Digital Reading Literacy in the OECD Programme for International Student Assessment (PISA 2009)

Summary of Results for Ireland

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Digital Reading Literacy in PISA 2009: Summary Report for Ireland

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The OECD's Programme for International Student Assessment, or PISA, is conducted among a growing number of countries every three years. Its focus is on the literacy knowledge and skills of 15-year-olds (that is, reading, mathematics and science). Ireland has participated in PISA since 2000.

The latest results from this study relate to a new assessment of reading literacy measured with computer-based tasks (here, referred to as 'digital reading literacy'). The digital assessment, which looks at students' ability to respond to reading literacy tasks in a simulated web-based environment, was administered for the first time in 2009.

Although 65 countries participated in the main component of PISA 2009, only 19 participated in the computer-based assessment of reading literacy. Arguably, this illustrates the logistic, cultural and other complexities of conducting a computer-based assessment in such a way as to be able to compare results across countries. However, the PISA Governing Board is committed to moving towards a full digitally-based assessment in the medium term.

Table 1 shows countries that participated in the digital literacy assessment in PISA 2009, with OECD countries in bold.

Table 1. PISA 2009: Digital Reading Participants

Australia	**Ireland**
Austria	**Japan**
Belgium	**Korea**
Chile	Macao-China
Colombia	**New Zealand**
Denmark	**Norway**
France	**Poland**
Hong Kong-China	**Spain**
Hungary	**Sweden**
Iceland	

OECD member countries are in bold.

This summary contains the key results emerging from the PISA digital reading literacy assessment, with comparisons of performance on print reading literacy where appropriate.

The PISA Approach to Assessing Reading Literacy

In PISA 2009, reading literacy was defined as '…understanding, using, reflecting on and engaging with written texts, in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society' (OECD, 2009, p. 23). This definition of reading is applicable to both paper and digital reading, as digital texts are considered to be a subset of written texts. Digital reading literacy was included in the 2009 assessment due to the growing importance of proficiency in this medium, not only in workplace contexts, but also in

personal, social and civic life. The OECD (2009, 2011) highlights the importance of skills that are more commonly required in processing digital text, i.e. the ability to skim, locate and scan large amounts of information and critically evaluate its credibility and relevance to the task at hand.

The assessment framework defines digital reading tasks in terms of situation or context (i.e. personal, educational, occupational or public), environment (authored, message-based, or mixed), text format (continuous, non-continuous, mixed, or multiple), type or purpose (description, narration, exposition, argumentation, instruction, or transaction), and aspect or process (access and retrieve, integrate and interpret, or reflect and evaluate) (OECD, 2009). The digital assessment of reading literacy comprised 21 multiple-choice questions and 8 questions that required a written response or specific action or set of actions (e.g, writing and sending an e-mail, filling out an online job application form).

In each participating school, up to 35 15-year-olds were selected to complete a two-hour paper-and-pencil test comprising a mixture of reading, mathematics and science questions (the majority of which were reading tasks) and a background questionnaire, while a sub-sample of up to 15 of these students also participated in a 40-minute assessment of digital reading. Students were administered the digital assessment on school computers, or on laptops that were brought into schools in cases where schools' computer equipment was unsuitable for the assessment.[1]

Readers interested in seeing example questions from the digital assessments of reading literacy are referred to http://erasq.acer.edu.au/ (user name – public; password – access). Example questions from the print reading assessment can be viewed at www.erc.ie/pisa

Country Average Performance on Print and Digital Literacy

Ireland's mean score on the digital reading assessment, 509, is some 13 points higher than its mean score on the print reading assessment (496) (across countries, the average is around 500 score points, and the standard deviation is about 100 points on these scales) (Table 2, column 3). Ireland ranked 8th out of the 19 countries that participated in the digital reading assessment, compared with 11th out of 19 countries on the print reading assessment (Table 2, columns 1, 6). However, because the confidence intervals around rankings overlap (OECD, 2011, Figure 2.22), this may not represent a real difference in rankings. Ireland's mean score on the digital reading assessment is significantly above the OECD average, while its mean on the print reading assessment is not significantly different from the OECD average.

