Learning for Life:

The Achievements of 15-year-olds in Mathematics, Reading Literacy and Science in PISA 2012

Rachel Perkins, Gerry Shiel, Brían Merriman, Jude Cosgrove and Gráinne Moran

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Overview of PISA

- **P**rogramme for **I**nternational **S**tudent **A**ssessment
  - Project of the OECD
  - International survey of the achievements of 15-year-old students
  - Mathematical literacy, reading literacy, scientific literacy
  - Three-yearly-cycles since 2000
  - In each cycle, one subject area is designated as the main focus, or 'major' domain , and the others are assessed as minor domains
    - Mathematics is the major domain in 2012

New assessments in 2012

- Computer-based assessment of problem solving
  - Core domain
  - 44 countries/economies, including Ireland
- Computer-based assessments of mathematics
  - Digital reading assessment from 2009 also administered
  - 32 countries/economies, including Ireland

All assessment domains 2012

- Paper-based assessment
  - Print mathematics
  - Print reading
  - Science
- Computer-based assessments
  - Computer-based mathematics
  - Digital reading
  - Problem solving (results released in spring 2014)

Participation in PISA 2012

- In 2012, 65 countries/economies participated in PISA
  - 34 OECD member countries and 31 'partner' countries/economies
- In Ireland, 182 schools and 5,016 students participated in PISA in March 2012
  - Including all 23 initial Project Maths schools
  - Age-based sample (15-year-olds)
    - 2% in First/Second Year
    - 61% in Third Year
    - 24% in Transition Year
    - 13% in Fifth Year

Interpreting Achievement Scores

- The scale for each domain was set to have an OECD average of 500 and a standard deviation of 100 when the domain was first a 'major' domain
  - i.e. 2003 for mathematics
- Standard deviation refers to the distribution, or spread, of the scores
  - On average across OECD, two-thirds of students score between 400 and 600 (500±100)

Interpreting Achievement Scores

- Proficiency levels group students' scores on the reading, mathematics and science scales into levels so that the skills of students at each level can be described

Domain	Levels
Print reading	7 levels (1b, 1a, 2, 3, 4, 5, 6)
Digital reading	4 levels (2, 3, 4, 5)
Mathematics	6 levels (1, 2, 3, 4, 5, 6)
Science	6 levels (1,2, 3, 4, 5, 6)

- In PISA, Level 2 is considered the minimal level of competency required for future participation in education, work and society
- Students performing at Level 5 or above are considered to be higher-achieving students

Print Mathematics in 2012

- Four mathematics content subscales (same as 2003)
  - Change & Relationships
    - *Using mathematical models to describe and interpret change.*
  - Space & Shape
    - *Geometry, spatial visualisation, measurement & algebra.*
  - Quantity
    - *Understanding measurements, counts, indicators, relative size, numerical trends and patterns, number sense, multiple representations of numbers, mental calculation, estimation, and assessment of reasonableness of results.*
  - Uncertainty & Data
    - *identifying and summarising messages that are embedded in sets of data presented in many ways, and appreciating the likely impact of the variability that is inherent in many real processes*
- Three new mathematical process subscales are described for 2012
  - Formulating, Employing and Interpreting
- Results for reading and science are described in terms of *overall* performance only in 2012

Print Mathematics in 2012

- Ireland's mean print mathematics score is significantly above the OECD average

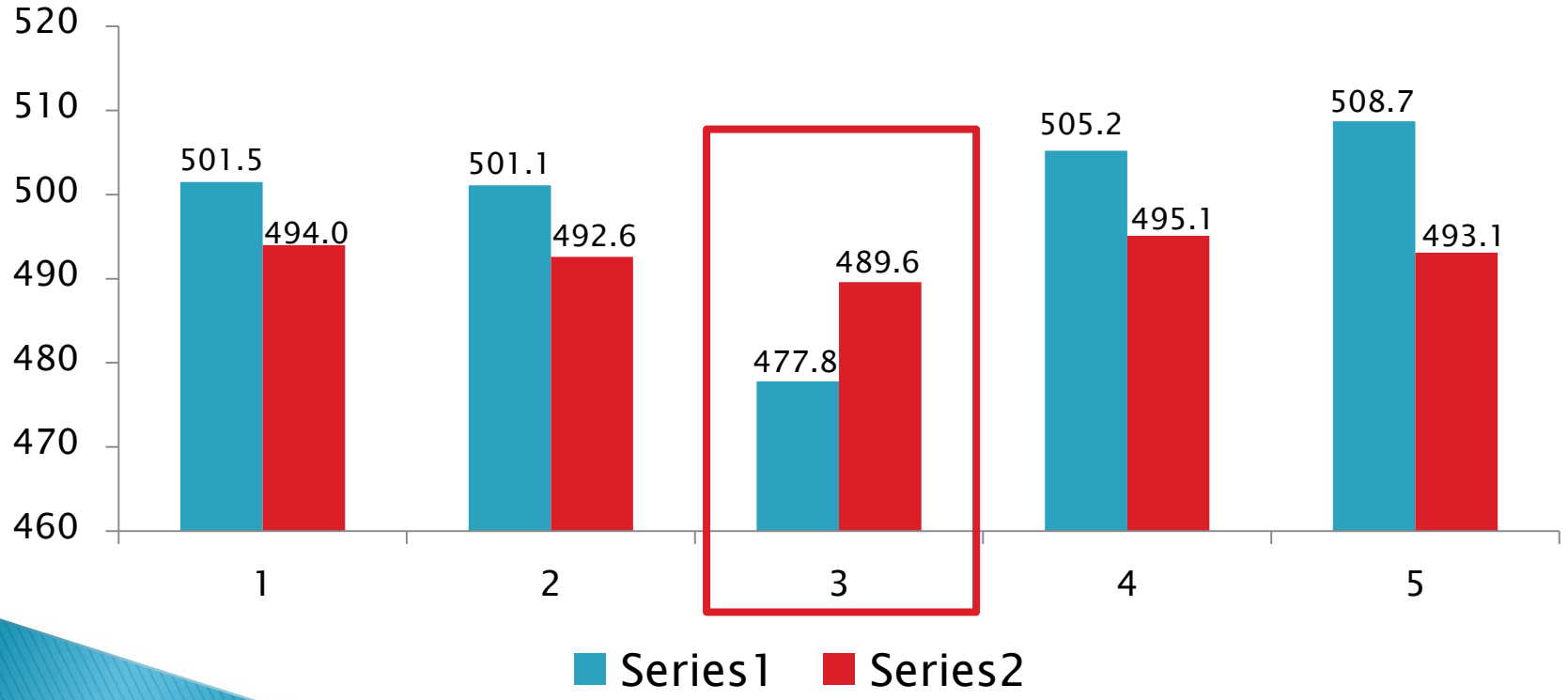
	Ireland	OECD
Print mathematics	501.5	494.0

- Ireland is ranked 13th of 34 OECD countries and 20th of all 65 countries/economies

Above OECD	Same as OECD	Below OECD
Shanghai-China	France	Italy
Korea	United Kingdom	Spain
Finland	Iceland	Slovak Rep.
Canada	Norway	United States
Poland	Portugal	Sweden
Ireland	(Northern Ireland)	Hungary

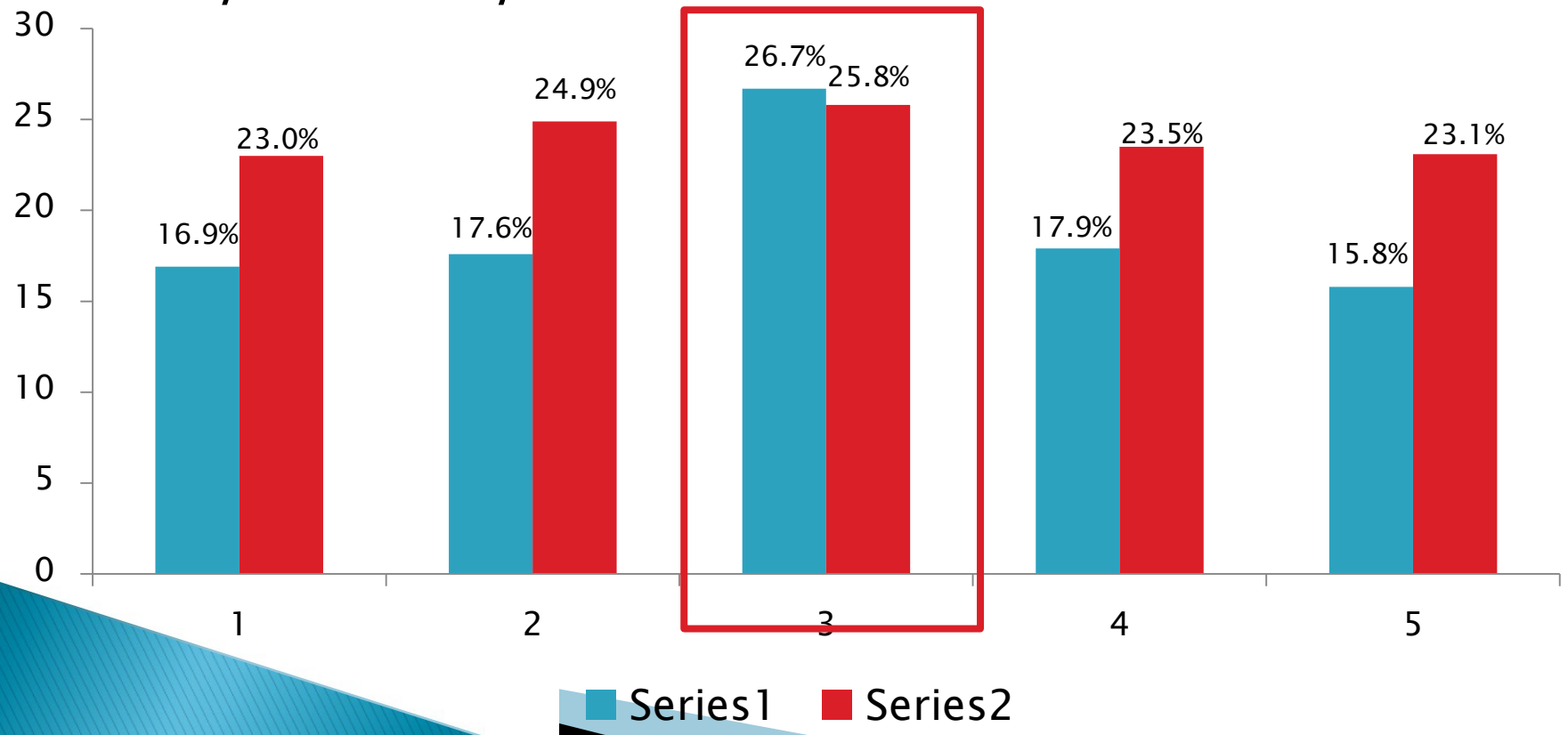
Print Mathematics Performance in 2012 – overall and subscales

- Students in Ireland have significantly lower mean scores on the *Space & Shape* subscale compared to the OECD average; however, they perform significantly better on the other content area subscales.



