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Northern Ireland and international educational studies

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Northern Ireland has participated in a number of international educational studies in recent years that aim to allow for international benchmarking on students' performance. This paper considers the findings of recent studies, discusses the common attributes of high performing countries and limitations of such studies.

Key Points

- In the 2011 Progress in International Reading Literacy Study (PIRLS) NI was ranked fifth of 45 countries at ages nine to ten;
- In the Trends in International Maths and Science Study (TIMSS) NI was ranked 6th of 50 countries in mathematics and 18th in science;
- PIRLS and TIMSS provide a range of other information on the school and home learning environment. Examples include:
 - NI had the highest levels of emphasis on academic success of all participating countries;
 - NI reported the lowest levels of collaboration between teachers;
 - Just over half of primary teachers felt 'very well prepared' to teach science;
- NI also took part in the Programme for International Student Assessment (PISA) in 2009;
- Performance in reading in PIRLS was higher than in PISA; Performance in TIMSS maths was higher than in PISA, while in science the scores were similar across the two studies;
- The evidence shows that the link between socio-economic background and performance is weaker than most countries at primary but stronger than average at post-primary;
- However comparisons between PISA and PIRLS and TIMSS should be treated with caution due to differences in the age and content of assessment;
- A number of attributes common to the highest performing countries internationally have been identified, including a valued teaching profession; autonomy for schools (with accountability) and effective pre-primary education;
- While some studies have identified a correlation between higher performance in international studies and outputs such as GDP, others caution against over-emphasis and point to limitations in terms of the areas assessed;
- A number of areas could be given further consideration, including:
 - The level of collaboration between teachers and the extent to which primary teachers feel prepared to teach science;
 - The amount of teaching time for science at the primary level and the level of emphasis on science investigation in class; and
 - The attributes common to high performing education systems.

Executive Summary

Introduction

Northern Ireland has participated in a number of international educational studies in recent years, allowing for international benchmarking on students' performance. This paper considers the findings of recent studies, discusses the common attributes of high performing countries and the limitations of such studies.

PIRLS and TIMSS

Northern Ireland participated in the Progress in International Reading Literacy Study (PIRLS) and the Trends in International Maths and Science Study (TIMSS) for the first time in 2011. NI took part at ages nine-ten. The key findings included:

- **Reading:** NI was ranked **5th out of 45 countries**;
- **Mathematics:** NI was ranked **6th out of 50 countries**;
- **Science:** NI was ranked **18th out of 50 countries**;

The studies included surveys of teachers and principals on a range of issues. Table 1 sets out some of the key findings.

Table 1: Key findings from the teacher and principal surveys

Area	Key findings
School learning environment	<ul style="list-style-type: none"> • NI had highest levels of emphasis on academic success of all participating countries
	<ul style="list-style-type: none"> • NI reported among the lowest levels of collaboration with colleagues
	<ul style="list-style-type: none"> • 91% of pupils were taught by teachers who felt 'very well prepared' to teach maths; however the equivalent figure for science was 54%
School resources	<ul style="list-style-type: none"> • Principals in NI most frequently reported that teaching was 'somewhat affected' by resource shortages (70%-74%)
	<ul style="list-style-type: none"> • NI had among the highest levels of computer provision internationally
Curriculum and learning	<ul style="list-style-type: none"> • Teaching time in NI was higher than the international average for English and mathematics, but lower than the average for science
	<ul style="list-style-type: none"> • 13% of Year 6 pupils were taught by teachers who emphasised science investigation in 'half the lessons or more' (international average - 40%)

Area	Key findings
Pupils and their homes	<ul style="list-style-type: none"> • 85% of pupils had more than 25 children's books in their home, higher than the international average of 55%
	<ul style="list-style-type: none"> • 59%-61% of students had teachers who reported teaching is limited 'to some extent' due to pupils suffering from lack of sleep - higher than the international average.

PISA (including a comparison with PIRLS and TIMSS)

The Programme for International Student Assessment (PISA) assesses student performance at age 15. The findings across PISA, PIRLS and TIMSS include:

- **Reading:** NI's performance was not significantly¹ different from the Organisation for Economic Cooperation and Development (OECD) average – Performance in PIRLS was higher than in PISA;
- **Mathematics:** Not significantly different from the OECD average – Performance in TIMSS was higher than in PISA;
- **Science:** NI's performance was significantly higher than the OECD average – scores were similar across TIMSS and PISA.
- **Link between socio-economic background and performance:** at primary level the relationship between socio-economic background and performance is weaker than in most participating countries; however, at post-primary the link is stronger than the international average.

