The evaluation of DEIS at post-primary level: An update on trends over time in achievement and retention levels

Laura McAvinue and Susan Weir

Educational Research Centre

The evaluation of DEIS at post-primary level: An update on trends over time in achievement and retention levels.

Laura McAvinue and Susan Weir

2015

The evaluation of DEIS at post-primary level:

An update on trends over time in achievement and retention levels.

The Educational Research Centre has been evaluating the impact of the DEIS programme on participating schools on behalf of the Department of Education and Skills (DES) since the programme began in 2007. The availability of centrally-held data on students' performance in state examinations and on retention levels at post-primary level has made it possible to examine changes over time in these variables for all post-primary schools. An earlier evaluation report (Weir, McAvinue, Moran, & O'Flaherty, 2014) described principals' views of DEIS, including their views on planning and resourcing under the programme, used data provided by the Teacher Education Section of the DES to examine schools' uptake of educational programmes (e.g., JCSP) under DEIS, and used other data provided by the DES to examine change over times in retention levels, performance in the Junior Certificate Examination, and rates of medical card possession among students enrolled in DEIS post-primary schools. In the report's conclusion, Weir et al. (2014) noted:

> Outcome data, including student retention levels and performance in the Junior Certificate Examination, reveal increases in both since the programme was introduced. Although not clear cut, there are indications that progress in these outcome measures may be associated with the introduction of DEIS. These outcome data require further monitoring in the future, and it will be important to examine (insofar as the data allow), the relationship between implementation levels and outcomes. It is planned to prepare brief updates on outcomes such as retention and examination performance as further datasets become available (Weir et al., 2014, p55).

While the DES publishes fairly regular reports on retention at second level [see, for example, DES (2015) for the most recent report], the analyses here differ in that they involve longitudinal studies of trends in Junior and Leaving Certificate retention as well as Junior Certificate examination performance. Since Weir et al.'s (2014) report was published, the longitudinal analyses have been extended to include an additional year of data for Junior Certificate and Leaving Certificate retention (the 2008 entry cohort), and three additional years of data on Junior Certificate results (for the 2012, 2013 and 2014 examination cohorts).

Data are presented for 703[1] schools, including 200 schools which were enlisted into the DEIS School Support Programme (SSP[2]) in the year 2006/2007 and 503 which did not participate in

---

[1] Only schools that have data for **all years** over the time period of the trend analysis are included. Therefore, newer schools will not be included in these analyses.

the SSP. The data describe trends over time in relation to academic achievement (i.e., Junior Certificate Overall Performance Score; Junior Certificate English and Junior Certificate Maths) and retention levels (i.e., retention to Junior Certificate and retention to Leaving Certificate). The data were analysed with a view to establishing whether there were any significant trends across time in each of the variables for all schools, whether rates of change differed for SSP and non-SSP schools and whether the introduction of the DEIS programme in 2006/2007 had any impact on trends across time.

The use of the linear mixed model in the current analyses

Data were analysed using a statistical technique known as a linear mixed model. A detailed explanation of this technique is provided in Appendix 1. In brief, a linear mixed model is a statistical technique that is suitable for the analysis of longitudinal data. Essentially, it is an augmented regression model, which enables the regression of a dependent variable of interest upon time, while accounting for the serial dependency that arises due to the longitudinal nature of the data. In the current analysis, the linear mixed model was used to examine trends over time for all 703 post-primary schools (described as 'Effect of Time / Cohort'). In addition, a time-invariant covariate, signifying whether schools were in the SSP or not, was added to examine whether the two kinds of school had significantly different average levels of performance or retention ('Effect of SSP status') and whether they experienced different rates of change over time ('Time / Cohort X SSP status Interaction'). Finally, to examine whether or not the introduction of DEIS had any impact on the trends for SSP schools, a time varying covariate, signifying the presence of DEIS resources in schools from 2008 on was added to the model ('Time / Cohort X DEIS resources Interaction').

---

[2] Schools are referred to here as SSP and non-SSP, although the terms DEIS and non-DEIS normally tend to be used to distinguish between schools that are and are not in the programme.

Achievement in the Junior Certificate Examination

Junior Certificate Overall Performance Score (OPS)

Student performance in the Junior Certificate Examination (JCE) is described here using an Overall Performance Scale (OPS) score which has been adopted directly from that used by Kellaghan and Dwan (1995) in their analysis of the 1994 Junior Certificate results. The OPS scale involves the allocation of numerical values to the alphabetical grades awarded to candidates, which when summed, produce an index of a candidate's general scholastic achievement (Table 1). The OPS score is based on a student's performance in the seven subjects in which he or she performed best. The maximum possible OPS score is 84 (which is achieved by a student who is awarded seven "A" grades on Higher Level papers), while the lowest possible OPS score is 0 (where a student fails to achieve at least a grade "F" on any of his/her best seven papers). The OPS score is considered to be a useful broad measure of a candidate's achievements in the JCE.

Table 1. Individual overall performance scale (OPS) scores corresponding to grade categories at each examination level.

Higher	Ordinary	Foundation	OPS score
A			12
B			11
C			10
D	A		9
E	B		8
F	C		7
	D	A	6
	E	B	5
	F	C	4
		D	3
		E	2
		F	1