Ireland is one of seven countries (along with Australia, Iceland, Korea, Macao-China, New Zealand and Sweden) that had a digital reading score that is significantly higher than the corresponding print reading score. In contrast, in six other countries (Austria, Chile, Colombia, Hong Kong-China, Hungary and Poland), the digital reading literacy mean score was significantly lower than the paper-based mean score. In the remaining six countries (Belgium, Denmark, France, Japan, Norway and Spain) the mean scores on the two reading

[1] In Ireland, 139 of the 144 schools participating in PISA took part in the assessment of digital literacy.

assessments did not differ significantly. Iceland and Sweden show similar performance patterns to Ireland on both assessments.

Just four countries (Korea, New Zealand, Australia and Japan) had significantly higher digital reading scores than Ireland (Table 2, column 4). Among the 19 countries participating in digital reading, six had significantly higher print reading scores than Ireland (Korea, New Zealand, Australia, Japan, Hong-Kong China and Belgium) (Table 2, column 7). France, which had a mean score that was not significantly different from Ireland on print reading, had a significantly lower mean score on digital reading. No countries with significantly lower mean scores than Ireland on print reading had mean scores on digital reading that were similar to or better than the mean score of Ireland.

Like Ireland, Sweden slipped from a position in which it was above the OECD average on print reading in PISA 2000 to one in which it was not significantly different in PISA 2009. Both countries are above the OECD average on digital reading. On the other hand, Poland, which was significantly below the OECD average on print reading in 2000, but significantly above it in 2009 (though not significantly different from Ireland), performed below the OECD average on digital reading.

Table 2. Mean country scores and rank for the digital and paper-based reading scales

Digital reading rank	Country	Digital Reading Mean Score	Digital Reading vs. Ireland	Paper-based Reading Mean Score	Paper-based rank*	Paper-based Reading vs Ireland
1	Korea	568	▲	539	1	▲
2	New Zealand	537	▲	521	3	▲
3	Australia	537	▲	515	5	▲
4	Japan	519	▲	520	4	▲
5	Hong Kong-China	515	o	533	2	▲
6	Iceland	512	o	500	9	o
7	Sweden	510	o	497	10	o
8	Ireland	509		496	11	
9	Belgium	507	o	506	6	▲
10	Norway	500	▼	503	7	o
11	France	494	▼	496	12	o
12	Macao-China	492	▼	487	15	▼
13	Denmark	489	▼	495	13	o
14	Spain	475	▼	481	16	▼
15	Hungary	468	▼	494	14	o
16	Poland	464	▼	500	8	o
17	Austria	459	▼	470	17	▼
18	Chile	435	▼	449	18	▼
19	Colombia	368	▼	413	19	▼

	Significantly above OECD digital reading average	▲	Mean score significant higher than Ireland
	At OECD digital reading average	o	Mean score not significantly different to Ireland
	Significantly below OECD digital reading average	▼	Mean score significantly lower than Ireland

*Paper-based rank is based on the relative rank among the 19 countries that participated in the digital reading assessment.

It doesn't seem to be the case that Ireland's stronger performance on digital reading can be explained by the absence of higher-performing print-reading countries from the assessment of digital reading. The top five countries on digital reading – Korea, New Zealand, Australia, Japan and Hong Kong-China – were among the top ten performers on print reading.

Distribution of Performance on Print and Digital Literacy

The country averages discussed previously are a useful initial way to consider the results from PISA 2009. However, the distribution of performance is arguably more informative, since countries with similar average scores can have differing numbers of low and high achievers.

In PISA, students were grouped on the basis of their reading scores into proficiency levels. For the purposes of comparing the distributions of performance on the print and digital reading assessments, students were assigned to five levels of proficiency, i.e. below Level 2, Level 2 , Level 3, Level 4, and Level 5 or higher (Table 3). The OECD (2010, 2011) considers Level 2 as a minimal literacy requirement for successful participation in adult life and future learning, while students scoring at Level 5 or higher are considered to be advanced readers.

