading and maths in the 2012 cycle returned to similar levels seen in the 2006 cycle. Also, the 2015 cycle saw the introduction of computer-based testing and, in the case of science only (the major domain), involved new interactive science items incorporating virtual experiments, which may have contributed to the decline in the performance of students in Ireland in science(Shiel et al., 2016). All of these interactive items were subsequently used in PISA 2018 science.

14 A further change introduced in PISA 2015 involved the computation of linking error based on participants' mean scores, whereas in earlier cycles, this had been computed based on item parameters.

Figure 3.1. Overall performance of PISA reading, mathematics and science literacy in Ireland from 2006-2015.



3.2 COMPARISON OF OVERALL PERFORMANCE (SPRING VS AUTUMN)

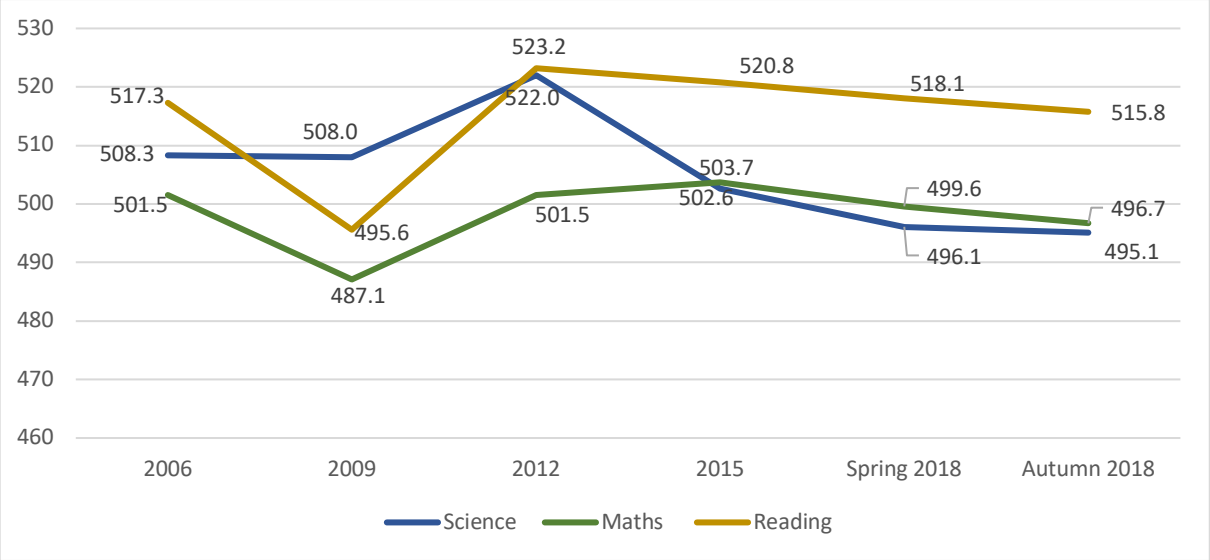
Table 3.1 presents the overall mean scores, standard deviations and standard errors for PISA 2018 spring testing and PISA 2018 autumn testing in reading, mathematics and science. The mean score for PISA 2018 spring testing on the reading scale is 518.1, compared to 515.8 for the PISA 2018 autumn testing. Using an adjusted alpha level of .01, the difference (2.3 score points) is not statistically significant, and is not substantively different either. Similarly, the mean mathematics score for PISA 2018 spring testing is 499.6 compared to 496.7 in the autumn, yielding a small 2.9 point difference which is not statistically significant. The mean score difference for science between the PISA 2018 spring testing and PISA 2018 autumn testing is just 1.0, and as with the other two domains, the difference is not statistically significant. Therefore, it can be concluded that there is no meaningful difference in the overall performance of students in Ireland on reading, mathematics and science in spring versus autumn administrations of PISA 2018. It is also worth noting that the distributions of scores, indicated by the standard deviation, are broadly similar in all three domains in spring and autumn.

Table 3.1. Overall mean scores, standard deviations and standard errors for PISA 2018 spring testing and PISA 2018 autumn testing, reading, mathematics and science.

	Reading				Science				Mathematics			
	Mean	SE	SD	SE	Mean	SE	SD	SE	Mean	SE	SD	SE
PISA Spring 2018	518.1	(2.2)	90.7	(1.0)	496.1	(2.2)	88.3	(1.2)	499.6	(2.2)	77.8	(1.0)
PISA Autumn 2018	515.8	(4.1)	92.0	(2.0)	495.1	(4.0)	88.3	(1.7)	496.7	(3.6)	81.9	(1.6)
Score difference (spring-autumn)												
	Diff	**SE Diff**			**Diff**	**SE Diff**			**Diff**	**SE Diff**		
	2.3	(4.7)			1.0	(4.5)			2.9	(4.2)		

Figure 3.2 plots the overall mean scores in the three domains, reading, science and mathematics across all cycles from 2006 to 2018, including spring and autumn testing in 2018.

Figure 3.2 Overall performance of PISA reading, mathematics and science literacy in Ireland from 2006-2015, including PISA 2018 spring and autumn testing.



3.3 COMPARISON OF OVERALL PERFORMANCE BY SELECTED KEY VARIABLES

Student performance on reading literacy in spring and autumn is examined in this section with reference to selected background variables: student gender, student socio-economic status, school gender composition, school fee-paying status and school DEIS status.

3.3.1 Gender

The mean score for males in the PISA 2018 spring testing on the reading scale is 506.4 compared to 503.1 for males in the PISA 2018 autumn testing. This small 3.3 score-point difference is not statistically significant at the 99% CI (Table 3.2). Similarly, the 0.9-point difference in reading between females in spring 2018 and autumn 2018 testing is not statistically significant (529.6 and 528.7 respectively). The gender gap in reading has widened slightly from 23.2 to 25.6 points.

Table 3.2. Mean scores and standard errors for PISA 2018 spring testing and PISA 2018 autumn testing reading, mathematics and science by gender.