Figure 1 depicts the mean OPS in the JCE over a thirteen year period from 2002 to 2014. Separate lines represent average scores for all schools in the sample, SSP schools and non-SSP schools.
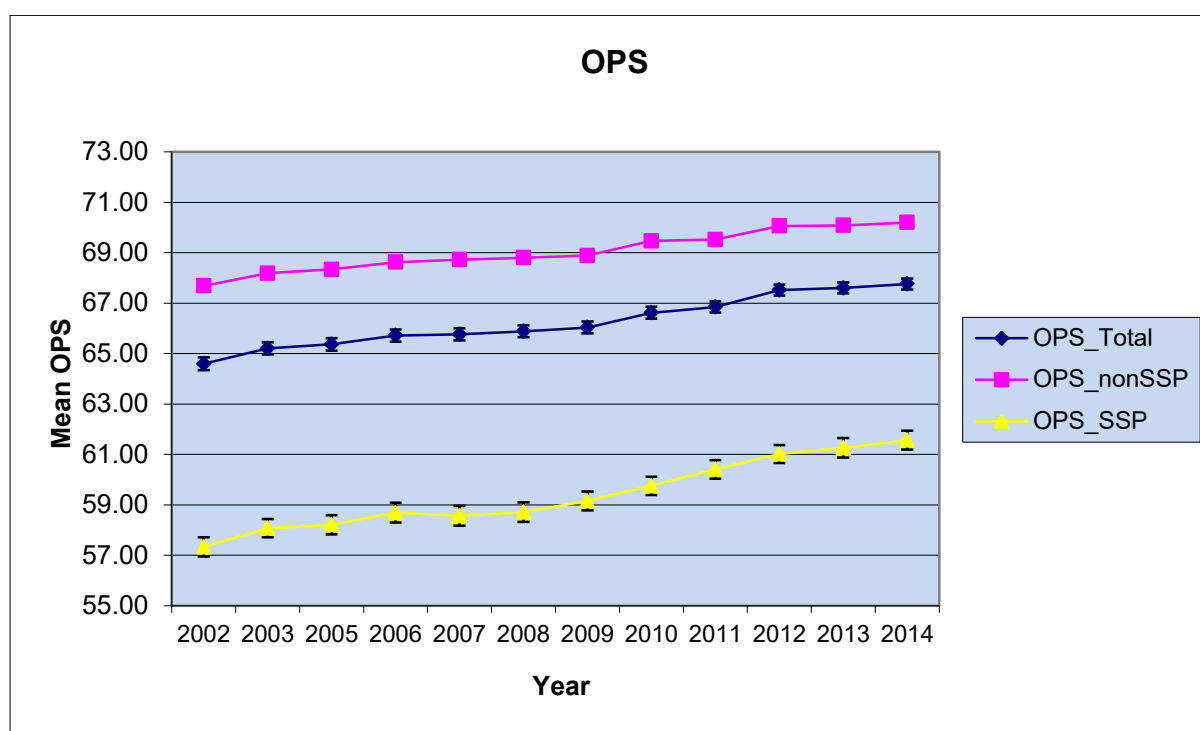

Figure 1. Mean OPS from 2002 to 2014 for all schools, SSP schools and non-SSP schools[3].

Trends over time

When all schools were considered, the Linear Mixed Model indicated that there was a significant positive linear trend in average OPS across time [Effect of Time: $F(1, 674.7) = 646.79$, $p < .001$]. According to the model, the OPS for all schools increased on average by .26 points per year between 2002 and 2014. There was also a significant gap between the two kinds of school in terms of OPS across the time period [Effect of SSP status: $F(1, 693.87) = 866.47$, $p < .001$]. For example, in 2002, the average OPS in non-SSP schools was 10.5 points higher than the average for SSP schools. There was, however, also evidence of significantly differing trends for SSP and non-SSP schools [Time x SSP status interaction: $F(1, 668.08) = 44.42$, $p < .001$], with the increase in OPS with each passing year estimated as being .15 points greater for SSP than for non-SSP schools. Specifically, non-SSP schools were estimated as beginning with an average OPS of 67.83 in 2002 and increasing each year

---

[3] As was the case in the report by (Weir et al., 2014), examination data are missing for 2004 for all analyses.

by .22 points while SSP schools were estimated as beginning with an average OPS of 57.33 in 2002 and increasing each year by .37 points.

Impact of DEIS resources

To examine the impact of the introduction of DEIS in 2006/2007 on the trend in OPS over time, a time varying covariate (DEIS resources), which indicated the presence of SSP resources from 2008 on, was included in the model for SSP schools. The analysis revealed that there was, indeed, a significant increase in the magnitude of the positive trend (by .18 points) following the introduction of DEIS resources [Time x DEIS resources interaction: F (1, 624.26) = 8.33, p = .004]. Specifically, this model suggested that between 2002 and 2007, OPS increased by an average of .3 points per year and that this increased to an average of .48 points per year from 2008 on. A similar analysis conducted for the non-SSP schools indicated no such impact of the time varying covariate [Time x DEIS resources interaction: F (1, 1577.45) < 1].

Junior Certificate English Scores

Figure 2 presents the mean English scores for all schools, SSP schools and non-SSP schools for the years 2002 to 2014 (missing 2004).
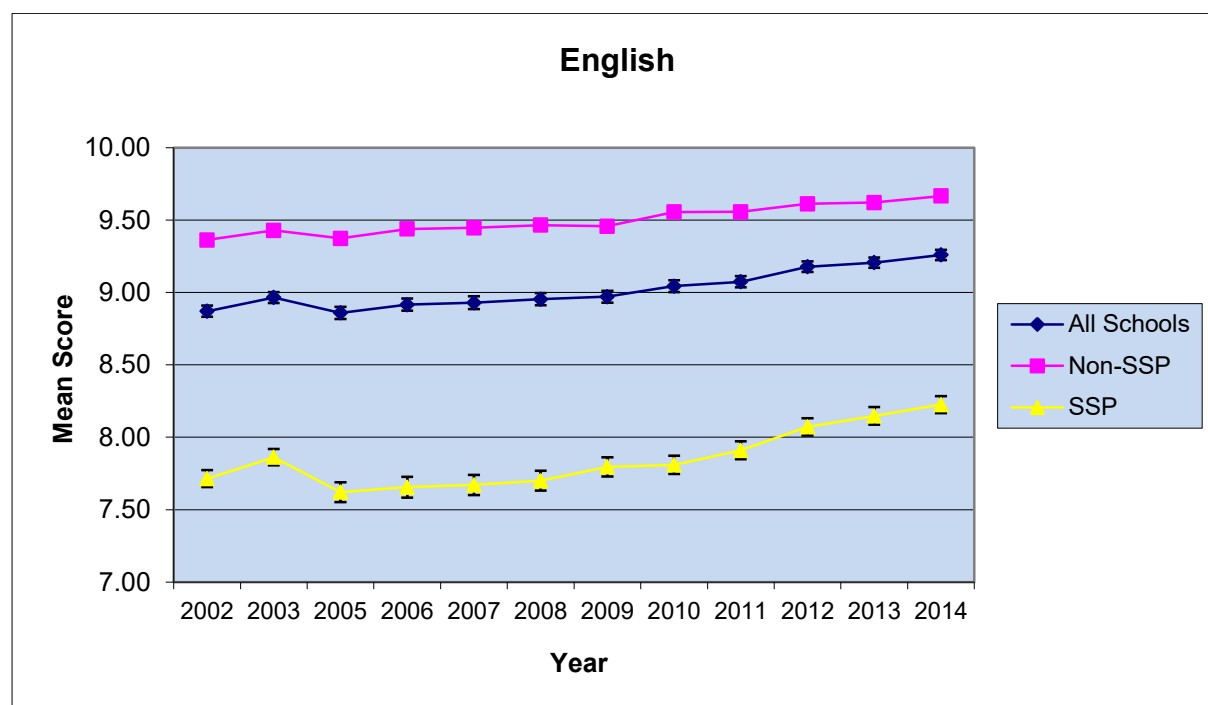

Figure 2. Mean English Scores from 2002 to 2014 for all schools, SSP schools and non-SSP schools.