On the digital reading assessment, a similar percentage of students in Ireland and across the OECD on average (8% in both cases) scored at or above Level 5. In contrast, fewer students in Ireland (12%) compared with the OECD average (17%) scored below Level 2. This suggests that the high average score on digital reading literacy in Ireland may be due to the strong performance of lower-achieving students, relative to the OECD average. The proportion of students in Ireland achieving at or above Level 5 on digital literacy is not significantly different from the corresponding OECD average. This can be interpreted as indicating that higher-achievers in Ireland are underperforming on digital reading. This raises questions about the knowledge, digital reading skills and motivations of higher achievers. It also echoes the outcomes of PISA assessments of science in 2006 and 2009, where, although Ireland achieved mean scores significantly above the corresponding OECD averages, percentages of students at Level 5 or higher did not differ from the OECD averages, while percentages below Level 2 were significantly lower.

The performance of Irish students on the print reading assessment was not as strong as on the digital reading assessment, when one considers the percentages of students below Level 2 and at or above Level 5. In Ireland, 17% of students scored below Level 2 on print reading, the same as the OECD average, while 7% scored at Level 5 or above, compared with an OECD average of 9%.

It might be noted that the percentage of students in Ireland scoring below Level 2 on digital reading in 2009 (12%) is about the same as the percentage that scored below Level 2 on print reading in the first three PISA cycles (11% in 2000 and 2003, 12% in 2006). On the other hand, the percentage scoring at or above Level 5 on digital reading in 2009 (8%) is below the percentages scoring at or above Level 5 on print reading in 2000 (14%) and 2006 (12%) and about the same as on print reading in 2003 (9%).

Table 3: Proficiency levels on the PISA 2009 digital reading scale and percentages of students achieving each level (Ireland and OECD average)

Level (Score range)	Students at this level are capable of:	OECD	Ireland
5 and above (above 626)	Students at this level can be regarded as 'top performers' in digital reading. They are able to critically evaluate information from several web-based sources using criteria that they have generated themselves. They are also able to navigate across multiple sites without explicit direction, allowing them to locate information efficiently.	8%	8%
4 (554 to 626)	Students at this level are considered to be able to perform challenging digital reading tasks. They are able to judge the authority and relevance of sources of information when provided with support. They can locate and synthesise information from several sites when this requires a low-level of inference. They are also capable of dealing with a range of text formats and types and can compare and contrast information from different sites and form opinions about what they read by drawing on information from their everyday life.	23%	24%
3 (481 to 553)	Students at this level can respond to digital texts in both authored and message-based environments. They are able to locate information across several pages and compare and contrast information from a number of texts when given explicit guidance. They evaluate information in terms of its usefulness for a specified purpose or in terms of personal preference. They can be considered able to perform moderately complex digital reading tasks.	30%	33%
2 (408 to 480)	Students at this level can use conventional navigation tools to locate information when given explicit instructions. They can perform tasks such as selecting relevant information from search results or a drop down menu, locating and transferring information from one text to another and from generalisations (e.g. recognising the intended audience of a website).	22%	23%
Below Level 2 (lower than or equal to 407)	These students are performing at levels below those that would allow them to meet the digital reading demands of the 21st century.	17%	12%

Source: OECD 2011

Another way to consider the distribution in performance is through an examination of the extent to which schools differ from one another with respect to achievement on the print and digital reading assessments. If schools are offering similar educational experiences and opportunities to their students leading to broadly similar outcomes, then school average achievement will not vary much. In contrast, if a country's education system is characterised by stratification along academic/vocational and/or socioeconomic lines, average achievement can expect to differ markedly from one school to the next. A statistic reported by the OECD (2010, 2011) that captures this is the percent of achievement variance that lies between schools. The lower this value, the more equitable schools can be considered in terms of the learning outcome measured.