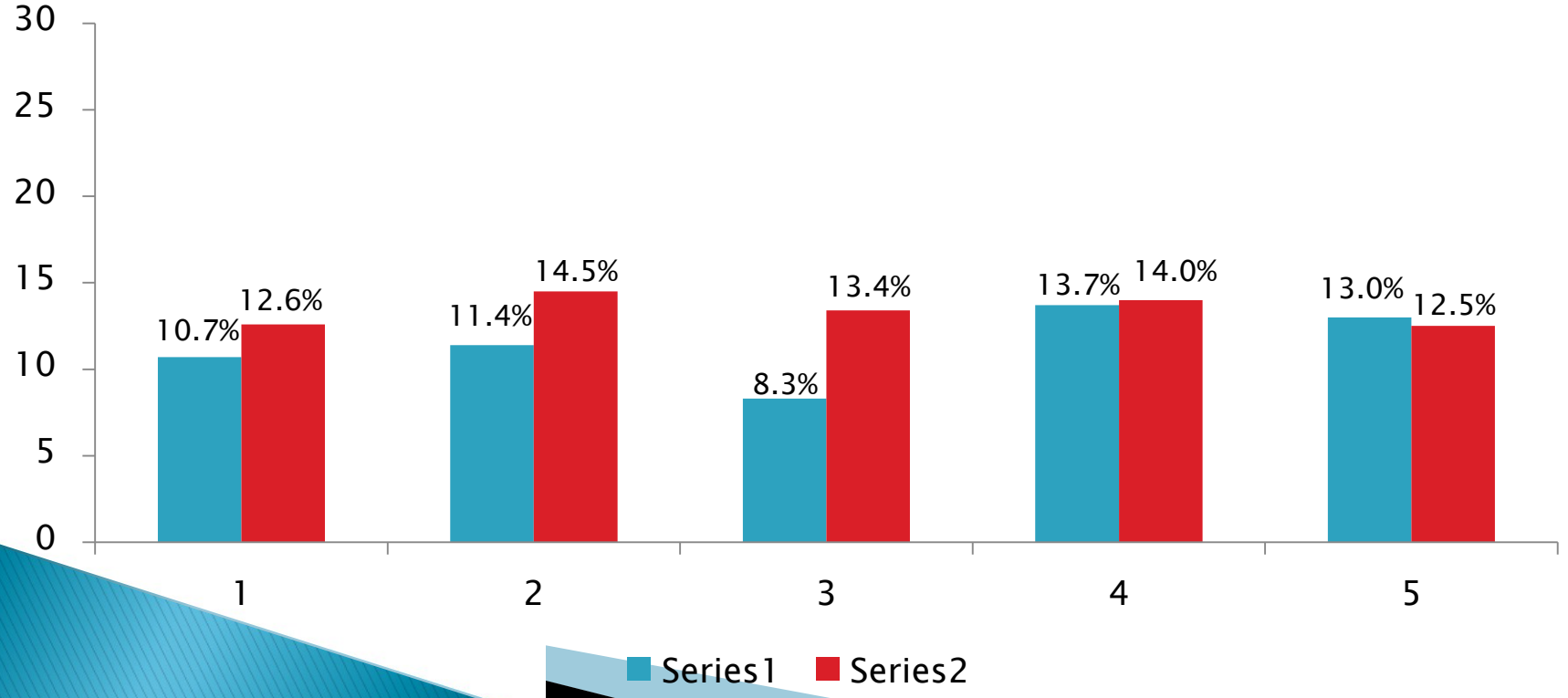
Print Mathematics Proficiency Levels in 2012 – overall and subscales

- Ireland also has lower percentages of students performing below Level 2 on the content area subscales compared to the OECD averages, with the exception of the *Space & Shape* subscale



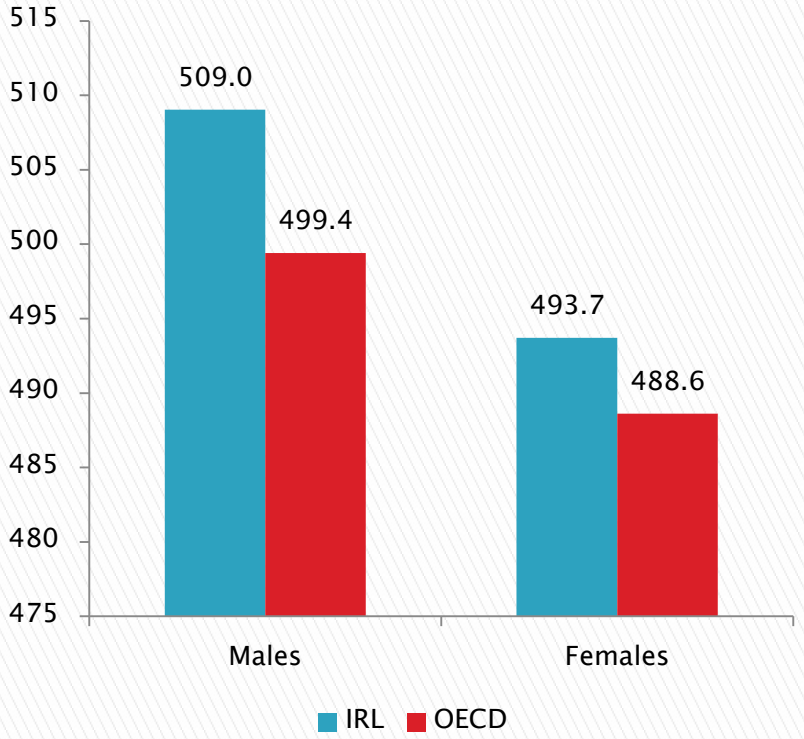
Print Mathematics Proficiency Levels in 2012 – overall and subscales

- Ireland also has lower percentages of students performing at Level 5 or above on the *Change & Relationships* and *Space & Shape* subscales compared to the OECD averages
- The proportions for the *Quantity* and *Uncertainty & Data* subscales are similar to the OECD averages



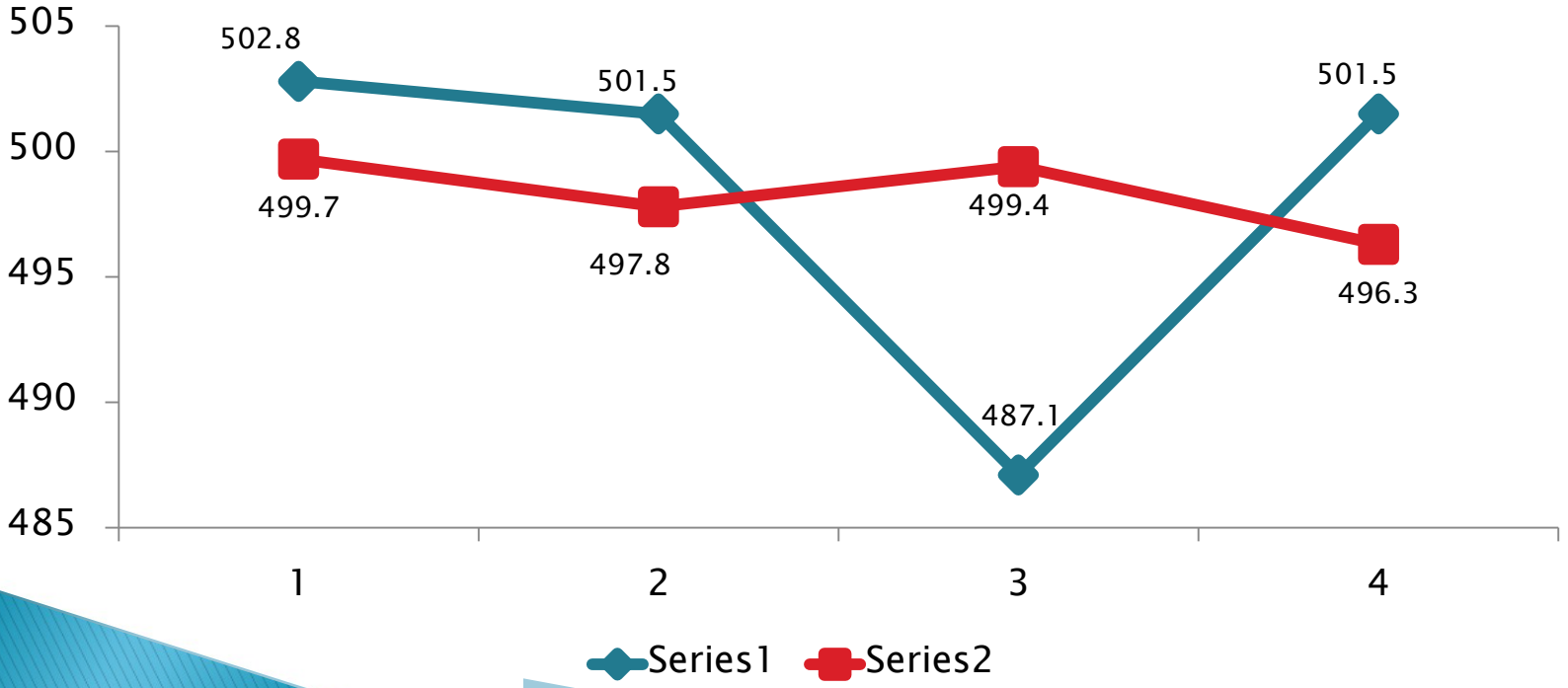
Gender Differences on Print Mathematics in 2012