In comparing the results it is important to remember that there are some key differences between the studies. While some insights can be drawn from comparing the findings, *variations between them should be taken into account*.

Key differences between PIRLS and TIMSS and PISA

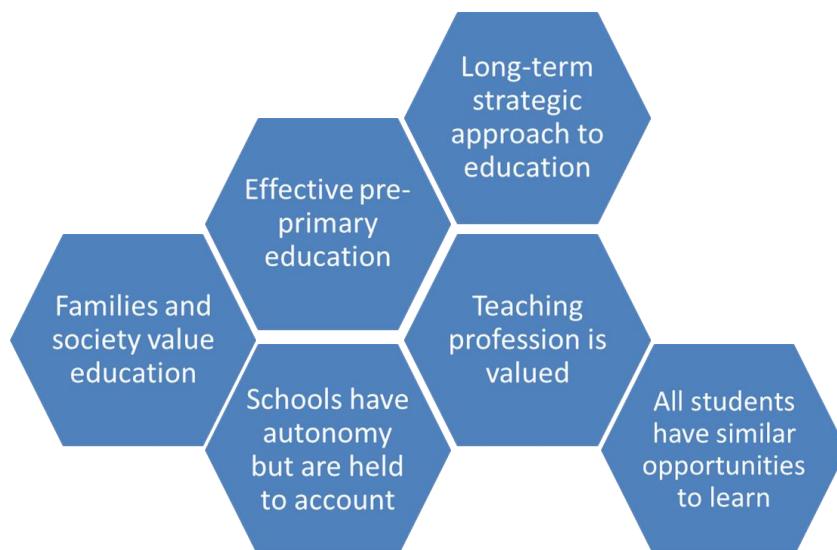
- PISA applies at age 15 while PIRLS and TIMSS assess at nine to ten
- PIRLS and TIMSS are *curriculum-based* (reflecting skills and knowledge taught in school) while PISA examines whether students can apply their learning to solve problems
- The scales used in the three surveys mean something different in each case (in regard to the content of assessment)
- There is some variation in the countries participating

¹ Throughout this paper the term 'significant' refers to statistical significance

Attributes of high performing countries

The highest performing education systems internationally are reported to include Finland, South Korea, Hong Kong, Japan and Singapore. Research has highlighted a number of common attributes across high performing countries.

Figure 1: Key features of high performing education systems



Views on international studies and limitations

Research has identified a correlation between performance in international studies such as PISA and higher Gross Domestic Product rates. Nonetheless, some authors have voiced concerns over such studies, suggesting that too much focus may be placed on them at the expense of other issues.

In addition, it is important to note that the studies considered in this paper examine specific aspects of education, but not all subjects or skills. An example is a study showing that the higher a country's score in PISA, the less likely it was to score well for entrepreneurial capacity.

Conclusion

This paper has explored the performance of Northern Ireland in a number of international studies, including the views of teachers and principals in regard to a range of factors affecting school life. Areas for further consideration could include:

- The level of collaboration between teachers in order to improve learning;
- The extent to which primary teachers feel prepared to teach science;
- Amount of teaching time for science at the primary level and the level of emphasis on science investigation in class; and
- Attributes of high performing systems, such as the high value placed on teaching profession and levels of autonomy for schools.

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1 Introduction

This paper provides an overview of the recent findings of a number of international studies: Trends in International Maths and Science Study (TIMSS); Progress in International Reading Literacy Study (PIRLS); the Programme for International Student Assessment (PISA); and the Pearson Index. It also considers the common attributes of high performing education systems internationally and discusses views on international studies and their limitations.

2 PIRLS and TIMSS

The PIRLS study compares reading at ages nine to ten internationally and is carried out every five years. TIMSS is an international study of mathematics and science at ages nine-ten, conducted every four years.

