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Title

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Permalink

<https://escholarship.org/uc/item/27t023cq>

Journal

International Review of Education, 66(2-3)

ISSN

0020-8566

Author

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Publication Date

2020-06-01

DOI

10.1007/s11159-020-09842-1

Peer reviewed

Micro and macro drivers affecting adult literacy proficiency profiles across countries

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Abstract

This article analyses comparative data from the 1994–1998 International Adult Literacy Survey (IALS) and the 2012 Programme for the International Assessment of Adult Competencies (PIAAC). At the micro level, the author considers factors involved in the development of an individual person's literacy from a lifecycle perspective. At the macro level, he investigates trends in literacy proficiency profiles for countries that participated in both the IALS and PIAAC studies. In a number of countries, small average declines in literacy were recorded. This apparent stagnation in overall literacy at the population level in so many member countries of the Organisation for Economic Cooperation and Development (OECD) merits a closer look at the trend data made available from IALS and PIAAC. The aim of this research is to understand the determinants of literacy proficiency in terms of (1) how they may be affecting the development of literacy from an individual lifecycle perspective, and (2) how they may be affecting the development of national profiles of literacy proficiency as countries' sociodemographic compositions, sociocultural practices and economies change over time. There are few other comparative data like these that can help to improve insights on what drives the development and maintenance of literacy in adult populations. The data suggest that macro trends in literacy practices in work-related contexts may be on the decline, an impression the author discusses in relation to the observed stagnation in literacy profiles across many of the countries for which trend data are available. He considers the implications of his findings in relation to the upskilling and deskilling of occupations, changes in the distribution of work tasks, and the continued measurement of practices in PIAAC.

Keywords

International Adult Literacy Survey (IALS); Programme for the International Assessment of Adult Competencies (PIAAC); literacy; practice engagement theory; determinants of literacy; drivers of literacy; cross-national literacy profiles; aggregation problem

Introduction

Successive waves of the first large-scale international comparative study of adult literacy, the International Adult Literacy Survey (IALS), conducted between 1994 and 1998, revealed results for over 20 countries around the world that came as a shock to many policymakers as well as the general public (OECD and Statistics Canada 2000; OECD and HRDC 1997). On the basis of comparable literacy profiles across national, linguistic and cultural boundaries, large proportions of adult populations, ranging from 40 to 60 per cent, were found to have proficiency levels which were potentially insufficient in terms of discretionary decision making in the context of literacy-rich environments.

Approximately 15 years later, the Programme for the International Assessment of Adult Competencies (PIAAC), run by the Organisation for Economic Cooperation and Development (OECD), revealed very few changes in overall literacy proficiency profiles across countries that had participated in both PIAAC and IALS (OECD 2013a). In fact, in a number of countries, small average *declines* in literacy were recorded. This was particularly unexpected given the fact that in the majority of the participating countries, post-secondary qualifications among adult populations had increased substantially in the interim, as had the proportion of knowledge-oriented jobs, such as those in managerial, professional and technical fields.

A key question is: why have national literacy profiles *stagnated* or failed to improve in a number of countries despite *substantial growth* in educational qualifications and skilled occupations? After all, different types of research conducted from an individual (or micro-level) perspective have strongly suggested that educational qualifications and skilled occupations are among the most significant determinants of literacy proficiency (Desjardins 2003; OECD 2013a). Indeed, from a policy and practice perspective, a reasonable expectation gained from such research is that investment in education and growth in the economy in favour of occupations requiring higher levels of cognitive skills would improve the overall national literacy profile.

The apparent stagnation in overall literacy at the macro (or population) level in so many OECD member countries merits a closer look at the trend data made available from IALS and PIAAC. The aim of this research is to understand the determinants of literacy proficiency in terms of (1) how they may be affecting the development of literacy from an individual lifecycle perspective, and (2) how they may be affecting the development of national profiles of literacy proficiency as countries' sociodemographic compositions, sociocultural practices and economies change over time. There are few other comparative data like these that can help us improve our insights on what drives the development and maintenance of literacy in adult populations.

First results of the PIAAC study were reported in the *OECD Skills Outlook 2013* (OECD 2013a), which included some analysis of the determinants of literacy proficiency. Earlier results from an extensive analysis of the determinants of literacy based on the IALS are summarised in Desjardins (2003). The purpose of this article is to revisit research examining the determinants of literacy proficiency, and specifically to take a closer look at the underlying structure of the determinants from (1) a lifecycle (micro-level) perspective, and (2) a country (macro-level) perspective in terms of the trends in this structure for countries that participated in both the IALS and PIAAC studies.

I begin with a discussion of the factors that have been found to affect the development of literacy proficiency on the basis of theoretical reasoning and previous research. Next, I estimate and discuss a micro-level model predicting individual citizens' literacy proficiency. Third, I present a macro-level analysis of the relationship between changes to national literacy profiles and country-level changes to the determinants included in the micro-level

analysis. The purpose of this is to ascertain how well the micro-level results aggregate to country-level results. Finally, I discuss some implications of the insights emerging from this analysis.

Sociodemographic and practice-oriented factors related to literacy proficiency

The development of literacy proficiency involves several factors for which data are made available by IALS and PIAAC in a comparable manner over time and across countries. In this section, I discuss these factors on the basis of theoretical reasoning and prior research, distinguishing between two different types of factors related to literacy proficiency, namely *sociodemographic* and *practice-oriented* factors. These are introduced by focusing on how the different factors have been found to affect the development of proficiency at an individual (or micro) level from a lifecycle perspective.

Sociodemographic factors related to proficiency

Sociodemographic characteristics of all kinds are potentially important factors relevant to the development and maintenance of literacy proficiency over a person's lifecycle, primarily by being related in some way to the opportunity of adults to practise and develop literacy proficiency. However, the way in which a factor may be relevant is complex and not always clear from available data. Often sociodemographic factors are simply markers of *social status* that can be associated with advantaged or disadvantaged access to contexts, opportunities or other experiences conducive to the development and maintenance of – and thereby impacting on – literacy proficiency. They can also, however, be a marker for different types of *preferences for certain behaviours, lifestyles and outcomes*, and thus by extension influence individuals' choices to engage in certain contexts instead of others.

These two types of markers have different meanings and implications, for example for policy purposes, but it is rarely possible to disentangle them in real life, since human and social behaviour should be understood as a product of the interaction of the existence of contexts, the structural conditions (of authority, power, norms etc. ...) affecting access to those contexts as well as individual choices to engage in those contexts (Giddens 1984; Harper 2015; Lin 2017). Furthermore, it is even more difficult to be able to distinguish among the alternatives mentioned on the basis of data made available by large-scale datasets, and thus appropriately interpret the meaning of statistical results. To complicate things further, *literacy proficiency* is itself a characteristic that affects individual behaviours and choices, as well as access to contexts and opportunities that have the potential to foster further development or maintenance of literacy proficiency.

Despite these difficulties, social research typically strives to take a handful of core sociodemographic factors into account, namely gender, socioeconomic status (parents' education, own income), immigration, language and/or other minority status, and age. Whether a strong or weak impact on the outcome is interpreted as a consequence of disadvantaged/advantaged access and/or individual preferences or choices often depends on the nature of the factor itself in relation to historical, social, cultural and political circumstances, but also on the framing and emphasis of the analysis being carried out. The next subsections briefly discuss a set of core sociodemographic characteristics for which data are made available by IALS and PIAAC and which are potentially decisive in the development of literacy proficiency from a lifecycle perspective.

Gender

There are no strong theoretical expectations regarding the direct effect of gender on literacy proficiency. However, preferences for engaging in reading-related behaviours may play a role, particularly at younger ages. Some research suggests that girls tend to read more at an earlier age and that this translates into better literacy proficiency than for boys of the same age (Tsai et al. 2017; Borgonovi et al. 2017; Loveless 2015; Halldórsson and Ólafsson 2009). But research also suggests that the gap narrows considerably in adulthood (Martin 2018; Borgonovi et al. 2017; Solheim and Lundetræ 2016). The latter finding may reflect indirect effects that arise as a consequence of differential access to contexts and/or preferences for engaging in certain contexts that develop literacy proficiency (e.g. types of major subjects studied and careers embarked on). Historically, women have had unfavourable access to contexts conducive to the development of literacy, including formal educational contexts, or work-related contexts in which cognitive demands are higher, such as professional and leadership positions. Much progress has been made in this regard in many advanced industrialised countries, for example in terms of educational attainment and labour force participation, but it is not uniform and can vary substantially by country or even by region within countries. Separately, some research suggests that men and women have different occupational preferences (Barbulescu and Bidwell 2013; World Bank 2011; Hakim 2006). This may indirectly affect the development and maintenance of literacy proficiency from a lifecycle perspective. Gender therefore may have an indirect effect on literacy proficiency via educational attainment and/or type of occupation, particularly more so in countries where gender differences remain in either of those pathways (Shoham et al. 2011).

Parents' education (socioeconomic origins, class)

Class, or socioeconomic status (SES), and differences in access to opportunities for gainful employment is a classical research topic. Typically, the emphasis is on the status of different social classes in terms of power and resources, in particular regarding advantage or disadvantage in access to contexts, opportunities or other experiences fostering further development and/or maintenance of power and resources. For the purposes of this article, the focus is limited to *opportunities for developing and maintaining literacy proficiency*, which is widely believed to be a crucial resource for individuals to acquire further resources and capacities to realise what it is that matters to them and then take steps to make it happen (Crocker and Robeyns 2009; Lynch 2009; Sen 1992, 1993; Shore et al. 2013).

Broad access to quality education for all is believed to alleviate many of the disadvantages associated with lower SES. This policy is an important basis for maintaining universal and compulsory public education up to a minimum age of at least 15 in most advanced industrialised countries, and an even higher age in many others such as the United States. But in most countries, albeit to varying degrees, SES remains associated with achievement of skills such as literacy proficiency (Schmidt et al. 2015; Shore et al. 2013; Willms 2010; Brozo et al. 2007), as well as continuous educational attainment and learning over the course of a person's life which further enhances literacy proficiency (Martin 2018; Barnes et al. 2017; Willms and Murray 2007). Therefore, SES may have direct effects on literacy proficiency as a consequence of the educative impact of the home background for which schools are unable to compensate (Coleman 1966; Downey and Condrón 2016; Reder 2015). But it may also have indirect effects as a consequence of impacts of the quality and quantity of education and access to other educative and nurturing contexts over a person's lifespan.

Given that socioeconomic background is a difficult concept to measure, requiring data on income, wealth and occupation of parents during the time adult test respondents were growing up, it is often necessary to use proxies. The only data item in IALS and PIAAC that is relevant to respondents' class or socioeconomic origins is their parents' education. Parents' education has been used as a proxy for SES in the research literature (e.g.

Bradbury et al. 2015), and it is a good proxy, since education is an important predictor of income, wealth and occupation. It is also indicative of the educative environment of the home respondents grew up in, which may have had direct effects on the development of their literacy proficiency at a younger age. While emphasis is placed on the actual measure (i.e. parents' education) in the empirical analysis presented in this article, my discussion and interpretation of results refers to SES since it is used a proxy for this concept.

In defining the variable for the analysis presented in this article, I consider the education of both parents in the following three categories: (a) at least one parent attained higher than upper secondary education; (b) at least one parent attained at least upper secondary education; or (c) neither parent attained upper secondary education.

Earnings

While I use parents' education to control for socioeconomic origins, to account for the current socioeconomic status of adults it is more relevant to use respondents' current earnings (in the year preceding the survey). Those who earn more are more likely to have resources at their disposal and thus considerable advantage in access to contexts, opportunities or other experiences conducive to further development and/or maintenance of literacy proficiency.

In my analysis, this variable is defined according to quintiles, ranging from highest to lowest earnings; plus an additional no earnings category.

