



# Developing a digital literacy scale & measuring digital divide using PIAAC data

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# Objectives

Work in progress

## (1) Create a construct measuring digital literacy

- Validate the digital literacy scales for adult population
  - Confirmatory factor analysis (CFA)
  - Measurement invariance testing *<work in progress>*
  - Validation with PIAAC assessment- problem solving in technology rich environment (PSTRE)

## (2) Identify the left-behind

- The extent of adults having low or high digital literacy skills use
- What characteristics are associated with low digital literacy?
- Do they vary across countries?

## (3) Policy recommendations

- What have countries done to improve digital literacy?



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# Digital literacy

## Why is it important?

- Inevitable that technology and the internet would change one's life (Paul Glistner, 1997)
- The lack of digital skills has effectively become a barrier to social integration and personal development (European Commission, 2008)
- The importance of digital skills and the lack of it have generated a great deal of interest
  - Previous researches and definition used may not have kept up with time

# Meaning...

**“The ability to understand and to evaluate and integrate information in multiple format that the computer can deliver.”**

**-Paul Glister, 1997**

- U.K Skills for Life survey (2003) defines digital literacy as possessing basic skills required to perform basic operations like saving data and the use of word processor, spreadsheets and search engines
- Catts and Lau (2008), in a paper for UNESCO, refer digital literacy to the use of information technologies to locate and collect information, evaluate, analyze and create information and communication of ideas
- Spires and Barlett (2012) grouped digital literacy into 1) Finding and consuming digital content 2) Creating digital content 3) communicating or sharing digital content
- PIAAC PS-TRE is defined as of acquiring and evaluating information, communicating and performing tasks in the digital environment.



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# The digital literacy skills use construct

## Construct

Parallel sets of survey questions on frequency of use of ICT at work and everyday life

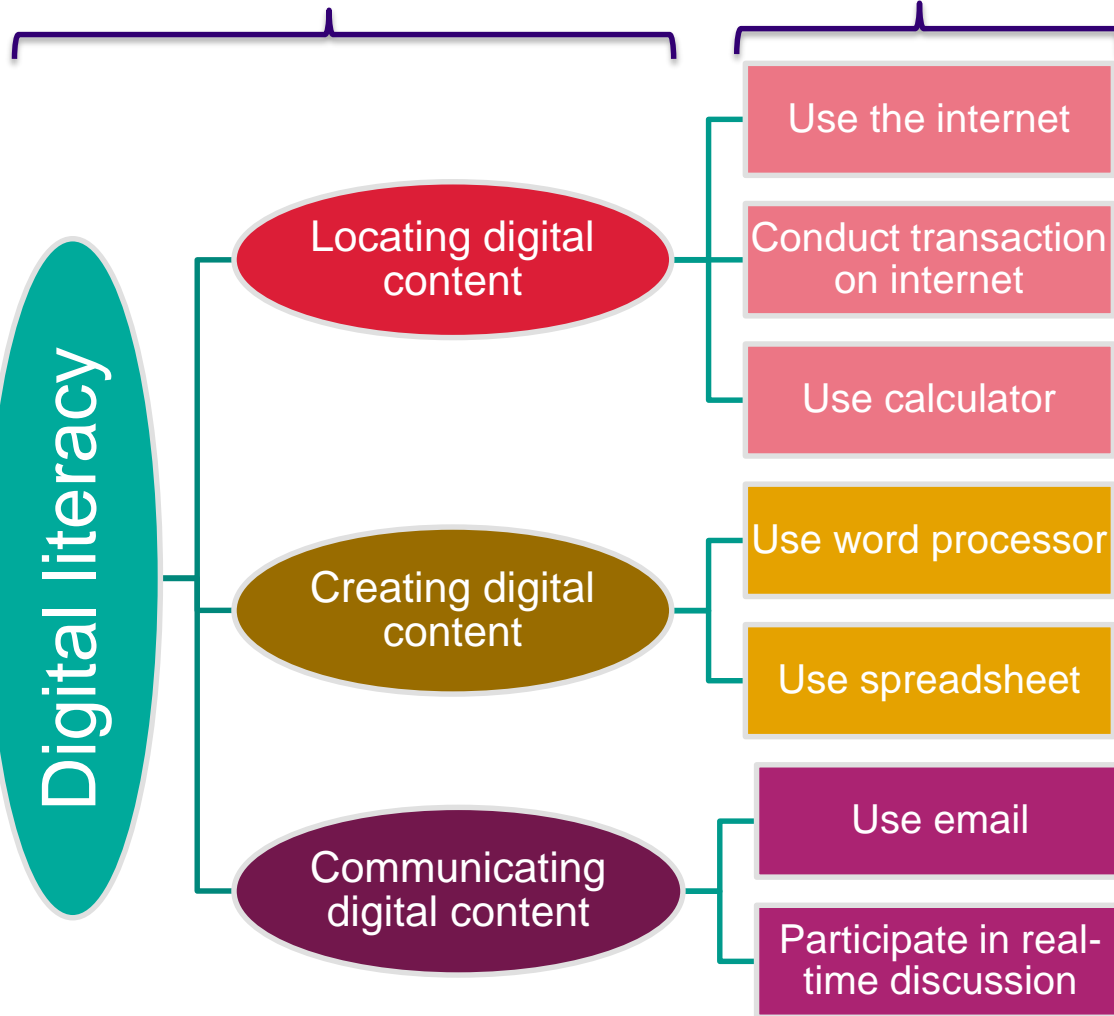
## Five point Likert scale

1. Never\*
2. Less than once a month
3. Less than once a week and at least once a month
4. At least once a week but not every day
5. Every day

## Confirmatory factor analysis & measurement invariance testing

E.g., Singapore and Canada

- RMSEA suggests scalar invariance
- CFI suggests metric invariance



Model	RMSEA	CFI	SRMR	TLI
Configural	0.034	0.988	0.020	0.965
Metric	0.034	0.985	0.029	0.963
Scalar	0.047	0.967	0.042	0.931

▲ \*Recoded as never: respondents who have never used the computer were routed away from the questions.