Northern Ireland participated in the two studies for the first time in 2011. PIRLS and TIMSS also assess at ages 13-14, however NI only participated in the lower age range. A total of 136 primary schools took part in the studies (each school undertook both PIRLS and TIMSS).²

PIRLS

PIRLS assesses reading for literacy experience and reading to acquire and use information. In 2011 Northern Ireland was ranked fifth out of 45 countries, and the mean score for reading was significantly³ higher than in 36 of the countries taking part. The countries that outperformed NI included Finland and Singapore, and the countries performing at a significantly lower level included England and the Republic of Ireland.⁴

Girls in Northern Ireland had significantly higher attainment than boys in PIRLS, in line with international findings and typical of many reading assessments.⁵

TIMSS

This study assesses:⁶

- Mathematics: number, geometric shapes and measures, data display; and
- Science: life science, physical science, earth science.

² Sturman, L., Twist, L., Burge, B. et al. (2012) *PIRLS and TIMSS 2011 in Northern Ireland: Reading, Mathematics and Science* Slough: NFER

³ Note: Throughout this paper the term 'significant' refers to statistical significance

⁴ Sturman, L., Twist, L., Burge, B. et al. (2012) *PIRLS and TIMSS 2011 in Northern Ireland: Reading, Mathematics and Science* Slough: NFER

⁵ As above

⁶ Sturman, L., Twist, L., Burge, B. et al. (2012) *PIRLS and TIMSS 2011 in Northern Ireland: Reading, Mathematics and Science* Slough: NFER

Mathematics

In TIMSS 2011 mathematics Northern Ireland was ranked sixth out of 50 countries internationally, significantly outperforming 44 of the 50 participating countries.

The five countries that performed significantly better than NI were all in East Asia (including Singapore, Hong Kong and Japan). Countries performing at a significantly lower level than NI included Finland, England, the Republic of Ireland and Australia.⁷

There were no significant gender differences in mathematics in Northern Ireland, in line with the findings for 25 other participating countries (including England, the Republic of Ireland and Singapore). There was a significant difference between genders for a total of 24 of the 50 participating countries, mostly with boys performing at a higher level.⁸

Science

In TIMSS science Northern Ireland was ranked 18th and placed in a band of ten countries with similar scores (including the Republic of Ireland). While this score is ‘notably weaker’ than for mathematics and reading, it was still above the TIMSS international average.⁹

Korea, Finland, the US and England were among the 17 countries that performed at a significantly higher level than NI. 23 countries had significantly lower results than NI.¹⁰

The primary curriculum in Northern Ireland does not include science as a distinct subject; it is included within ‘The World Around Us’. All of the TIMSS science topics are included within the NI curriculum.¹¹

There was no significant difference between the performance of boys and girls in science here, in line with 22 other countries (again including England, the Republic of Ireland and Singapore).¹²

Findings on the school learning environment

Surveys of teachers and principals included questions on the school learning environment. Internationally in TIMSS and PIRLS, pupils with the highest levels of attainment went to schools that emphasised academic success. Teachers’ satisfaction with their careers was also associated positively with achievement.¹³

⁷ Sturman, L., Twist, L., Burge, B. et al. (2012) *PIRLS and TIMSS 2011 in Northern Ireland: Reading, Mathematics and Science* Slough: NFER

⁸ As above

⁹ Sturman, L., Twist, L., Burge, B. et al. (2012) *PIRLS and TIMSS 2011 in Northern Ireland: Reading, Mathematics and Science* Slough: NFER

¹⁰ As above

¹¹ Sturman, L., Twist, L., Burge, B. et al. (2012) *PIRLS and TIMSS 2011 in Northern Ireland: Reading, Mathematics and Science* Slough: NFER

¹² As above

¹³ Mullis, I., O'Martin, M., Foy, P. and Arora, A. (2012) *TIMSS 2011 International Results in Mathematics* International Association for the Evaluation of Educational Achievement and Mullis, I., O'Martin, M., Foy, P. and Drucker, K.T. (2012) *PIRLS 2011 International Results in Reading* International Association for the Evaluation of Educational Achievement

Table 2: Overview of teacher and principal views on the school learning environment