Immigration, language and other minority status

Birthplace and first language(s) used while growing up can be markers of social advantage or disadvantage in terms of access to opportunities to develop literacy in the majority (or native) language(s). In the case of immigrants, the disadvantage may be confined to the length of time one has been exposed to the local language as well as the local context. Otherwise, being native-born and/or a native speaker may provide advantaged access to opportunities which are often conditioned by the local and majority cultures which typically have more power to regulate norms and laws.

Disadvantages may arise due to proficiency deficiencies in the local and majority language – which is the case for many immigrants who are not native speakers. This can typically be addressed with tutoring initiatives and additional resources, although systemic discrimination and social exclusion of “others” or “foreigners” may well persist. Further, minority status may also apply to native-born adults who are part of a local minority culture which is not related to immigration and speak a language which may not be officially recognised or is different from the language in which the literacy assessment was administered (e.g. Swedish-speaking Finns in Finland, Native Americans in the United States). Finally, in other cases some native-born and native speakers carry minority status as a consequence of other markers such as ethnicity. In the United States, for example, race is a crucial marker of minority status for historical reasons and is associated with deep structural differences related to educational attainment and achievement (Arora 2018; Rothstein 2015; Kao and Thompson 2003).

The meaning of the relationship between this socioeconomic factor and literacy proficiency is thus highly context-dependent, which is a challenge in international and comparative studies such as IALS and PIAAC. It is nevertheless crucial, since literacy proficiency is assessed through language and, depending on the country, often only in one or two of the country's official languages. Given these complexities, and to preserve the comparative nature of the analysis presented in this article, I focus only on whether adults are native-born or not and whether they are native speakers (in the language of the assessment) or not.

Specifically, in defining the variable, I consider the following four categories: (a) native-born and native speaker (test language same as at least one of the languages learned as a child);

(b) native-born and foreign speaker (test language different from language(s) learned as a child); (c) foreign-born (immigrant) and native speaker; and (d) foreign-born and foreign speaker.

For a number of countries, the number of immigrants who are non-native speakers has grown substantially since the 1990s – an important factor that may explain changes in national literacy profiles. In the discussion later on in this article, my analysis will directly consider the native language of immigrants as well as their level of proficiency to distinguish between high-skill and low-skill immigrants.

Age

Older age groups tend to be associated with lower average levels of literacy proficiency than younger adults (OECD 2013a; OECD and Statistics Canada 2000; Steen-Baker et al. 2017). There are several alternative explanations for this observation. Similar to gender, age can be a marker of dispositions or preferences in terms of choice of contexts in which to engage, and/or discrimination in terms of access to opportunities to develop proficiency. For example, some research suggests that younger adults have a greater disposition to engage in intellectually challenging contexts than older adults, possibly associated with risk-taking behaviours, which can influence the development or decline of proficiency (Reder and Bynner 2008; Grotlüschen et al. 2016). Other research suggests that employers are more likely to adopt new technologies or processes with younger workers than older ones (Hämäläinen et al. 2015; Charness et al. 2015; Morris and Venkatesh 2000) which may negatively affect the opportunity for older workers to develop or maintain their proficiency. Age may thus directly affect proficiency on the basis of such alternatives.

However, in the context of a lifespan analysis, age carries special properties in at least two ways which may relate to a range of indirect effects on proficiency. First, age is a marker of *cumulative experience*, specifically a marker of practice in, exposure to and familiarity (or lack thereof) with different situations such as literacy-related ones. In other words, not all older adults necessarily show lower levels of proficiency. Those who have engaged in diverse literacy-related situations frequently their whole lives, perhaps as a consequence of the type of job they hold, may well have continued to develop or at least maintain their literacy proficiency into older age. By contrast, those who have engaged in few literacy-related situations and less frequently so, may have experienced substantial declines in proficiency as they aged. In this regard, the average result at the country level may reflect the relative number of adults who have (had) the opportunity to practise their literacy skills, and want(ed) to do so, over their lifespan (Boeren 2016; Desjardins and Warnke 2012; Reder 2015).

Second, because IALS and PIAAC are cross-sectional studies, age is also a marker for *cohort effects*. As an example, a large number of older adults may have had less exposure to formal educational contexts simply because fewer opportunities existed when they were younger. Similarly, fewer older adults, at least compared to younger cohorts, have had less opportunity to obtain skilled work at earlier ages because of the growth of knowledge economies and the introduction of information communications technologies over time (Desjardins and Warnke 2012).

Accordingly, in defining the variable, I consider age groups that correspond roughly to distinct stages of career in the following three categories: (a) 26–40; (b) 41–55; and (c) 56–65.

Practice-oriented factors over the lifespan related to proficiency

As alluded to in the above discussion, the opportunity to engage in literacy-related situations is a crucial element linking sociodemographic factors to literacy proficiency. The following emphasises a range of factors for which data are available in IALS and PIAAC which are proximally closer to the opportunity to engage – and ultimately the actual engagement – in literacy-related situations in terms of frequency and variety. The idea that exposure to literacy-related situations, the opportunity to engage in literacy situations, and ultimately the actual practice of literacy, are directly related to literacy proficiency is often referred to as *practice engagement theory*. This theory contends that literacy proficiency and engagement in literacy practices reinforce each other over time (Barton 2017; Reder 2015, 1994). The next subsections briefly discuss a set of core practice-oriented factors in relation to literacy proficiency for which data are made available by IALS and PIAAC and which are potentially decisive in the development of literacy proficiency from a lifecycle perspective.

Education

Formal education that leads to qualifications plays a dual role in terms of being a practice-oriented factor as well as a sociodemographic factor relevant to the development of literacy proficiency. As a practice-oriented factor, it is easy to see how schooling can enhance literacy proficiency, since this is one of its core purposes, to produce a population which is able to read and write. In most countries, a principal goal of primary schools is to teach basic literacy skills, and then for secondary schools to practise the use of these skills for learning specific content. Tertiary institutions extend this into specialised areas. As literacy skills are practised through educational contexts, proficiency increases. Stephen Reder terms this effect of education on literacy as the “literacy development effect” (Reder 1998). As a sociodemographic factor, educational qualifications can provide or limit access to opportunities to develop proficiency. For example, qualifications can affect the type of job one may be able to secure, or alternatively the frequency and variety of different types of opportunities to practise literacy in work-related contexts. It can also affect preferences for particular occupations and more generally engagement in literacy-related practices.

In the analysis presented in this article, the variable is defined according to three categories: (a) completed less than upper secondary; (b) completed upper secondary; and (c) completed more than upper secondary.

Other types of educational opportunities such as formal and non-formal types of adult education can also lead to the development and maintenance of literacy proficiency, but given the highly variable nature of such opportunities, it is not always clear to what extent they may or may not be proximal to literacy. To the extent that adult education involves certain types and intensity of text-based instruction and learning, it may directly affect the development and maintenance of literacy (Belzer 2017; Crossley et al. 2017; Purcell-Gates et al. 2002).

Unfortunately, in PIAAC the information about the nature of adult education opportunities undertaken by respondents is somewhat undifferentiated. For example, there is insufficient information to ascertain whether the activity was undertaken to improve basic skills such as literacy, or whether it was related to the development of manual skills or advanced professional development. Moreover, at a population level, there is a confounding relationship between adult education and literacy proficiency. Research has shown that highly proficient adults are more likely to participate in adult education of various kinds, for example, including further professional development (Grotlüschen et al. 2016). This suggests a positive mutually reinforcing relationship, namely that proficiency may induce participation which may further improve proficiency.

At the same time, low proficiency adults may also be likely to participate in adult education, but of specific kinds – including schemes specifically designed to improve proficiency, although this would depend on the available opportunities, which varies greatly by country. This suggests a negative relationship, namely those who undertake adult education for basic skills do so because they have low proficiency.

In other words, without information on the type of adult education and for what reason it was engaged in, there is a highly confounding relationship between adult education and literacy proficiency. For this reason, adult education is not included in the micro-level analysis presented in this article, although its growth as well as its possible role in the development of national literacy profiles is acknowledged in the discussion and interpretation of results.

Occupation

Similar to education, occupation can play a dual role in terms of being a practice-oriented factor as well as a sociodemographic factor relevant to the development of literacy proficiency. As a sociodemographic factor, occupational status may improve or limit access to opportunities to develop proficiency outside the work context, such as access to specific types of professional networks that involve extensive engagement in literacy (Boeren 2016; Grotlüschen et al. 2016). However, one's occupation is also a marker for the types of practices that one may or may be engaged in on a recurring basis over one's career, and in this sense, is a proximal factor reflecting engagement in literacy-related situations. For example, certain occupations are much more likely to involve engagement in a diverse and challenging set of literacy-related situations than others.

In my analysis, the variable is defined according to four categories: (a) skilled workers (International Standard Classification of Occupations [ISCO] 1, 2 and 3: managers, professionals and associate professionals); (b) semi-skilled white-collar workers (ISCO 4, 5 and 6: clerks and service, shop and sales workers); (c) semi-skilled blue-collar workers (ISCO 7, 8: craft and trades, plant and machine operators, assemblers); and (d) elementary workers (ISCO 9: cleaners, agricultural labourers etc.).

Literacy practice at work

Both IALS and PIAAC contain data on actual engagement in specific literacy-related situations in terms of frequency and variety. According to practice engagement theory (discussed above), more literacy-related practice should translate into greater proficiency. Importantly, however, it is not only the frequency of practice that should matter but also the variety (Smith 1996).

Accordingly, questionnaires in both IALS and PIAAC included three items related to literacy practice in work-related contexts. Respondents were asked about how often they practised each of the reading activities described in the items on a 3-point Likert frequency scale: (1) at least once a week; (2) less than once a week; or (3) rarely or never. The results served to construct a sum scale which was in turn used to generate the two following categories: (a) at least two types of reading at work weekly or several others less than once a week; and (b) little to no reading at work.

The three items collected in both IALS and PIAAC in a comparable manner are as follows: (1) as part of job ... read or use letters, memos or e-mails; (2) as part of job ... read reports, articles, magazines or journals; and (3) as part of job ... read manuals or reference books. While there are comparable items related to literacy practice both at work and outside of work, my analysis only considers those related to work. The reasons for this are the high correlation between the two domains and the fact that there is less variation for practices outside work; another reason was to keep this analysis parsimonious.

Constructing a micro-level model to predict literacy proficiency

This section constructs and estimates a multivariate model which presumes a causal structure that may underlie literacy proficiency. The purpose of the model is to disentangle the influences of various factors and to estimate the relative importance of different factors which may contribute to the development of an individual person's literacy proficiency. In so doing, causal directions among the factors are hypothesised. My hypotheses are merely advanced on the basis of the theoretical reasoning and previous research discussed above. The findings do not in themselves prove or disprove the hypotheses, but they provide reasonable support for or against the potential role of different factors. Causality is therefore not established empirically and constitutes an important limitation to the results presented.

Conceptual model

Figure 1 summarises a simplified conceptual model which includes each of the factors discussed above (except participation in adult education for reasons already discussed) and their hypothesised relationship to literacy proficiency. Although the structure of determinants of literacy proficiency are complex – as alluded to above – with multiple direct and indirect pathways among the independent and dependent variables, it is useful to focus on simplified multivariate models which estimate only direct effects. This facilitates the disentanglement of direct influences of various factors, and by extension allows for the estimation of the relative importance of different factors on the basis of their direct effects.