Trends over time in English

When all schools were considered, the Linear Mixed Model indicated the presence of a significant positive trend over time [Effect of Time, $F(1, 677.35) = 307.86$, $p < .001$], with the average English score estimated to be increasing in a linear fashion by .03 points each year. The model also confirmed the existence of a significant gap between the English scores of SSP and non-SSP schools [Effect of SSP status, $F(1, 694.08) = 922.48$, $p < .001$]. In 2002, non-SSP schools were estimated to have an average English score that was greater than that of SSP schools by 1.75 points.

There was also evidence of significantly different trends over time for SSP and non-SSP schools, [Time x SSP status Interaction: $F(1, 675.81) = 21.74$, $p < .001$], with SSP schools showing a significantly greater trend by .02 points. Specifically, in 2002, SSP schools were estimated as having an average English score of 7.6 and increasing each year by an average of .045 points while non-SSP schools were estimated as having an average English score of 9.35 points and increasing by .026 points each year.

Impact of DEIS resources on English scores

For the SSP schools, there was a significant interaction between the time varying covariate and time [Time x DEIS resources Interaction: $F(1, 617.44) = 86.46$, $p < .001$], indicating a significant effect of the introduction of DEIS resources on changes in average English scores over time. Specifically, when the time varying covariate was added to the model for SSP schools, the estimates specified a negative linear trend of -.028 points per year between 2002 and 2007, followed by a positive linear trend of .09 points between 2008 and 2014. However, a similar analysis conducted for non-SSP schools indicated that the positive trend for these schools was also of significantly greater magnitude during this time period [Time x DEIS resources Interaction: $F(1, 1662.14) = 7.3$, $p = .007$]. Specifically, the trend for non-SSP schools for the years 2002 to 2007 was .019 and this increased significantly to .035 for the period from 2008 onwards. While trends for both types of school increased during the time period of 2008 onwards, the increase was significantly greater for SSP (increase in trend of .12 points) than for non-SSP schools (increase in trend of .015 points), as evidenced by a significant three-way interaction between Time, DEIS resources and SSP status [$F(1, 2239.55) = 75.8$, $p < .001$].

Junior Certificate Mathematics Scores

Figure 3 presents the mean Junior Certificate maths scores for all schools, SSP schools and non-SSP schools from 2002 to 2014 (missing 2004).
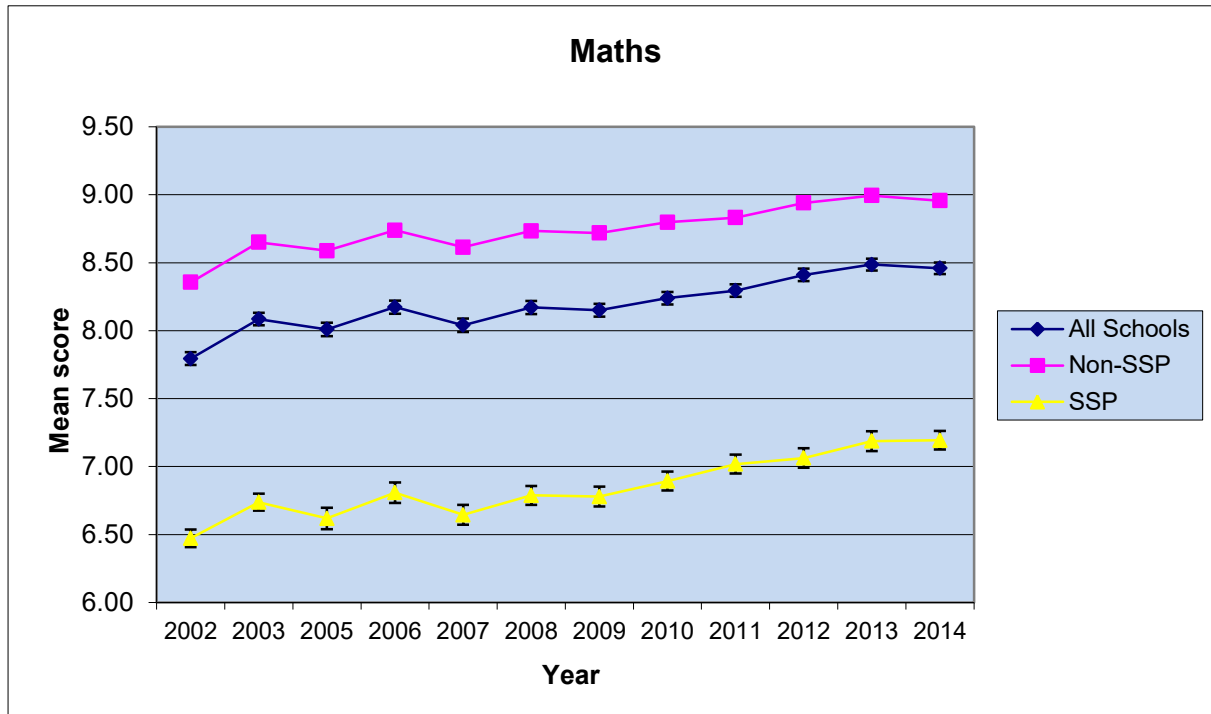

Figure 3. Mean Maths Scores from 2002 to 2014 for all schools, SSP schools and non-SSP schools.

Trends over time in Mathematics

When all schools were considered, a significant positive linear trend was identified [Effect of Time, F (1, 643.64) = 565.18, p < .001], with an average increase of .05 points each year being estimated. Maths scores for non-SSP schools were found to be significantly higher than scores for SSP schools, [Effect of SSP status, F (1, 692.68) = 783.64, p < .001], with average maths scores for non-SSP schools estimated as exceeding those of SSP schools by 1.95 points in 2002. There was also evidence of significantly different trends over time for the two kinds of school [Time x SSP status Interaction, F (1, 648.51) = 6.78, p = .009], with SSP schools showing a trend which was .01 points greater than that of non-SSP schools. Specifically, SSP schools had an average maths score of 6.52 in 2002 and showed a significant average increase of .058 points with each year while non-SSP schools had an average score of 8.47 in 2002 and showed a linear increase of .047 points each year.

7

Impact of DEIS resources on Mathematics scores

Inclusion of the time varying covariate specifying the presence of DEIS resources from 2008 on in SSP schools indicated that the provision of DEIS resources during this period coincided with a significant increase in the positive trend by .03 points [Time x DEIS resources Interaction, F (1, 611.28) = 6.59, p = .01]. Specifically, the trend for SSP schools prior to 2008 was of the magnitude of .04 points each year and this increased to .07 points each year from 2008 on.