Area	Findings for NI	International comparison
Emphasis on academic success	<ul style="list-style-type: none"> 93% of pupils had principals who reported 'high' or 'very high' emphasis 	<ul style="list-style-type: none"> International average: 66%-68% NI had highest levels of emphasis of all participating countries Internationally, higher pupil attainment was associated with increased emphasis
Teachers' career satisfaction	<ul style="list-style-type: none"> 54%-56% of pupils had teachers who were 'satisfied' with their career with a further 40%-41% 'somewhat satisfied' 	<ul style="list-style-type: none"> In line with international averages A number of high performing countries had lower levels of satisfaction than NI, including Singapore and Finland
Teachers' reports of collaboration with colleagues to improve learning	<ul style="list-style-type: none"> Teachers reported relatively low levels of collaboration (21%-22% were 'very collaborative') 	<ul style="list-style-type: none"> International average was 35%-36% choosing 'very collaborative' NI and RoI reported the least collaboration in PIRLS internationally
Teachers feeling prepared to teach maths and science ¹⁴	<ul style="list-style-type: none"> 91% of pupils taught by teachers who felt 'very well prepared' for maths Equivalent for science was 54% of pupils 	<ul style="list-style-type: none"> International average for maths was 83% International average for science was 62%
Teachers' subject specialism	<ul style="list-style-type: none"> 76% of pupils in maths and 75% in science were taught by teachers whose main area of study was primary education (without specialisation in maths/science) 	<ul style="list-style-type: none"> Comparable international averages were 46% and 48% respectively Internationally 28% of teachers in maths and 25% in science had a major in primary education and a major or specialism in maths/ science (10/11% in NI)

Source: Sturman, L., Twist, L., Burge, B. et al. (2012) *PIRLS and TIMSS 2011 in Northern Ireland: Reading, Mathematics and Science* Slough: NFER

¹⁴ This question was not included within the PIRLS study

Findings on school resources

The TIMSS and PIRLS studies included a survey of teachers and principals on their school's resources for teaching reading, mathematics and science and on their working conditions (for example the condition of buildings and the availability of materials). Overall, the surveys found that successful schools internationally tend to be well-resourced.¹⁵ The key findings for Northern Ireland include:¹⁶

- Majority of principals reported that teaching was '**somewhat affected**' by **resource shortages** (71%-74%), in line with international findings;
- However, for **reading and mathematics just 1% of pupils were in schools in which teaching was 'affected a lot'** by shortages in resources (science: 3%);
- **Teachers rated their working conditions relatively highly** compared to international averages, with most reporting that they had '*minor problems*' or '*hardly any problems*' with their working conditions;
- **NI had among the highest levels of computer provision** internationally for reading, mathematics and science (only England had greater provision).

With regard to computer provision, over three-quarters (77%) of schools in NI had one computer available for every one or two students, compared to an international average of 38%-41%. A further 17% of schools had one computer between three-five pupils, and 5% had one computer for six or more pupils. However, there are no clear patterns of achievement in relation to computer availability.¹⁷

Findings on the curriculum and learning activities

The PIRLS and TIMSS studies also investigated teachers' and principals' views on teaching practices and the curriculum in reading, mathematics and science.

Teaching time

In NI overall teaching time was higher than the international average. For the individual subjects, it was higher for English and mathematics, but lower than the average in science. The highest ranked countries had greater teaching time in science.¹⁸

Emphasis on science investigation

Just 13% of Year 6 pupils in NI were taught by teachers who emphasised science investigation in about 'half the lessons or more', in comparison to the international average of 40%. In England the figure was 41% and in ROI it was 43%.¹⁹

¹⁵ Mullis, I., O'Martin, M., Foy, P. and Arora, A. (2012) *TIMSS 2011 International Results in Mathematics* International Association for the Evaluation of Educational Achievement

¹⁶ Sturman, L., Twist, L., Burge, B. et al. (2012) *PIRLS and TIMSS 2011 in Northern Ireland: Reading, Mathematics and Science* Slough: NFER

¹⁷ As above

¹⁸ Sturman, L., Twist, L., Burge, B. et al. (2012) *PIRLS and TIMSS 2011 in Northern Ireland: Reading, Mathematics and Science* Slough: NFER

On average internationally, pupils whose teachers emphasised science investigation in ‘about half of lessons or more’ had higher performance than those whose teachers who focused on it to a lesser degree. However in Northern Ireland there was no clear pattern between the focus on science investigation and pupils’ average achievement.²⁰

Findings on characteristics of pupils and their homes

Access to resources and socio-economic background are known to have an impact on student outcomes. Indeed, in the studies higher average scores were associated with students attending schools where more students were from better-off backgrounds.²¹

In PIRLS pupils performed better if their parents had more resources for learning at home; liked reading themselves and often engaged in literacy activities with their children.²² Some of the key findings of PIRLS and TIMSS in this regard are highlighted in the following paragraphs.