- Males significantly outperform females on overall print mathematics and on each of the process and content area subscales
- Both males and females in Ireland have significantly higher mean print mathematics scores than the corresponding OECD averages
- Males and females in Ireland have a significantly higher mean scores on each of the content area subscales than the corresponding OECD averages, with the exception of the *Space & Shape* subscale



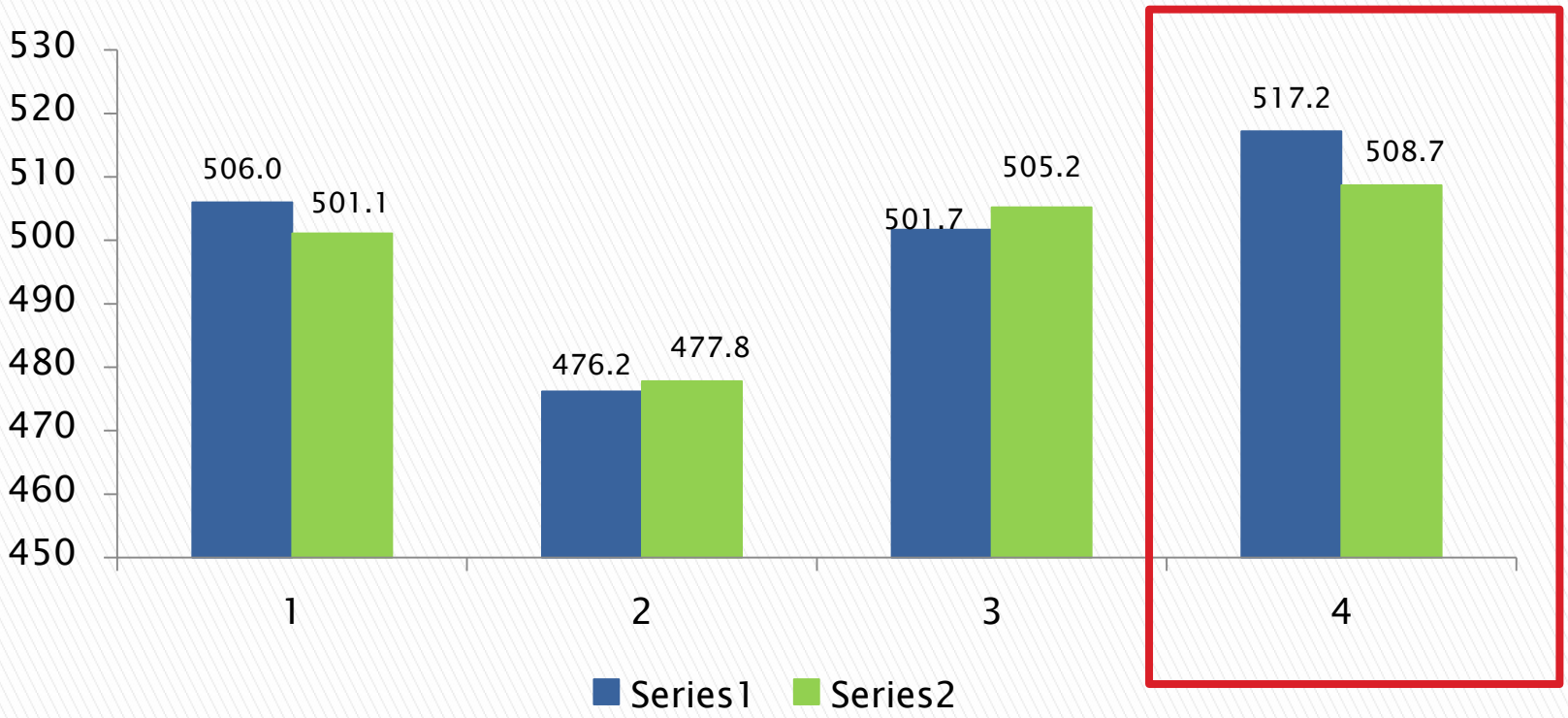
Print Mathematics 2003-2012

- In Ireland, mean print mathematics performance in 2012 is significantly higher than in 2009, but not significantly different to 2003 or 2006
- Ireland's performance is statistically significantly above the OECD average for the first time in 2012



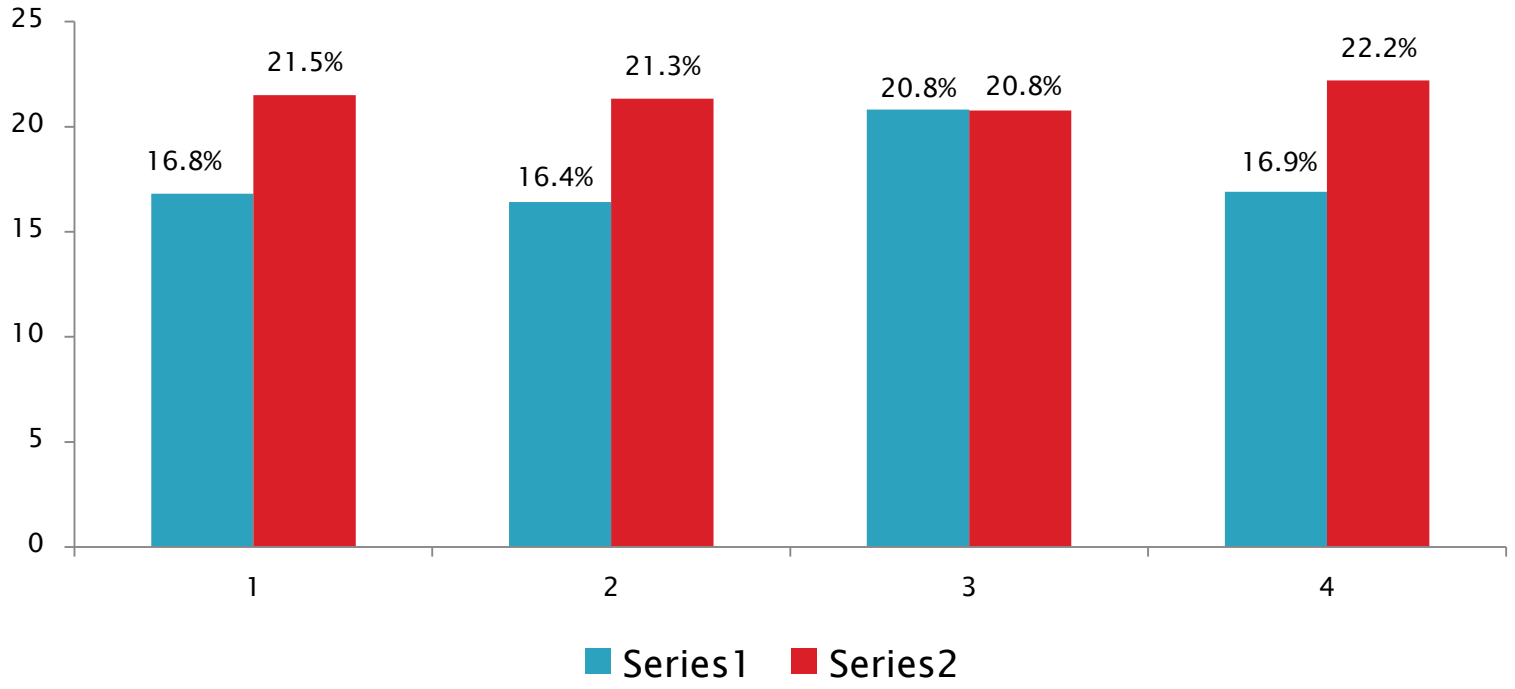
Print Mathematics Subscales 2003–2012

- In general, there is little variation in the mean scores for Ireland on the four content area subscales between 2003 and 2012
- However, the performance of students in Ireland on the Uncertainty & Data subscale has dropped significantly



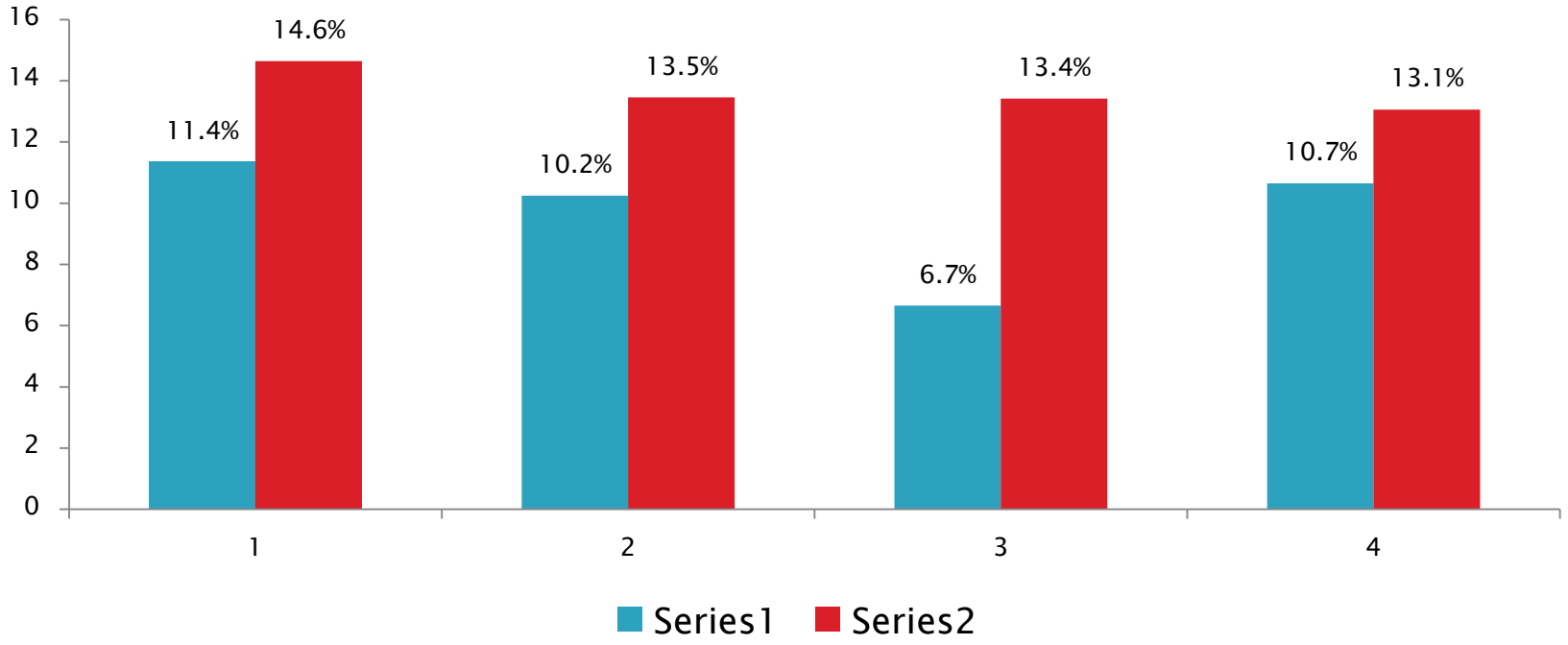
Print Mathematics – % Below Level 2 between 2003 and 2012