In Ireland, 29% of variation in achievement on the print reading assessment was between schools, compared to an OECD average of 39% (OECD, 2010). This indicates a comparatively equitable education system at second level. Nonetheless, several countries, including Finland, Iceland and Sweden had 20% or less of the achievement variation in print reading between schools, indicating more school-level equity than in Ireland.

In the case of the digital reading assessment, the percentage of between-school variance in Ireland (22%) was considerably lower than the OECD average of 37%, and in fact was the third lowest across the 19 countries participating in the digital reading assessment (Norway and Iceland had somewhat lower between-school variation than Ireland on this measure). This can be interpreted as indicating equitable performance in digital reading across schools in Ireland, and poses a challenge for the future – to raise performance on digital reading while ensuring that performance continues to be spread as evenly as possible across schools.

Gender Differences on Print and Digital Literacy

In all countries, with the exception of Colombia, females significantly outperformed males on the assessment of digital reading literacy. The OECD average difference was 24 score points, and the gender difference in Ireland was higher than this, at 31 score points. Indeed, Ireland had the third highest gender difference in performance on the assessment of digital reading literacy, behind just Norway (35 points) and New Zealand (41 points).

In the assessment of print reading, females significantly outperformed males in all 65 participating countries. The gender difference of 39 points associated with print reading in Ireland was similar to the OECD average (39 points).

Correlation between Digital Literacy and Print Literacy Performance

The overall pupil-level correlation between digital reading and print reading in Ireland in PISA 2009 was 0.84 (Table 4). This indicates that students who did well on print reading generally did well on digital reading and vice versa, and supports the view that performance on digital reading is associated with performance on print reading, even though the latter may also require higher-level searching and integration skills.

The OECD imputed scores for pupils who did not participate in the digital assessment, based on their performance on other PISA tests administered in 2009, and on background variables such as school SES. Table 4 also shows that the correlations between digital reading and print reading for those who did and did not take the digital reading test were almost identical (0.82 and 0.84 respectively). This may be interpreted as evidence of the accuracy of imputed scores for students not taking the digital reading test compared with actual scores achieved by students taking the test.

Table 4: School- and pupil-level correlations between print and digital reading, overall and by participation in the assessment of digital reading (Ireland, 2009)

	Print and digital reading (r) – Pupil level	Print and digital reading (r) – School level
Overall	.835	.732
Students who participated in digital reading	.823	.690
Students who did not participate in digital reading	.840	.746

At school level, the overall correlation between print and digital reading was 0.73. This indicates that, while schools with high mean scores on digital reading generally had high

mean scores on print reading (and vice versa), this was not always the case. This is an issue that will be examined in greater detail in the full national report on PISA 2009(forthcoming, see below).

Digital Reading Performance and Navigation through the Text

As noted in the PISA assessment framework, efficient navigation is considered essential for successful digital reading. It was possible to capture the behaviour of students during the assessment of digital reading in terms of the total number of pages that they visited, the number of relevant pages visited and the number of visits to relevant pages. In Ireland, the correlation between the number of relevant pages visited and digital reading performance was strong (0.82). There were weaker correlations between number of visits to relevant pages (0.64) and overall number of pages visited (0.42). Hence, it seems that the highest-performing digital readers are those who are able to target those pages that contain the most relevant information. The OECD report (2011) has more detail on student behaviour during the assessment of digital reading literacy and its relationship with performance on the test.

Digital Literacy Performance and Socio-economic Background

The OECD (2011) has also shown that the relationship between socio-economic background and language spoken at home is similar for both print reading and digital reading. For example, the performance gap on digital reading in Ireland between students who report speaking the language of the test at home and those who report speaking another language (38 points) is similar to the gap in print reading (35 points) and both are lower than the OECD averages of 46 and 52 points, respectively. The score-point difference associated with a unit increase in students' economic, social and cultural status is similar for digital reading (34) and print reading (39), and these are close to the corresponding OECD averages (38 and 40).