Home resources for learning

Just under a third (31%) of children in NI reported having more than 100 books in their home, higher than the international average and in line with findings in Singapore, the Republic of Ireland and England. Other key findings include:²³

- The majority (85%) of pupils had more than 25 children’s books in their home, higher than the average internationally;
- 35% of children had at least one parent who was educated to university level or higher, just above the international average;
- Around half of children had at least one parent in a professional occupation, higher than the international average of 36%.

Pupil level factors that limit teaching

Teachers were also asked about the degree to which pupil level factors such as levels of nutrition and sleep limited their teaching. The key findings are outlined in Table 3.

¹⁹ As above

²⁰ Sturman, L., Twist, L., Burge, B. et al. (2012) *PIRLS and TIMSS 2011 in Northern Ireland: Reading, Mathematics and Science* Slough: NFER

²¹ Mullis, I., O’Martin, M., Foy, P. and Arora, A. (2012) *TIMSS 2011 International Results in Mathematics* International Association for the Evaluation of Educational Achievement and Mullis, I., O’Martin, M., Foy, P. and Drucker, K.T. (2012) *PIRLS 2011 International Results in Reading* International Association for the Evaluation of Educational Achievement

²² As above

²³ Sturman, L., Twist, L., Burge, B. et al. (2012) *PIRLS and TIMSS 2011 in Northern Ireland: Reading, Mathematics and Science* Slough: NFER

Table 3: Overview of pupil level factors that limit teaching

Area	Findings for NI	International comparison
Pupils lacking prerequisite knowledge or skills	<ul style="list-style-type: none"> • 68% of students in classrooms where teachers report teaching is limited ‘to some extent’ • 26% in classrooms where teaching is ‘not at all’ limited 	<ul style="list-style-type: none"> • Broadly in line with international averages of 61% reporting ‘to some extent’ and 28% reporting ‘not at all’ • Internationally there was an association between attainment and reports of limitations, but not in Northern Ireland
Pupils suffering from a lack of basic nutrition	<ul style="list-style-type: none"> • 19%-20% of students in classrooms where teachers report instruction is limited 	<ul style="list-style-type: none"> • Lower than the international averages of 27%-29%
Pupils suffering from a lack of sufficient sleep	<ul style="list-style-type: none"> • 59%-61% of students in classrooms where teachers report instruction is limited 	<ul style="list-style-type: none"> • Higher than the international averages of 46%-49%

Source: Sturman, L., Twist, L., Burge, B. et al. (2012) *PIRLS and TIMSS 2011 in Northern Ireland: Reading, Mathematics and Science* Slough: NFER

3 Programme for International Student Assessment (PISA)

In the PISA 2009 study Northern Ireland’s performance in reading and mathematics was not significantly different from the Organisation for Economic Cooperation and Development (OECD) average. In reading the spread of attainment was slightly wider than the OECD average, but it was slightly narrower for mathematics.²⁴

However in science, NI’s performance was higher than the OECD average – this difference was statistically significant. Compared to other countries, NI had a high proportion of pupils at the top levels of science attainment in PISA.²⁵

Comparisons between PIRLS and TIMSS and PISA

The National Foundation for Educational Research (NFER) notes that PIRLS and TIMSS are not directly comparable to PISA. The key differences include:²⁶

²⁴ Bradshaw, J., Ager, R., Burge, B., Wheater, R. (2010) *PISA 2009: Achievement of 15-Year-Olds in Northern Ireland* Slough: NFER

²⁵ As above

²⁶ Sturman, L., Twist, L., Burge, B. et al. (2012) *PIRLS and TIMSS 2011 in Northern Ireland: Reading, Mathematics and Science* Slough: NFER

- PISA assesses 15 year olds whereas the relevant PIRLS and TIMSS findings relate to nine and ten year olds;
- PIRLS and TIMSS aim to *evaluate schools systems* by exploring curriculum-based concepts, while PISA aims to explore the *skills of students* by investigating literacy in reading, mathematics and science;
- The scales used in the three surveys indicate something different in each case (in terms of the content of assessment);
- There were some differences in the countries taking part in the studies.