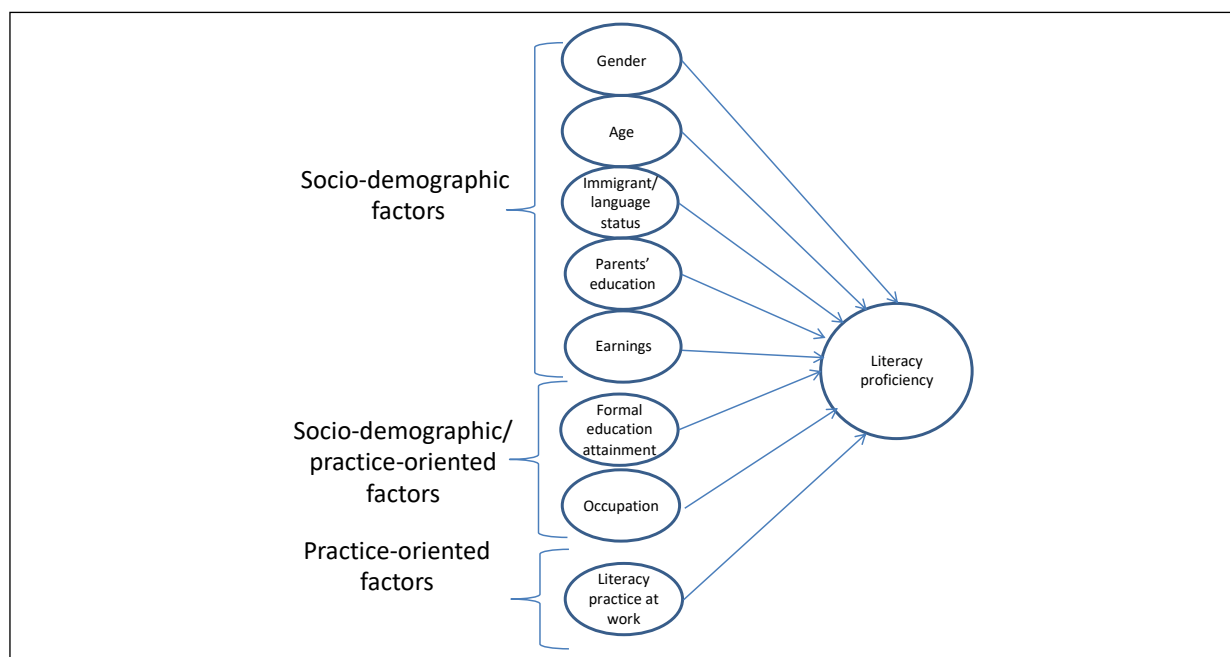


Figure 1 Multivariate model depicting sociodemographic and practice-oriented factors' hypothesised relationship to the development of an individual person's literacy proficiency

Method

The model shown in Figure 1 is operationalised and estimated using logistic regression. Estimates are provided and discussed in the results section. The odds ratios along with the unadjusted (or observed) probabilities are used to estimate adjusted probabilities which are easier to interpret and facilitate comparisons across all variables as well as over time. Unadjusted probabilities are defined as those resulting from bivariate (two-variable) distributions without statistically controlling for other variables. The formula used to estimate probabilities associated with odds ratios is as follows:

$$[(p/(1-p)*\text{odds ratio})/[1+(p/(1-p)*\text{odds ratio})]],$$

where p is the unadjusted probability (see Liberman 2005). Note that all results discussed are statistically significant at the 5% level of significance unless otherwise indicated.

Data

IALS was a large-scale co-operative effort undertaken by governments, national statistics agencies, research institutions and multi-lateral agencies in the period between 1994 and 1998 (for more details, see OECD and Statistics Canada 2000). PIAAC is a follow up study that targeted the same population (aged 16 to 65) with the same objectives, namely to provide direct measures of the extent and distribution of literacy proficiency among and within countries in a comparable manner. Its purpose was also to study earlier surveys and their findings as well as individual and societal outcomes associated with literacy and other competencies; and, for the most part implemented near identical survey and measurement instruments that are comparable in nature to those of IALS (for more details see OECD 2013a; 2013b). PIAAC currently provides data for countries that participated in different rounds between 2012 and 2016, but the countries included in the analysis are all in the 2012 dataset. Both IALS and PIAAC are cross-sectional studies based on a unique combination of household survey methodologies (as in the case of Labour Force Surveys)¹ and direct skills assessment methods. Both studies were primarily designed as international comparative assessments of literacy proficiency, which were administered to nationally representative samples of adults aged 16 to 65 (large sample sizes ranging between 2,000 to 5,000 cases per country).

Based on the available IALS and PIAAC data, the analysis presented in this article only considers adult populations aged 26 to 65. My reason for omitting young people aged 16 to 25 is that most youth continue to experience substantial cognitive development into their early 20s, and in most countries, the majority of them are still in their first cycle of studies, which are themselves major determinants of proficiency.

I include a total of twelve countries from IALS and PIAAC in my analysis, namely: Belgium (Flanders), Denmark, Finland, Germany, Ireland, Italy, Netherlands, Norway, Poland, Sweden, the United Kingdom (England and Northern Ireland), and the United States. Though a small number of other countries also participated in both studies, I had to exclude them from my analysis due to restricted data access for these countries (e.g. Australia and Canada). Table 1 lists the countries included in my analysis along with sample sizes. The sample sizes apply to all analyses reported. Missing values for each independent variable are included in the logistic regression estimation models as separate categories to avoid the assumption of missing at random, or cases of when values are missing by design such as respondents who had no earnings or did not read at work because they were not employed. All data presented are based on my own calculations of data made available by the 1994–1998 IALS and 2012 PIAAC databases.

¹ Annual Labour Force Surveys (LFS) are mandatory in all member states of the European Union, but also conducted in a number of other countries in other world regions. Their purpose is to calculate a country's unemployment rate according to the definitions provided by the International Labour Organization (ILO).

Table 1 Countries included in analysis, target population and sample sizes

	IALS 1994–1998 sample size (age 26–65)	PIAAC 2012 sample size (age 26–65)
Belgium (Flanders) (BE)	1,511	3,978
Denmark (DK)	2,434	6,130
Finland (FI)	2,320	4,480
Germany (DE)	1,723	4,232
Ireland (IE)	1,806	5,110
Italy (IT)	2,451	4,004
Netherlands (NL)	2,436	4,122
Norway (NO)	2,586	3,897
Poland (PL)	2,326	4,246
Sweden (SE)	2,069	3,554
United Kingdom (England and Northern Ireland) (UK)	3,262	7,450
United States (US)	2,432	3,986

Note: A 13th country, the Czech Republic (CZ), also participated in both surveys, but is omitted because it did not collect data on literacy practice at work in IALS.

Variables

The dependent variable is a dichotomous measure of literacy proficiency based on the ordinal and categorical measure of literacy proficiency, namely *low proficiency* (Level 2 or below)² vs *medium to high proficiency* (Level 3 or above). This allows for insight on the basis of a multivariate analysis into some of the factors that may be involved in the increase or decrease of the number of adults who scored at Level 2 or below in the 2012 period compared to the 1990s. The binary between low vs medium to high proficiency builds on the criterion-based approach embedded in the PIAAC and IALS studies (which helps to translate the measures into meanings about what people can actually do in their daily lives with their literacy skills). The break point is somewhat arbitrary, but what is clear is that people who score at Level 2 or below have substantively lower levels of literacy proficiency than those who score at Level 3 or higher. The *2013 Skills Outlook* (OECD 2013a) defines the distinction between the levels. In short, people who score at Level 2 are literate by demonstrating an ability to integrate two or more pieces of information or to compare and contrast easily identifiable information when responding to text-based stimuli, but are more

² The “Levels” referred to here are the PIAAC levels defined by the OECD. PIAAC uses a total of six proficiency levels, ranging from Level 1 to Level 5, with an additional “below Level 1” category at the bottom end of the scale. For descriptions of each of these levels, see OECD (2013a, pp. 66–67).

likely to make errors when there are several distractors or when plausible but incorrect pieces of information are present, or when more complex inferences are required.

Predictors of proficiency in the model are categorically defined as follows (reference categories are underlined): *age* (26–40, 41–55, 56–65), *gender* (men, women), *immigrant and language status* (native-born, native-language; native-born, foreign-language; foreign-born, native-language; foreign-born, foreign-language), *parents' highest level of education* (at least one parent completed post-secondary, at least one parent completed upper secondary, both parents did not complete upper secondary), *respondent's highest level of educational attainment* (completed higher than upper secondary, completed upper secondary, did not complete upper secondary), *employment status* (employed, unemployed, other), *occupation* (skilled; semi-skilled, white-collar; semi-skilled, blue-collar; elementary; no work for at least five years), *literacy practice at work* (at least two types of reading at work weekly or several others less than once a week, little to no reading) and *earnings* (highest quintile, next to highest quintile, middle quintile, next to lowest quintile, lowest quintile, no earnings). In nearly all cases, the reference category chosen displays the most advantaged in terms of literacy proficiency. Table 2 summarises the percentage distribution of each variable included in the models for both IALS and PIAAC.

Table 2 Per cent distribution of sociodemographic and practice-oriented factors related to literacy proficiency, populations aged 26–65