- The percentages of students in Ireland performing below Level 2 is about the same in 2012 as in 2003 and 2006



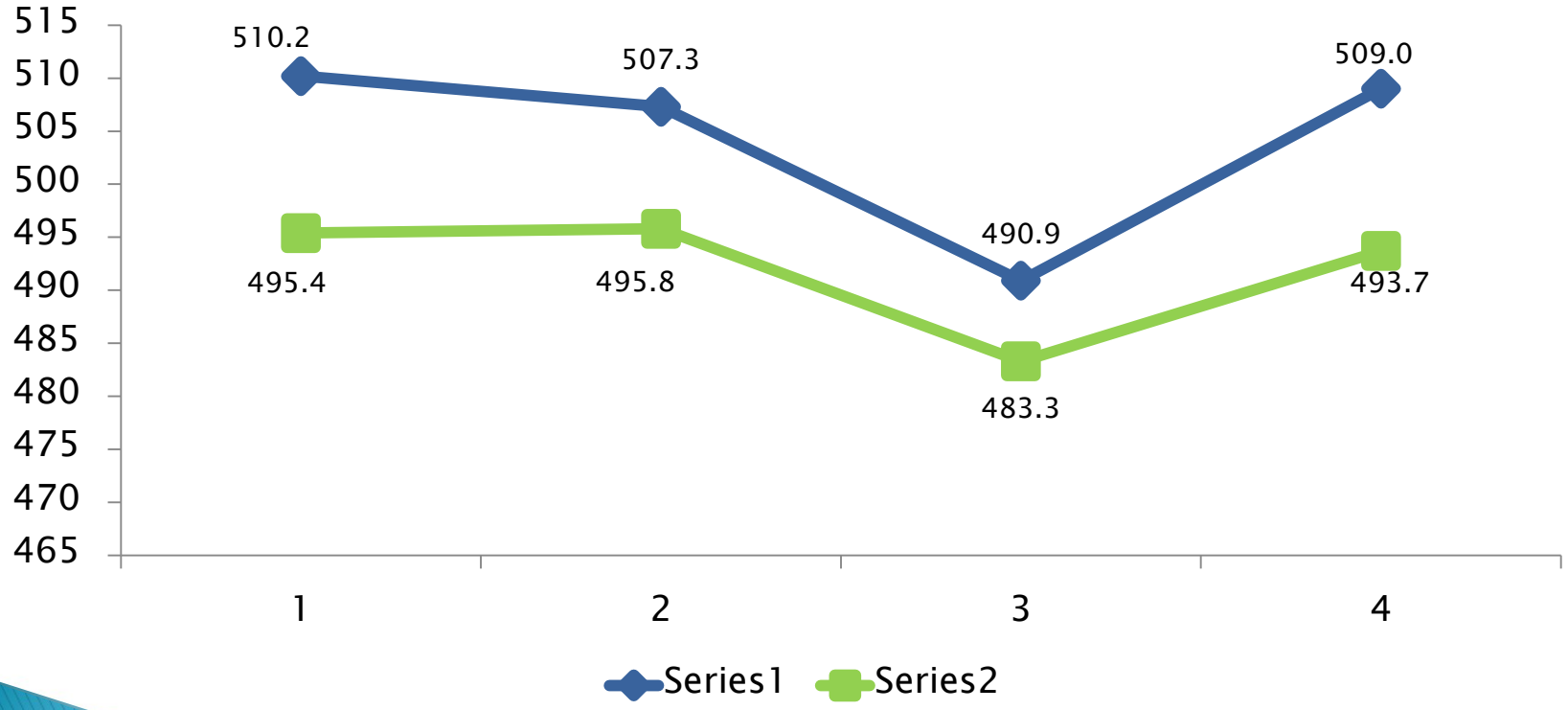
Print Mathematics – % at Level 5 or Above between 2003 and 2012

- The percentages of students in Ireland performing at Level 5 or above is also about the same in 2012 as in 2003 and 2006, but higher than in 2009



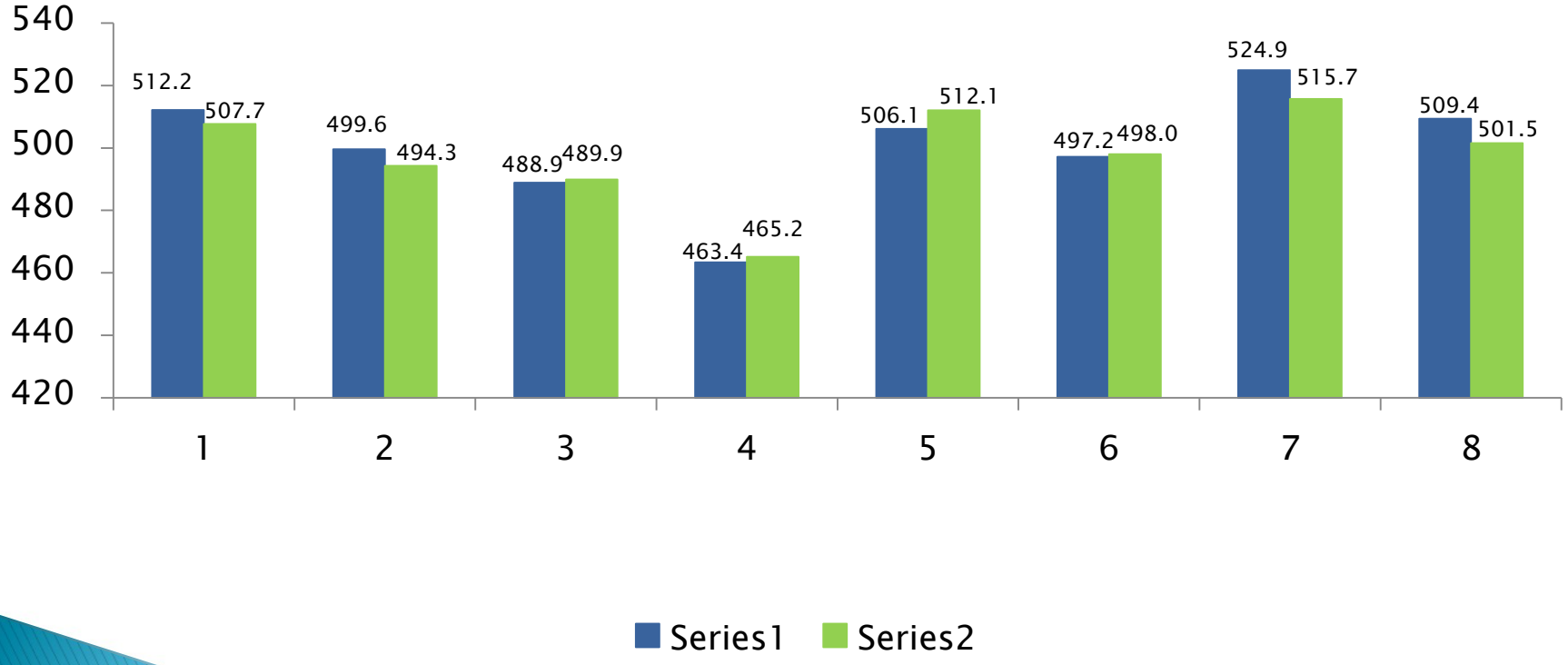
Print Mathematics –Males and Females 2003–2012

- The mean scores of males and females on overall print mathematics in Ireland are about the same in 2012 as in 2003



Print Mathematics Subscales 2003–2012

- In Ireland, there are no significant differences in the scores of males and females across the content area subscales when comparing 2003 and 2012



Computer-based Mathematics in 2012

- Ireland's mean computer-based mathematics score is about the same as the OECD average

	Ireland	OECD
Computer-based Mathematics	493.1	497.1

- Ireland is ranked 15th of 23 OECD countries and 20th of all 32 countries/economies

Above OECD	Same as OECD	Below OECD
Shanghai-China	Italy	Sweden
Korea	United States	Poland
Canada	Norway	Portugal
Germany	Slovak Republic	Slovenia
France	Denmark	Spain
Australia	**Ireland**	Hungary

Computer-based Mathematics in 2012

- In Ireland, the percentages of students performing below Level 2 and at Level 5 or above are below the corresponding OECD averages

	Below Level 2	At or Above Level 5
Ireland	17.9%	7.0%
OECD	20.0%	11.3%

- The mean score for males in Ireland does not differ significantly from the OECD average score for males
- Females in Ireland perform significantly less well than the OECD average for females

	Males	Females
Ireland	502.2	483.6
OECD	503.3	490.8

Print Reading in 2012

- Ireland's mean print reading score is significantly above the OECD average

	Ireland	OECD
Print reading	523.2	496.5

- Ireland is ranked 4th of 34 OECD countries and 7th of all 65 countries/economies

Above OECD	Same as OECD	Below OECD
Shanghai-China	United Kingdom	Italy
Singapore	(Northern Ireland)	Austria
Finland	United States	Hungary
Ireland	Denmark	Spain
Canada	Czech Republic	Sweden
New Zealand		Iceland

Print Reading in 2012

- Ireland has considerably fewer students performing below Level 2 and more performing at Level 5 or above than the OECD averages

