The Fundamental Importance of Knowledge and Skills for Individuals and Society

Seminar on the importance of Education Research and Innovation
– strengthening the European knowledge base
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Effects of education

- Education has been shown to have positive effects on:
  - economic growth;
  - labor market outcomes;
  - social status;
  - health and longevity;
  - civic participation and values;
  - cognitive abilities; and
  - knowledge and skills
- These are highly desirable outcomes, but we know little about the mechanisms behind the effects.

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Human capital theory

- Human capital theory is since around 1950 an important field within economics (e.g., Becker, Mincer, Schultz).
- Human capital has in empirical research primarily been measured by number of years of attained schooling.
- Recent work has demonstrated that knowledge and skills are more appropriate indicators of human capital than years of schooling:
  - Knowledge and skills in the population are more important for country-level economic growth than years of schooling.
  - Individual earnings also are more strongly influenced by knowledge and skills than years of schooling

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Quantity and quality of education

- Massive increases in years of attained education: In 2016, 80 % of people aged 25–54 in the EU-28 had attained at least an upper secondary level of education, compared with 64 % of those aged 55–74.
- The increases may be expected to continue.
- Quality of education is more difficult to measure. However, great progress has been made with the establishment of the international large scale assessments of student achievement in compulsory schooling.

International large-scale studies of educational achievement (ILSA)

- ILSAs provide information about knowledge and skills in different educational systems:
  - *Trends in International Mathematics and Science Study (TIMSS)*: Mathematics and Science in Grade 4 and Grade 8. Every fourth year since 1995.
  - *Progress in International Reading Literacy Study (PIRLS)*: Reading literacy in Grade 4. Every fifth year since 2001.
  - *Programme for International Student Assessment (PISA*). Mathematics, Science and Reading among 15-year-olds. Every third year since 2000.
  - *Programme for the International Assessment of Adult Competencies* (*PIAAC).* Literacy, Numeracy and Problem-solving in a technology-rich environment. Adults 16 – 65 years. Conducted in 2011/12, every 10 years.

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Differences in quality of education

- ILSAs have demonstrated large achievement differences between countries. The achievement difference between students at the end of compulsory school in an average performing country and a top performing country is roughly what students learn during two years.
- Substantial within-country achievement changes over time have also been observed, some countries showing improvements and others declining achievement.
- Such variation reflects differences in quality of education across countries and time.

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Two fundamental questions

- To the extent that the knowledge and skills acquired in compulsory schooling are long-lasting, they will influence outcomes of schooling at upper secondary and tertiary levels of education. *We therefore need to know to what extent there are long-term effects of education on knowledge and skills?*
- *We also need to know in what ways quality of education in compulsory school influence knowledge and skills?*

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Determinants of quality of basic schooling

- Class-size and teacher density:
  - Few consistent effects on outcomes.
  - Positive effects for certain groups of students (lower grades, low SES).
- Organization of schooling:
  - Organizational differentitation and segregation tends to increase variance in student achievement and produce lower mean levels.
  - Instructional time has positive effects.
- Quality of teachers and teaching:
  - Positive effects.

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Teachers as determinants of quality differences

- Very large differences in effects on student achievement of individual teachers (teacher fixed effects).
- Many commonly used indicators of teacher differences are not consistently related to student achievement (e.g., education, experience levels, sources and nature of teacher preparation, and salary).
- Measures of teachers' knowledge and skills are related to student outcomes (e.g., Baumert et al., 2010; Hanushek et al., 2017).

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Baumert, J. et al. (2010) Teachers' Mathematical Knowledge, Cognitive Activation in the Classroom, and Student Progress. *American Educational Research Journal*, *47*(1), 133-180

- Investigated the significance of teachers' content knowledge (CK) and pedagogical content knowledge (PCK) for quality of instruction and student progress in secondary-level mathematics.
- Tests were developed to measure teachers CK and PCK.
- One-year follow-up of PISA in Germany
- Substantial positive effect of PCK on students' learning gains.
- Effects were mediated by the provision of cognitive activation and individual learning support.

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Hanushek, E.A., et al. (2017). The Value of Smarter Teachers: International Evidence on Teacher Cognitive Skills and Student Performance. NBER Working Paper No. 20727

- For 31 countries participating in PIAAC those employed as teachers were identified and their literacy and numeracy scores were aggregated to the country level.
- Achievement data from PISA for the same countries was combined with the teacher information.
- Substantial effects of teachers' literacy and numeracy scores were found on students' reading and mathematics achievement, respectively.

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Conclusions concerning quality determinants

- Teachers are determinants of quality of compulsory schooling.
- Teachers' general knowledge and skills are important, as are specific teaching skills.
- The effects are likely to be mediated via quality of instruction.
- Improvement factors:
  - Recruitment and selection;
  - Initial teacher education;
  - Continuing professional development;
  - Research and development on how knowledge and skills are developed through instruction.

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Are there long-term effects of quality of education?

- Schneeweis, Skirbekk and Winter-Ebmer (2014) found in six European countries that longer compulsory schooling causally improved cognitive performance up to four decades later.
- Freriksson, Öckert & Osterbeek (2013) found in a Swedish study long-term effects of class size in primary school on completed education, wages, and earnings at adult age.
- If there are long-lasting changes in quality of schooling over time, these can be expected to be reflected in age cohort differences in levels of skills in the adult population.