	PIAAC (2012)												IALS (1994-1998)											
	BE	DE	DK	FI	IE	IT	NL	NO	PL	SE	UK	US	BE	DE	DK	FI	IE	IT	NL	NO	PL	SE	UK	US
Education																								
Less than upper secondary	17.6	10.0	19.7	14.6	28.0	52.6	28.8	21.4	10.5	19.7	24.5	10.5	42.9	61.1	25.2	30.4	57.9	59.5	43.9	12.0	60.7	27.7	61.5	14.2
Upper secondary	40.2	49.2	37.7	37.8	18.9	32.9	36.4	26.1	56.1	38.4	35.6	39.8	32.6	21.5	46.2	47.5	25.0	30.6	35.6	61.1	23.7	43.3	17.1	45.4
More than upper secondary	42.2	40.7	42.5	47.6	53.0	14.5	34.8	52.4	33.4	41.9	39.9	49.7	24.4	17.4	28.5	22.1	17.2	9.8	20.5	26.9	15.6	29.0	21.4	40.4
Parents' education																								
Neither parent has attained upper secondary	46.0	12.0	34.7	47.7	56.6	78.6	54.3	31.5	33.9	47.6	33.0	19.7	68.8	83.2	40.2	62.0	80.5	83.0	70.5	42.5	81.4	66.1	84.1	28.4
At least one parent has attained upper secondary	32.4	54.6	37.8	37.1	25.5	16.7	24.5	38.8	54.6	21.5	43.6	45.4	19.6	8.5	43.8	23.4	12.2	12.6	17.7	40.4	12.4	19.7	5.4	45.3
At one parent has attained tertiary	21.6	33.3	27.5	15.2	18.0	4.8	21.1	29.7	11.5	30.9	23.4	34.9	11.6	8.3	16.0	14.6	7.3	4.3	11.8	17.2	6.2	14.2	10.5	26.3
Occupation																								
Elementary	7.6	7.6	7.8	6.2	7.4	9.1	5.8	4.0	6.5	4.8	8.3	6.3	0.0	3.5	6.8	5.1	5.9	7.7	3.7	5.0	6.0	2.9	6.7	0.0
Semi-skilled, blue-collar	16.1	20.8	17.5	22.1	20.0	21.9	10.1	14.8	26.5	19.1	15.1	15.3	17.4	18.0	18.4	19.9	19.6	15.7	13.1	19.3	31.5	17.5	16.3	19.3
Semi-skilled, white-collar	21.3	26.8	21.7	23.9	25.4	22.0	22.7	25.6	17.1	24.1	28.5	24.1	37.4	18.7	21.8	15.8	13.6	20.1	13.0	22.1	10.7	15.2	21.3	31.4
Skilled	42.5	35.5	45.0	39.3	31.9	24.4	49.1	47.8	31.1	44.5	36.6	44.7	9.8	22.5	35.6	36.0	20.2	20.0	37.3	40.3	19.6	47.8	29.7	30.8
Immigration and language status																								
Native-native	89.9	84.3	87.8	94.8	77.9	88.3	85.3	84.8	98.6	79.4	83.1	81.2	91.1	92.2	97.9	97.0	92.0	95.3	90.3	92.6	97.0	87.6	90.1	82.3
Native-foreign	3.2	1.3	0.6	1.7	1.0	2.2	0.8	1.0	1.2	2.0	1.6	2.4	4.2	0.3	0.3	0.9	1.3	2.4	3.1	0.7	0.7	2.1	1.5	2.8
Foreign-native	2.9	3.5	1.4	1.2	11.7	1.9	3.5	0.9	0.2	2.2	6.4	4.0	1.4	2.5	0.6	0.7	6.0	1.4	2.3	1.5	1.7	1.7	3.3	2.2
Foreign-foreign	3.9	10.9	10.2	2.2	9.4	7.5	10.4	13.2	0.1	16.4	8.9	12.4	2.3	5.0	1.1	1.4	0.7	0.8	4.2	5.2	0.5	8.5	5.2	10.5
Total foreign-speaking	7.1	12.2	10.8	3.9	10.4	9.7	11.2	14.2	1.3	18.4	10.5	14.8	6.5	5.3	1.4	2.3	2.0	3.2	7.3	5.9	1.2	10.6	6.7	13.3
Immigrant by skill																								
Native low-skill	42.0	42.2	42.6	35.4	43.8	63.5	32.4	33.5	59.1	30.5	39.5	40.3	47.6	45.2	46.7	40.3	52.0	68.2	39.6	32.8	78.5	24.4	47.4	33.8
Native medium- to high-skill	50.3	43.3	45.8	58.7	35.2	27.0	53.7	52.3	40.7	50.9	45.1	43.3	48.6	47.3	51.5	57.6	41.3	29.6	53.8	60.5	19.2	65.4	44.2	53.2
Immigrant low-skill	5.4	11.1	8.6	3.7	11.6	8.1	9.2	8.9	0.2	12.9	9.0	12.0	2.7	5.5	1.1	1.1	3.4	1.7	3.8	3.2	2.1	5.5	5.9	9.5
Immigrant medium- to high-skill	2.3	3.4	3.0	2.1	9.4	1.4	4.7	5.3	0.1	5.7	6.5	4.4	1.1	2.0	0.6	1.0	3.3	0.5	2.8	3.5	0.2	4.7	2.6	3.4
Reading at work																								
At least 2 types per week	39.4	45.8	52.9	48.4	40.0	24.0	48.3	58.9	26.4	55.1	47.7	51.6	42.7	48.4	61.2	58.4	35.6	32.7	47.0	65.3	24.0	62.3	51.8	56.3
Little to none	40.1	37.8	30.0	33.4	31.3	43.8	33.5	28.1	45.0	31.1	31.5	30.7	25.5	14.4	21.1	18.7	25.1	30.6	20.4	21.5	44.0	20.3	22.1	22.5
Adult education																								
Did not participate	52.1	48.0	34.9	34.9	50.0	76.0	37.0	36.9	65.9	35.6	44.5	41.3	78.2	82.0	44.7	42.9	78.2	79.0	64.2	52.3	86.1	46.4	55.9	58.2
Participated	47.9	52.0	65.1	65.1	50.0	24.0	63.0	63.1	34.1	64.4	55.5	58.7	21.8	18.0	55.3	57.1	21.8	21.0	35.8	47.7	13.9	53.6	44.1	41.8
Literacy skill level																								
Low-skill (Level 1 or 2)	47.4	53.3	51.1	39.2	55.4	71.5	41.6	42.4	59.2	43.5	48.4	52.3	50.5	50.7	47.9	41.4	55.4	69.9	43.3	36.1	80.6	29.9	53.2	44.6
Medium- to high-skill (Level 3, 4 or 5)	52.6	46.7	48.9	60.8	44.6	28.5	58.4	57.6	40.8	56.5	51.6	47.7	49.5	49.3	52.1	58.6	44.6	30.1	56.7	63.9	19.4	70.1	46.8	55.4

Results

Tables 3A and 3B provide complete estimation details including odds ratios along with their design-based p -values, as well as adjusted and unadjusted probabilities. Tables 4A and 4B summarise the results for discussion purposes in terms of effects sizes measured as the difference between adjusted probabilities of two selected contrast categories. As mentioned, this is done by converting odds ratios from the binary logistic model into adjusted probabilities which are deemed to be simpler to interpret and compare across the variables. Then effect sizes are calculated as the difference in adjusted probabilities between two contrast categories associated with a variable (e.g. difference in adjusted probabilities between men and women is an effect size). Typically, contrast categories include the most advantaged (this is usually the reference category by design) vs the most pertinent disadvantaged category that applies across the majority of countries (e.g. native-born and native-language vs foreign-born and foreign-language are chosen as contrast categories since the other two categories are not applicable in all countries but nevertheless may reveal greater disadvantage in some countries). Summarising the results in terms of effect sizes makes it easier to distinguish the relative importance of different predictors and thus produces an easy-to-interpret rank order and comparison of the most important predictors across countries and over time. Substantial effects are defined as those that are statistically significant at the .05 level and are near to at least .10 probability points or higher.

Table 3A Unadjusted and adjusted probabilities (derived from a binary logistic regression) of scoring at Level 2 or below on the literacy scale by a range of socio-demographic and practice-oriented factors, populations aged 26–65, PIAAC 2012

	BE					DK					FI					DE					IE					IT					
	u.p.	OR	pv		a.p.	u.p.	OR	pv		a.p.	u.p.	OR	pv		a.p.	u.p.	OR	pv		a.p.	u.p.	OR	pv		a.p.	u.p.	OR	pv		a.p.	
Age																															
26–40 (reference)	0.34	1.00			0.34	0.40	1.00			0.40	0.21	1.00			0.21	0.45	1.00			0.45	0.48	1.00			0.48	0.63	1.00			0.63	
41–55	0.48	1.76	.00	***	0.62	0.50	1.68	.00	***	0.63	0.38	2.32	.00	***	0.59	0.51	1.49	.00	***	0.61	0.59	1.33	.00	***	0.66	0.74	1.29	.00	***	0.78	
56–65	0.64	2.35	.00	***	0.81	0.68	3.04	.00	***	0.87	0.64	5.03	.00	***	0.90	0.70	3.34	.00	***	0.89	0.68	1.35	.00	***	0.74	0.83	1.70	.00	***	0.89	
Gender																															
Men (reference)	0.45	1.00			0.45	0.50	1.00			0.50	0.41	1.00			0.41	0.51	1.00			0.51	0.54	1.00			0.54	0.70	1.00			0.70	
Women	0.50	1.23	.02	**	0.55	0.53	1.20	.01	***	0.57	0.38	0.95	.52		0.37	0.56	0.96	.60		0.55	0.57	1.24	.00	***	0.62	0.73	1.07	.45		0.74	
Immigration and language status																															
Native–native (reference)	0.46	1.00			0.46	0.48	1.00			0.48	0.37	1.00			0.49	1.00			0.49	0.56	1.00			0.56	0.70	1.00			0.70		
Native–foreign	0.46	1.59	.02	**	0.57	0.45	1.69	.16		0.58	0.48	1.75	.04	**	0.62	0.72	1.88	.09	*	0.83	0.50	0.61	.12		0.38	0.68	0.70	.18		0.60	
Foreign–native	0.44	1.29	.24		0.50	0.56	1.87	.02	**	0.70	0.23	0.70	.32		0.17	0.64	1.34	.16		0.70	0.46	0.87	.16		0.43	0.74	1.32	.32		0.79	
Foreign–foreign	0.85	6.64	.00	***	0.97	0.76	4.45	.00	***	0.93	0.71	5.45	.00	***	0.93	0.80	3.89	.00	***	0.94	0.67	2.47	.00	***	0.83	0.88	3.27	.00	***	0.96	
Parents' education																															
At least one parent with tertiary (reference)	0.22	1.00			0.22	0.33	1.00			0.33	0.20	1.00			0.20	0.36	1.00			0.36	0.34	1.00			0.34	0.40	1.00			0.40	
At least one parent with upper secondary	0.59	1.37	.01	***	0.66	0.53	1.56	.00	***	0.63	0.29	1.43	.00	***	0.37	0.54	1.25	.01	**	0.59	0.44	1.26	.02	**	0.49	0.49	1.15	.43		0.53	
Neither parent with upper secondary	0.81	2.12	.00	***	0.90	0.64	1.63	.00	***	0.74	0.52	1.89	.00	***	0.67	0.81	2.05	.00	***	0.90	0.66	2.03	.00	***	0.79	0.78	1.98	.00	***	0.88	
Education																															
More than upper secondary (reference)	0.22	1.00			0.22	0.31	1.00			0.31	0.24	1.00			0.24	0.29	1.00			0.29	0.41	1.00			0.41	0.41	1.00			0.41	
Upper secondary	0.59	3.12	.00	***	0.82	0.59	2.09	.00	***	0.75	0.47	1.83	.00	***	0.61	0.66	3.11	.00	***	0.86	0.55	1.32	.00	***	0.62	0.61	1.39	.01	***	0.68	
Less than upper secondary	0.81	5.70	.00	***	0.96	0.80	4.02	.00	***	0.94	0.71	2.99	.00	***	0.88	0.89	7.57	.00	***	0.98	0.83	4.11	.00	***	0.95	0.87	3.53	.00	***	0.96	
Employment status																															
Employed (reference)	0.41	1.00			0.41	0.45	1.00			0.45	0.33	1.00			0.33	0.49	1.00			0.49	0.49	1.00			0.49	0.64	1.00			0.64	
Unemployed	0.68	1.44	.22		0.76	0.64	1.17	.39		0.68	0.50	0.50	.00	***	0.33	0.69	0.79	.30		0.63	0.69	1.08	.65		0.70	0.79	1.93	.01	***	0.88	
Occupation																															
Skilled (reference)	0.27	1.00			0.27	0.32	1.00			0.32	0.21	1.00			0.21	0.30	1.00			0.30	0.36	1.00			0.36	0.49	1.00			0.49	
Semi-skilled, white-collar	0.48	1.07	.54		0.50	0.57	1.32	.00	***	0.64	0.39	1.52	.00	***	0.50	0.58	1.45	.00	***	0.66	0.59	1.52	.00	***	0.69	0.68	1.08	.53		0.69	
Semi-skilled, blue-collar	0.65	1.92	.00	***	0.78	0.69	2.48	.00	***	0.84	0.51	1.91	.00	***	0.67	0.68	1.94	.00	***	0.80	0.64	1.59	.00	***	0.74	0.81	1.51	.00	***	0.87	
Elementary	0.80	2.66	.00	***	0.92	0.75	1.98	.00	***	0.86	0.61	2.46	.00	***	0.79	0.79	1.92	.00	***	0.88	0.69	1.53	.00	***	0.77	0.85	1.52	.03		0.89	
Reading at work																															
At least 2 types per week (reference)	0.30	1.00			0.30	0.39	1.00			0.39	0.27	1.00			0.27	0.36	1.00			0.36	0.41	1.00			0.41	0.48	1.00			0.48	
Little to none	0.54	1.14	.15		0.57	0.60	1.14	.07	*	0.63	0.42	1.05	.61		0.43	0.65	1.26	.01	**	0.70	0.60	1.12	.18		0.63	0.75	1.44	.00	***	0.81	
Earnings																															
Highest quintile (reference)	0.24	1.00			0.24	0.24	1.00			0.24	0.19	1.00			0.19	0.25	1.00			0.25	0.26	1.00			0.26	0.52	1.00			0.52	
Next to highest quintile	0.34	1.13	.38		0.37	0.41	1.72	.00	***	0.55	0.28	1.56	.00	***	0.38	0.48	1.70	.00	***	0.61	0.43	1.75	.00	***	0.56	0.60	1.19	.29		0.64	
Middle quintile	0.40	1.32	.06	*	0.47	0.48	1.89	.00	***	0.63	0.33	1.59	.00	***	0.44	0.54	1.89	.00	***	0.69	0.52	2.14	.00	***	0.70	0.64	1.18	.32		0.67	
Next to lowest quintile	0.51	1.72	.00	***	0.65	0.64	3.18	.00	***	0.85	0.37	1.44	.02	**	0.46	0.60	2.07	.00	***	0.76	0.60	2.28	.00	***	0.77	0.70	1.29	.15		0.75	
Lowest quintile	0.62	2.15	.00	***	0.78	0.58	2.21	.00	***	0.75	0.43	1.89	.00	***	0.59	0.63	2.11	.00	***	0.78	0.65	2.23	.00	***	0.80	0.75	1.64	.01	***	0.83	
No earnings	0.67	1.80	.03	**	0.78	0.70	2.08	.00	***	0.83	0.61	2.74	.00	***	0.81	0.70	2.16	.00	***	0.83	0.67	1.94	.00	***	0.79	0.81	0.82	.47		0.78	
Fit statistics																															
Cox & Snell R-square	0.28				0.26					0.26					0.28						0.20					0.18					