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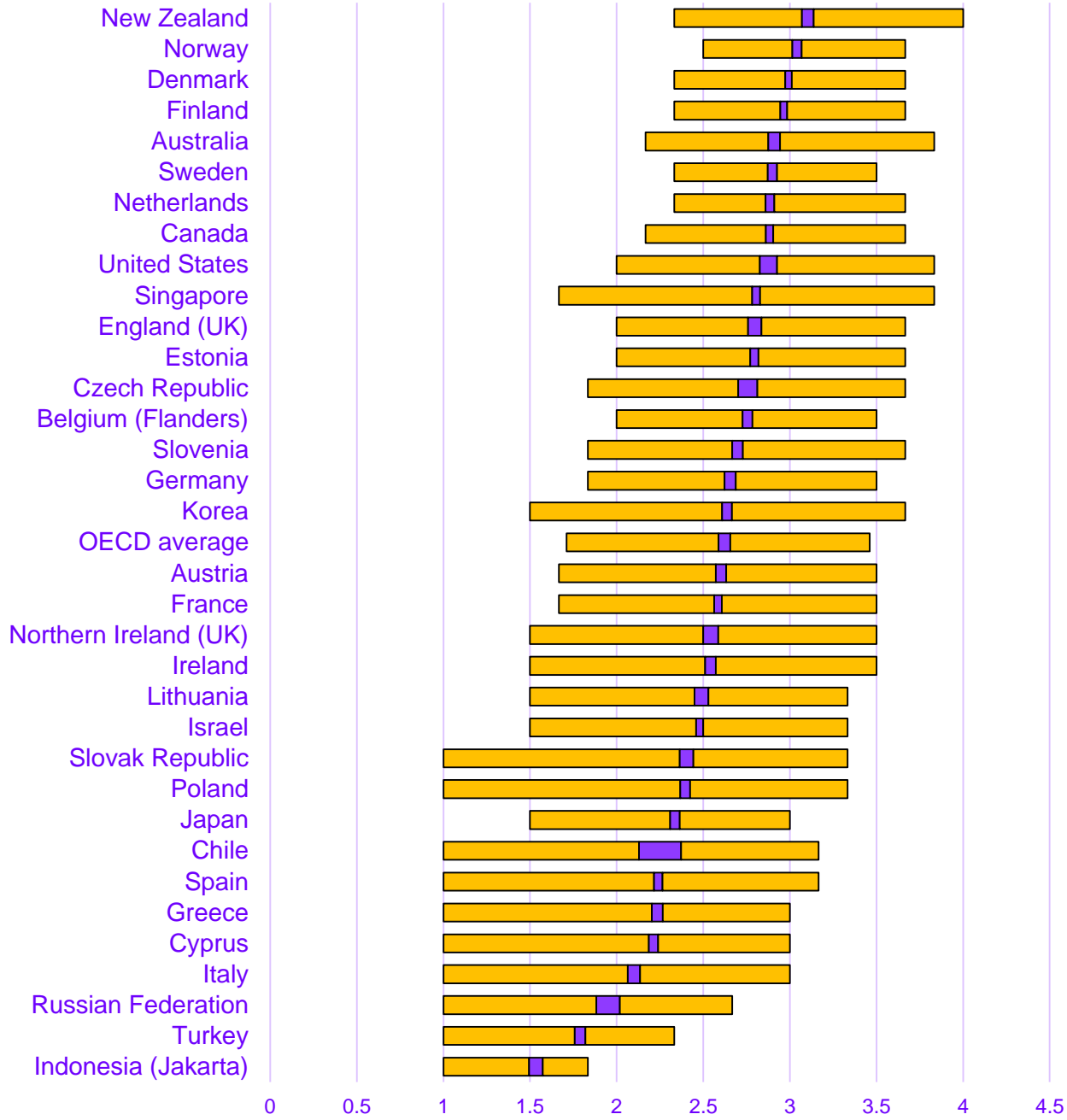
Results

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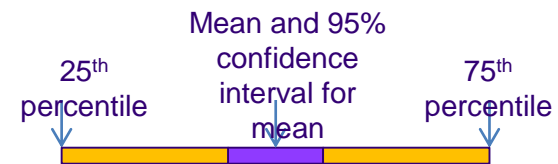
Policies