		Reading		Science		Mathematics	
Gender	%	Mean	SE	Mean	SE	Mean	SE
PISA Spring 2018							
Male (ref.)	49.7	506.4	(3.0)	495.4	(3.0)	502.6	(2.9)
Female	50.3	**529.6**	(2.5)	496.9	(2.6)	496.7	(2.7)
PISA Autumn 2018							
Male (ref.)	50.4	503.1	(5.7)	492.7	(5.6)	493.4	(4.9)
Female	49.6	**528.7**	(4.0)	497.6	(4.0)	500.1	(3.8)
Score difference (spring- autumn)							
		Diff	**SE Diff**	**Diff**	**SE Diff**	**Diff**	**SE Diff**
Male		3.3	(6.5)	2.7	(6.3)	9.3	(5.7)
Female		0.9	(4.7)	-0.8	(4.7)	-3.4	(4.6)

Significant differences in **bold**.

Table 3.2 also presents the means scores for science broken down by gender for both testing periods. The mean score for males in the PISA 2018 spring testing on the science scale is just 2.7 points higher (495.4) compared to autumn (492.7). The score difference on the science scale for females between both testing periods was 0.8 and is not statistically significant. The gender gap in science has widened slightly from 1.5 to 4.9 points.

Finally, Table 3.2 presents the mathematics scores for males and females for both testing periods. While there is a 9.3 point difference for males between PISA 2018 spring testing and PISA 2018 autumn testing (502.6 and 493.4 respectively), the difference is not significantly different. The score difference for females, 3.4 points, is also not significant. The gender gap in mathematics has changed from males achieving a non-significantly higher score in the spring to females performing better, though not significantly so, in the autumn.

3.3.2 Grade

PISA-eligible students are distributed over a number of the grades in post-primary schools. Third Year students accounted for 61.6% of students in the PISA 2018 spring testing compared to only 26.4% of students in the PISA 2018 autumn testing. In contrast, TY students accounted for 27.9% in the PISA 2018 spring testing and this increased to 52.6%

when testing is carried out in the autumn. Table 3.3 shows the mean scores for PISA 2018 spring testing and PISA 2018 autumn testing on reading, mathematics and science, by grade.

While students in Third Year scored significantly lower in the autumn testing compared to the spring testing across all three domains (score differences of 16.1 in reading, 12.5 in science and 19.3 in mathematics), it must be noted that the comparison is not like with like (and, as noted earlier, PISA is not designed to assess performance associated with a particular grade level).

Two points worth noting. Firstly, there is over a 50% drop in the proportion of students in Third Year from the PISA 2018 spring testing to the PISA 2018 testing (61.4% to 26.4%). Secondly, Third Year students in spring 2018 have had 4-5 months of additional schooling and the experience of completing mock exams, compared to Third Year students assessed in autumn 2018.

Table 3.3. Mean scores and standard errors for PISA 2018 spring testing and PISA 2018 autumn testing, reading, mathematics and science by grade.

		Reading		Science		Mathematics	
Grade	**%**	**Mean**	**SE**	**Mean**	**SE**	**Mean**	**SE**
PISA Spring 2018							
First / Second Year	2.0	**436.1**	(10.9)	**431.1**	(11.1)	**434.2**	(9.4)
Third Year	61.6	**517.0**	(2.4)	**494.7**	(2.5)	**497.7**	(2.2)
Transition Year (ref.)	27.9	534.6	(3.2)	510.2	(3.2)	514.4	(3.4)
Fifth/Sixth Year	8.5	**491.1**	(5.5)	**476.0**	(4.7)	**480.9**	(5.0)
PISA Autumn 2018							
First / Second Year	0.6	**416.5**	(25.9)	**400.1**	(24.3)	**399.7**	(26.5)
Third Year	26.4	**500.9**	(5.2)	**482.1**	(5.1)	**478.4**	(5.1)
Transition Year (ref.)	52.6	536.0	(4.7)	512.3	(4.8)	515.2	(3.6)
Fifth/Sixth Year	20.5	**485.9**	(8.2)	**470.5**	(8.1)	**475.5**	(7.4)
Score difference (spring- autumn)							
		Diff	**SE Diff**	**Diff**	**SE Diff**	**Diff**	**SE Diff**
First / Second Year		19.6	(28.1)	31.0	(26.8)	34.6	(28.1)
Third Year		**16.1**	(5.7)	**12.5**	(5.6)	**19.3**	(5.5)
Transition Year		-1.5	(5.6)	-2.2	(5.8)	-0.8	(5.0)
Fifth/Sixth Year		5.2	(9.9)	5.5	(9.4)	5.4	(9.0)

Significant differences in **bold**.

Examining the overall results for the PISA 2018 spring testing compared to PISA 2018 autumn testing, Transition Year students scored significantly higher than students in all other grades on all three domains in both test windows.

3.3.3 Student Socio-economic Status

Students' economic, social and cultural status (ESCS) is a known predictor of student achievement and is associated with significant differences in student performance across many PISA countries and economies (OECD, 2016a). In PISA 2018, the ESCS index[15] was derived from three variables: home possessions (a composite of cultural, educational and material possessions, and books in the home), parental occupation, and parental education.[16] Higher scores on the ESCS index indicate higher student economic, social and cultural status. The average score for the PISA 2018 spring testing was 0.13 compared to 0.14 for the autumn testing period.

As noted, PISA testing in the autumn began six weeks after the summer holidays; however, there is a possibility, owing to differential rates of summer learning loss, that PISA testing in the autumn may have a greater negative impact on students in lower socio-economic environments. In a widely-cited meta-analysis by Cooper et al. (1996), summer learning loss was equated to about one-tenth of a standard deviation in test scores on average; was greater for mathematics than for reading; and was greater for children of lower-income than higher-income families.[17] However, more recent research, involving children in kindergarten to 8th grade, which has used longitudinal analysis techniques (Kuhfield, 2020), has shown that the extent of summer learning loss is associated with the size of gains made in the previous school year.

Very little research on summer learning loss has been carried out in Ireland and the research that was conducted in the US mainly involved children in the early years of schooling (primary schools). In 2007/2008 the ERC took advantage of the existence of data[18] already collected as part of the development of a test for diagnosing reading difficulties among young school children (Weir & Archer, 2011). The study found that, contrary to expectations, significant gains rather than losses were observed overall. Furthermore, students in SSP/DEIS[19] schools showed larger average gains between spring and autumn that those in non-SSP/DEIS schools. The authors noted that there are other issues at play in their methodology that may have impacted on the outcomes (e.g., half of the students took an alternate form of the test, practice effects may have had some impact).