Notes:

u.p. denotes unadjusted probabilities; a.p. denotes adjusted probabilities; OR denotes odds ratios; pv denotes p-value

-- data unavailable

*p<.1, **p<.05, ***p<.01

Table 3A (cont'd) Unadjusted and adjusted probabilities (derived from a binary logistic regression) of scoring at Level 2 or below on the literacy scale by a range of socio-demographic and practice-oriented factors, populations aged 26–65, PIAAC 2012–201

	NL					NO					PL					SE					UK					US					
	u.p.	OR	p.v.		a.p.	u.p.	OR	p.v.		a.p.	u.p.	OR	p.v.		a.p.	u.p.	OR	p.v.		a.p.	u.p.	OR	p.v.		a.p.	u.p.	OR	p.v.		a.p.	
Age																															
26–40 (reference)	0.29	1.00			0.29	0.30	1.00			0.30	0.51	1.00			0.51	0.32	1.00			0.32	0.43	1.00			0.43	0.43	1.00			0.43	
41–55	0.40	1.44	.00	***	0.49	0.43	1.90	.00	***	0.59	0.61	1.11	.21		0.63	0.43	1.59	.00	***	0.54	0.50	1.14	.04	**	0.53	0.53	1.19	.05	*	0.57	
56–65	0.62	3.20	.00	***	0.84	0.62	3.82	.00	***	0.86	0.71	1.44	.00	***	0.78	0.62	3.28	.00	***	0.84	0.56	1.12	.15		0.59	0.64	1.35	.01	***	0.71	
Gender																															
Men (reference)	0.38	1.00			0.38	0.41	1.00			0.41	0.61	1.00			0.61	0.42	1.00			0.42	0.47	1.00			0.47	0.52	1.00			0.52	
Women	0.45	1.24	.02	**	0.51	0.44	1.05	.58		0.46	0.57	1.05	.50		0.58	0.45	1.12	.24		0.48	0.50	1.00	.96		0.50	0.53	0.98	.78		0.52	
Immigration and language status																															
Native–native (reference)	0.37	1.00			0.37	0.39	1.00			0.39	0.59	1.00			0.59	0.37	1.00			0.37	0.46	1.00			0.46	0.48	1.00			0.48	
Native–foreign	0.70	7.05	.00	***	0.94	0.50	1.32	.42		0.57	0.66	2.12	.03	**	0.81	0.40	1.25	.43		0.46	0.60	2.30	.00	***	0.77	0.64	2.18	.00	***	0.80	
Foreign–native	0.56	3.19	.00	***	0.80	0.24	0.82	.66		0.21	0.74	2.21	.38		0.86	0.49	1.63	.07	*	0.61	0.50	1.46	.00	***	0.59	0.60	1.46	.06	*	0.69	
Foreign–foreign	0.69	3.87	.00	***	0.90	0.65	4.01	.00	***	0.88	0.46	1.82	.71		0.61	0.72	4.98	.00	***	0.93	0.64	2.90	.00	***	0.84	0.77	3.42	.00	***	0.92	
Parents' education																															
At least one parent with tertiary (reference)	0.22	1.00			0.22	0.26	1.00			0.26	0.34	1.00			0.34	0.28	1.00			0.28	0.28	1.00			0.28	0.32	1.00			0.32	
At least one parent with upper secondary	0.31	1.11	.40		0.33	0.40	1.38	.00	***	0.48	0.54	1.25	.06	*	0.60	0.37	1.15	.23		0.41	0.38	1.26	.00	***	0.44	0.52	1.76	.00	***	0.65	
Neither parent with upper secondary	0.53	1.80	.00	***	0.67	0.59	1.83	.00	***	0.72	0.74	1.67	.00	***	0.83	0.55	1.45	.00	***	0.64	0.67	2.63	.00	***	0.84	0.83	3.53	.00	***	0.94	
Education																															
More than upper secondary (reference)	0.18	1.00			0.18	0.28	1.00			0.28	0.33	1.00			0.33	0.24	1.00			0.24	0.30	1.00			0.30	0.33	1.00			0.33	
Upper secondary	0.41	2.67	.00	***	0.65	0.51	1.88	.00	***	0.66	0.70	2.17	.00	***	0.83	0.48	2.53	.00	***	0.70	0.49	1.45	.00	***	0.59	0.66	2.11	.00	***	0.80	
Less than upper secondary	0.71	6.08	.00	***	0.94	0.67	2.52	.00	***	0.84	0.86	4.40	.00	***	0.96	0.76	5.11	.00	***	0.94	0.77	3.69	.00	***	0.92	0.93	7.42	.00	***	0.99	
Employment status																															
Employed (reference)	0.35	1.00			0.35	0.38	1.00			0.38	0.52	1.00			0.52	0.38	1.00			0.38	0.43	1.00			0.43	0.47			0.47		
Unemployed	0.60	1.17	.56		0.64	0.50	0.71	.21		0.42	0.73	1.83	.00	***	0.83	0.58	0.96	.89		0.57	0.70	1.35	.09	*	0.76	0.70	0.98	.92		0.70	
Occupation																															
Skilled (reference)	0.25	1.00			0.25	0.24	1.00			0.24	0.33	1.00			0.33	0.25	1.00			0.25	0.28	1.00			0.28	0.32	1.00			0.32	
Semi-skilled, white-collar	0.45	1.10	.38		0.47	0.55	2.08	.00	***	0.72	0.61	1.64	.00	***	0.72	0.50	1.22	.11		0.55	0.52	1.44	.00	***	0.61	0.60	1.68	.00	***	0.71	
Semi-skilled, blue-collar	0.61	1.91	.00	***	0.75	0.58	2.47	.00	***	0.77	0.75	2.40	.00	***	0.88	0.57	1.78	.00	***	0.70	0.59	1.66	.00	***	0.70	0.74	2.66	.00	***	0.88	
Elementary	0.72	2.20	.00	***	0.85	0.77	3.24	.00	***	0.91	0.73	1.78	.00	***	0.83	0.72	1.71	.02		0.81	0.76	2.59	.00	***	0.89	0.84	3.52	.00	***	0.95	
Reading at work																															
At least 2 types per week (reference)	0.27	1.00			0.27	0.32	1.00			0.32	0.35	1.00			0.35	0.31	1.00			0.31	0.36	1.00			0.36	0.40	1.00			0.40	
Little to none	0.49	1.11	.27		0.52	0.52	1.16	.10	*	0.55	0.66	1.33	.00	***	0.72	0.50	1.15	.14		0.54	0.56	1.12	.08	*	0.59	0.63	1.06	.56		0.64	
Earnings																															
Highest quintile (reference)	0.18	1.00			0.18	0.21	1.00			0.21	0.34	1.00			0.34	0.20	1.00			0.20	0.21	1.00			0.21	0.23	1.00			0.23	
Next to highest quintile	0.27	1.24	.16		0.31	0.31	1.37	.02	**	0.38	0.54	1.69	.00	***	0.67	0.27	1.07	.66		0.28	0.40	1.84	.00	***	0.55	0.38	1.62	.00	***	0.50	
Middle quintile	0.39	1.65	.00	***	0.51	0.39	1.69	.00	***	0.52	0.63	2.11	.00	***	0.78	0.43	2.09	.00	***	0.61	0.48	2.01	.00	***	0.65	0.56	2.43	.00	***	0.75	
Next to lowest quintile	0.44	1.64	.00	***	0.56	0.49	1.63	.00	***	0.62	0.65	1.58	.00	***	0.75	0.50	1.97	.00	***	0.67	0.61	3.00	.00	***	0.82	0.67	2.67	.00	***	0.84	
Lowest quintile	0.50	1.94	.00	***	0.66	0.60	2.54	.00	***	0.79	0.70	1.77	.00	***	0.80	0.47	1.60	.01	***	0.59	0.54	2.21	.00	***	0.72	0.61	2.15	.00	***	0.77	
No earnings	0.62	1.88	.02	**	0.75	0.62	1.68	.03	**	0.73	0.69	1.06	.77		0.70	0.67	1.54	.16		0.76	0.63	2.36	.00	***	0.80	0.67	2.69	.00	***	0.85	
Fit statistics																															
Cox & Snell R-square	0.29				0.25					0.19					0.28						0.22										

Notes:

u.p. denotes unadjusted probabilities; a.p. denotes adjusted probabilities; OR denotes odds ratios; p.v. denotes p-value

-- data unavailable

*p<.1, **p<.05, ***p<.01

Table 3B Unadjusted and adjusted probabilities (derived from a binary logistic regression) of scoring at Level 2 or below on the literacy scale by a range of socio-demographic and practice-oriented factors, populations aged 26–65, IALS 1994–1998