# Locating digital content- internet searches, conduct online transaction

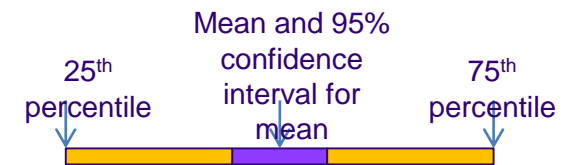
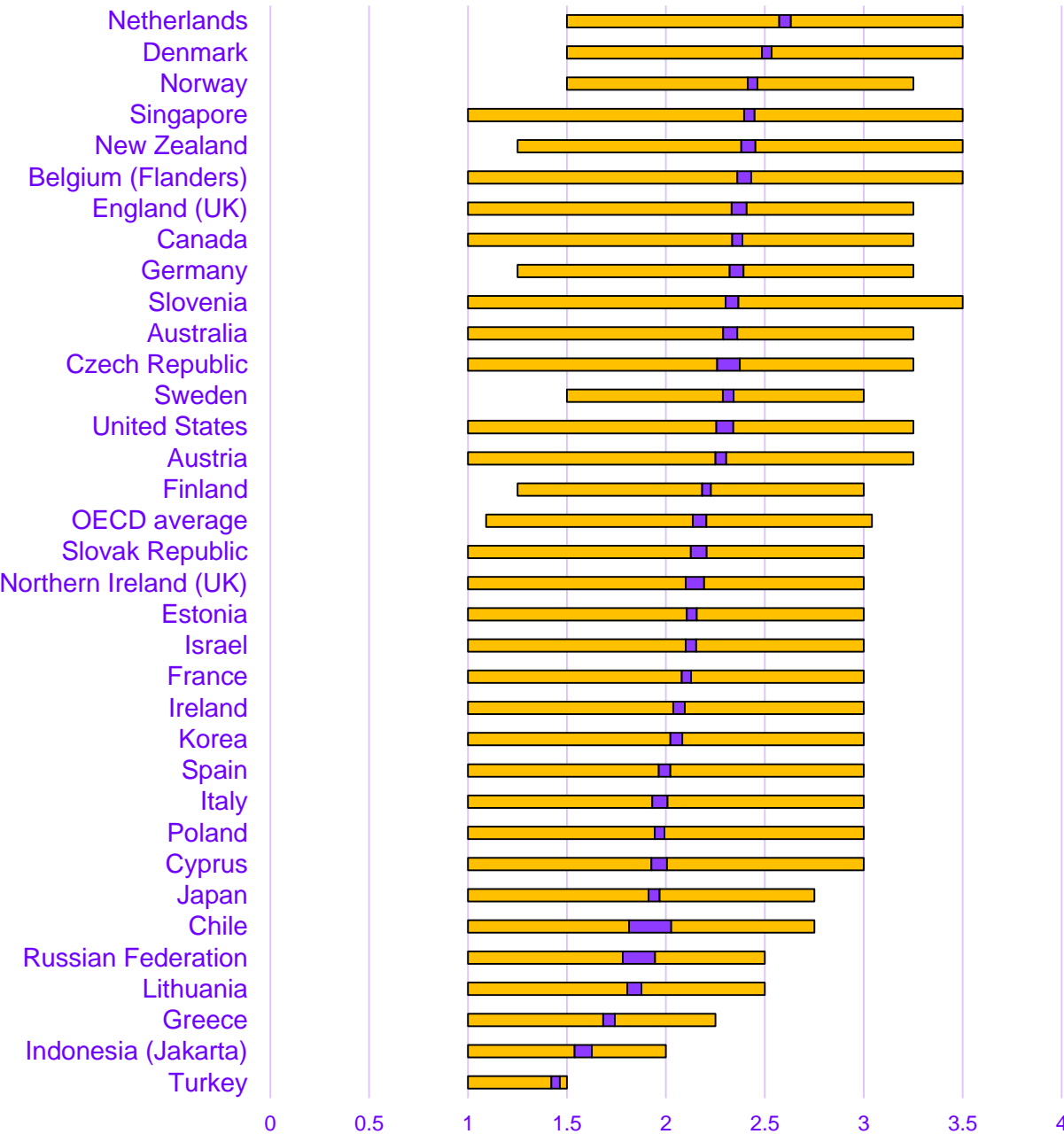


Over 25% of the population in a number of countries have never use technology for locating digital content