Table 3.4 shows the mean scores for PISA 2018 spring and autumn testing in reading, mathematics and science by ESCS quartile. The ESCS quartile corresponds to the original, continuous ESCS scale split into four roughly equal groups. Students in the lowest quartile of ESCS on the reading scale in PISA 2018 autumn testing did not score significantly differently from students in the lowest quartile of ESCS in PISA 2018 spring testing (482.3 and 479.3 respectively). Similarly, students in the lowest quartile of ESCS on the science and mathematics scales in PISA 2018 autumn testing did not score significantly differently

15 In 2018, a small number of changes were made to improve the measure of ESCS, including equal weighting of all components, scores assigned to parents in education, in receipt of welfare, or at home (previously treated as missing), and country-specific parameters assigned for several international home possession items. However, in the present analysis, the ESCS scores of the spring and autumn 2018 cohorts are fully equivalent.

16 Full details of the components of the ESCS may be found in the PISA 2018 Technical Report (OECD, 2020, in press).

17 The studies focused mainly on kindergarten to grade 8 children

18 Pupils in 39 schools took a standardised group test of reading ability on two occasions, initially at the end of First class (typically aged six to seven) as part of the development of a diagnostic test, and again at the beginning of Second class to investigate summer learning

19 Delivering Equality of Opportunity in Schools (DEIS) is the Action Plan for Educational Inclusion and provides for a standardised system for identifying levels of disadvantage and an integrated School Support Programme (SSP).

from students in the lowest quartile of ESCS in PISA 2018 spring testing (460.0 compared to 458.3 on the science scale and 466.9 compared to 463.4 on the mathematics scale). This analysis does not provide evidence of a differential impact of testing in spring versus autumn on students in the lowest SES quartile, or in other SES quartiles.

Table 3.4. Mean scores and standard errors for PISA 2018 spring testing and PISA 2018 autumn testing, reading, mathematics and science by ESCS Quartile

		Reading		Science		Mathematics	
Quartiles of ESCS	**%**	**Mean**	**SE**	**Mean**	**SE**	**Mean**	**SE**
PISA Spring 2018							
Lowest (ref)	25.0	482.3	(3.0)	460.0	(3.3)	466.9	(3.1)
Low-Medium ESCS	25.0	**510.0**	(3.0)	**487.4**	(2.9)	**491.4**	(2.5)
Medium-High ESCS	25.0	**527.4**	(2.9)	**506.8**	(2.8)	**509.0**	(2.8)
Highest	25.0	**556.7**	(3.0)	**533.6**	(3.4)	**533.9**	(3.2)
PISA Autumn 2018							
Lowest (ref)	25.0	479.3	(6.1)	458.3	(6.3)	463.4	(5.3)
Low-Medium ESCS	25.0	500.6	(5.1)	480.1	(5.1)	483.5	(4.7)
Medium-High ESCS	25.0	**531.4**	(5.2)	**509.2**	(5.3)	**509.1**	(5.0)
Highest	25.0	**554.1**	(5.1)	**534.4**	(4.8)	**532.2**	(4.3)
Score difference (spring-autumn)							
		Diff	**SE Diff**	**Diff**	**SE Diff**	**Diff**	**SE Diff**
Lowest		3.0	(6.8)	1.7	(7.1)	3.5	(6.1)
Low-Medium ESCS		9.4	(5.9)	7.3	(5.9)	7.8	(5.3)
Medium-High ESCS		-4.1	(5.9)	-2.4	(6.0)	-0.2	(5.7)
Highest		2.6	(5.9)	-0.8	(5.9)	1.7	(5.4)

Significant differences in **bold**. See Appendix B, Table B1 for mean scores by ESCS quartile, spring and autumn

3.3.4 School Gender Composition

In Ireland, schools are categorised into five types based on sector and gender composition: girls' secondary, boys' secondary, mixed secondary, community/comprehensive, and ETB vocational. Table 3.5 shows the mean scores for students in each school category for the PISA 2018 spring and PISA 2018 autumn testing on the reading, mathematics and science literacy scales.

Across four of the five school types compared, mean scores in spring and autumn are very similar. However, in the case of mixed secondary schools, mean scores were higher in spring than autumn by some 23-25 score points in each domain. Although these differences are not statistically significant, they represent differences in the region of a quarter of a standard deviation. It should be noted that the numbers of mixed secondary schools (28 in spring and 10 in autumn) are small.

Table 3.5. Mean scores and standard errors for PISA 2018 spring testing and PISA 2018 autumn testing, reading, mathematics and science by School Type and Gender Composition.

		Reading		Science		Mathematics	
School type	**%**	**Mean**	**SE**	**Mean**	**SE**	**Mean**	**SE**
PISA Spring 2018							
Girls' secondary	21.2	**541.7**	(3.5)	**506.6**	(3.8)	**506.6**	(3.9)
Boys' secondary	15.0	511.1	(6.0)	**498.8**	(5.5)	**510.0**	(5.6)
Community/ comprehensive	16.9	507.6	(3.8)	488.3	(4.0)	492.2	(4.2)
Mixed secondary	17.4	**536.0**	(7.7)	515.0	(7.7)	**517.4**	(6.5)
ETB vocational (ref)	29.5	500.0	(4.2)	480.5	(4.0)	483.2	(3.9)
PISA Autumn 2018							
Girls' secondary	19.2	**538.4**	(7.5)	504.4	(8.4)	507.7	(7.9)
Boys' secondary	15.9	515.3	(11.3)	503.6	(10.6)	508.2	(10.0)
Community/ comprehensive	17.5	516.6	(6.5)	497.6	(5.1)	494.4	(4.8)
Mixed secondary	19.0	511.5	(13.4)	492.2	(13.5)	494.4	(11.4)
ETB vocational (ref)	28.3	503.1	(7.0)	484.6	(6.8)	485.8	(5.5)
Score difference (spring- autumn)							
		Diff	SE Diff	Diff	SE Diff	Diff	SE Diff
Girls' secondary		3.3	(8.3)	2.2	(9.2)	-1.1	(8.8)
Boys' secondary		-4.2	(12.8)	-4.8	(11.9)	1.7	(11.5)
Community/ comprehensive		-9.0	(7.6)	-9.3	(6.5)	-2.3	(6.4)
Mixed secondary		24.5	(15.5)	22.9	(15.5)	23.0	(13.2)
ETB vocational		-3.1	(8.1)	-4.1	(7.9)	-2.6	(6.7)

Significant differences in **bold.** Mean ESCS scores by school type and gender composition are given in Appendix B, Table B2.