The national report on PISA 2009 will include in-depth analyses of background variables that are related to achievement in print and digital reading, including multi-level models of performance.

Engagement in Reading and Performance on Digital Literacy

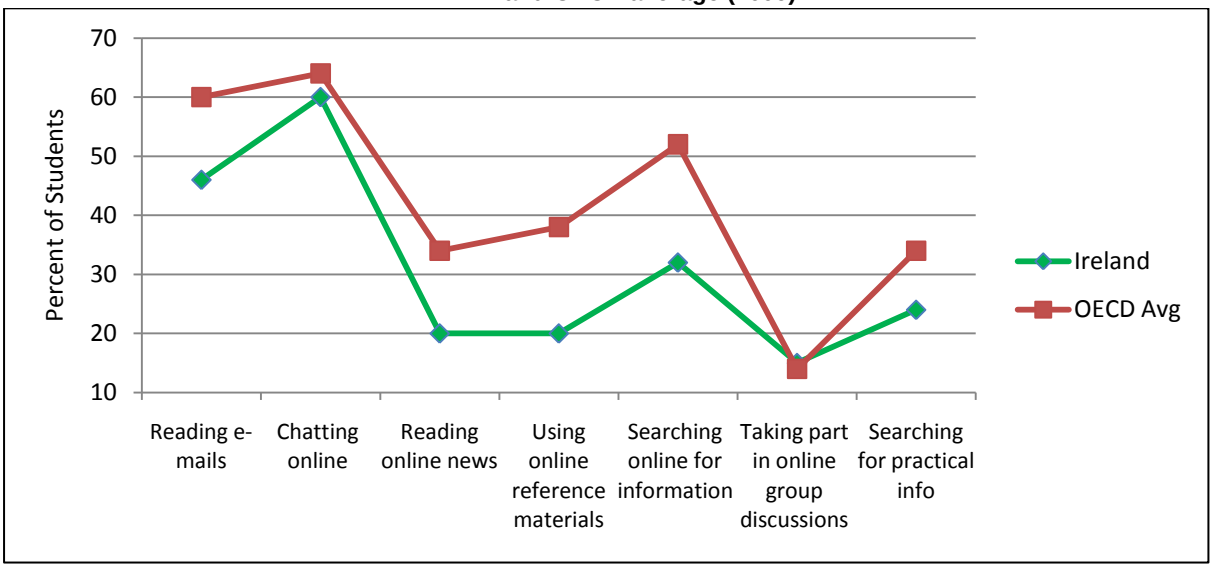
Students in Ireland who reported that they did not engage in any print reading for enjoyment (42% of 15 year olds) achieved significantly lower scores on both print reading and digital reading than their counterparts who read for up to 30 minutes a day (26%). Students who read 30-60 minutes per day (16%) achieved performance levels on both print and digital reading that were stronger than those who read for up to 30 minutes, but were not significantly different from those who read for an hour a day or longer (16%).

Students in Ireland reported similar weekly levels of chatting online and taking part in online discussions as their counterparts on average across OECD countries (see Figure 1). However, by comparison with the corresponding OECD averages, they reported less frequent engagement in activities such as reading online news, using online reference materials,

searching online for information about particular topics, and searching for practical information.

On an OECD-wide index of diversity of online materials read, students in Ireland achieved a mean score (-0.50) that was well below the OECD average (0.0), indicating regular use of a narrow range of digital texts. Nevertheless, students in the top quarter of the diversity index in Ireland achieved an average score on digital literacy that was significantly higher (512 points) than students in the bottom quarter (468). It may be that proficiency in digital literacy accrues from a combination of print reading proficiency (driven by engagement in leisure reading) and frequent engagement in relevant digital literacy tasks.