A similar analysis conducted with non-SSP schools also revealed a significant change in the trend [Time x DEIS resources, F (1, 1413.81) = 7.25, p = .007]. The change was in the opposite direction, however, with the trend prior to 2008 being of .06 points per year and this retracting to .045 points per year from 2008 on.

Retention to Junior Certificate in SSP and non-SSP schools

Figure 4 presents the average percentage retention to Junior Certificate for cohorts between 1995 and 2008.
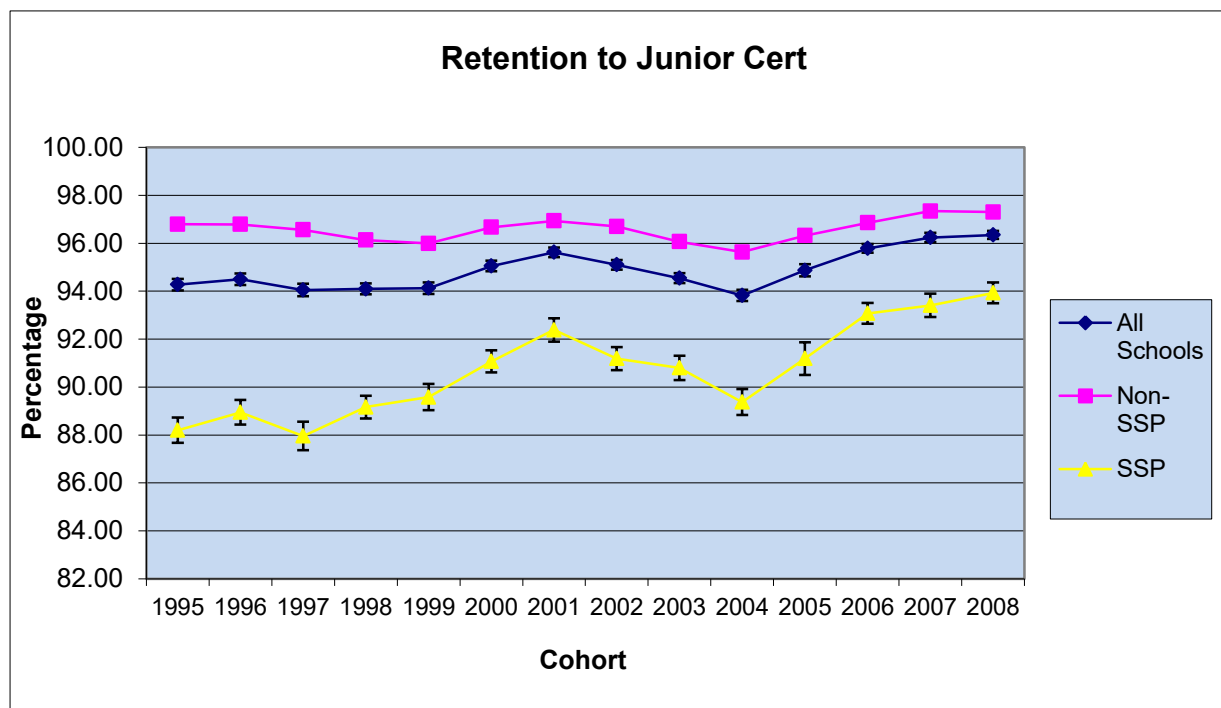

Figure 4. Average percentage retention to Junior Certificate for the 1995-2008 cohorts in all schools, SSP and non-SSP schools.

Trends over time in retention to Junior Certificate

When all schools were considered, the Linear Mixed Model revealed a significant effect of Cohort [F (1, 665.76) = 70.15, $p < .001$], indicating the presence of a significant increasing trend over time, with retention rate increasing on average by .14 percentage points per year. There was, however, a significant effect of SSP status [F (1, 668.09) = 460.87, $p < .001$], and a significant interaction between SSP status and Cohort [F (1, 653.55) = 123.85, $p < .001$], signifying a significant gap between retention rates in the two types of school and differing trends over time. The 1995 cohort of non-SSP schools was estimated as having a retention rate that was 8.2% higher than that of SSP schools but SSP schools showed a significantly higher rate of growth in percentage retention over time, exceeding that of non-SSP schools by .37 percentage points (change of .4 v .03 percentage points, respectively). SSP schools were estimated as beginning with a percentage retention rate of 88.1% for the 1995 cohort, followed by a significant positive trend with an average increase of .4 points per year. In contrast, non-SSP schools were estimated as beginning with a very high retention rate of 96.34% in 1995, with a statistically significant but low magnitude trend of .03 for the cohorts of 1995 to 2008 [Effect of Cohort: F (1, 447, 46) = 4.79, $p = .03$].

Impact of DEIS resources on retention to Junior Certificate

An examination of the trend line in Figure 4 suggests, however, that a linear trend may not adequately describe the trajectory in mean retention rates for the SSP schools. An inspection by eye suggests a general linear increase until a peak for the 2001 cohort, followed by a linear decline between 2002 and 2004, with an increasing trend characterising the cohorts from 2004 onwards. The 2004 cohort would have benefitted from the presence of DEIS resources (introduced in 2006/2007) in their third year of secondary school. The Mixed Model was re-estimated for SSP schools, including a parameter representing a downward slope for the cohorts of 2001 to 2003 and a parameter representing the introduction of DEIS resources for the cohorts of 2004 to 2008. The model revealed the presence of a statistically significant increasing trend of .5 percentage points for the cohorts of 1995 to 2000 [F (1, 1198.97) = 26.32, $p < .001$], a significant downward trend involving an average decrease of .73 percentage points per year for the 2001 to 2003 cohorts [F (1, 1724.85) = 20.22, $p < .001$], followed by a significant upturn for the cohorts of 2004 to 2008 [F (1, 1088.35) = 19.95, $p < .001$], for which there was an average increase of 1.17 percentage points per year.

An equivalent analysis for non-SSP schools revealed the presence of a significant decline of .1 percentage points per year for the cohorts of 1995 to 2000 [F (1, 3137.06) = 8.4, p = .004], a further decline of .41 percentage points per year for the cohorts of 2001 to 2003 [F (1, 4319.52) = 10.22, p = .001], and a significant increasing trend of .43 percentage points per year for the cohorts of 2004 on [F (1, 2879.55) = 100.97, p < .001]. The analysis was re-run including a three-way interaction term (Cohort x DEIS resources x SSP status) to examine whether the increase in trend for the cohorts from 2004 to 2008 was significantly greater for the SSP than for the non-SSP schools. The interaction term was statistically significant [F (1, 3106.92) = 4.2, p = .04], indicating that this was indeed the case. The data suggest that while both kinds of school experienced an increase in magnitude of positive trend during these years, the increase was greater for SSP schools.