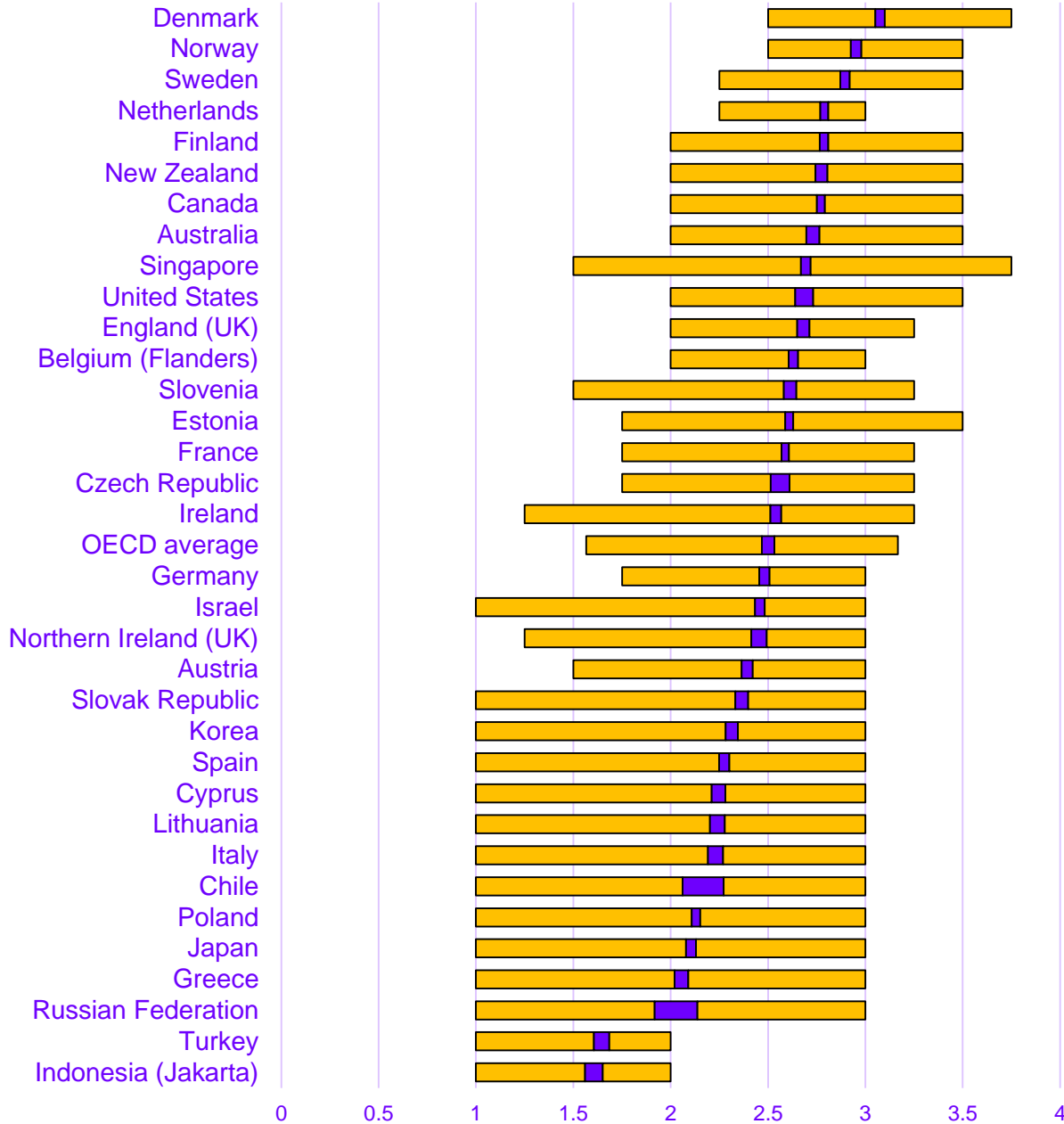


# Creating digital content- use of spreadsheet and word processor

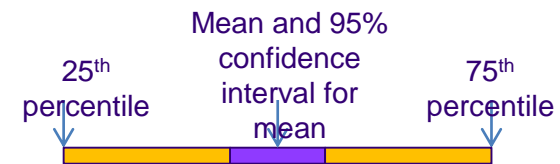
A significantly lesser use of technology in creating content for most countries



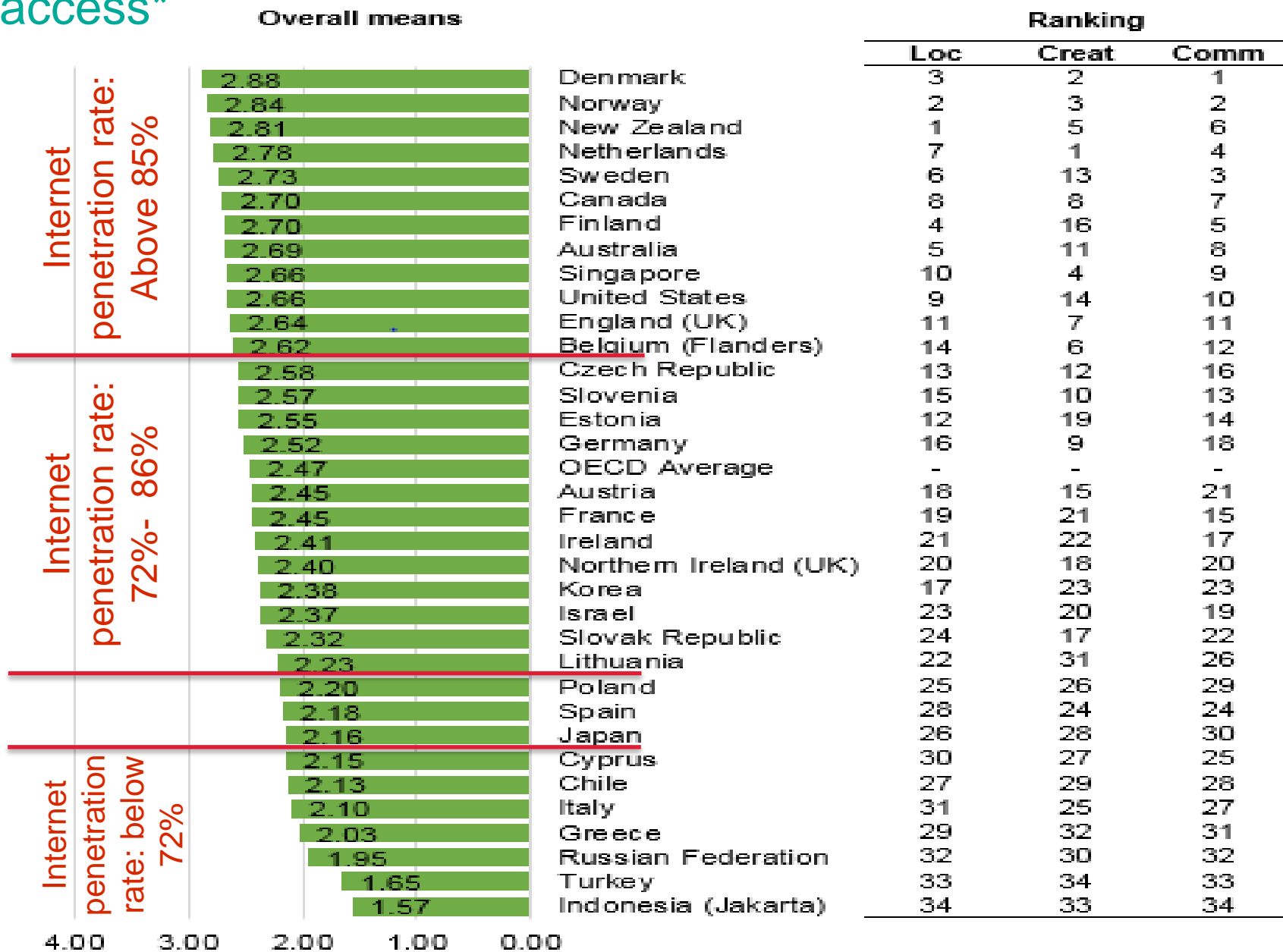
# Communicating digital content-email, real-time discussion