	BE				DK				FI				DE				IE				IT									
	u.p.	OR	pv	a.p.	u.p.	OR	pv	a.p.	u.p.	OR	pv	a.p.	u.p.	OR	pv	a.p.	u.p.	OR	pv	a.p.	u.p.	OR	pv	a.p.						
Age																														
26–40 (reference)	0.39	1.00			0.39	0.37	1.00			0.37	0.24	1.00			0.24	0.44	1.00			0.44	0.48	1.00			0.48	0.59	1.00			0.59
41–55	0.54	1.81	.00	***	0.68	0.49	1.76	.00	***	0.63	0.44	2.27	.00	***	0.64	0.50	1.37	.01	***	0.58	0.59	1.43	.01	***	0.68	0.73	1.51	.00	***	0.80
56–65	0.75	3.92	.00	***	0.92	0.69	3.02	.00	***	0.87	0.72	5.08	.00	***	0.93	0.65	2.17	.00	***	0.80	0.70	1.72	.00	***	0.80	0.88	3.03	.00	***	0.96
Gender																														
Men (reference)	0.48	1.00			0.48	0.49	1.00			0.49	0.45	1.00			0.45	0.50	1.00			0.50	0.55	1.00			0.55	0.69	1.00			0.69
Women	0.53	0.99	.94		0.52	0.47	0.74	.01	***	0.39	0.37	0.65	.00	***	0.28	0.52	0.95	.68		0.50	0.56	0.87	.32		0.52	0.71	0.77	.04	**	0.65
Immigration and language status																														
Native–native (reference)	0.50	1.00			0.50	0.48	1.00			0.48	0.41	1.00			0.41	0.49	1.00			0.49	0.56	1.00			0.56	0.69	1.00			0.69
Native–foreign	0.45	0.99	.96		0.44	0.24	0.99	.99		0.24	0.30	1.13	.82		0.32	0.49	1.73	.56		0.62	0.64	0.74	.54		0.57	0.95	6.96	.00	***	0.99
Foreign–native	0.42	0.99	.99		0.42	0.50	1.40	.58		0.58	0.19	0.53	.40		0.11	0.75	2.42	.02	**	0.88	0.52	1.11	.67		0.55	0.71	2.06	.10	*	0.83
Foreign–foreign	0.89	9.92	.00	***	0.99	0.73	2.96	.03	**	0.89	0.69	4.70	.00	***	0.91	0.72	2.79	.00	***	0.88	0.41	0.85	.81		0.37	0.91	10.61	.00	***	0.99
Parents' education																														
At least one parent with tertiary (reference)	0.26	1.00			0.26	0.24	1.00			0.24	0.17	1.00			0.17	0.29	1.00			0.29	0.37	1.00			0.37	0.38	1.00			0.38
At least one parent with upper secondary	0.35	1.05	.82		0.36	0.44	1.73	.00	***	0.58	0.30	1.31	.17		0.36	0.42	1.29	.39		0.49	0.31	0.55	.04	**	0.20	0.51	1.23	.44		0.56
Neither parent with upper secondary	0.57	1.02	.92		0.58	0.60	2.05	.00	***	0.75	0.51	1.94	.00	***	0.68	0.54	1.49	.09	*	0.64	0.59	0.71	.16		0.51	0.74	1.22	.42		0.77
Education																														
More than upper secondary (reference)	0.16	1.00			0.16	0.18	1.00			0.18	0.12	1.00			0.12	0.21	1.00			0.21	0.19	1.00			0.19	0.32	1.00			0.32
Upper secondary	0.42	3.08	.00	***	0.69	0.50	2.68	.00	***	0.72	0.36	3.26	.00	***	0.64	0.48	2.63	.00	***	0.71	0.35	1.52	.04	**	0.45	0.48	1.67	.00	***	0.60
Less than upper secondary	0.76	9.76	.00	***	0.97	0.78	6.65	.00	***	0.96	0.72	8.43	.00	***	0.96	0.58	3.15	.00	***	0.81	0.75	6.18	.00	***	0.95	0.87	8.58	.00	***	0.98
Employment status																														
Employed (reference)	0.41	1.00			0.41	0.43	1.00			0.43	0.33	1.00			0.33	0.45	1.00			0.45	0.44	1.00			0.44	0.62	1.00			0.62
Unemployed	0.70	1.79	.08	*	0.80	0.58	0.80	.40		0.52	0.59	1.19	.42		0.63	0.58	1.80	.04	**	0.72	0.74	1.04	.90		0.75	0.73	0.98	.95		0.72
Occupation																														
Skilled (reference)	0.31	1.00			0.31	0.24	1.00			0.24	0.20	1.00			0.20	0.26	1.00			0.26	0.26	1.00			0.26	0.38	1.00			0.38
Semi-skilled, white-collar	0.27	0.56	.01	**	0.17	0.47	1.42	.02	**	0.56	0.29	0.84	.30		0.26	0.51	1.89	.00	***	0.66	0.39	1.34	.18		0.46	0.64	1.45	.02	**	0.72
Semi-skilled, blue-collar	0.69	1.81	.02	**	0.80	0.66	2.54	.00	***	0.83	0.57	1.93	.00	***	0.72	0.59	2.21	.00	***	0.76	0.60	1.51	.05	**	0.69	0.79	1.37	.13		0.84
Elementary	--	--	--		0.75	4.09	.00			0.93	0.62	2.39	.00		0.80	0.70	2.94	.00		0.87	0.77	2.54	.00		0.90	0.86	2.65	.00		0.94
Reading at work																														
At least 2 types per week (reference)	0.30	1.00			0.30	0.36	1.00			0.36	0.26	1.00			0.26	0.42	1.00			0.42	0.33	1.00			0.33	0.49	1.00			0.49
Little to none	0.60	1.20	.25		0.64	0.64	1.41	.01	***	0.71	0.58	1.59	.00	***	0.68	0.59	1.20	.28		0.63	0.63	1.48	.02	**	0.72	0.76	1.53	.00	***	0.83
Earnings																														
Highest quintile (reference)	0.29	1.00			0.29	0.30	1.00			0.30	0.24	1.00			0.24	0.33	1.00			0.33	0.23	1.00			0.23	0.54	1.00			0.54
Next to highest quintile	0.31	0.78	.62		0.26	0.41	1.21	.23		0.46	0.26	1.13	.51		0.29	0.48	1.21	.36		0.53	0.39	1.47	.14		0.49	0.59	0.98	.94		0.58
Middle quintile	0.25	0.45	.08	*	0.13	0.50	1.66	.00	***	0.63	0.39	1.81	.00	***	0.54	0.55	1.66	.03	**	0.67	0.48	1.41	.19		0.57	0.67	1.02	.92		0.68
Next to lowest quintile	0.42	0.79	.58		0.36	0.55	1.86	.00	***	0.69	0.36	1.42	.12		0.45	0.62	1.74	.02	**	0.74	0.67	2.25	.00	***	0.82	0.72	1.01	.97		0.72
Lowest quintile	0.57	1.36	.50		0.64	0.41	0.99	.98		0.41	0.33	1.23	.52		0.38	0.47	0.92	.79		0.45	0.72	2.68	.00	***	0.88	0.69	0.99	.98		0.69
No earnings	0.70	1.05	.92		0.71	0.71	2.73	.00	***	0.87	0.66	2.45	.00	***	0.83	0.55	0.80	.38		0.49	0.65	1.51	.17		0.74	0.82	0.57	.16		0.73

Notes:

u.p. denotes unadjusted probabilities; a.p. denotes adjusted probabilities; OR denotes odds ratios; pv denotes p-value

-- data unavailable

*p<.1, **p<.05, ***p<.01

Table 3B (cont'd) Unadjusted and adjusted probabilities (derived from a binary logistic regression) of scoring at Level 2 or below on the literacy scale by a range of socio-demographic and practice-oriented factors, populations aged 26–65, IALS 1994–1998

	NL				NO				PL				SE				UK				US										
	u.p.	OR	pv	a.p.	u.p.	OR	pv	a.p.	u.p.	OR	pv	a.p.	u.p.	OR	pv	a.p.	u.p.	OR	pv	a.p.	u.p.	OR	pv	a.p.							
Age																															
26–40 (reference)	0.29	1.00			0.29	0.24	1.00			0.24	0.75	1.00			0.75	0.21	1.00			0.21	0.46	1.00			0.46	0.42	1.00			0.42	
41–55	0.50	2.65	.00	***	0.73	0.38	2.04	.00	***	0.56	0.83	1.72	.00	***	0.90	0.30	1.59	.00	***	0.40	0.50	1.09	.36		0.52	0.43	1.04	.76		0.44	
56–65	0.68	3.54	.00	***	0.88	0.64	4.12	.00	***	0.88	0.90	1.91	.00	***	0.95	0.49	2.46	.00	***	0.70	0.75	2.10	.00	***	0.86	0.54	1.24	.15		0.59	
Gender																															
Men (reference)	0.44	1.00			0.44	0.38	1.00			0.38	0.81	1.00			0.81	0.31	1.00			0.31	0.51	1.00			0.51	0.49	1.00			0.49	
Women	0.43	0.61	.00	***	0.31	0.34	0.57	.00	***	0.22	0.80	1.15	.29		0.83	0.29	0.84	.17		0.25	0.55	0.85	.13		0.51	0.41	0.51	.00	***	0.26	
Immigration and language status																															
Native–native (reference)	0.42	1.00			0.42	0.35	1.00			0.35	0.80	1.00			0.80	0.27	1.00			0.27	0.51	1.00			0.51	0.38	1.00			0.38	
Native–foreign	0.39	1.09	.78		0.41	0.50	1.53	.42		0.60	0.90	2.32	.33		0.95	0.27	0.84	.65		0.23	0.72	3.44	.00	***	0.90	0.67	2.90	.00	***	0.86	
Foreign–native	0.37	1.43	.29		0.46	0.33	1.41	.40		0.41	0.89	1.22	.72		0.91	0.37	1.09	.84		0.39	0.51	1.67	.04	**	0.63	0.36	1.30	.45		0.42	
Foreign–foreign	0.68	3.79	.00	***	0.89	0.53	3.80	.00	***	0.81	1.00	u.e.	.99		u.e.	0.57	3.37	.00	***	0.82	0.81	6.89	.00	***	0.97	0.81	6.91	.00	***	0.97	
Parents' education																															
At least one parent with tertiary (reference)	0.21	1.00			0.21	0.18	1.00			0.18	0.51	1.00			0.51	0.14	1.00			0.14	0.20	1.00			0.20	0.25	1.00			0.25	
At least one parent with upper secondary	0.27	1.02	.92		0.27	0.27	0.96	.81		0.26	0.63	1.01	.95		0.63	0.18	1.06	.81		0.19	0.26	1.02	.93		0.26	0.36	1.11	.45		0.38	
Neither parent with upper secondary	0.50	1.37	.11		0.57	0.50	1.75	.00	***	0.64	0.85	1.62	.02	**	0.90	0.36	1.57	.04	**	0.47	0.55	2.48	.00	***	0.75	0.63	1.77	.00	***	0.75	
Education																															
More than upper secondary (reference)	0.14	1.00			0.14	0.11	1.00			0.11	0.49	1.00			0.49	0.10	1.00			0.10	0.19	1.00			0.19	0.24	1.00			0.24	
Upper secondary	0.29	2.27	.00	***	0.49	0.40	3.22	.00	***	0.69	0.72	2.22	.00	***	0.85	0.27	2.55	.00	***	0.49	0.45	2.40	.00	***	0.66	0.49	2.07	.00	***	0.67	
Less than upper secondary	0.69	7.55	.00	***	0.94	0.70	7.50	.00	***	0.95	0.92	7.31	.00	***	0.99	0.54	4.95	.00	***	0.85	0.67	4.53	.00	***	0.90	0.90	8.95	.00	***	0.99	
Employment status																															
Employed (reference)	0.35	1.00			0.35	0.31	1.00			0.31	0.76	1.00			0.76	0.25	1.00			0.25	0.46	1.00			0.46	0.40	1.00			0.40	
Unemployed	0.51	1.12	.73		0.53	0.51	1.43	.23		0.60	0.85	1.49	.21		0.89	0.38	0.78	.39		0.32	0.59	0.62	.18		0.47	0.56	0.82	.55		0.51	
Occupation																															
Skilled (reference)	0.23	1.00			0.23	0.17	1.00			0.17	0.57	1.00			0.57	0.17	1.00			0.17	0.27	1.00			0.27	0.19	1.00			0.19	
Semi-skilled, white-collar	0.40	1.40	.06	*	0.48	0.38	1.92	.00	***	0.54	0.74	0.88	.53		0.71	0.29	1.26	.18		0.34	0.48	1.05	.72		0.50	0.45	2.11	.00	***	0.63	
Semi-skilled, blue-collar	0.58	1.86	.00	***	0.72	0.48	2.04	.00	***	0.65	0.89	1.48	.07	*	0.92	0.39	1.64	.01	***	0.51	0.66	2.28	.00	***	0.82	0.67	2.74	.00	***	0.85	
Elementary	0.66	2.54	.00	***	0.83	0.64	3.67	.00	***	0.87	0.92	1.70	.16		0.95	0.55	2.26	.01		0.73	0.74	2.22	.00		0.86	--	--	--			
Reading at work																															
At least 2 types per week (reference)	0.26	1.00			0.26	0.26	1.00			0.26	0.62	1.00			0.62	0.20	1.00			0.20	0.37	1.00			0.37	0.29	1.00			0.29	
Little to none	0.57	1.54	.01	***	0.68	0.50	1.30	.04	**	0.56	0.86	1.09	.62		0.87	0.41	1.51	.01	***	0.51	0.67	1.41	.01	***	0.74	0.66	1.74	.00	***	0.77	
Earnings																															
Highest quintile (reference)	0.22	1.00			0.22	0.24	1.00			0.24	0.67	1.00			0.67	0.18	1.00			0.18	0.25	1.00			0.25	0.16	1.00			0.16	
Next to highest quintile	0.41	1.98	.00	***	0.58	0.25	0.75	.07	*	0.20	0.71	1.17	.45		0.74	0.30	1.52	.02	**	0.39	0.45	1.53	.01	***	0.56	0.19	0.96	.91		0.18	
Middle quintile	0.41	1.64	.01	**	0.53	0.35	1.17	.35		0.39	0.75	1.18	.42		0.78	0.32	1.58	.03	**	0.43	0.52	1.69	.00	***	0.65	0.30	1.51	.19		0.39	
Next to lowest quintile	0.35	1.44	.15		0.43	0.39	1.30	.18		0.45	0.81	1.17	.50		0.83	0.35	1.39	.17		0.42	0.56	1.96	.00	***	0.71	0.44	2.07	.02	**	0.62	
Lowest quintile	0.41	1.57	.11		0.52	0.33	0.77	.40		0.28	0.88	1.52	.14		0.91	0.24	1.35	.33		0.30	0.61	2.45	.00	***	0.79	0.56	2.40	.01	***	0.75	
No earnings	0.60	1.81	.01	**	0.73	0.65	2.86	.00	***	0.84	1.00	u.e.	.99		u.e.	0.62	1.75	.61		0.74	0.70	1.96	.05	**	0.82	0.59	2.71	.00	***	0.79	