Retention to Leaving Certificate in SSP and non-SSP schools

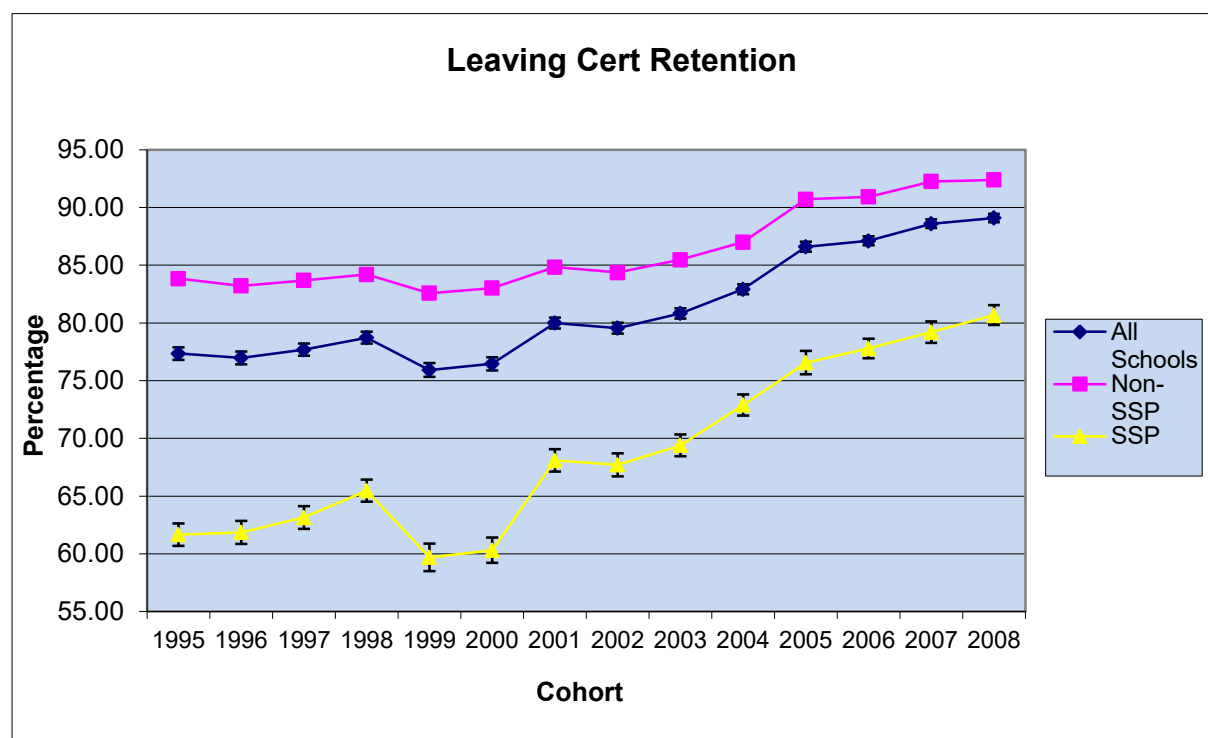Figure 5 presents the average percentage retention to Leaving Certificate for the 1995 to 2008 cohorts.

Figure 5. Average percentage retention to Leaving Certificate for the 1995-2008 cohorts in all schools, SSP and non-SSP schools

Trends over time in retention to Leaving Certificate

When all schools were considered, the Linear Mixed Model estimated that the time series began with an average percentage retention of 74.86% for the 1995 cohort, and was then marked by a significant linear increase of 1 percentage point per year [Effect of Cohort, F (1, 661.5) = 1086.14, $p < .001$]. There was also a significant effect of SSP status [F (1, 661.9) = 785.22, $p < .001$], and an interaction between SSP status and Cohort [F (1, 645.35) = 208.52, $p < .001$]. The average percentage retention level for the 1995 cohort was estimated to be 22.9 percentage points higher in the non-SSP schools. Their trend across time was, however, estimated to be .85 percentage points lower than the trend for the SSP schools. For SSP schools, the 1995 cohort was estimated as having a 58.45% retention rate, followed by an average increase of 1.61 percentage points per year between 1995 and 2008. The non-SSP schools were estimated as beginning with an average percentage retention of 81.4% for the 1995 cohort, followed by a significant average increase of .76 percentage points per year.

Impact of DEIS resources on retention to Leaving Certificate

A time varying covariate, specifying the presence of DEIS resources for the cohorts of 2004 on, was added to the model to examine if the introduction of the SSP had an effect on trends in retention for SSP schools[4]. The intervention variable had a significant interaction with Cohort [Cohort x DEIS resources Interaction: F (1, 912.77) = 17.07, $p < .001$], indicating that the cohorts from 2004 on experienced a significantly different linear trend to prior cohorts. Specifically, the model estimated the cohorts between 1995 and 2003 as having a positive linear trend of .98, with the cohorts of 2004 to 2008 experiencing a significant increase of .91 points in that trend (i.e., a positive trend of 1.89 per year for the cohorts of 2004 to 2008). However, a similar analysis with non-SSP schools also indicated that the cohorts from 2004 on experienced a significant increase in the linear trend [F (1, 2177.94) = 145.67, $p < .001$]. The trend for the cohorts between 1995 and 2003 was estimated as being .22, with an increase of 1.06 percentage points for the cohorts of 2004 to 2008 (i.e., a positive trend of 1.28 per year for these cohorts). Inclusion of a three-way interaction term between Cohort, DEIS resources and SSP status in the model indicated that this was not statistically significant

---

[4] The models estimated in this section also include a parameter specifying an interruption to the general increasing trend for the 1999 and 2000 cohorts. Figure 5 suggests that the cohorts of 1999 and 2000 were marked by a downward shift in the generally increasing trend for both SSP and Non-SSP schools. The parameter representing this 'interruption' to the trend was statistically significant when added to the models for the SSP and the Non-SSP schools.

[$F_{(1, 3134.32)} < 1$], signifying that the increase in trend for the cohorts from 2004 on was not significantly greater in the SSP than in the non-SSP schools.

A comparison of the current findings with previous ones

The current analyses build upon the previous analyses reported in Weir et al. (2014) by adding further data for recent years. The analysis of trends in Junior Certificate examination performance was expanded to include the years, 2012 to 2014, while data for one additional cohort, 2008, were added to the analyses of retention to Junior Certificate and Leaving Certificate, enabling trends to be described for cohorts from 1995 to 2008.