Higher usage of technology for communication than creating digital data

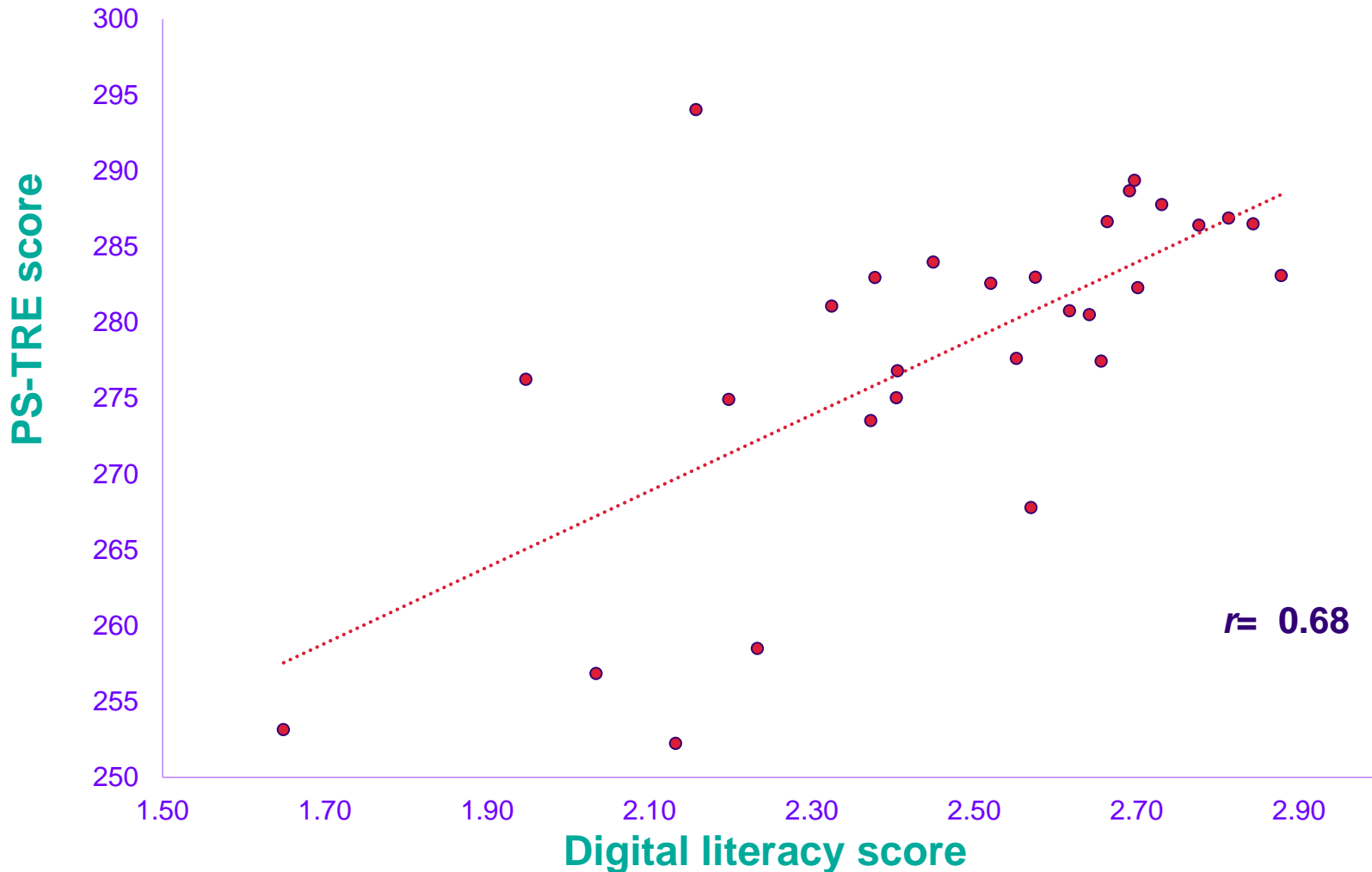


# High digital literacy is associated with high level of internet access\*



\*source: Data on 2014 internet penetration rate extracted from [www.internetlivestats.com](http://www.internetlivestats.com).