3.3.5 School Fee-paying Status

In their reports on PISA, the OECD distinguishes between 'public' and 'private' schools based on the governance of schools rather than on funding. In Ireland, a distinction can be made between schools whose students pay fees and those whose students do not. Table 3.6 presents the mean scores on the reading, mathematics and science literacy scales for the PISA 2018 spring and PISA 2018 autumn testing periods. While there is a large score difference on the reading scale (11.6) for students in fee-paying schools between the spring and autumn testing periods, the difference is not significant; in any case it should be noted that only 7.0% of students in the spring sample and 5.3% in the autumn sample were classified as attending fee-paying schools.

Likewise, performance on the science and mathematics scales is not significantly different

between the two testing periods for students in fee-paying schools. Similarly, students in non-fee-paying schools achieved at similar levels in both the PISA 2018 spring and PISA 2018 autumn testing. Within these testing periods, students in non-fee-paying schools performed significantly below students in fee-paying schools in all domains in both the PISA 2018 spring and PISA 2018 autumn testing.

Table 3.6. Mean scores and standard errors for PISA 2018 spring and PISA 2018 autumn testing, reading, mathematics and science by students attending fee-paying and non-fee-paying schools.

		Reading		Science		Mathematics	
Fee-paying status	**%**	**Mean**	**SE**	**Mean**	**SE**	**Mean**	**SE**
PISA Spring 2018							
Fee-paying	7.0	**567.8**	(7.8)	**548.5**	(10.5)	**540.9**	(8.0)
Non fee-paying (ref.)	93.0	514.4	(2.1)	492.2	(2.0)	496.5	(2.2)
PISA Autumn 2018							
Fee-paying	5.2	**556.2**	(8.6)	**543.4**	(9.6)	**535.3**	(8.3)
Non fee-paying (ref.)	94.8	513.6	(4.3)	492.5	(4.1)	494.6	(3.7)
Score difference (spring-autumn)							
		Diff	**SE Diff**	**Diff**	**SE Diff**	**Diff**	**SE Diff**
Fee-paying		11.6	(11.6)	5.0	(14.2)	5.6	(11.5)
Non fee-paying		0.8	(4.8)	-0.3	(4.6)	2.0	(4.3)

Significant differences in **bold**.

3.3.6 School DEIS Status

Table 3.7 presents the mean scores for reading, mathematics and science in the PISA 2018 spring and PISA 2018 autumn testing by students attending DEIS and non-DEIS schools. Consistent with the analyses of ESCS shown in Table 3.4, students in DEIS schools did not score significantly differently in the PISA 2018 spring testing compared to the PISA 2018 autumn testing on any of the three domains (a score difference of 0.3 in reading, 4.8 in science and 0.9 in mathematics). Similarly, students in non-DEIS schools did not score significantly differently in the PISA 2018 spring testing compared to the PISA 2018 autumn testing on any of the domains with the score differences very alike (score differences of 1.9 in reading, 1.2 in science and 2.7 in mathematics).

Table 3.7. Mean scores and standard errors for PISA 2018 spring and PISA 2018 autumn testing on reading, mathematics and science, by students attending DEIS and non-DEIS schools.

		Reading		Science		Mathematics	
School DEIS status	**%**	**Mean**	**SE**	**Mean**	**SE**	**Mean**	**SE**
PISA Spring 2018							
Non-DEIS (ref.)	75.9	530.4	(2.5)	506.0	(2.6)	510.2	(2.4)
DEIS	24.1	**479.2**	(4.8)	**465.0**	(4.7)	**466.4**	(4.5)
PISA Autumn 2018							
Non-DEIS (ref.)	74.4	528.5	(3.7)	507.1	(3.5)	507.5	(3.4)
DEIS	25.6	**478.9**	(6.5)	**460.3**	(6.3)	**465.4**	(5.0)
Score Difference (spring-autumn)							
		Diff	**SE Diff**	**Diff**	**SE Diff**	**Diff**	**SE Diff**
Non-DEIS		1.9	(4.5)	-1.2	(4.3)	2.7	(4.2)
DEIS		0.3	(8.0)	4.8	(7.9)	0.9	(6.8)

Significant differences in **bold**.

3.4 PROFICIENCY LEVELS

To interpret what students' scores mean in substantive terms, the OECD has divided the scales into levels of proficiency. The reading scale in the 2018 cycle of PISA has been divided into eight levels of proficiency, with each level indicating the types of tasks that students would be expected to complete successfully.[20] PISA 2018 describes seven levels of proficiency for the overall science literacy scale which define the skills, abilities and competencies that students scoring within specific score ranges are likely to demonstrate. The descriptors around the science proficiency levels were established when PISA Science was a major assessment domain in 2015. Six proficiency levels were used to report on mathematics performance in PISA 2018. The levels are the same as those established for PISA 2012, and subsequently used in PISA 2015 and range from Level 1 to Level 6.

Students performing below Level 2 are often referred to as lower-achieving students or low performers and are considered by the OECD as being below a baseline level of proficiency in literacy required to enable successful participation in education and work (OECD, 2019). In contrast, the term 'high achievers' is often used to describe the combined percentages of students at Levels 5 and 6. The Department of Education and Skills' National Strategy, Literacy and Numeracy for Learning and Life 2011-2020 (interim review) (DES, 2017, p. 10) includes targets for reading and mathematics in 2020 based on PISA. For example, one of the targets for reading for 2020 is to reduce the percentage of 15-year-olds below Level 2 to 8.5%, and for mathematics, this target is 10.5%. However, these targets based on fixed percentages do not take into account measurement error (McKeown et al., 2019).

20 For full details of the proficiency levels, see OECD (2019).

Table 3.8 presents the percentages of students performing below Level 2 (low achievers), performing at Level 3 and 4 (average achievers), and performing at Level 5 and above (high achievers) on the reading, mathematics and science scale for PISA 2018 spring and PISA 2018 autumn testing.