The results of the updated analysis of Junior Certificate OPS were very similar to the previous results. Once again, when all schools were considered, a significant positive trend in OPS was identified. Non-SSP schools were found to have significantly higher average OPS scores and while both types of school were marked by a positive trend over time, SSP schools showed a higher rate of change. There was evidence that the period from 2008 on, when DEIS resources were in place, was marked by a significant increase in the positive trend for SSP but not for Non-SSP schools.

While the updated analysis of the Junior Certificate OPS data yielded very similar results to the previous analysis, there were some differences between the results for the updated and previous analyses of the Junior Certificate English and Maths scores. As before, analyses of the English scores revealed a significant positive trend across time when all schools were considered, and a significant gap in English performance between SSP and Non-SSP schools, with the latter showing significantly higher scores. However, the addition of data for recent years revealed the existence of significantly different trends for the two types of school, which had not previously been identified. According to the updated analysis, while both kinds of school showed a positive trend, the trend was of significantly greater magnitude for SSP schools. As regards the potential impact of the presence of DEIS resources, Weir et al. (2014) identified a significant increase in the positive trend during the period of 2008 to 2011 for SSP but not for Non-SSP schools. The updated analyses confirmed the existence of an increase in trend for the SSP schools but now also revealed a significant increase in trend for Non-SSP schools during the period from 2008 to 2014. Further analyses indicated that while the trend increased for both types of school during this period, the increase in trend was greater for SSP schools.

The updated analyses of the Junior Certificate Mathematics scores once again identified a significant positive trend when all schools were considered and a significant gap between SSP and Non-SSP schools. Similar to the results for the analysis of English scores, while there was no evidence of significantly differing trends during the time period from 2002 to 2011, the addition of the years 2012 to 2014 enabled the identification of a trend of significantly greater magnitude in SSP schools. Similarly, while the previous analyses found no evidence for an increase in positive trend in Maths scores for the time period of 2008 to 2011, the updated analyses revealed evidence of a significant increase in trend during the period of 2008 to 2014 for SSP schools. This increase in trend for SSP schools contrasted with a significant retraction in trend evident in Non-SSP schools during the same time period.

With the addition of the 2008 cohort to the retention data, the results of the previous analyses were essentially replicated, with some refinement. As before, for both Junior Certificate and Leaving Certificate retention data, a significant positive trend over time was noted when all schools were considered. Non-SSP schools were found to have significantly higher levels of retention to Junior Certificate and Leaving Certificate but SSP schools were found to show a significantly higher rate of growth over time. As in the previous analyses, the cohorts from 2004 onwards, attending both SSP and Non-SSP schools, were found to be marked by a significant increase in trend in relation to both Junior Certificate and Leaving Certificate retention. A more fine-grained analysis conducted for the current report indicated that, for retention to Junior Certificate, although both types of school experienced an increase in trend for the 2004 to 2008 cohorts, the magnitude of the increase was greater for SSP schools. A similar analysis for retention to Leaving Certificate revealed no such difference, suggesting that the increase in trend during this period was of similar magnitude for both SSP and Non-SSP schools.

Percentage of medical card holders in DEIS and non-DEIS schools

Data on the percentage of medical card holders among the Junior Certificate examination cohort is available for each school. This is because the examination fee is waived for students that hold a full medical card. Figure 6 presents the average percentage of students with medical cards in all schools, in SSP schools and in non-SSP schools between 2002 and 2014.
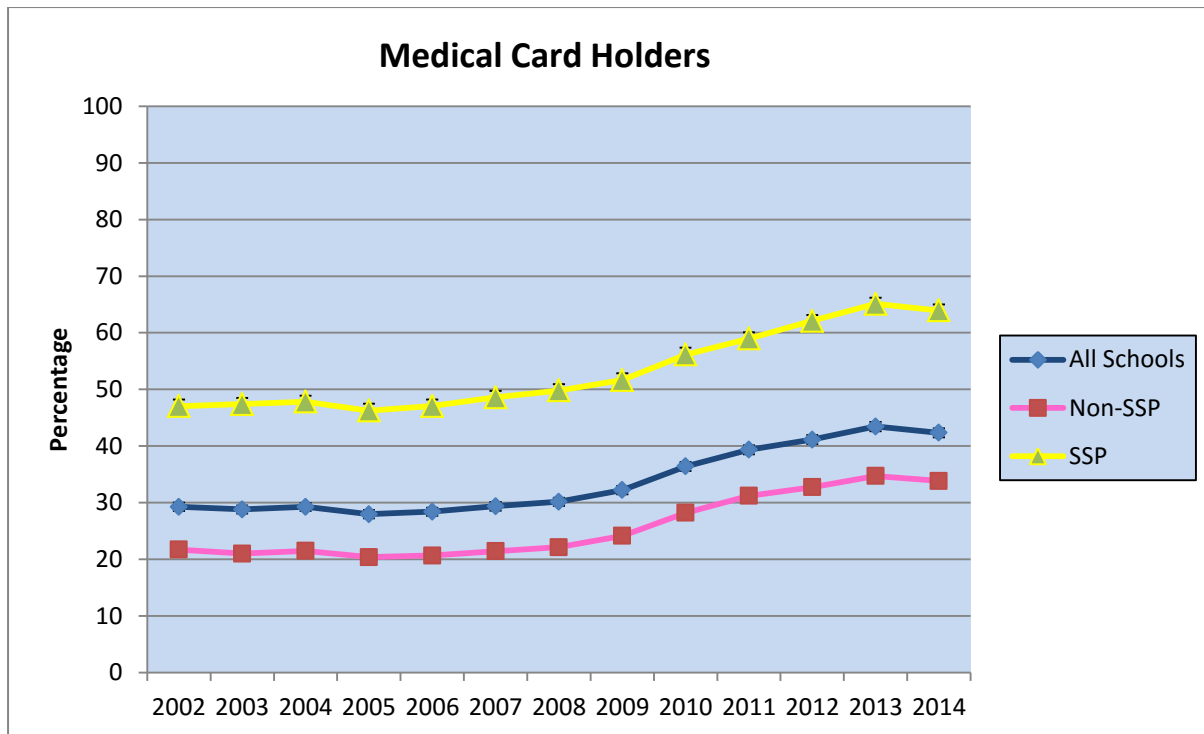
Figure 6. Average percentage of students with medical cards in all schools, SSP schools and non-SSP schools from 2002 to 2014.