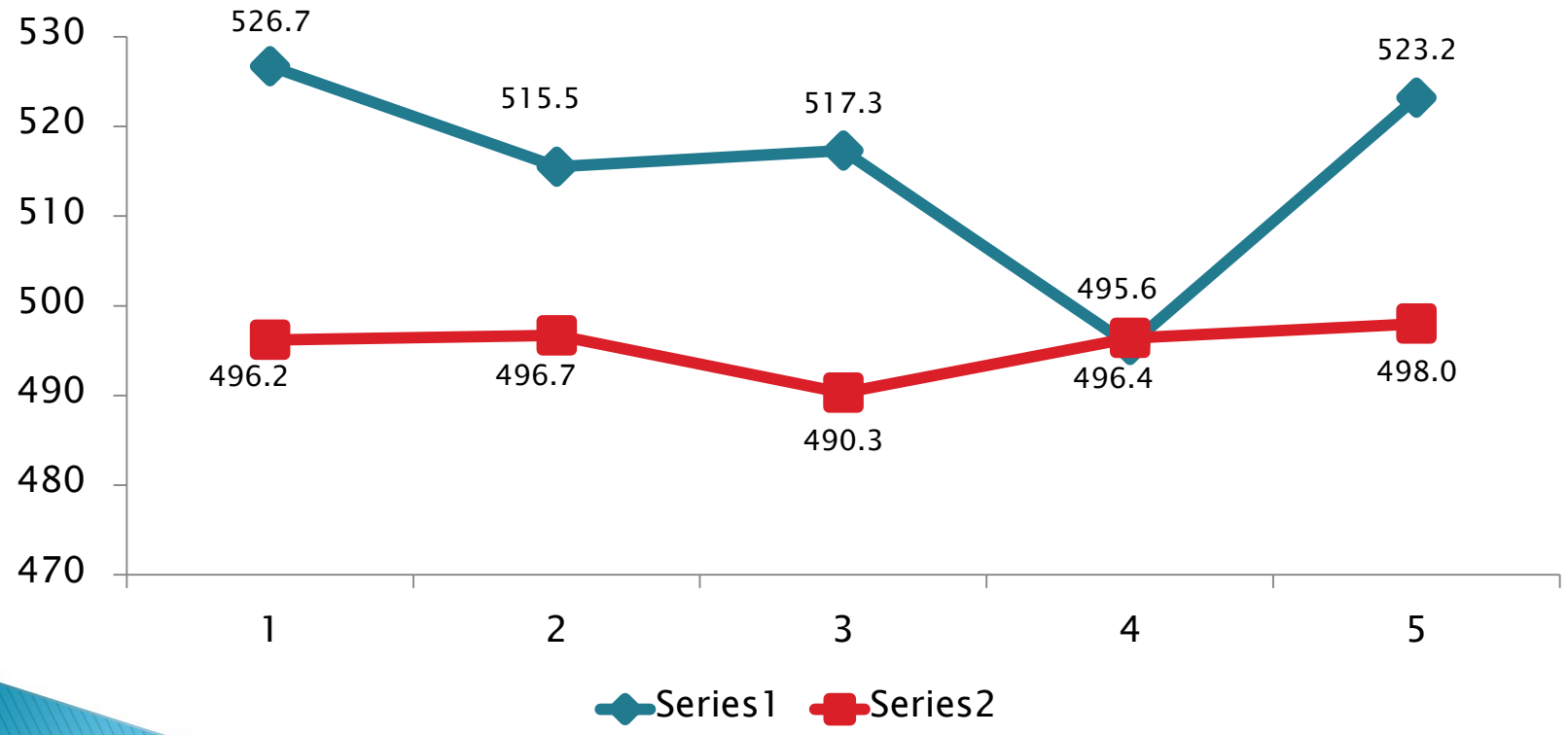
	Below Level 2	At or Above Level 5
Ireland	9.6%	11.4%
OECD	18.0%	8.5%

- In Ireland, both male and female students in have significantly higher scores than the corresponding OECD averages

	Male	Female
Ireland	509.2	537.7
OECD	477.8	515.4

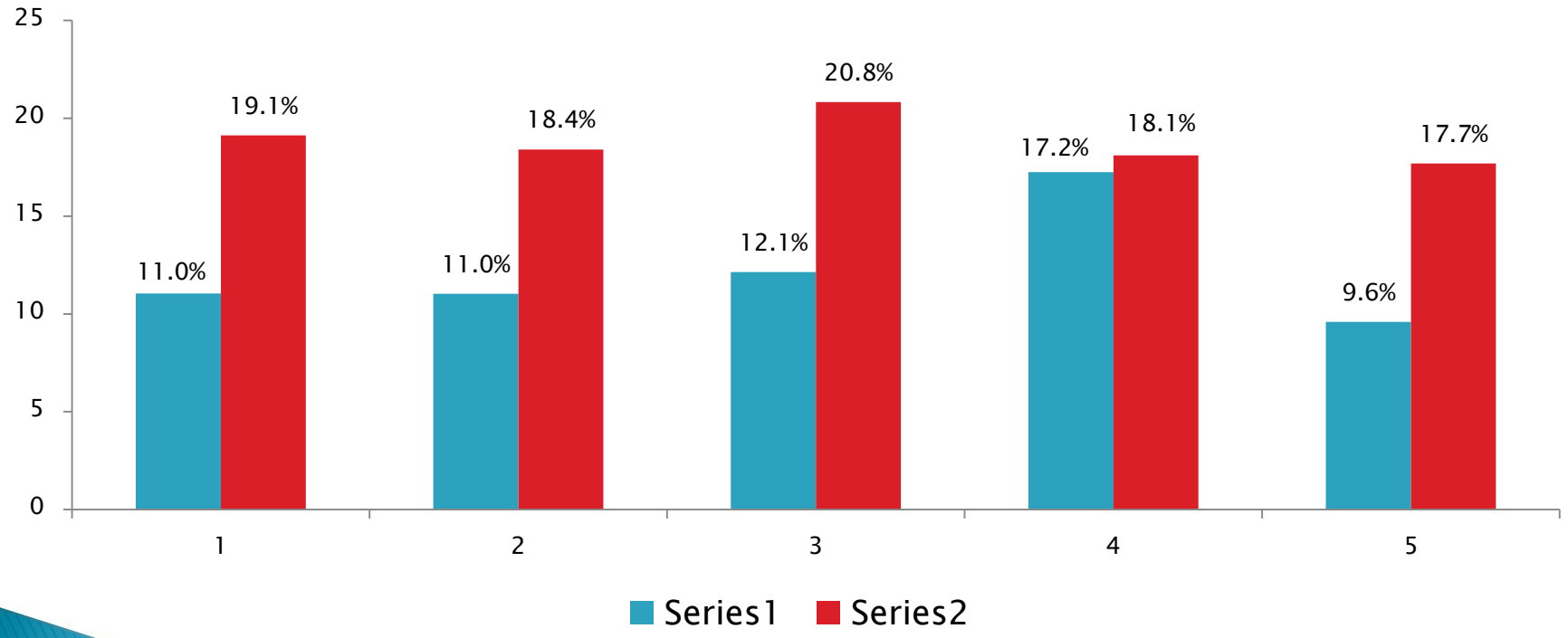
Print Reading between 2000 and 2012

- Ireland's mean print reading score in 2012 is significantly higher than the mean score in 2009, but not significantly different from the mean scores in 2000, 2003 or 2006



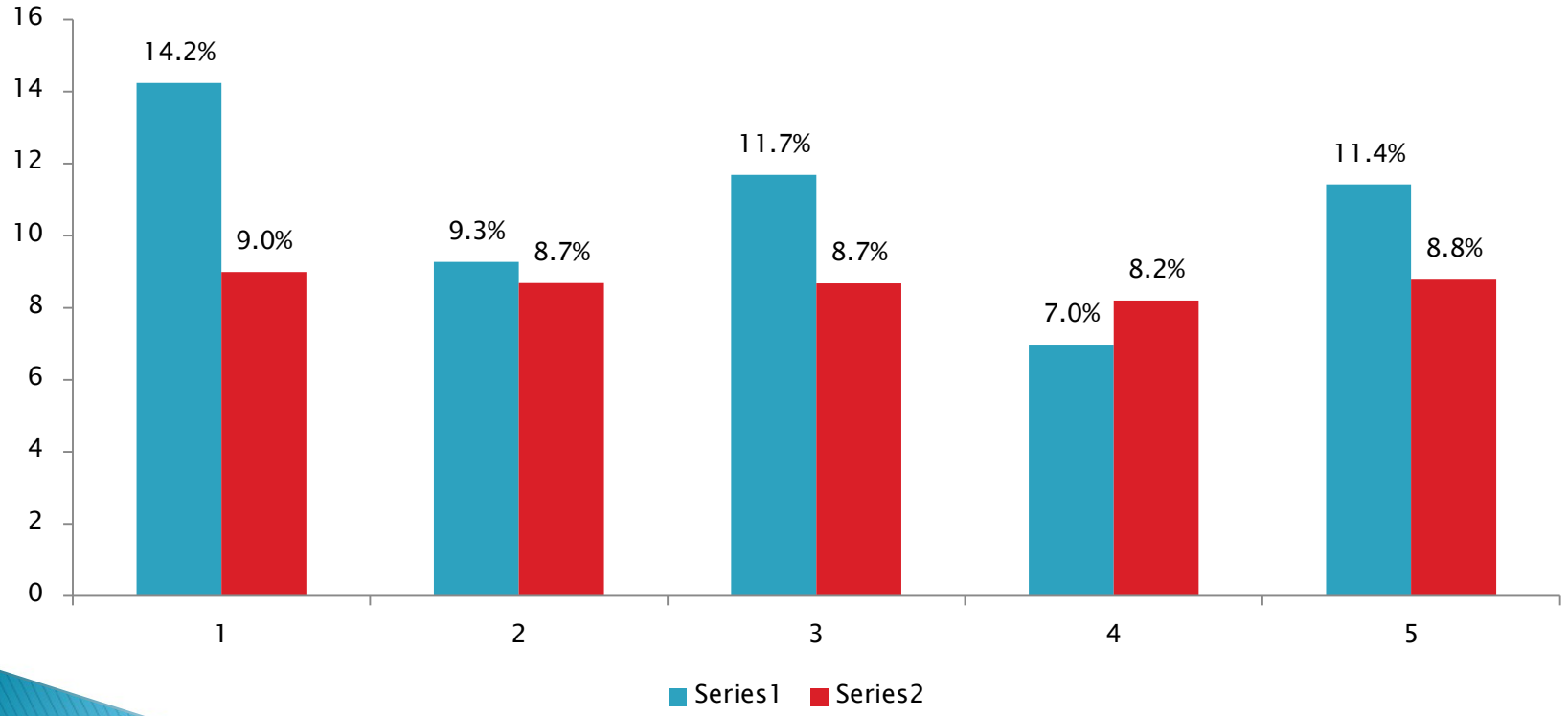
Print Reading – % Below Level 2 between 2000 and 2012