Table 3.8. Percentages of students at three cut-points on the proficiency levels (below Level 2, Level 3 and 4 and Level 5 and above), for PISA 2018 spring and PISA 2018 autumn testing, reading, mathematics and science

	Reading		Science		Mathematics	
	%	SE	%	SE	%	SE
PISA Spring 2018						
Below Level 2	11.8	(0.7)	17.0	(0.8)	15.7	(0.8)
Level 3 and 4	76.1	(0.7)	77.1	(0.9)	76.1	(0.8)
Level 5 and above	12.1	(0.7)	5.8	(0.6)	8.2	(0.7)
PISA Autumn 2018						
Below Level 2	12.4	(1.4)	17.3	(1.5)	18.1	(1.7)
Level 3 and 4	76.2	(1.3)	77.3	(1.4)	73.3	(1.6)
Level 5 and above	11.3	(1.1)	5.4	(0.8)	8.6	(0.9)
Score Difference (spring-autumn)						
	Diff	**SE Diff**	**Diff**	**SE Diff**	**Diff**	**SE Diff**
Below Level 2	-0.6	(1.5)	-0.3	(1.7)	-2.4	(1.9)
Level 3 and 4	-0.1	(1.4)	-0.2	(1.7)	2.8	(1.8)
Level 5 and above	0.8	(1.3)	0.4	(0.9)	-0.4	(1.2)

Significant differences in **bold**.

The percentage point difference for each of the three levels considered between spring and autumn testing on PISA reading and science is less than 1% (see bottom section of Table 3.8). However, while there are larger percentage point differences between spring and autumn on PISA mathematics, the differences are not statistically significant either. The percentage point difference on the PISA mathematics for students below Level 2 between PISA 2018 spring and PISA 2018 autumn testing is 2.4%; it is 2.8% for levels Level 3 and 4 just 0.4% for at or above Level 5 category. Therefore, overall, performance on the PISA proficiency levels is comparable across spring and autumn, with some evidence of slightly, though not significantly, more students at or below Level 2 on PISA mathematics in autumn compared with spring.

3.4.1 Proficiency Levels by gender

Table 3.9 clarifies the differences presented in Table 3.8 by comparing performance on proficiency levels in spring and autumn separately for boys and girls. In general, differences are small and not statistically significant. However, in the case of mathematics, there are significantly more males scoring at or below Level 2 in the autumn than in the spring. This difference is significant at the 95% confidence level but not the 99% level. This

suggests that the difference observed in Table 3.8 is mainly attributable to the somewhat lower performance of boys on mathematics in the autumn relative to the spring, as the performance of girls on mathematics is consistent across spring and autumn.

Table 3.9. Percentages of students at three cut-points on the proficiency levels (below Level 2, Level 3 and 4 and Level 5 and above), for PISA 2018 spring and PISA 2018 autumn testing, reading, mathematics and science by gender.

	Reading				Science				Mathematics			
	Male		Female		Male		Female		Male		Female	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
PISA Spring 2018												
Below Level 2	15.1	(1.0)	8.5	(0.7)	18.1	(1.2)	16.0	(1.1)	15.7	(1.1)	15.7	(1.1)
Level 3/4	74.6	(1.0)	77.6	(0.9)	75.2	(1.2)	79.1	(1.3)	74.4	(1.2)	77.7	(1.0)
Level 5 and above	10.3	(0.9)	13.8	(0.8)	6.8	(0.8)	4.9	(0.6)	9.9	(0.9)	6.6	(0.8)
PISA Autumn 2018												
Below Level 2	17.6	(2.2)	7.2	(1.1)	19.9	(2.1)	14.7	(1.6)	21.4	(2.5)	14.7	(1.6)
Level 3 and 4	72.5	(2.0)	80.0	(1.5)	74.1	(2.0)	80.5	(1.8)	68.9	(2.5)	77.8	(1.6)
Level 5 and above	9.8	(1.3)	12.8	(1.5)	6.0	(1.1)	4.8	(1.0)	9.7	(1.2)	7.5	(1.1)
Score Difference (spring- autumn)												
	Diff	**SE Diff**	**Diff**	**SE Diff**	**Diff**	**SE Diff**	**Diff**	**SE Diff**	**Diff**	**SE Diff**	**Diff**	**SE Diff**
Below Level 2	-2.5	(2.4)	1.4	(1.3)	-1.8	(2.4)	1.3	(2.0)	-5.7	(2.8)	1.0	(1.9)
Level 3 and 4	2.0	(2.2)	-2.4	(1.7)	1.1	(2.3)	-1.5	(2.2)	5.5	(2.8)	0.0	(1.9)
Level 5 and above	0.5	(1.6)	1.0	(1.7)	0.7	(1.4)	0.2	(1.1)	0.2	(1.5)	-1.0	(1.4)

Significant differences in **bold**.

4 TEST ADMINISTRATORS' VIEWS ON AUTUMN TESTING

As part of ongoing monitoring of the administration of PISA, the ERC invited test administrators (TAs) to complete a short survey about their views on, and suggestions for improvements to, training and administration for future cycles. As part of the present study, test administrators were asked about their preference for testing in either the spring or autumn and reasons for this preference. Of the 29 TAs who assisted in the administration of the autumn testing, 22 TAs responded to the survey.

Table 4.1 presents the preferences given by test administrators based on their previous experience of test administration in PISA. Ten of the TAs indicated that they had 'no preference', 12 of them ticked that they would prefer to test in the autumn and none of them had a preference to test in the spring, based on their previous experience of test administration.

Table 4.1 Test Administrators' preferences for time of PISA testing based on their previous experience of test administration in PISA

TA preference	N	%
No preference	10	45.4
Prefer to test in the spring	0	0.0
Prefer to test in the autumn	12	54.6

Figure 4.1 presents some of the reasons given by the TAs who indicated that they had 'no preference'. Of the ten Test Administrators who indicated that they had 'no preference' only four gave a reason. The first two reasons noted in Figure 4.1 would appear to be general comments (with the second one related to weather conditions – Storm Emma occurred in the first week of PISA testing in spring 2018); the third acknowledges the autumn being a less busy time to the spring and the last one recognises that in the springtime there are orals, practical exams and the timing of Easter to consider.