Figure 1: Percentages of students engaging at least weekly in various online reading activities – Ireland and OECD average (2009)



Computer Usage at Home and at School

Despite almost universal access to computers at home and at school, students in Ireland reported low levels of computer usage in key home and school contexts. Table 5 shows lower levels of computer usage at home for schoolwork, compared with the corresponding OECD averages. For example, just one-quarter of students in Ireland report doing homework on a computer, compared to one-half on average across OECD countries (73% report doing so in both Norway and Poland).

Table 5: Percentages of students engaged in school-related computer activities at home at least weekly – Ireland and OECD average (2009)

Activity	Ireland	OECD Average
Browse the Internet for schoolwork	28.8	45.6
Doing homework on the computer	25.3	49.8
Use of e-mail for communication with teachers	5.4	13.9
Check your school's website for announcements	5.8	20.9
Download, upload or browse materials from your school's website	8.3	23.0

The OECD constructed scales based on item sets such as those in Table 5 that measured use of computers at home for leisure purposes, use of computers at home for schoolwork, and use of computer at school. Average scores and standard deviations for students across OECD countries were set at 0.0 and 1.0 respectively. Outcomes for Ireland, which are below the corresponding OECD average scores (0.0 in all cases), are as follows:

- Use of computers at home for leisure purposes (-0.18)
- Use of computers at home for schoolwork (-0.62)
- Use of computers at school (-0.37)

While students in Ireland reported relatively positive attitudes to computers (mean score = 0.02), they reported low self-confidence in performing high-level ICT tasks such as using a spreadsheet or creating a webpage (-0.11). In Ireland, the relationship between levels of computer usage at school and performance on digital reading is strong, though students reporting medium usage levels perform at a higher level than those reporting high levels. In the case of school-related activities, this may reflect greater use of computers by less-able students, perhaps in learning support contexts.

Finally, across countries, the relationship between use of technology at home and at school and performance on the PISA assessment of digital literacy varies. For example, Korea and Japan, countries with significantly higher digital literacy performance than Ireland, had lower mean scores on the use of computers at school index (-0.91 and -1.05 respectively). Hence, it does not seem to follow that high levels of computer usage in school are always associated with high levels of performance on digital literacy. On the other hand, countries such as Australia and New Zealand, which also had significantly higher mean scores than Ireland on digital literacy, had above average computer usage levels at school (0.40 and 0.15 respectively).

Conclusion

The performance of students in Ireland on digital literacy in PISA 2009 was above the corresponding OECD average, and contrasted with performance on print literacy, which was not significantly different from the OECD average. Whereas six of the 19 countries in the digital literacy assessment achieved significantly higher mean scores than Ireland on print reading, just four achieved significantly higher mean scores on digital reading. A number of countries that performed at about the same level as Ireland on print reading (France, Denmark, Hungary and Poland) achieved significantly lower scores on digital reading. While fewer students in Ireland (12%) than on average across OECD countries (17%) performed at or below Level 1 on the PISA digital reading proficiency scale, the percentage of students scoring at or above Level 5 in digital reading (8%) was the same as the corresponding OECD average (8%). This can be interpreted as indicating that lower-achieving readers contributed to Ireland's relatively strong performance on digital reading to a greater extent than their higher-performing counterparts.

The outcomes for Ireland on the test of digital reading do not confirm the outcomes reported by the OECD (2010) for print reading. However, a number of observations can be made:

- Performance on the test of digital reading was not constrained by the need to establish a link back to an earlier assessment (PISA 2000, in the case of print reading), or to factor in an unexplained but substantive drop in print reading that occurred in Ireland between 2000 and 2003. Hence, criticisms relating to an insufficient number of link items between PISA 2009 and earlier assessments of PISA reading literacy do not apply to digital reading, nor do concerns about the size of the link error associated with trend scores.
- The apparently strong level of engagement by students in Ireland in the assessment of digital literacy stands in contrast to a high level of disengagement on the print reading assessment, as evidenced by increased levels of missing and not-reached items as students progressed through their test booklets. Although performance in all countries dropped on blocks of print reading items appearing in the final position in test booklets compared with the initial position, this position effect was much greater in Ireland compared with the OECD average in PISA 2009, and was much more noticeable in Ireland, compared with earlier PISA assessments.[2]

While Ireland did well on digital reading in PISA 2009 with a mean score of 509 points, performance on digital reading in PISA 2009 still lags behind performance on print reading in PISA 2000 (527). This, together with the strong correlation between print and digital reading, suggests that Ireland's actual level of performance on reading literacy lies above 496 (Ireland's mean score on PISA 2009 reading literacy) but is lower than 527. PISA 2012 should provide a clearer picture of the situation with respect to print reading, especially if the link back to 2000 is dropped.