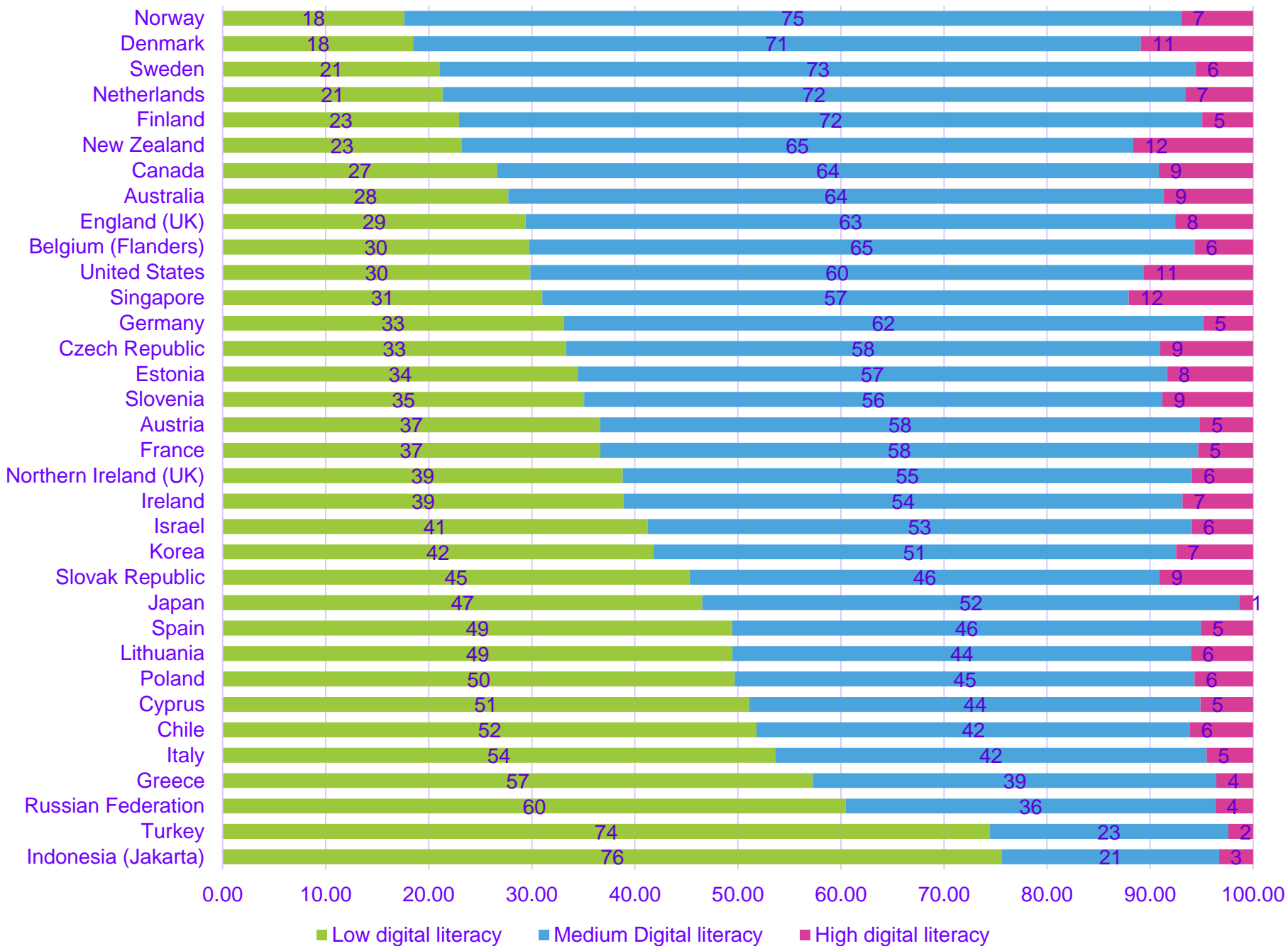
Overall, digital literacy score is correlated with problem solving in technology rich environment (PS-TRE) assessment score