Figure 4.1 Reasons given by Test Administrators who indicated 'no preference' for time of PISA testing

'the lack of knowledge about PISA'

'Unusual circumstances in Spring of 2018 led to a little more concern re: transport etc. However acceptable'

'Schools less busy in the Autumn but early set up better in the Spring'

'Timing should take into account national assessment such as orals and practical exams. Late March and April would be preferable depending on the timing of Easter'

Figure 4.2 presents the reasons given by Test Administrators who indicated a preference to 'test in the autumn'. While a number of the TAs indicated that the autumn time is 'less hectic', they also mentioned that, as the schools have less going on in the autumn, there was 'a somewhat friendlier "reception" for PISA' and that there might be a 'better chance of greater participation rates'.

Figure 4.2 Reasons given by Test Administrators who indicated a preference 'to test in the autumn

'Schools appeared to be less busy...'

'..less hectic in the autumn..'

'It was a little calmer...'

'Less busy and challenging time of the school year in general and for the school personnel involved'

'There are an awful lot of activities taking place in schools in the spring'

'..more settled time. Better chance of greater participation rates'

The cohort seemed more engaged... less disruption to the overall school..'

'...autumn is better suited and allows for maximum availability of students and least disruption'

'...there was a somewhat friendlier "reception" for PISA at that time of the school year.'

Test administrators were presented with a number of situations and were asked to think about them in relation to testing in the spring compared to the autumn. For example, nearly two thirds of the test administrators said there was no difference in the level of school support between the autumn and spring testing periods, with the majority of the remaining TAs saying that it was better in the autumn (36.4%). Similar percentages were reported for overall school engagement, with 54.5% reporting no difference between the spring and autumn testing and 45.5% reporting better overall school engagement in the autumn. Over three-quarter of the TAs reported that there was no difference in how well prepared the school contact (school coordinator) was for the testing. Finally, in relation to

student engagement, 63.6% of the TAs reported no difference with student engagement between the spring and autumn testing, with a further 36.4% reporting that students were more engaged in the autumn compared to the spring.

Table 4.2 Comparison of the PISA spring and autumn testing in relation to four areas – views of test administrators

How would you compare PISA testing in spring to autumn in relation to the following?	**Better in the autumn**		**No difference**		**Better in the spring**	
	N	%	N	%	N	%
School support for PISA in general.	8	36.4	13	59.1	1	4.5
Overall school engagement (e.g., on the test date).	10	45.5	12	54.5	0	0.0
Preparedness of school contact for the testing.	4	18.2	17	77.3	1	4.5
Student engagement with the PISA test and questionnaire.	8	36.4	14	63.6	0	0.0

5 IMPACT OF CHANGES TO TIMELINE

This section examines the main areas of impact on changing PISA testing from the spring to the autumn in relation to the three key groups involved in the administration of PISA in Ireland. An overview of the autumn testing timeline and potential challenges can be found in Appendix A.

SCHOOLS

For schools, the impact of the change in test window would result in a shift in the time frame for administrative tasks from the busy spring period between mocks and state oral and practical exams, to the first six weeks of the school year. Schools would be required to update the list of PISA-eligible students by mid-September. This up-date would involve receiving the list of PISA-eligible students who were in their school the previous academic year from the ERC, during the first week of September. Schools would be asked to check all the students on the list and ensure that they are in the correct grade and programme of study. This will be easier for some schools where all the Third Year students move into Transition Year, or all into Fifth Year. For other schools there will be more checking required (Third Year students moving to either TY or Fifth Year). PISA-eligible students not in the school in the previous school year would have to be added to the list, and those who were no longer enrolled in the school would need to be identified.

Once sampling of students had been completed and schools had received their list of sampled students, the nominated school contact person would be responsible for liaising with the ERC and the test administrator on SEN exemptions and plans for testing, and informing students and their parents of the administration of PISA in their school.

Transition Year work experience, typically scheduled for the spring, though sometimes occurring in autumn, would be less likely to impact on participation in autumn. Other school events in relation to sports and preparation for state exams would be less likely in the months of October and November.

If testing occurs in the autumn, the main challenge for schools will be to have completed updating the list of PISA-eligible students by the middle of September.

STUDENTS

For students and their parents, a shift to autumn testing might be less stressful, as PISA would not be competing with other assessments such as mocks or school-based assessments.

DEPARTMENT OF EDUCATION AND SKILLS (DES)

For the DES, consideration needs to be given to Inspectors' availability for both test administrator training in early September and for the testing window of mid-October to mid-November.

EDUCATIONAL RESEARCH CENTRE (ERC)

For the ERC, a shift to autumn testing would result in a longer run into the PISA Main Study after the Field Trial in the spring of the previous calendar year. The longer timeframe to inform and prepare schools in late spring for testing in the following autumn could be of further benefit.

With autumn testing, Ireland would not be one of the first countries to receive the final version of their assessment software, and would use later versions of the sampling software (Maple), coding software (OECS) and data management software (DME). Many, though not all, bugs will would have been eliminated in advance of their use by the national centre if the testing occurs in the autumn as opposed to the spring.

There would, however, be a few challenges for the ERC with moving the testing from the spring to the autumn. The first concerns the administration tasks required by the ERC before testing. The ERC need to receive the up-dated list of PISA-eligible students from the schools as early as possible in September so that the list can be imported into the Within School Sampling Software (Maple), students within schools can be sampled, and student lists, login forms and labels for questionnaires can be generated, printed and packed and sent back out to schools before testing begins. While there is a potential risk in these tasks not being completed on time, with additional resources (e.g., hiring of extra part-time personnel) this could be overcome.

The second challenge for the ERC would be after the testing, to ensure that the coding process is be completed with time for data to be checked and submitted. The submission date will be sometime in January of the calendar year following autumn testing. Data are submitted in three batches to the PISA contractors during the year of testing; the first batch is usually in July and this includes all countries conducting their testing early in the spring of the year. However, if countries miss this deadline, they can submit with the second batch around September time. The challenge with autumn testing is that the data can only be submitted with batch three and there is no later time. With the Christmas closure in the ERC, all tasks related to coding, data checking and data submission will need to be completed in a timely manner (i.e., by early to mid-January), with no room for delay.

Finally, the hiring of coders for the PISA 2018 autumn study was more difficult than for the PISA 2018 spring study, so recruitment procedures would need to be reviewed if consideration was been given to conducting PISA in the autumn for future cycles.

6 SUMMARY OF FINDINGS

The overall objective of this study was to establish whether or not there is any impact on PISA outcomes when the PISA assessment is administered in the autumn compared with the spring, holding sampling, procedural and test administration processes constant.