Trends over time in medical card possession

When all schools were considered, the linear mixed model indicated that there was evidence of a significant positive linear trend in terms of increasing percentages of medical card holders in schools across the period of 2002 to 2014 [Effect of Time: F (1, 682.93) = 1280.91, p < .001]. Specifically, in 2002 the average percentage of medical card holders across schools was estimated as being 25.5%, with a linear trend of 1.38% increase each year. There was, however, a significant effect of SSP status [F (1, 692.92) = 530.26, p < .001], indicating a significant gap between the two kinds of school in terms of the percentage of medical card holders over the period and a significant interaction between SSP status and Year [F (1, 672.21) = 18.96, p < .001], indicating significantly different trends for the two kinds of school. The trend of increasing percentages of medical card holders was estimated as being .37 points higher for SSP schools than for non-SSP schools. Specifically, SSP schools were estimated as beginning with an average percentage of medical card holders of 43.56% and increasing by an average of 1.64 percentage points per year while non-SSP schools were estimated as beginning with an average of 18% medical card holders, which increased by 1.28 percentage points per year.

14

Were there any observable effects of the economic recession on medical card possession?

To examine whether the onset of the recession from 2008 on had any effect on the trend over time, a time varying covariate, specifying the presence of the recession from 2008 to 2014, was added to the model. When all schools were considered, the effect of this variable was statistically significant, [Time x Recession: F (1, 2191.8) = 676.07, p < .001]. In fact, the analyses revealed that there was no increasing trend in the percentage of medical cards during the years prior to the recession [non-statistically significant trend of -.03 points: [Effect of Time: F (1, 3897.17) < 1], but that there was a significant trend of 2.3 points per year from 2008 on. There was no evidence of a differential impact of the recession on the two kinds of school, however [Time x Recession x SSP status Interaction: F (1, 2184.81) = 1.32, p = .25], indicating that the increase in percentage medical card holders during the recession years was similar in SSP and non-SSP schools. To illustrate, when SSP schools were considered, the years prior to the recession were marked by a non-statistically significant trend of .17 points [Effect of Time: F (1, 1156.82 < 1)] while the recession years were marked by a statistically significant trend of 2.65 points per year [Time x Recession: F (1, 596.38) = 120.64, p < .001]. Non-SSP schools were estimated as having a non-statistically significant negative trend of -.1 points per year prior to 2008 [Effect of Time: F (1, 2723.62) = 1.8, p = .18], with a statistically significant positive trend of 2.2 points per year from 2008 on [Time x Recession: F (1, 1639.95) = 692.69, p < .001].

How are the individual variables related to each other?

The analyses reported in the current paper have, thus far, been reported separately for each variable, and because schools tend to be quite stable in terms of their characteristics (see Weir and Denner, forthcoming), data on a given variable in one year tend to correlate very closely with data for the next and subsequent years. However, the individual variables are not unrelated to each other. An obvious example is the fact that Leaving Certificate completion rates already incorporate Junior Certificate completion rates due to the way retention is calculated. That is, the number of students in a cohort that started in a post-primary school in a given year is tracked through Junior Certificate to Leaving Certificate to check how many students sat both examinations. The result is that, if a school has a poor Junior Cycle completion rate, that fact will be reflected in its Senior Cycle completion rate. Equally, schools with very good retention rates to Senior Cycle are likely to have full completion rates to Junior Cycle.

The variables are also related in other ways. In particular, there is a well-established relationship between the social profile of a school and the achievements of students enrolled in that school. Therefore, there will be a negative correlation between performance in the JCE and the percentage of students from families with medical cards (see for example, Sofroniou, Archer & Weir, 2008). As intercorrelations between the variables involved in the analyses here show, all of what might be considered the educational outcome variables are negatively related to the percentage of medical cards in the school (Table 2). For example, there is a correlation of -.79 between the percentage of medical holders taking the JCE in 2014 and student achievement aggregated to school level in the JCE in the same year. However, the relationship between retention and other variables is less straightforward. For example, there is a weaker relationship between medical card possession and both retention to Junior Cycle (-.36 to -.40) and Senior Cycle (-.58 to -.59) than between medical card possession and JCE achievement (-.77 to -.79). This may be partly because the distribution of retention data is not linear and, unlike the other variables, has a restricted range. Also, the fact that students who drop out of school before taking the JCE are probably all from poorer socioeconomic groups means that they are not reflected in the medical card percentages at school level which is based solely on students who survive to take the examination (see Weir, 2006). The correlations between achievement in the JCE and retention is moderately high but much lower than the correlation between JCE achievement and medical card possession. There may be some cancelling out of the retention variables against others. Although the data available do not permit the reasons for this to be explored empirically, anecdotal evidence indicates that students with weaker achievement levels are less likely to complete Junior, and particularly, Senior Cycle. It also may be the case that some schools that make great efforts to retain students through Junior Cycle have poorer OPS outcomes as a result.

Table 2. Correlations* between key educational variables and medical card possession at post-primary school level for the most recent years** available.

	JC ret 2007	JC ret 2008	LC ret 2007	LC ret 2008	JC med card 2013	JC med card 2014	JC OPS 2013	JC OPS 2014
JC ret 2007	—	.54	.76	.58	-.38	-.40	.45	.46
JC ret 2008		—	.58	.69	-.36	-.37	.42	.44
LC ret 2007			—	.77	-.58	-.59	.70	.70
LC ret 2008				—	-.59	-.59	.68	.69
JC med card 2013					—	.90	-.78	-.77
JC med card 2014						—	-.78	-.79
JC OPS 2013							—	.94
JC OPS 2014								—

*All correlations are statistically significant at .01 level

**In some cases the data for given years relate directly to each other. For example, the overall OPS in 2013 relates directly to the medical card percentages at school level for that year (JC med 2013) as the same students are involved. The retention data relate largely, but not perfectly to, the same student cohort. Students in the 'JC ret 2007' cohort, for example, started post-primary school in 2007, but the relationship between this and the other variables is not one-to one, as students may have repeated a year or transferred to another school.

Summary

Centrally-held data on achievement and retention in 703 post-primary schools were analysed to examine trends over time in relation to Junior Certificate performance (specifically, Overall Performance, and performance in English and Mathematics) between 2002 and 2014, and in relation to retention to Junior and Leaving Certificate for the cohorts from 1995 to 2008. Significant positive trends were identified in both performance and retention levels across the time period. The data also afforded the opportunity to compare the 200 schools that had participated in the SSP programme under DEIS with the 503 schools which had not. The differing socioeconomic circumstances of these two kinds of school are obvious from the significant divide between them in terms of the average percentage of medical card holders within the schools. This divide was substantial and remained throughout the period between 2002 and 2014. At the same time, significant gaps between SSP and non-SSP schools were evident for all performance and retention variables across that time period. However, there was evidence of significantly greater increases in these outcomes in SSP than in non-SSP schools, indicating that while performance and retention levels remained significantly lower in SSP schools across the time period, they were improving at a significantly faster pace.