- The percentages of students in Ireland performing below Level 2 are slightly lower in 2012 than in 2000, 2003 and 2006, but considerably lower than in 2009



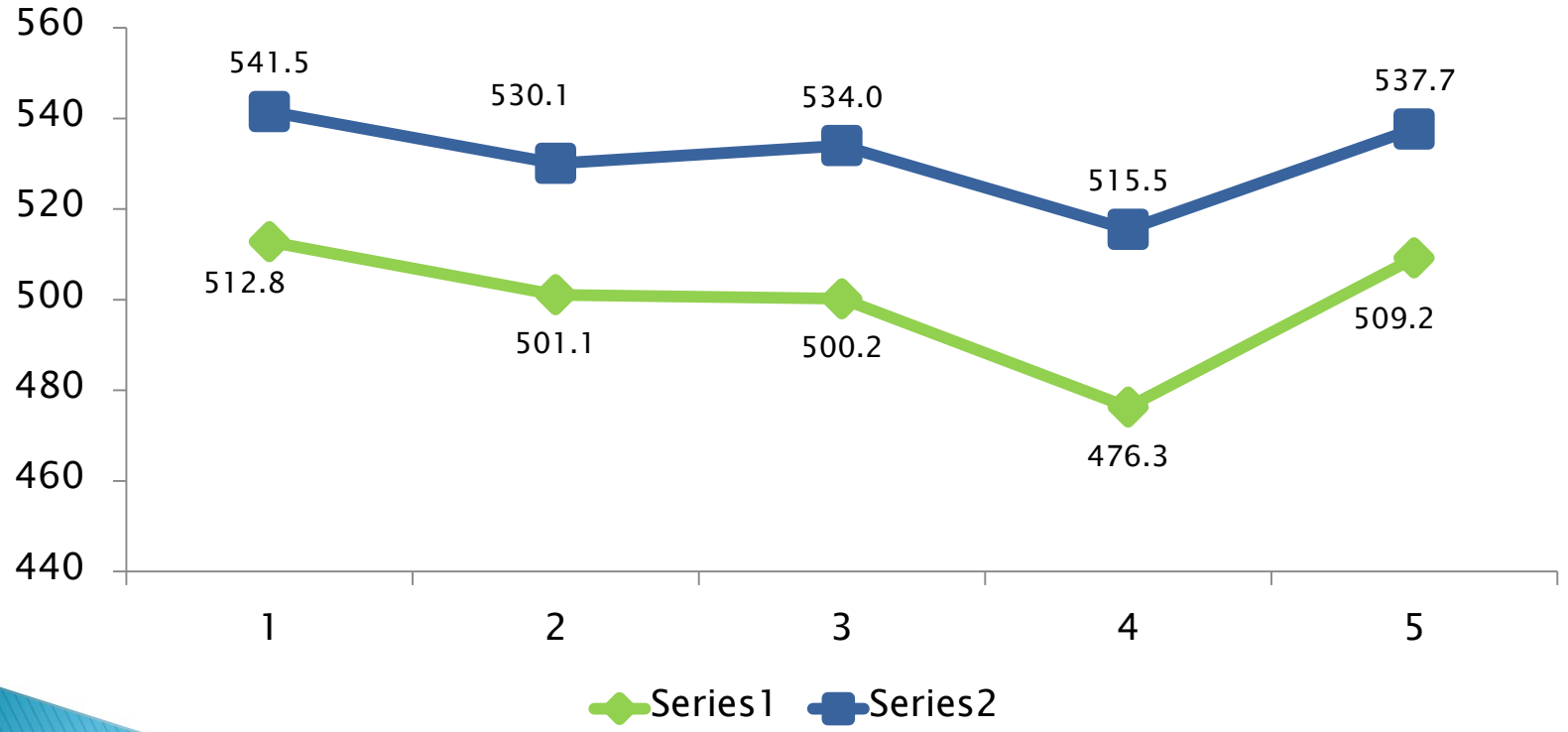
Print Reading – % at Level 5 or Above between 2000 and 2012

- The percentages of students in Ireland performing below Level 2 are slightly lower in 2012 than in 2000, 2003 and 2006, but considerably lower than in 2009



Print Reading –Males and Females between 2000 and 2012

- In Ireland, the mean scores of males and females on print reading in 2012 do not differ significantly from the corresponding scores in 2000, 2003 or 2006, but are significantly higher than the scores in 2009



Digital Reading in 2012

- Ireland's mean digital reading score is significantly above the OECD average

	Ireland	OECD
Digital reading	520.1	496.9

- Ireland is ranked 5th of 23 OECD countries and 9th of all 32 countries/economies

Above OECD	Same as OECD	Below OECD
Singapore	Italy	Portugal
Canada	Norway	Austria
Shanghai-China	Sweden	Poland
Australia	Denmark	Slovak Republic
Ireland	Germany	Slovenia
United States		Spain

Digital Reading in 2012

- In Ireland, the percentage of students performing below Level 2 is considerably below the OECD average
- The percentage of students performing at or above Level 5 is marginally above the OECD average

	Below Level 2	At or Above Level 5
Ireland	9.4%	9.0%
OECD	17.6%	8.0%

- The mean scores for males and females in Ireland are significantly higher than the OECD average scores

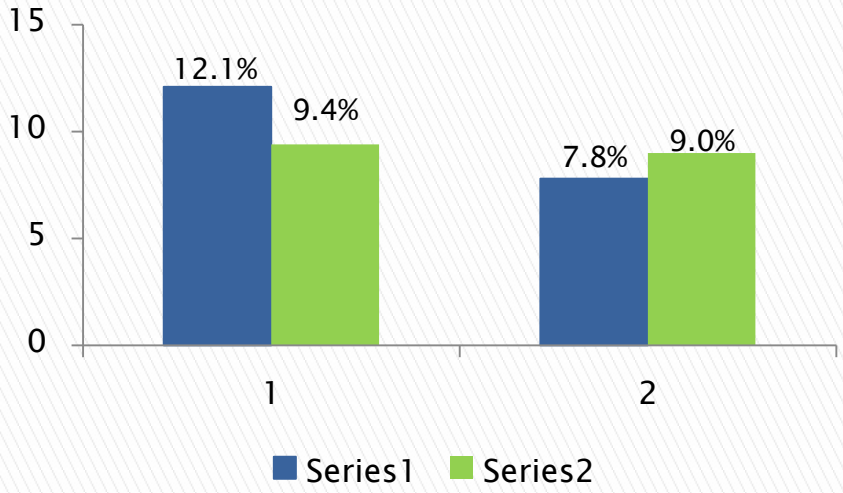
	Males	Females
Ireland	507.7	533.0
OECD	484.0	510.0

Digital Reading between 2009 and 2012

- Students in Ireland performed significantly better on digital reading in 2012 compared to 2009

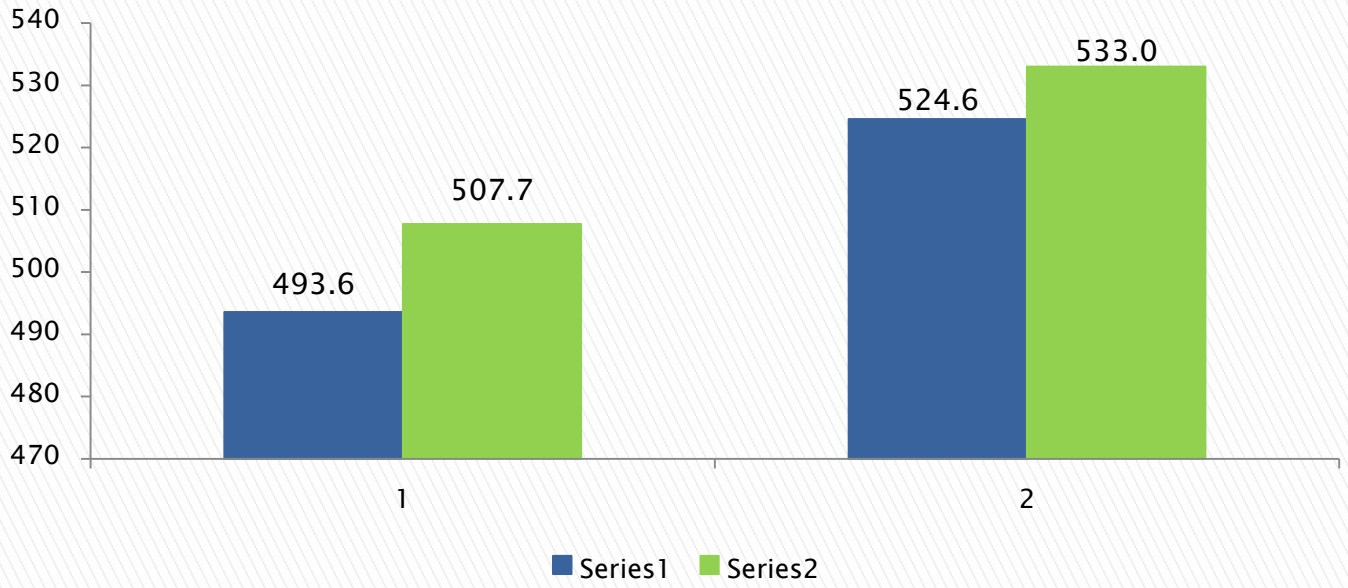
	2009	2012
Ireland	508.9	520.1
OECD	498.9	496.9

- The proportion of students in Ireland performing below Level 2 has dropped.
- The proportion of students in Ireland performing at Level 5 or above has increased marginally



Digital Reading between 2009 and 2012

- The mean scores of both males and females in Ireland have increased since 2009, although the difference is only significant for males



Science in 2012

- Ireland's mean science score is significantly above the OECD average

	Ireland	OECD
Science	522.0	496.5

- Ireland is ranked 9th of 34 OECD countries and 15th of all 65 countries/economies

Above OECD	Same as OECD	Below OECD
Shanghai-China	(Northern Ireland)	Norway
Singapore	Austria	Hungary
Finland	France	Italy
Canada	Denmark	Portugal
Ireland	United States	Sweden
United Kingdom	Spain	Iceland

Science in 2012

- The percentage of students in Ireland performing below Level 2 is considerably below the OECD average.
- The percentage of students performing at Level 5 or above is somewhat higher in Ireland compared to the OECD average.