This section provides a short summary of findings for each of the seven research questions of the study.

1. ***Are there any differences in response rates of schools and students in the autumn and spring samples?***
   The analysis indicated that school participation rates are the same across the spring and autumn. Furthermore, there are no differences in the overall school or student response rates. In spring 2018, the unweighted student response rate was 82.5%, and it was 82.0% in the autumn of 2018. Non-participation rates for different reasons (ineligibility, withdrawal, special educational needs, unexplained absence) were equivalent across spring and autumn.

2. ***How are PISA-eligible students distributed across grade levels in autumn compared with spring?***
   As would be expected in an age-based study such as PISA, moving the testing window from the spring to the autumn results in a different distribution of students across grade levels. In spring 2018, 63% of students were in Junior Cycle (almost all of these in Third Year) and 37% were in Senior Cycle. In autumn 2018, 27% of students were in Junior Cycle (again, largely Third Year) and 73% were in Senior Cycle. In the autumn testing situation, a majority of students in Ireland are not in an 'exam year', whereas in the spring testing, three in five PISA students are approaching their Junior Certificate examinations and completing a range of Classroom-based assessments.

3. ***Are there differences in the overall average performance of students on PISA reading, mathematics and science in autumn compared with spring?***
   There are no differences in the overall mean performance of students on all three PISA domains of reading, mathematics and science. The score-point differences observed, ranging from around 1 to 3, are marginal and of no substantive or statistical significance.

4. ***Are there differences in the distributions of performance of students on PISA reading, mathematics and science in autumn compared with spring?***
   An analysis of performance on reading, mathematics and science on the PISA proficiency levels across spring and autumn 2018 (split into below Level 2, Levels 2-4, Levels 5 and above) indicates that the differences are not statistically significant. In reading and science, differences in these percentages are all under 1%; in mathematics, 2.4% more students scored below Level 2 in autumn compared to spring, though this difference is not statistically significant. Comparing genders, there are significantly more males scoring at or below Level 2 in mathematics in the

autumn than in the spring. This difference is significant at the 95% confidence level but not the 99% level.

5. ***Are there differences in the performance of key sub-groups of students in PISA reading, mathematics and science in autumn compared with spring?***
   The performance of students who took part in PISA in the spring and autumn was compared for key sub-groups. It was found that performance was consistent by gender (although with a slight increase in the gender gap for reading and science and a reversing of gender for maths), student ESCS (socio-economic) status, school DEIS status, school fee-paying status and school sector/gender composition. An exception to this is the comparatively higher scores in reading, maths and science in spring compared to autumn of students in mixed secondary schools. Although not statistically significant, differences across domains are in the region of a quarter of a standard deviation. These can be attributed to the fact that the numbers of mixed secondary schools in the spring and autumn samples are small.

6. **Are schools and test administrators more favourably disposed to PISA testing in the autumn?**
   Based on responses from 22 of the 29 test administrators who conducted fieldwork in both spring and autumn, views, broadly speaking, tended to fall into two camps: one view was that autumn testing was preferable, most commonly because it was a less busy time for schools; the other view was no preference for testing in spring or autumn. In no case was spring testing was preferred over autumn testing.

7. ***From a national centre perspective, and from the experience of conducting PISA testing in the autumn, are there any administrative, operational or budgetary implications which pose potential risks to the integrity of the study, and if so, can these be mitigated?***
   The main administrative challenge for schools will be in the first week of September to update the list of PISA eligible students that they will have received from the ERC. There is a quick turn-around required for this task and the ERC will need to respond to any queries the schools may have in a timely manner (and vice versa). The main challenges for the ERC relate to the completion of administrative tasks prior to testing (sampling students, preparing, printing and packing all paperwork before testing begins), coder recruitment, the coding timeline and data processing activities (data checking and submission), which the ERC believes are feasible to overcome. On the plus side, moving to the autumn provides more time to complete the pre-fieldwork activities of translation, software testing and training. From ERC's perspective, moving from spring to autumn will be largely budget neutral, although some additional temporary staff may need to be hired (e.g., additional persons to pack parent questionnaires, additional coders to that coding can occur simultaneously across domains).

7 CONCLUSIONS AND RECOMMENDATIONS

This section presents the conclusions and recommendations that can be drawn from the implementation and analysis of the 2018 autumn Feasibility Study in comparison with the spring 2018 administration of PISA.

7.1 CONCLUSIONS

Conclusions cover three broad areas: overall implementation; performance of students tested in the spring compared to the autumn; and views of test administrators on testing in spring and autumn.

7.1.1 Overall implementation of the study

The PISA 2018 Main Study, implemented in March-April, 2018 was successfully replicated in a smaller yet fully representative sample of schools in October-November, 2018. Test administrators, including Inspectors of the Department of Education and Skills, technical support staff, and ERC staff successfully implemented all aspects of the autumn study. It can be concluded, from an operational and budgetary point of view, that PISA can be implemented in autumn, bearing in mind that, in a Main Study, there would be larger number of schools and students, compared with the Feasibility Study.

7.1.2 Performance

The data indicate that there are no statistically significant differences in the overall performance of students on reading literacy, mathematics and science, or on the distribution of performance across proficiency levels, between the spring and autumn administrations. This is consistent with earlier research conducted by the US Department of Education (Ferraro, Kali and Williams, 2009). The conclusion that performance on PISA is likely to be stable, whether it is administered in spring or autumn, is further supported by the finding that there were no significant differences in performance across spring and autumn testing when school-level variables such as DEIS status and fee-paying status, and student-level variables such as economic, social and cultural status and gender, are examined.

While the distribution of students by grade level changed between spring and autumn testing (since PISA uses an age-based sample), with more students in TY and in Fifth/Sixth Years in autumn, compared with spring, and fewer students in Third Year, these changes did not impact on performance.

It can be concluded that the overall performance of students in Ireland on reading literacy, mathematics and science is unlikely to differ significantly, whether PISA is implemented in spring or autumn in a given cycle.

7.1.3 Test administrator views on autumn vs spring testing

Several test administrators were of the view that autumn testing suited schools better than spring testing, as, in general, there is less pressure on schools and students in autumn, compared with spring. In no case was spring testing preferred over autumn testing. When test administrators were asked about overall school engagement, 54.5% reported no difference between the spring and autumn testing and a further 45.5% reporting better overall school engagement in the autumn. A transition to autumn testing for PISA may suit schools and students to a greater extent than spring testing.