Of particular interest was the potential impact that the introduction of resources associated with the DEIS programme in 2006/2007 may have had on trends for SSP schools. Indeed, the analyses revealed that the period of time in which resources were in place in SSP schools was marked by an increase in the magnitude of positive trend for all variables. This finding prompts the conclusion that the DEIS programme may have had a positive impact on performance and retention levels in post-primary SSP schools. However, it is important to remember that these data are correlational, and that this conclusion is impeded to an extent by the finding that non-SSP schools also experienced an increase in trend during this period on a number of variables (namely, Junior Certificate English scores, retention to Junior and Leaving Certificate). Although the increase in trend for non-SSP schools was generally not as great as that for SSP schools, this finding suggests that other mechanisms besides the introduction of DEIS resources may have been implicated in the increases.

Extending the trend analyses in the current report provides slightly stronger evidence to suggest that the increases in achievement in the JCE overall and in the subjects of English and Mathematics are more marked in SSP than in non-SSP schools than was found by Weir et al. (2014). Trend analysis of retention data revealed similar patterns to previous analyses

(i.e., retention rates increased over the period in both SSP and non-SSP schools but the magnitude of increase was greater for SSP schools). Also, cohorts from 2004 on, attending both SSP and non-SSP schools, were marked by a significant increase in trend in relation to both Junior and Senior Cycle retention. A finding that emerged from the current analysis but was not noted previously is that the magnitude of this increase in retention to Junior Cycle (but not Senior Cycle) was greater in SSP than non-SSP schools.

Although the data presented here confirm and augment the earlier findings by Weir et al. (2014), the absence of a control group makes it impossible to attribute improvements among SSP schools to participation in the DEIS programme. Therefore, ongoing monitoring in DEIS and non-DEIS schools is indicated. It is possible to conclude, however, that there has been an overall improvement in schools nationally, that the improvement is more marked in DEIS schools than in non-DEIS schools, and that the data are suggestive of a significant change in trend around the time that the DEIS programme might have been expected to have its first impact. It is intended to follow up on the current trend analyses as further cohorts of Junior and Senior Cycle students move through the system.

While the current set of analyses was limited to examining trends in separate variables over an extended time period, it was noted that the variables themselves are not unrelated to each other. Further analyses of the nature of those interrelationships would be worthwhile. The interrelationships between centrally available data such as those described here and other variables based on a survey of all post-primary schools in the state in 2014 is described by Weir and Denner (forthcoming). While the relationship between home background and achievement has been documented fairly extensively in Ireland, less attention has been given to examining other variables (e.g., retention) and how these variables interact with each other. The data on which the current analyses are based have limited usefulness in that regard, but there may be potential in a case-study approach.

References

DES (Department of Education and Skills). (2015). *Retention rates of pupils in second level schools: 2008 entry cohort.* Dublin: Author.

Kellaghan, T., & Dwan, B. (1995). *The 1994 Junior Certificate Examination: A review of results.* Dublin: National Council for Curriculum and Assessment.

Sofroniou, N., Archer, P., & Weir, S. (2004). An analysis of the association between socioeconomic context, gender and achievement. *Irish Journal of Education, 35,* 58-72.

Weir, S. (2006). *A report on the procedures used to identify post-primary schools for inclusion in the School Support Programme under DEIS.* Dublin: Educational Research Centre.

Weir, S., & Denner, S. (forthcoming). *A survey of the socioeconomic profile of all post-primary schools in 2014 in the context of developing a new resource allocation model.* Report to the Department of Education and Skills / National Council for Special Education. Dublin: Educational Research Centre.

Weir, S., McAvinue, L., Moran, E., & O'Flaherty, A. (2014). *A report on the evaluation of DEIS at second level.* Dublin: Educational Research Centre.

APPENDIX 1

Linear Mixed Models

Longitudinal analysis involves the study of change over time. A longitudinal dataset is one which contains repeated measurements of the same unit of analysis, such as an individual or a school, over a period of time. This repeated measurement gives rise to one characteristic of longitudinal datasets which complicates statistical analysis of change over time. This is serial dependency, the fact that repeated observations taken from the same individual tend not to be independent, but correlated with each other. To take an example, it is likely that a student's score on a reading test on one occasion would be correlated with his/her score on another occasion. Statistical analysis of longitudinal data must be able to take account of this dependency in the data.

The linear mixed model is a statistical tool which is equipped to do just that and has become a widely used tool for the analysis of longitudinal data. The technique has been mentioned in the literature under many different names, including mixed effects regression, hierarchical linear models, random effects models, and multilevel models. Essentially an augmented linear regression model, the linear mixed model accounts for the serial dependency in the data by including an estimation of 'random effects', specifying the influence of each individual on their repeated observations. It includes both a between-subjects model, which estimates group trends over time and a within-subjects model, which estimates variation related to individual trends across time. Specifically, the linear mixed model enables the regression of the dependent variable upon time, calculating the initial starting point (intercept) and trend or rate of change over time (slope) for the sample as a whole (between-subjects model), while allowing the intercept and slope to vary across individuals (within-subjects model). An additional advantage of the linear mixed model is its ability to estimate the impact of time invariant factors, such as gender or nationality, and time varying covariates, such as life events, on the trend over time.

In the current analysis, the linear mixed model was used to examine trends over time in a sample of 703 Irish schools in relation to Junior Certificate exam performance and retention rates to Junior and Leaving Certificate. The linear mixed model permitted the inclusion of a variable relating to SSP status, indicating whether or not schools were involved in the DEIS programme, as a time invariant factor, which enabled the existence of differing trends over

time for SSP and non-SSP schools to be investigated. The linear mixed model also facilitated the inclusion of a time varying covariate, which permitted an examination of whether or not trends differed significantly in the years following the introduction of the SSP in participating schools.

References

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2003). *Applied multiple regression / correlation analysis for the behavioral sciences* (3rd ed.). New Jersey: Lawrence Erlbaum Associates, Publishers.

Hedeker, D., & Gibbons, R. D. (2006). *Longitudinal data analysis*. New Jersey: John Wiley & Sons, Inc.

West, B. T. (2009). Analyzing longitudinal data with the linear mixed models procedure in SPSS. *Evaluation & the Health Professions*, *32*, 207-228.

West, B. T., Welch, K. B., & Galecki, A. T. (2007). *Linear mixed models: A practical guide using statistical software.* Florida: Chapman & Hall.