The correlation between digital reading and print reading in Ireland (0.82) is strong. It indicates that, in general, students who do well on digital reading also do well on print reading (and vice versa). It also suggests that the skills required to understand and use print-based texts are similar to those required to read and respond to digital texts. However, it has also been argued (e.g., Leu et al., 2008) that digital reading, and especially reading in web-based environments, requires specialised reading strategies including self-directed text construction, in which the reader must constantly monitor the relevance of information in relation to the question to be answered or the problem to be solved. It is unclear if such strategies can be taught to students in the same way as print-based reading strategies, or whether they develop as a consequence of experience in reading digital texts. There is some evidence of positive effects for web-based strategy instruction on reading comprehension as measured by print-based standardised tests (e.g., Meyer et al., 2010), though whether such gains transfer to tests of digital literacy is less clear.

Another consequence of the strong correlation between digital reading and print reading is that traditional print reading skills (e.g., decoding, fluency, comprehension) may be more important than ever. Indeed, Warschauer (2007) argues that 'competence in traditional literacy skills is often a gateway into the world of the new literacies' (p. 43). The converse of this is that students who are not competent in traditional literacy skills may not benefit from the new literacies. In this respect, proposals in the Draft National Plan to Improve Literacy

[2] The issue of engagement in PISA reading literacy will be examined in detail in the Irish National Report on PISA 2009, which will be released in November 2011.

and Numeracy in Schools (DES, 2010) to raise levels of performance on traditional literacy skills by 2020 could also secure stronger performance in digital literacy over the duration of the plan.

Notwithstanding the strong association between print and digital literacy, it is a matter of concern that the use of digital literacies by students in Ireland is low compared with their counterparts in other OECD countries. The mean score on diversity of online materials read is one-half of a standard deviation behind the OECD average, while students in Ireland also lag behind in the frequency in which they engage in activities such as browsing the Internet for schoolwork, doing homework on the computer, and using the school's website. Clearly, there is considerable scope for increasing the engagement of students in Ireland in purposeful digital literacy activities that could, in time, have a positive impact on both print and digital reading.

The performance of students in Ireland on the PISA 2009 assessment of digital literacy gives rise to other concerns, including the following:

- Why is the gender difference in favour of female students on digital literacy among the highest in participating countries?
- Why are there relatively few higher-achieving digital readers in Ireland (Ireland has the same proportion as the average across OECD countries, despite overall above average performance)?
- What can be done to encourage teenagers to engage in reading for pleasure more often, and can increased levels of reading for pleasure improve performance on print and digital literacy?

Finally, the achievement of a level of performance above the OECD average by students in Ireland on digital literacy bodes well for the future. It is likely that, by 2015, much of the PISA assessment will have migrated to a digital platform. It is unclear at this time whether traditional reading tasks (such as those found on the PISA assessment of print literacy) will appear side-by-side with the types of web-based tasks that students encountered in the 2009 assessment of digital reading literacy, or whether print reading will still be viewed as being relevant to the future needs of 15-year olds.

Additional Information

The full OECD report on digital literacy, and five earlier volumes of results from PISA 2009 can be accessed at http://www.pisa.oecd.org

National reports for Ireland on PISA are available at http://www.erc.ie/pisa

It is planned to publish an in-depth national report on PISA 2009 in November 2011, and this will include detailed comparisons of performance on print and digital reading literacy. The report will also be available on http://www.erc.ie/pisa

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