# Proportion of adults in high and low digital literacy level

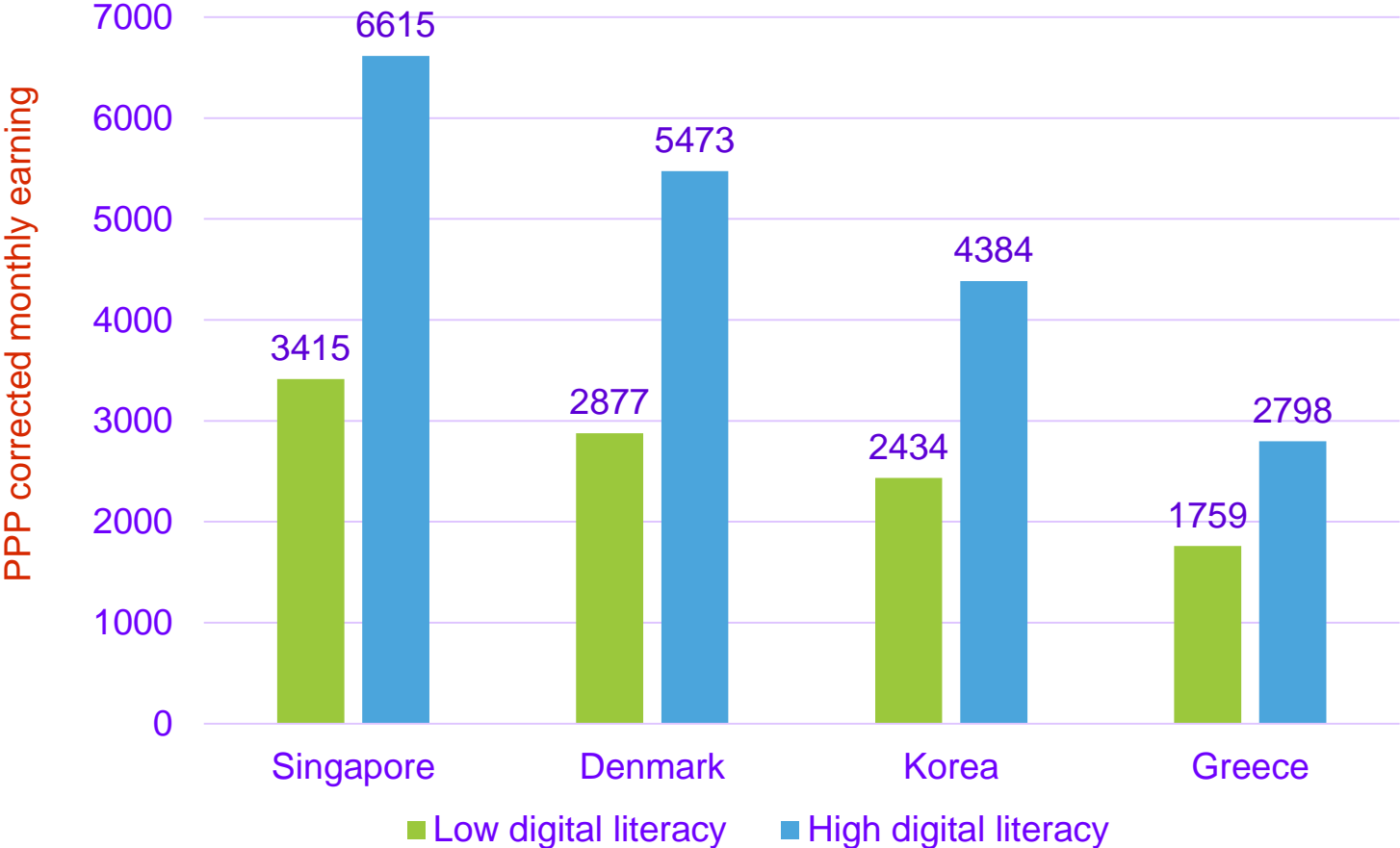
## Countries comparison

- Adults with a mean of “2” and below are identified as having low digital literacy
- Adults with a mean of “4” and above are identified as having high literacy
- Those with a mean between “2” and “4” are identified as having medium digital literacy



# Evidence showing adults with low digital literacy earning lesser than their counterparts with high digital literacy

**PPP corrected monthly earning including bonuses comparison of high and low digital literacy of adults with tertiary education**





# Logistic regression- age and individual's educational level have significant impacts on level of digital literacy

Explanatory variables include age and educational qualifications controlled for gender, parents' educational qualifications and language spoken, industry and occupation.

	Singapore	Denmark	Korea	Greece
<b>Gender</b>				
Female	-0.41**	-0.48**	0.21*	0.16
<b>Age (reference: 24 or less)</b>				
25- 34	-0.05	0.47*	0.38*	0.18
35- 44	0.40*	0.83**	0.79**	0.38
45-54	1.08**	1.08**	1.64**	0.63**
Above 55	1.57**	1.47**	2.16**	0.93**
<b>Education (reference: below upper secondary)</b>				
Upper Secondary	-1.72**	-0.97**	-1.57**	-1.28**
Tertiary	-3.10**	-1.82**	-2.99**	-2.27**

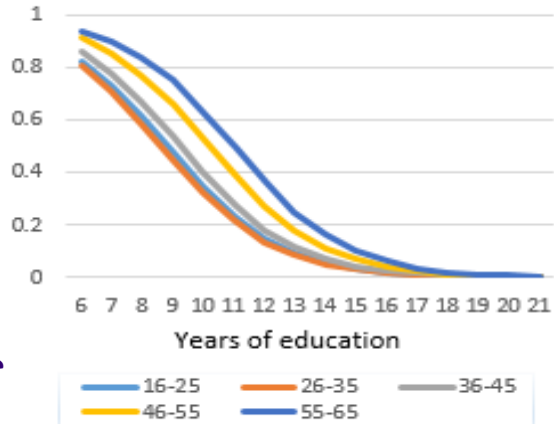
# Logistic regression- continued

	Singapore	Denmark	Korea	Greece
<b>Parents' Education (reference: Neither parent has attained upper secondary)</b>				
<b>At least one parent has attained secondary and post-secondary, non-tertiary</b>	-0.44**	-0.25**	-0.38**	-0.30*
<b>At least one parent has attained tertiary</b>	-0.70**	-0.68**	-0.65**	-0.93**
<b>Born language(reference: Native-born and native language)</b>				
<b>Native-born and foreign language</b>	-0.00	-0.29	-0.42	-0.11
<b>foreign-born and native language</b>	-0.02	0.50	1.09**	0.16
<b>Foreign-born and foreign language</b>	0.61**	0.57**	2.51**	0.70*
<b>Intercept</b>	-0.57	-2.17**	-0.20	0.91**
<b>Pseudo-r<sup>2</sup></b>	0.45	0.23	0.36	0.29