Notes:

u.p. denotes unadjusted probabilities; a.p. denotes adjusted probabilities; OR denotes odds ratios; pv denotes p-value

-- data unavailable

*p<.1, **p<.05, ***p<.01

Table 4A Summary of differences in adjusted probability points (effect sizes) of scoring at Level 2 or below in PIAAC between most advantaged (reference category) and selected disadvantaged categories associated with each determinant

	BE	DK	FI	DE	IE	IT	NL	NO	PL	SE	UK	US	Average
Older (56-65)	0.81	0.87	0.90	0.89	0.74	0.89	0.84	0.86	0.78	0.84	0.59	0.71	
Younger (26-40)	0.34	0.40	0.21	0.45	0.48	0.63	0.29	0.30	0.51	0.32	0.43	0.43	
Difference (effect size)	0.47 ***	0.47 ***	0.69 ***	0.43 ***	0.26 ***	0.27 ***	0.55 ***	0.56 ***	0.27 ***	0.53 ***	0.16	0.28 ***	0.40
Women	0.55	0.57	0.37	0.55	0.62	0.74	0.51	0.46	0.58	0.48	0.50	0.52	
Men	0.45	0.50	0.41	0.51	0.54	0.70	0.38	0.41	0.61	0.42	0.47	0.52	
Difference (effect size)	0.11 ***	0.07 ***	-0.04	0.04	0.09	0.04	0.13 **	0.05	-0.03	0.05	0.03	0.00	0.04
Immigrant	0.97	0.93	0.93	0.94	0.83 ***	0.96	0.90	0.88	0.61	0.93	0.84	0.92	
Native	0.46	0.48	0.37	0.49	0.56	0.70	0.37	0.39	0.59	0.37	0.46	0.48	
Difference (effect size)	0.52 ***	0.45 ***	0.56 ***	0.45 ***	0.28	0.26 ***	0.52 ***	0.49 ***	0.02	0.55 ***	0.37 ***	0.44 ***	0.41
Low SES	0.90	0.74	0.67	0.90	0.79	0.88	0.67	0.72	0.83	0.64	0.84	0.94	
High SES	0.22	0.33	0.20	0.36	0.34	0.40	0.22	0.26	0.34	0.28	0.28	0.32	
Difference (effect size)	0.68 ***	0.41 ***	0.47 ***	0.54 ***	0.45 ***	0.47 ***	0.45 ***	0.46 ***	0.49 ***	0.36 ***	0.56 ***	0.63 ***	0.50
Low Ed	0.96	0.94	0.88	0.98	0.95	0.96	0.94	0.84	0.96	0.94	0.92	0.99	
High Ed	0.22	0.31	0.24	0.29	0.41	0.41	0.18	0.28	0.33	0.24	0.30	0.33	
Difference (effect size)	0.74 ***	0.63 ***	0.65 ***	0.70 ***	0.54 ***	0.55 ***	0.76 ***	0.56 ***	0.63 ***	0.71 ***	0.62 ***	0.66 ***	0.65
Blue-collar	0.78	0.84	0.67	0.80	0.74	0.87	0.75	0.77	0.88	0.70	0.70	0.88	
Skilled	0.27	0.32	0.21	0.30	0.36	0.49	0.25	0.24	0.33	0.25	0.28	0.32	
Difference (effect size)	0.51 ***	0.52 ***	0.46 ***	0.51 ***	0.38 ***	0.38 ***	0.50 ***	0.53 ***	0.54 ***	0.46 ***	0.42 ***	0.57 ***	0.48
Low practice	0.57	0.63	0.43	0.70	0.63	0.81	0.52	0.55	0.72	0.54	0.59	0.64	
High practice	0.30	0.39	0.27	0.36	0.41	0.48	0.27	0.32	0.35	0.31	0.36	0.40	
Difference (effect size)	0.27	0.24 *	0.17	0.33 **	0.22	0.33 ***	0.25	0.23 *	0.37 ***	0.22	0.23 *	0.24	0.26
Low earnings	0.78	0.75	0.59	0.78	0.80	0.83	0.66	0.79	0.80	0.59	0.72	0.77	
High earnings	0.24	0.24	0.19	0.25	0.26	0.52	0.18	0.21	0.34	0.20	0.21	0.23	
Difference (effect size)	0.54 **	0.51 ***	0.39 ***	0.53 ***	0.55 ***	0.32 ***	0.48 ***	0.59 ***	0.46 ***	0.39 ***	0.52 ***	0.54 ***	0.47

Notes: For complete results see Table 3A.

* p<.1, ** p<.05, *** p<.01

Table 4B Summary of differences in adjusted probability points (effect sizes) of scoring at Level 2 or below in IALS between most advantaged (reference category) and selected disadvantaged categories associated with each determinant

	BE	DK	FI	DE	IE	IT	NL	NO	PL	SE	UK	US	Average
Older (56-65)	0.92	0.87	0.93	0.80	0.80	0.96	0.88	0.88	0.95	0.70	0.86	0.59	
Younger (26-40)	0.39	0.37	0.24	0.44	0.48	0.59	0.29	0.24	0.75	0.21	0.46	0.42	
Difference (effect size)	0.54 ***	0.50 ***	0.69 ***	0.37 ***	0.33 ***	0.37 ***	0.59 ***	0.63 ***	0.20 ***	0.49 ***	0.40 ***	0.17	0.44
Women	0.52	0.39	0.28	0.50	0.52	0.65	0.31	0.22	0.83	0.25	0.51	0.26	
Men	0.48	0.49	0.45	0.50	0.55	0.69	0.44	0.38	0.81	0.31	0.51	0.49	
Difference (effect size)	0.04	-0.10 ***	-0.18 ***	0.01	-0.03	-0.04 **	-0.13 ***	-0.16 ***	0.02	-0.05	0.00	-0.23 ***	-0.07
Immigrant	0.99	0.89	0.91	0.88	0.37	0.99	0.89	0.81	u.e	0.82	0.97	0.97	
Native	0.50	0.48	0.41	0.49	0.56	0.69	0.42	0.35	0.80	0.27	0.51	0.38	
Difference (effect size)	0.49 ***	0.41 **	0.50 ***	0.39 ***	-0.19	0.30 ***	0.47 ***	0.46 ***	--	0.55 ***	0.45 ***	0.59 ***	0.40
Low SES	0.58	0.75	0.66	0.64	0.51	0.77	0.57	0.64	0.90	0.47	0.75	0.75	
High SES	0.26	0.24	0.17	0.29	0.37	0.38	0.21	0.18	0.51	0.14	0.20	0.25	
Difference (effect size)	0.32	0.51 ***	0.50 ***	0.35 *	0.14	0.40	0.36	0.46 ***	0.39 **	0.33 **	0.55 ***	0.50 ***	0.40
Low Ed	0.97	0.96	0.96	0.81	0.95	0.98	0.94	0.95	0.99	0.85	0.90	0.99	
High Ed	0.16	0.18	0.12	0.21	0.19	0.32	0.14	0.11	0.49	0.10	0.19	0.24	
Difference (effect size)	0.81 ***	0.78 ***	0.84 ***	0.60 ***	0.76 ***	0.66 ***	0.81 ***	0.84 ***	0.50 ***	0.75 ***	0.71 ***	0.75 ***	0.73
Blue-collar	0.80	0.83	0.72	0.76	0.69	0.84	0.72	0.65	0.92	0.51	0.82	0.85	
Skilled	0.31	0.24	0.20	0.26	0.26	0.38	0.23	0.17	0.57	0.17	0.27	0.19	
Difference (effect size)	0.49 **	0.59 ***	0.52 ***	0.50 ***	0.43 **	0.46	0.49 ***	0.48 ***	0.35 *	0.35 ***	0.54 ***	0.66 ***	0.49
Low practice	0.64	0.71	0.68	0.63	0.72	0.83	0.68	0.56	0.87	0.51	0.74	0.77	
High practice	0.30	0.36	0.26	0.42	0.33	0.49	0.26	0.26	0.62	0.20	0.37	0.29	
Difference (effect size)	0.34	0.35 ***	0.42 ***	0.21 ***	0.39 **	0.34 ***	0.41 ***	0.31 **	0.25	0.31 ***	0.37 ***	0.48 ***	0.35
Low earnings	0.64	0.41	0.38	0.45	0.88	0.69	0.52	0.28	0.91	0.30	0.79	0.75	
High earnings	0.29	0.30	0.24	0.33	0.23	0.54	0.22	0.24	0.67	0.18	0.25	0.16	
Difference (effect size)	0.35	0.11	0.14	0.12	0.65 ***	0.15	0.30	0.04	0.24	0.12	0.54 ***	0.60 ***	0.28

Notes: For complete results see Table 3B.

* $p < .1$, ** $p < .05$, *** $p < .01$

Educational attainment

Tables 4A and 4B show that in the majority of countries considered, one of the most important predictors of scoring at Level 2 or below vs Level 3 or higher is *educational attainment*. It ranks first as the most substantial predictor in 9 of the 12 countries and second in the remaining countries. In PIAAC, the average effect size associated with educational attainment across countries is .65 adjusted probability points, which means that adults who attained less than upper secondary school completion have a .65 greater probability of scoring at Level 2 or lower than an adult who attained more than upper secondary school completion. Across countries, the higher the probability for an adult with low educational attainment to score at Level 2 or lower is, the fewer chances are open to low educated adults to develop and practise literacy over their lifespan. For example, in those countries, there may be fewer second chances for educational opportunities or adult education.

PIAAC data reflect the strongest effect of educational attainment in the Netherlands (.76), Belgium (.74), Sweden (.71), Germany (.70) and the United States (.66). It has the weakest effect in Ireland (.54) and Norway (.56). The estimates suggest that over the last two decades, the magnitude of the effect associated with low vs high educational attainment has declined substantially, exceeding a change in probability points of .1 in six countries, namely Denmark (from .78 in IALS to .63 in PIAAC), Finland (.84 to .65), Ireland (.76 to .54), Italy (.66 to .55) and Norway (.84 to .56). As can be seen from Tables 4A and 4B, the decline in five of the six countries is not due to an improvement in the chances of low educated people to score higher, instead it appears to be due to the most educated being increasingly likely to score at lower levels of proficiency. This is also the case in the United States, where the more educated have a higher probability (+.09 probability points) in PIAAC of scoring at Level 2 or below than in the 1990s in IALS. By contrast, the probability in the United States (US) for adults without upper secondary school completion to score at Level 2 or below remained unchanged at .99 between IALS and PIAAC.