7.2 RECOMMENDATIONS

Based on these aforementioned conclusions, it is therefore recommended that the DES given serious consideration to changing the PISA testing window from spring to autumn for PISA 2021. The Department will need to work through the various implications with the ERC and other partners and stakeholders to facilitate a decision being taken by end Q2 2020, if possible, as preparations for PISA 2021 spring testing are scheduled to begin soon afterwards.

- A consideration of the content of Appendix A, which lists key tasks associated with PISA and any challenges associated with them in spring and autumn, will facilitate this discussion.

Notwithstanding the need to implement this recommendation as early as possible in the PISA 2021 timeline, there is merit in further examining:

- the change in achievement patterns of boys on mathematics in spring and autumn testing,
- changes in the performance of students in mixed secondary schools in reading, mathematics and science between these testing windows, and
- the small achievement differences in reading, mathematics and science among students in Transition Year between spring and autumn, and, conversely, between autumn and spring.

7.3 LIMITATIONS OF THE STUDY

This section notes two of the main limitations to this study. Firstly, as mentioned previously, relates to the differences in the samples sizes (the autumn sample had 57 schools and the spring sample had 157 schools). The smaller autumn sample, although fully representative, is less precise, i.e. will give rise to somewhat larger standard errors in the autumn. Secondly, the findings of this study were based on reading as a major domain and mathematics and science as minor domains for both the spring and autumn testing. In recent cycles, the distinction between major and minor domains has begun to become less distinct, with much larger numbers of items used for minor domains. However, it is difficult to determine whether the findings would be similar if mathematics was the major and the other two the minor domains, as will be the framework for PISA 2022.

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APPENDIX A: AN OVERVIEW OF THE AUTUMN TESTING TIMELINE AND POTENTIAL CHALLENGES

Table A1: Pre-summer tasks

Task	Challenge?
Student lists for the academic year requested from the Dept. In September these list will be from the previous academic year e.g., student list from the academic year 2017-2018 for testing in the academic year 2018-2019.	No anticipated difficulty with this task.
Selection of and notification to schools of PISA participation in the MS.	No anticipated difficulty with this task.
Regional co-ordinators appointed (ERC staff).	No anticipated difficulty with this task.
Contact with schools – tasks to include, the selection of test date with principal, nomination of School Contact	Potential difficulty near the end of the school year and state exams.
Preparation of online tool for School Contact	No anticipated difficulty with this task.
Communications with School Contact – including provision of list of tasks and School Contact manual.	Potential difficulty – near end of year and this task is reliant on identification and briefing of the School Contact by the principal BEFORE third term ends.
• By the beginning of the summer all schools need to be signed up to participate in the study, with an agreed test date confirmed by the principal, and a nominated school contact person.	

Table A2: Summer tasks

Task	Challenge?
SDS testing (Student Delivery System- is a self-contained set of applications for delivery of the PISA computer-based assessments (CBA) and student questionnaires.).	No anticipated difficulty with this task.
Preparation of training materials for Test Administrators and Technical Support.	No anticipated difficulty with this task.
Preparation of manuals.	No anticipated difficulty with this task.
Conduct Test Administrator and Technical Support training.	Potential difficulty, as based on availability of Test Administrators (Inspectors mainly) in September of PISA autumn testing.
Translation and reconciliation of all GLE (Irish language) materials and GLE version of SDS.	No anticipated difficulty with this task.
Questionnaire build using software.	No anticipated difficulty with this task.

Preparation of parent packs No anticipated difficulty with this task.
• At the end of the summer, all translation tasks must be complete, the questionnaire build must be finalised, all manuals checked and verified, training materials finalised, and testing of the SDS should have taken place.

Table A3: Post-summer tasks

Task	Challenge?
Send out the School Contact manual	Potentially difficult if not done pre-summer. May result in additional queries from schools.
Update of student list from previous year by contacting schools, first week back from summer break.	Difficult to complete in the timeframe, it may take up to 2-3 weeks. Requires an effort on part of administrative staff, SC, and principal in each school.
Draw sample of students.	Potentially difficult if updated student lists are not returned by schools. Greater level of dependence on schools than when up-to-date lists are provided by the DES. (Student lists are provided for the previous academic year)
Send out the parent packs to schools after drawing the sample of students.	Potentially difficult if updated student lists are not returned by schools.
Contact School Contact for student SEN exemptions (including foreign language student exemptions).	Usually okay but requires communication between ERC regional co-ordinator and School Contact for each school. Can be a time consuming task.
• The main issue post summer is the updating of the student list in time to draw the sample and label all materials (including parent questionnaires) in advance of the test window. However, some of this difficulty can be avoided if schools are contacted and made aware before the summer break of the schedule of tasks.	

Table A4: Post-testing tasks

Task	Challenge?
Data tasks pre-coding	Potentially pressured as the soonest testing can start is the 15th October and, with a mid-term break at the end of October, testing will go well into the month of November, leaving very little time for preparation for coding.
Coding	Potentially difficult due to data submission date and Christmas closure.
Data processing	Potentially difficult to process all tasks pre and post-coding.
• With testing extending into November, data processing tasks post-testing and post-coding are likely to be under some pressure, given Christmas closure.	

APPENDIX B: SUPPLEMENTARY DATA TABLES

Table B1: Mean ESCS scores by ESCS quartile, spring and autumn

		Spring		Autumn	
	%	Mean	SE	Mean	SE
Lowest	25.0	-1.01	(0.01)	-1.01	(0.03)
Low-Medium ESCS	25.0	-0.16	(0.00)	-0.11	(0.01)
Medium-High ESCS	25.0	0.50	(0.00)	0.53	(0.01)
Highest	25.0	1.19	(0.01)	1.16	(0.02)

Table B2: Mean ESCS scores for students by school type and gender composition, spring and autumn

	Spring		Autumn	
	Mean ESCS	SE	Mean ESCS	SE
Girls Secondary	0.29	(0.06)	0.15	(0.07)
Boys Secondary	0.13	(0.07)	0.26	(0.09)
Community/Comprehension	-0.01	(0.05)	0.23	(0.09)
Mixed Secondary	0.31	(0.07)	0.18	(0.12)
Vocational	-0.03	(0.03)	-0.01	(0.05)


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