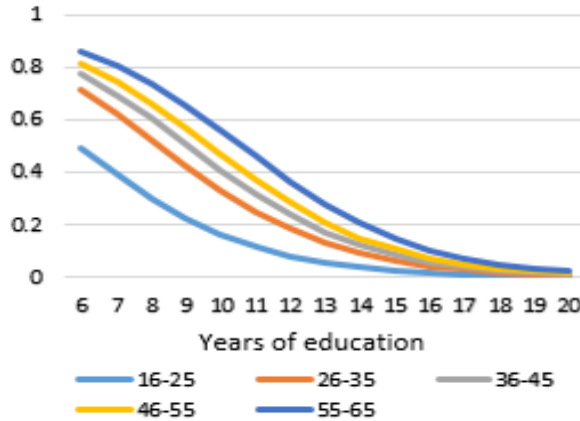
# Association between years of education, age and digital literacy

Probability of low digital literacy

Singapore



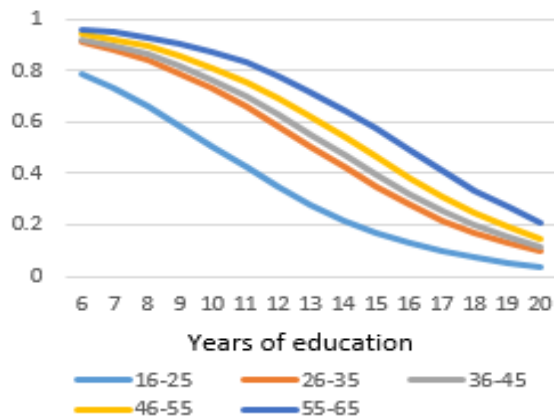
Denmark



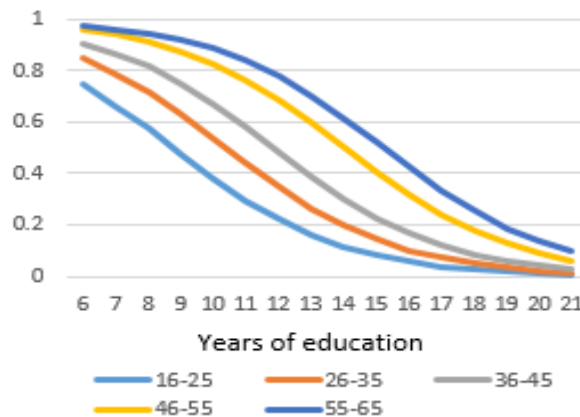
Lower years of education is associated with low level of digital literacy

Greece and Korea have relatively higher probability of having low digital literacy for older adults who had undertaken more years of education

Greece



Korea



16- 25 years old in Denmark who had six years of education have a lower probability of having low digital literacy

In Singapore, the probability of having low digital literacy is rather similar for adults 45 years old and below



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# Policies should focus on public and private sectors as well as ICT infrastructure

## Singapore

Public sector and private firms

- Efforts to computerize public agencies and encouraged usage of computers in businesses to improve efficiency in the 1980s

General public

- Promote interactive distance learning- participation of lectures delivered by schools outside of Singapore
- Internet is made readily available to the general public

## Denmark

Public sector and private firms

- One of the first countries to digitalize its public services
- worked closely with its stakeholder in the private sector to conceptualize ideas

General public

- access to high speed broadband internet for all citizen by 2020

# Implementation of ICT in schools may have impacted the digital literacy of the younger generation

## Singapore

### Schools

- Equipped students with computer knowledge through new subject and extra-curricular activities
- Schools were equipped with basic ICT infrastructure
- Teachers were trained and made use of technology to delivery lessons
- Baseline ICT standards for students were established

## Denmark

### Schools

- Students have access to the internet
- Teachers' ICT development and compulsory for the use of ICT in all curricula
- Blended learning are introduced
- Digital format homework
- Use of ICT are allowed in examination

# Promote awareness among the elderly

## Singapore

Specific group- Senior citizens

- Initiative to promote infocomm awareness among the elderly
- Customized hands-on training programmes in various languages
- Senior citizen ambassadors who have an active IT lifestyle to encourage their peers
- 160,000 seniors have benefited through the ICT courses and activities organized

## Denmark

Specific group- Senior citizens

- Campaigns to raise awareness on the benefits of ICT- informal IT tuitions for seniors run by ICT centers and libraries
- Involvement of NGOs, local communities and local businesses together with the government to train seniors on e-services like online banking, e-ticketing etc.



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# Limitations

- Score of adults who are not working would be solely based on frequency of ICT use in their everyday life
- Cut- off values for adults with high and low digital literacy
- Scales did not cover awareness of cyber-security



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# Conclusion

- Elderly with lesser years of education are more likely to have lower level of digital literacy
- Policies and initiatives implemented by countries have impacted their populations' digital literacy level
- Further validation and improvement is needed for the proposed digital literacy scale



Thank You