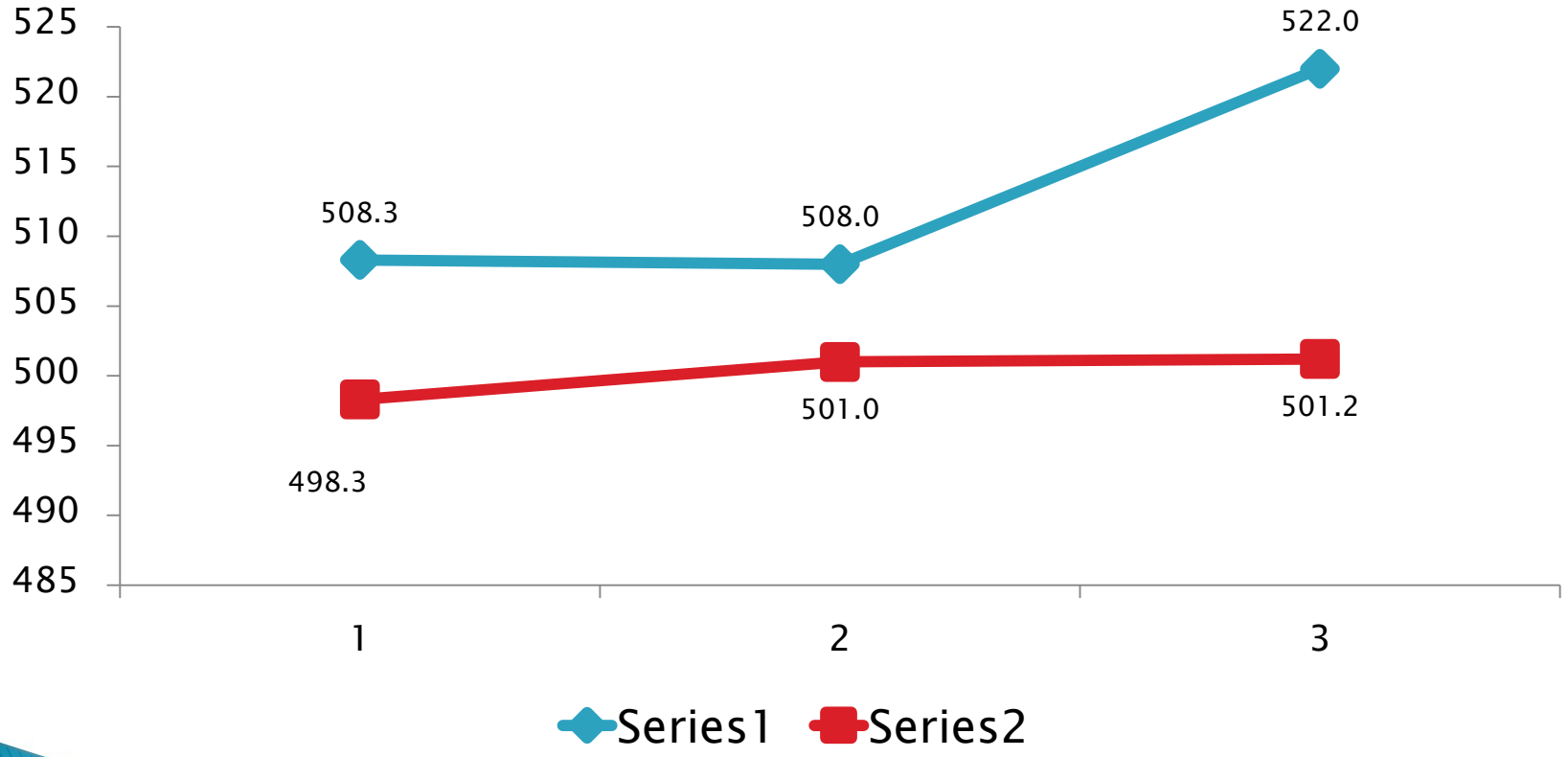
	Below Level 2	At or Above Level 5
Ireland	11.1%	10.8%
OECD	17.8%	8.4%

- Male and female students in Ireland have significantly higher mean scores than the corresponding OECD averages

	Male	Female
Ireland	523.9	520.0
OECD	501.8	500.5

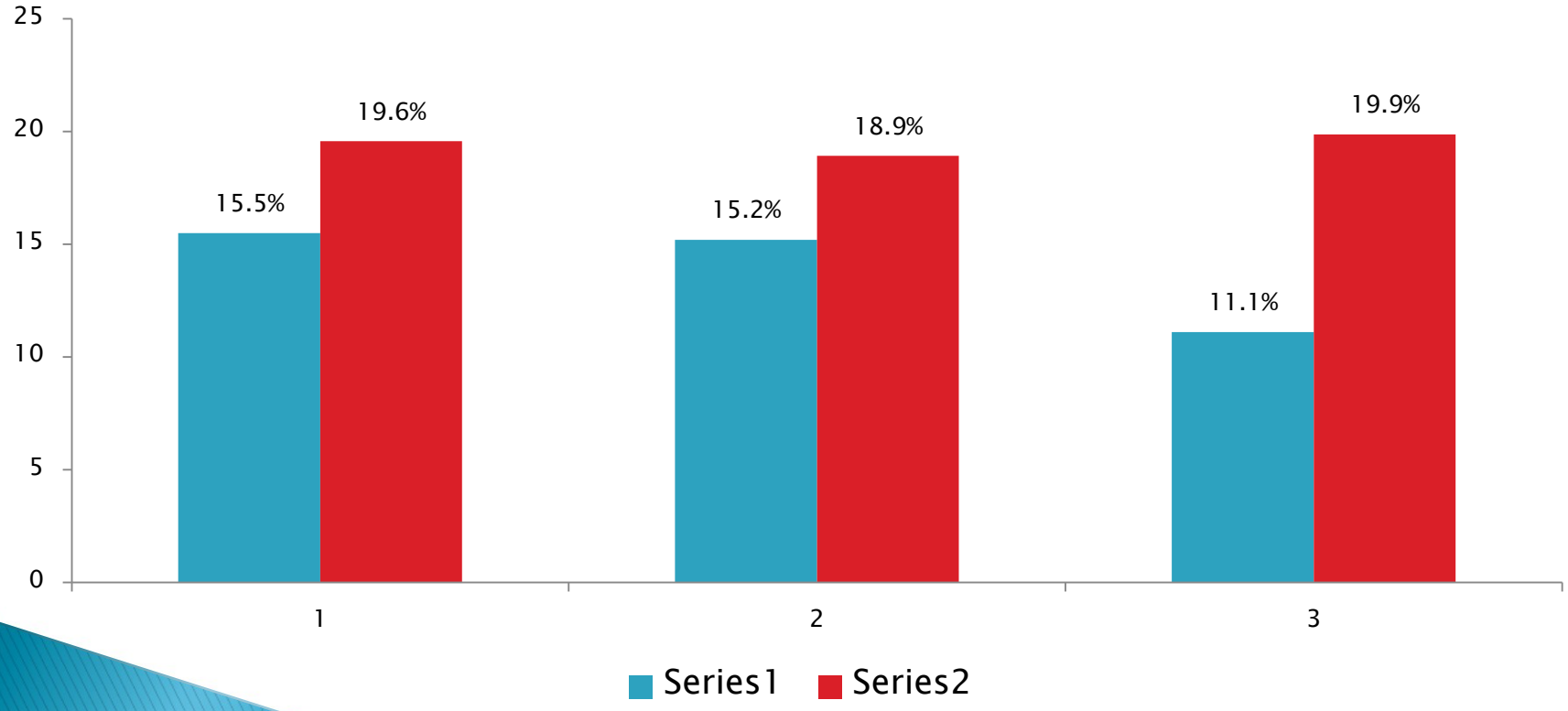
Science between 2006 and 2012

- Ireland's mean science performance in 2012 is significantly higher than in 2006 and 2009



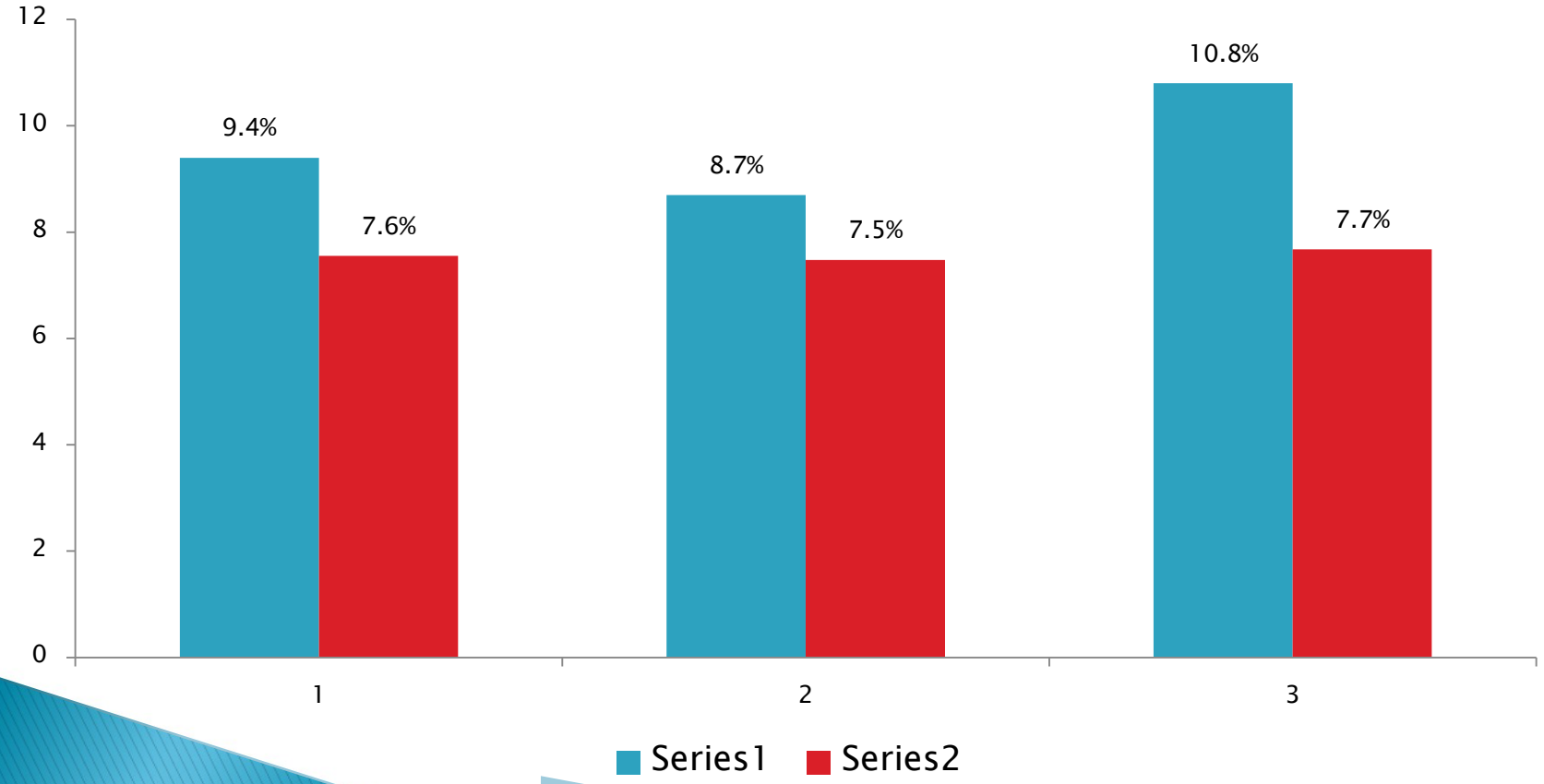
Science – % Below Level 2 between 2006 and 2012