Nonetheless the NFER asserts that ‘useful insights’ can be gained by comparing the scores, giving some indication of the degree to which a country performs similarly at primary and post-primary in relation to the other countries taking part.²⁷

Findings

Table 4 outlines the key findings of a comparison of PIRLS and TIMSS with PISA.²⁸

Table 4: Comparison of PIRLS and TIMSS (ages nine-ten) with PISA (age 15)

	Findings
Reading	<ul style="list-style-type: none"> • Pupils here performed better on PIRLS than PISA • NI was among a cluster of countries with this trend including England, the Republic of Ireland and the US
Mathematics	<ul style="list-style-type: none"> • Pupils here performed comparatively better in TIMSS than PISA • There was a similar trend for countries including England, the Republic of Ireland and the US
Science	<ul style="list-style-type: none"> • Scores were similar across TIMSS and PISA in NI • Other countries with a similar trend included England and ROI

Source: Sturman, L., Twist, L., Burge, B. et al. (2012) *PIRLS and TIMSS 2011 in Northern Ireland: Reading, Mathematics and Science* Slough: NFER

The two studies also give an indication of the effects of pupils’ socio-economic background on their performance. The key findings in this regard include:²⁹

- **At primary level** in reading, maths and science, NI has a shorter tail of underachievement than England;

²⁷ Sturman, L., Twist, L., Burge, B. et al. (2012) *PIRLS and TIMSS 2011 in Northern Ireland: Reading, Mathematics and Science* Slough: NFER

²⁸ As above

²⁹ *Independent Review of the Common Funding Scheme* (2013) Bangor: Department of Education

- In addition, findings from PIRLS show that the relationship between parental factors (employment and education) and achievement in reading is weaker than in most participating countries at primary;
- **At post-primary**, the relationship between socio-economic background and performance is stronger in NI in comparison to the international average in PISA;
- The tail of underachievement at post-primary tends to be longer than the average.

4 Pearson Index

A recent report by Pearson considered the attributes of high performing countries internationally, and produced a Global Index of Cognitive Skills and Educational Attainment. This index draws on the results of the PISA, PIRLS and TIMSS studies, and also takes into account other indicators including literacy levels and graduation rates to create a comparative index of educational performance.³⁰

The United Kingdom (including Northern Ireland) is ranked sixth within this Index (out of 40 countries). The figures for the UK are not broken down by jurisdiction.³¹ The highest performers were Finland and South Korea, followed by Hong Kong, Japan and Singapore. The Republic of Ireland was ranked 11th.³²

5 Attributes of education systems within high performing countries

While it has been noted that there are difficulties in establishing clear linkages between educational inputs and outputs,³³ research has identified a number of common features of the countries that consistently perform well in international studies.

Evidence highlights that rather than the amount of money spent on education, it is the way in which resources are targeted that plays a key role in contributing to outcomes.³⁴ The key findings are outlined in the following figure.

³⁰ Pearson (2012) *The Learning Curve: Lessons in country performance in education* Economist Intelligence Unit

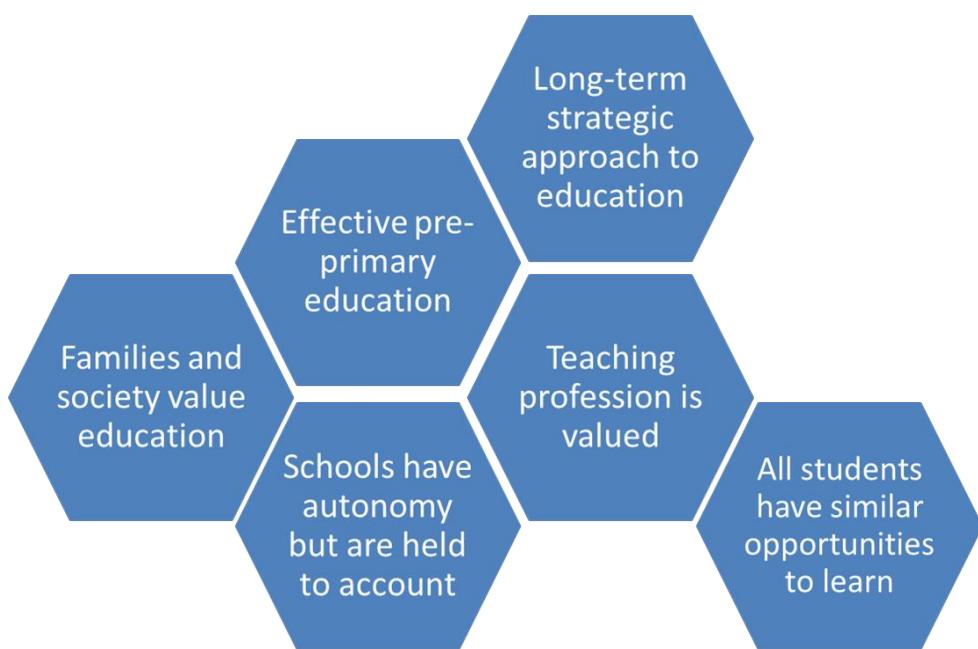
³¹ Information provided by the Economist Intelligence Unit, January 2013