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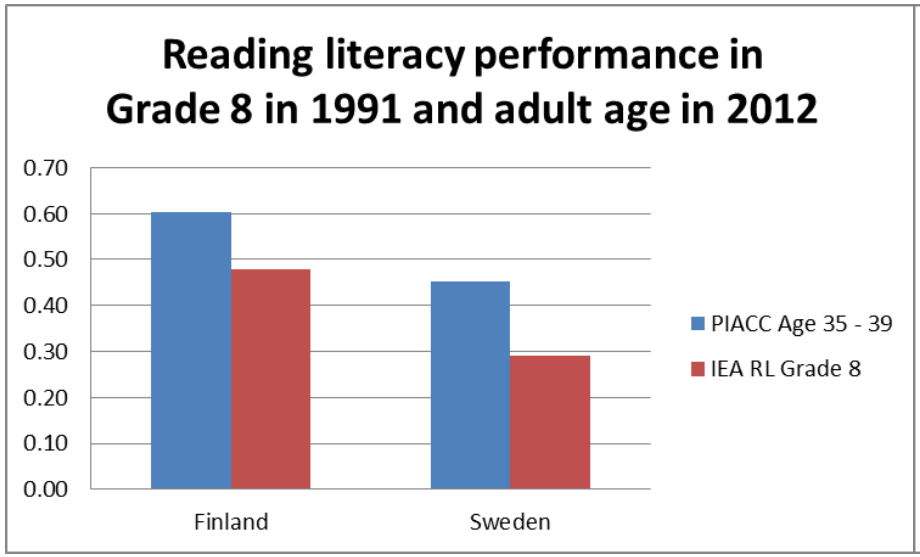
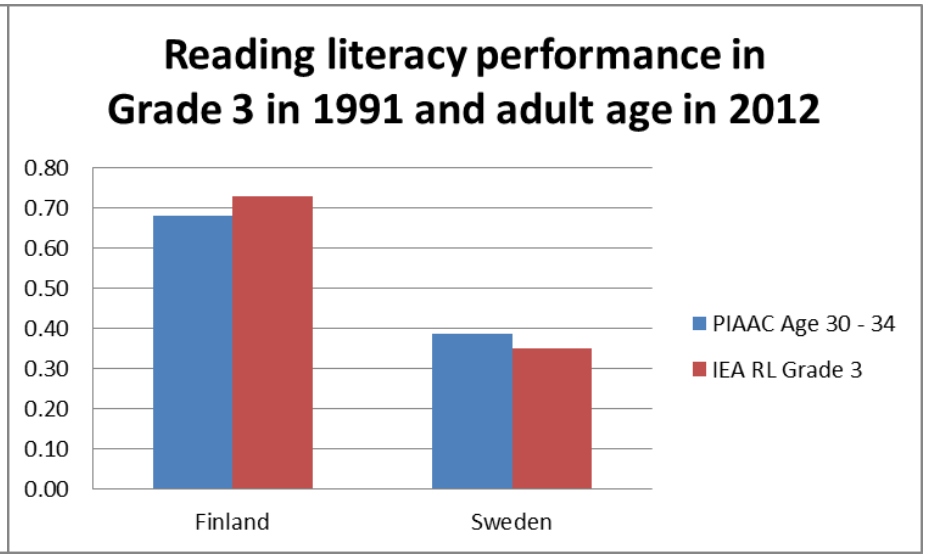
Gustafsson, J.-E. (2016). Lasting effects of quality of schooling: Evidence from PISA and PIAAC. *Intelligence*, 57, 66–72.

- Data from 20 countries:
  - Five rounds of PISA data 2000 – 2012
  - Cross-sectional PIAAC 2012 survey of skills among 16 – 65 year-olds
- Linear achievement trends across the five PISA rounds were estimated to indicate change in quality of schooling. For PIAAC mean skill differences were computed between a younger (16 – 19 years) and an older (25 – 29 years) age group.
- Age-group performance differences were strongly and significantly related to the PISA achievement trends (r = .70).
- It was concluded that quality of schooling has lasting impact on adult literacy and numeracy performance levels

Comparisons between the IEA Reading Literacy Study in 1991 and PIAAC in 2012 Gustafsson & Blömeke (in press).

Development of school achievement in the Nordic countries during half a century. *Scandinavian Journal of Educational Research*





This study too supports the hypothesis that there are lasting effects of education

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Conclusions

- Quality of schooling has a strong impact on student achievement.
- Knowledge and skills acquired in compulsory school are long-lasting and can therefore be expected to influence the outcomes of upper secondary and tertiary education.
- Currently our knowledge how to best support development of knowledge and skills through the processes of schooling is limited. Massive research efforts are therefore needed on how to improve teaching for development of knowledge and skills.

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Conclusions, cont

- Two main areas of research:
  - How can teacher education be improved so that teachers are better equipped to teach so that students develop knowledge and skills?
  - How can school instruction be improved so that students better develop knowledge and skills?
- To answer these categories of question at least two types of research are needed:
  - Basic research on factors and processes involved in student learning
  - Applied research focussing on issues and problems related to teaching practices and how these influence knowledge and skills.