- The Percentage of students in Ireland performing below Level 2 in 2012 is lower than in 2009 and 2006



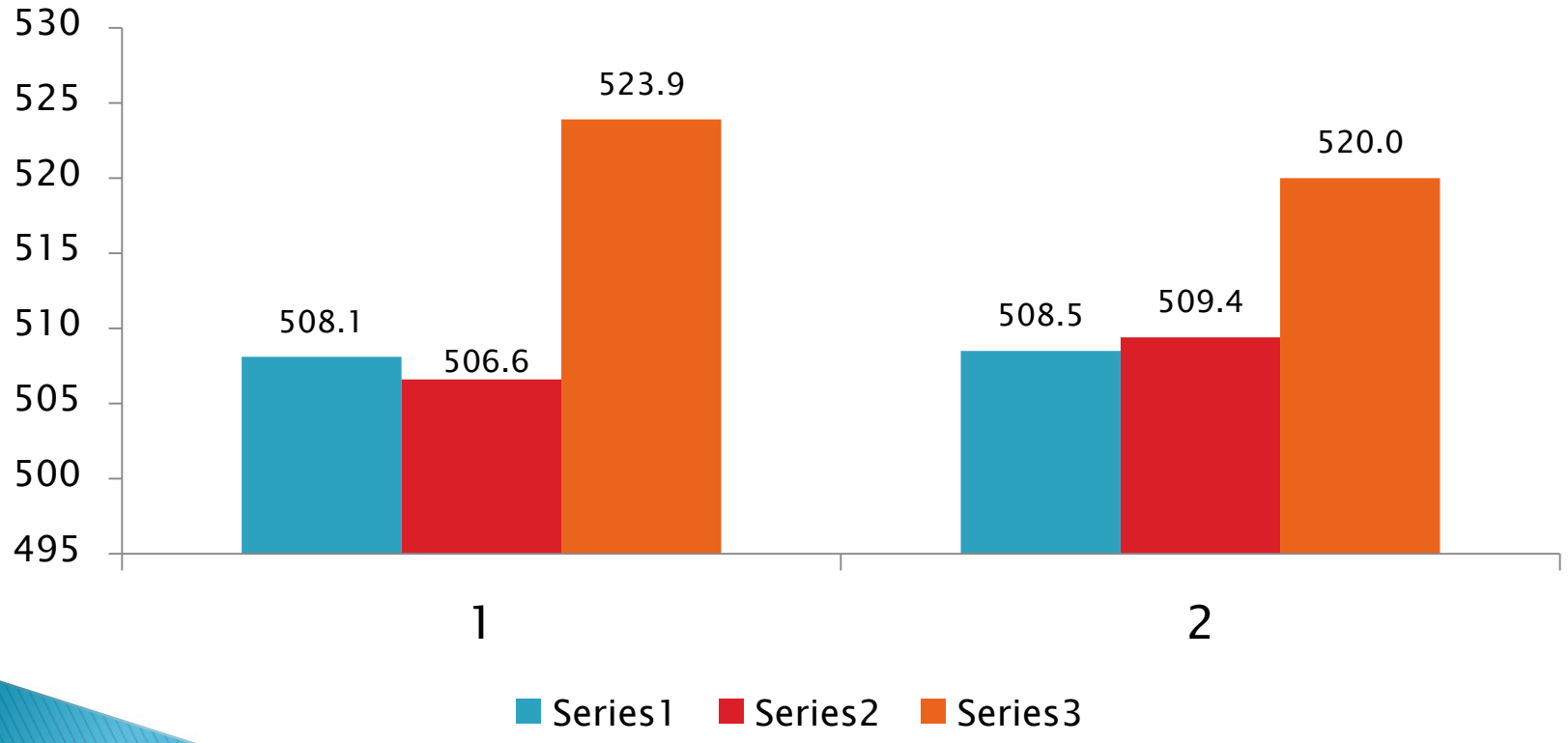
Science – % at Level 5 or Above between 2006 and 2012

- The Percentage of students in Ireland performing at Level 5 or above in 2012 is somewhat higher than in 2009 and 2006



Science – Males and Females between 2006 and 2012

- The mean science scores of males and females in Ireland are significantly higher in 2012 than in 2009 and 2006



Between-school Variance

- For print mathematics the percentage of variance in performance that can be attributed to differences between schools increased between 2003 and 2012 but is still considerably below the OECD average

	2003	2012
Ireland	14.9%	18.1%
OECD	34.9%	36.5%

Trends in students' response patterns

- The percentage of test items that were skipped by students in Ireland in 2009 was higher than in previous cycles
- In 2012, the percentage of items answered correctly has increased since 2009, with a corresponding decrease in the percentage of items that were skipped
  - Students in Ireland invested more effort in the 2012 assessment

Other factors related to changes since 2009

- The number of link items for print reading has increased from 26 to 44 items between 2009 and 2012, creating a more stable link between these two cycles for print reading.
- Possible factors which could have contributed to changes in student engagement with the assessment in 2012, include lower levels of survey fatigue, the use of external test administrators in 2012 and greater awareness of PISA due to the 2009 results
- The introduction of social, environmental and scientific education to the primary curriculum in 1999 and the revised science syllabus in 2003 are likely to have contributed to the increase in science achievement in 2012

Student and school characteristics

- The percentage of immigrant students in Ireland has increased since 2003

	2003	2012
Native	96.6%	90.4%
Immigrant with Eng/Irish	2.7%	5.1%
Immigrant with other language	0.7%	4.5%

- In 2012, native students do not differ from immigrant students who speak English/Irish as first language on any achievement domain
- Immigrant students who speak a language other than English or Irish are performing significantly less well than native students on print reading; however, they do not differ significantly on any of the other achievement domains in 2012.

Student and school characteristics

- Average Economic, Social and Cultural Status (ESCS) has increase in Ireland since 2003. The average ESCS of students in Ireland in 2012 is significantly higher than the OECD average.
- Students with significantly lower performance include:
  - Students who engage in paid work during term time for more than 8 hours a week (-29 points)
  - Students who never attended preschool (-15 points)
  - Students attending non-fee-paying schools (-57 points)
  - Students attending schools in the School Support Programme under DEIS (-60 points)
  - Students at risk of early school leaving (-63 points for print mathematics)
    - The percentage of 'at-risk' students in Ireland has decreased since 2003, from 20.5% to 6.5%

Attitudes, Beliefs and Behaviours

Ireland > OECD	Ireland =OECD	Ireland < OECD
Intrinsic motivation	Mathematics self-efficacy	Mathematics activities (e.g. chess, mathematics clubs)
Instrumental motivation	Mathematics self-concept	Intend to use mathematics in future study or career
Perseverance in learning	Sense of belonging to school	
Mathematics anxiety		

- Girls in Ireland have significantly lower levels of instrumental motivation, perseverance, self-efficacy, self-concept and intentions to use mathematics in their future study or career, but have significantly higher levels of mathematics anxiety when compared to boys.

Conclusions

- Ireland's print mathematics performance is above the OECD average for the first time, however, Ireland's performance has not changed significantly since 2003
- Space & Shape seems to be a particular weakness among students in Ireland
- Ireland's computer-based mathematics performance is similar to the OECD average, although females in Ireland are performing at below average levels
- The mean print reading score for Ireland is above the OECD average in 2012. Ireland's print reading performance is significantly higher than in 2009, but does not differ from 2000, 2003 or 2006.
- Student engagement with the assessment has contributed to the improved scores for reading and mathematics in 2012 compared to 2009. Also, the increase in the number of link items used to establish trends for reading in 2012 provides a more stable and reliable link to PISA 2009.

Conclusions

- Ireland's mean digital reading performance is significantly above the OECD average in 2012 and significantly higher than in 2009
- The mean score for science is also above the OECD average in 2012 and significantly higher than in 2006 and 2009.
- The introduction of social, environmental and scientific education to the primary curriculum in 1999 and the revised science syllabus in 2003 are likely to have contributed to the increase in science achievement in 2012
- Between school variance in print mathematics has increased slightly in Ireland since 2003, but is still considerably lower than the OECD average.
- Across all domains, Ireland's above average performance can be attributed to the relatively good performance of lower-achieving students
- Despite Ireland's above average performance in 2012, higher-achieving students in Ireland are underperforming relative to other countries.

Thank you.

www.erc.ie/p12mainreport
www.erc.ie/p12eappendix

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