³² Pearson (2012) *The Learning Curve: Lessons in country performance in education* Economist Intelligence Unit

³³ As above

³⁴ Pearson (2012) *The Learning Curve: Lessons in country performance in education* Economist Intelligence Unit

Figure 2: Key features of high performing education systems



Source: Barber, M., Donnelly, K., Rizvi, S. (2012) *Oceans of Innovation: the Atlantic, the Pacific, global leadership and the future of education* London: Institute for Public Policy Research; OECD (2010) *PISA 2009 Results: What makes a school successful? Resources, policies and practices* (Volume IV); and Pearson (2012) *The Learning Curve: Lessons in country performance in education* Economist Intelligence Unit

6 Views on international studies and limitations

A number of articles have considered the usefulness of international studies such as PISA, PIRLS and TIMSS. For example, research has highlighted correlations between higher performance in PISA and higher Gross Domestic Product (GDP) rates.³⁵

However, some authors have questioned the usefulness of such studies, suggesting that a focus on them can divert attention from other issues, such as underperforming schools.³⁶ Other concerns include countries attempting to copy the education systems of top performing countries without taking into account the differing contexts.³⁷

Indeed, many of the top performing countries have very different social, cultural, linguistic and demographical contexts to those in NI. For example, in Finland society is highly equitable, reading is an innate part of the culture and Finnish is one of the easiest languages to learn to read. While in Singapore, Shanghai and Hong Kong students undergo ‘punishing’ study schedules.³⁸

³⁵ Hanushek, E. A., Wößmann, L. (2010) “Education and Economic Growth” *International Encyclopedia of Education* Vol. 2, pp. 245-252 Oxford: Elsevier and Pearson (2012) *The Learning Curve: Lessons in country performance in education* Economist Intelligence Unit

³⁶ Baker, K. (2007) “Are international tests worth anything?” *Phi Delta Kappan*, 89 (2), pp. 101-104

³⁷ Stewart, W. (2012) “Dissemination or contamination?” *Times Educational Supplement*, 14th December 2012 pp. 24-28

³⁸ Buckingham, J. (2012) *Keeping PISA in Perspective: Why Australian education policy should not be driven by international test results* Australia: Centre for Independent Studies

Limitations

PISA, TIMSS and PIRLS measure specific aspects of education but do not cover all subjects or skills. For example, research has found a ‘striking’; negative correlation between countries’ rankings on PISA mathematics and their perceived entrepreneurial capacity. Indeed, many of the highest performing countries had the lowest rankings for entrepreneurship.³⁹

7 Conclusion

This paper has discussed the performance of Northern Ireland in international studies, including the views of teachers and principals in regard to a range of factors affecting school life. Areas for consideration could include:

- The level of collaboration between teachers in order to improve learning;
- The extent to which primary teachers feel prepared to teach science;
- Amount of teaching time for science at the primary level and the level of emphasis on science investigation in class; and
- Attributes of high performing systems, such as the high value placed on teaching profession and levels of autonomy for schools.

³⁹ Zhao, Y. (2012) *‘Test Scores vs. Entrepreneurship: PISA, TIMSS, and Confidence’* [online] Available at: <http://zhaolearning.com/2012/06/06/test-scores-vs-entrepreneurship-pisa-timss-and-confidence/>