Parents' level of education

From Tables 4A and 4B, it can be seen that the second most important predictor on average of scoring at low levels of proficiency is *parents' level of education*, an indicator of SES, with an average probability difference between low and high educated parents of .50. Taken as an indicator of SES, parents' education has the strongest effect in Belgium (.68), and the US (.63) followed by the United Kingdom (.56) and Germany (.54). The lowest effect of SES origins on proficiency is in Sweden (.36), Denmark (.41), Ireland (.45), the Netherlands (.45), Norway (.46) and Finland (.47). Over the past two decades (spanning IALS and PIAAC), the relative importance of SES *increased* substantially in five countries, namely Belgium (from .32 to .68), , Germany (.35 to .54), Ireland (.14 to .45) and the US (.50 to .63). It *decreased* substantially in Denmark (from .51 to .41), not due to improvement of the chances of adults with low SES origins, but instead due to an increase in the probability of adults with high SES origins to score at lower levels of proficiency. In the US, the change is driven by a large increase in the probability of adults with low SES origins to score at lower levels (from .75 to .94), but this is somewhat offset by the increased probability of adults with high SES origins to also score at lower levels (from .25 to .32).

The remaining rank order continues with *occupation* as the third most important predictor (.48 probability difference between blue-collar and skilled workers), followed by *earnings* (.47 probability difference between lowest and highest earners), *immigrant and language status* (.41 probability difference between native-born native-speakers and foreign-born foreign-speakers), *age* (.4 probability difference between older and younger adults), *literacy practice at work* (.26 probability difference between workers who read frequently vs rarely) and *gender* (.04 probability difference between women and men).

Occupation

Comparing Tables 4A and 4B, it can be seen that the relative importance of occupation *increased* substantially in Poland (.35 to .54) and Sweden (.35 to .46), but *decreased* substantially in the UK (.54 to .42) over the past two decades. The relative significance of occupation also declined in the US, decreasing from .66 to .57. For Sweden, the increase in relative significance of occupation appears to be primarily driven by an increased probability of blue-collar workers to score at lower levels. In the UK, the decline is because blue-collar workers show an increased probability of scoring at higher levels, whereas in the US the decline is due to the increased probability of skilled workers scoring at lower levels (from .19 to .32).

Earnings

A comparison of Tables 4A and 4B, shows that earnings increased substantially in relative importance in Belgium (from .35 to .54), Finland (.14 to .39), Germany (.12 to .53), Italy (.11 to .32), the Netherlands (.30 to .48), Norway (.04 to .59), Poland (.24 to .46), and Sweden (.12 to .39). In most of these countries, this was driven by large increases in the probability of low earners to score at lower levels. The only exception is Poland, where the change is driven primarily by a sharp drop in the probability of high earners scoring at low levels. The earnings effect on proficiency was among the highest in the US in the 1990s, but a small decline in relative significance is estimated (from .60 to .54), which appears to be primarily because the probability of high earners of scoring at lower levels increased from .16 to .23.

Immigrant and language status

The relative significance of native-born native-speakers vs foreign-born foreign-speakers only changed in a handful of countries. In Ireland, where immigrants had an advantage in the 1990s but now have a .28 probability of scoring at low levels (this remains at a very low difference in comparison to other countries), and in the US, where the effect size declined from .59 to .44. The decline in relative importance in the US is primarily due to the increased probability of native-born and native speakers scoring at lower levels (from .38 in IALS to .48 in PIAAC).

Age

While age substantially declined in relative importance as a predictor in the UK (.40 to .16), it increased in the US from an effect size of .17 to .28. The increase in the importance of age in the US is primarily driven from an increased probability of older adults aged 56 to 65 scoring at Level 2 or lower (.59 to .71).

Literacy practice at work

The relative importance of literacy practice at work substantially *decreased* in Denmark (.35 to .24), Finland (.42 to .17), Ireland (.39 to .22), the Netherlands (.41 to .25), the UK (.7 to .23) and the US (.48 to .24), but *increased* in Germany (.21 to .33) and Poland (.25 to .37). For most countries, this reflects the probability of workers who read little (as part of job ... letters, memos or e-mails, reports, articles, magazines, journals, manuals or reference books) to show a reduced probability of scoring at Level 2 or lower. In Poland, those who read frequently as part of their job show a much lower probability of scoring at low levels compared to the 1990s. By contrast, for the US, adults who read frequently as part of their job are more likely to score at lower levels in PIAAC by a wide margin (.29 vs .40).

Gender

Gender has a low relative significance in the majority of countries. In PIAAC, the effect size is only substantial in Belgium (.11) and the Netherlands (.13), in both cases revealing that women have a higher probability of scoring at Level 2 or below. While the effect sizes for gender appear to be marginal, it is important to note substantial changes in the relative size

of the effects from IALS to PIAAC in a few countries, namely Denmark (–.1 to .07), Finland (–.17 to –.04). Ireland (–.03 to .09), the Netherlands (–.12 to .13), Norway (–.16 to .05) and Sweden (–.05 to .05).

Macro drivers affecting literacy proficiency profiles across countries

Despite the fact, shown in the above analysis, that educational attainment and occupation are among the most significant determinants of literacy proficiency – which is consistent with previous research and theoretical reasoning–, and despite the overall substantial growth in educational qualifications and skilled occupations (as can be seen from Table 2), Table 5 helps us to see that for most of the countries included in my analysis, literacy proficiency is either stagnant with only very minor improvements or on the decline.

Table 5 Changes to national literacy profiles and macro drivers affecting profiles

	Literacy inequality index			Percentage point change of adults with literacy proficiency Level 2 or below	Percentage point change from PIAAC (2012) to IALS (1990s) in key macro level drivers of change in adult literacy					
	Ratio of adults at Level 2 or below to adults at Level 3 or higher in PIAAC (2012)	Ratio of adults at Level 2 or below to adults at Level 3 or higher in IALS (1990s)	Change in literacy inequality		Adults with tertiary qualifications	Adults in professional, managerial or technical jobs	Immigrants with literacy proficiency at Level 2 or below	Immigrants with literacy proficiency at Levels 3 or higher	Adults reading frequently a variety of texts at work	Adults participating in organized learning in last 12 months
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Finland	0.64	0.67	-	-0.9	21	8	2.7	1.0	-17	7
Netherlands	0.71	0.64	+	2.5	14	19	5.3	1.7	-11	28
Sweden	0.77	0.35	+	17.3	5	1	7.7	0.7	-12	11
Norway	0.74	0.43	+	12.5	13	12	5.8	1.5	-8	16
Belgium	0.90	0.90	+	0.1	13	40	2.7	0.8	-13	26
UK	0.93	1.08	-	-3.7	18	12	3.0	3.8	-10	10
Denmark	1.05	0.58	+	14.6	12	14	7.4	2.3	-11	10
Germany	1.14	0.86	+	6.8	18	18	5.5	1.3	-22	
US	1.09	0.80	+	7.8	-2	20	2.2	0.9	-9	17
Ireland	1.24	1.40	-	-3.0	18	17	8.1	6.2	-3	28
Poland	1.45	3.95	-	-20.5	13	19	0.0	0.0	2	20
Italy	2.53	2.58	-	-0.4	4	12	6.4	0.8	-16	2

Columns 1 and 2 in Table 5 show the ratios of adults aged 26–65 who scored at Level 2 or below to those who scored at Level 3 or higher, respectively for PIAAC and IALS, and column 3 summarises the comparison. Starting from a relatively low point in the 1990s, Poland stands out as being the only country that substantively improved the overall literacy proficiency of the adult population, with a decrease of adults scoring at Level 2 or below of over 20 percentage points (Table 5, column 4). Results indicate that overall literacy proficiency improved only marginally in Ireland and the UK (about 3 percentage points) as well as Finland and Italy (less than 1 percentage point), while it declined only marginally in Belgium and the Netherlands (about 2 percentage points or less).

By contrast, the decline is substantial for the Scandinavian countries (Denmark, Norway and Sweden), with increases of adults at Level 2 or below being very large, ranging from 12 to 17 percentage points (Table 5, column 4). Similarly, for Germany and the US, increases of adults at Level 2 or below are substantial, ranging from about 6 to 8 percentage points. Columns 5 to 10 summarise the macro-level changes for key select determinants discussed in the micro-level model, namely education, occupation, immigration and literacy practice, which may have played a role for the observed changes to national literacy profiles.

In the next section, each of these determinants are considered in turn in terms of their growth or decline at the macro level between the interim period between the 1994–1998 IALS and the 2012 PIAAC study.

Growth of tertiary qualifications

Earlier in this article, I discussed education as a key micro-level driver of literacy proficiency. It is reasonable to expect, therefore, that national growth in numbers of people attaining tertiary qualifications over the past two decades may have improved countries' overall literacy profiles. According to IALS and PIAAC, tertiary qualifications can be seen to have increased in most countries in excess of 10 percentage points (Table 5, column 5). Featuring an already elevated level of tertiary qualifications in the 1990s, the US is an exception. For similar reasons, Sweden did not add much to the proportion of adults with tertiary qualifications, which partly explains this country's disproportionate increase in adults scoring at lower levels. Italy, on the other hand, continues to feature relatively low levels of tertiary qualifications, which is consistent with its high proportion of adults scoring at lower levels in both the 1990s and in 2012.

Growth of knowledge economies

Related to occupation as a micro-level factor affecting literacy proficiency, the growth of knowledge economies is another macro-level factor that one might expect to have an improving effect on national literacy profiles. Naturally, increases in qualifications and knowledge jobs tend to go hand in hand. But one might expect that the presence of both would surely add to overall levels of proficiency (at least for a growing proportion of the population), because it would mutually reinforce the development of literacy or at least mitigate the loss of cognition as people age – which is so important for literacy proficiency (Desjardins and Warnke 2012). With the exception of Finland and Sweden, which already had very high levels of knowledge-oriented jobs in the 1990s, Table 5 (column 6) shows that managerial, professional and technical jobs are indeed on the rise, exceeding 10 percentage points in most countries.

Growth of low- vs high-skill immigrants

With qualifications and knowledge jobs presumably driving national literacy proficiency profiles upwards, what might be driving them down? An obvious factor that may lead to overall declines in literacy proficiency is the change in the proportion of immigrants with low levels of literacy in the host language (Table 5, column 7). This is where the Scandinavian countries stand out most. They are among the countries who have embraced the most immigrants who tend not to score very high on the literacy test administered in PIAAC.

It is important to note that *low literacy* in this context refers to *literacy in the language of the host country*. This is significant because many immigrants, especially in Europe, in addition to being literate in their own language, are now also literate in the English language, but not necessarily the local language. Yet they thrive in the host country, especially in the high-skill sector. PIAAC does not capture this phenomenon very well, and also brings into question the purpose of a narrow national language-based approach to literacy, especially for small open economies in non-English-speaking countries which are fully integrated into the “English-speaking” global economy. On this point, interestingly, Ireland and the UK (both English-speaking) have benefited the most from immigrants who tend to score well in PIAAC (Table 5, column 8). This in part explains why they are among the few countries whose literacy profile did not decline.

Declining literacy practice

A less obvious factor that might be driving national literacy proficiency profiles down is literacy practice, discussed earlier in this article as an important micro-level driver. We might expect literacy practice at the macro level to be on the rise as average levels of education increase and there are more demanding high-skill jobs in the economy. But is this the case?

Not according to PIAAC data. With a couple exceptions, results in Table 5 show major declines in the proportion of people who reported engaging in at least two types of reading once a week and one other less than once a week. Although not presented here, additional analysis has revealed that this pattern holds by type of job, suggesting that the downward trend is present in many countries even among people holding high-skill jobs. Unfortunately, only a handful of measures on literacy practices at work are comparable between IALS and PIAAC, and it is not possible to see if the pattern is similar for literacy practice outside work. Even so, this is puzzling, and it is not clear whether the data are reliable since these are self-reports of literacy practices.

But it turns out that this observation helps to explain the overall declines in national literacy profiles very well. If we sum the percentage point changes in columns 5–9 of Table 5 (adjusting column 7 as a negative) and correlate the result to the percentage point change of adults scoring at Level 3 or higher, the correlation is very strong (see Figure 2). The marked strength of this correlation suggests that considering the range of macro-level drivers together explains the change in overall national literacy rather well.

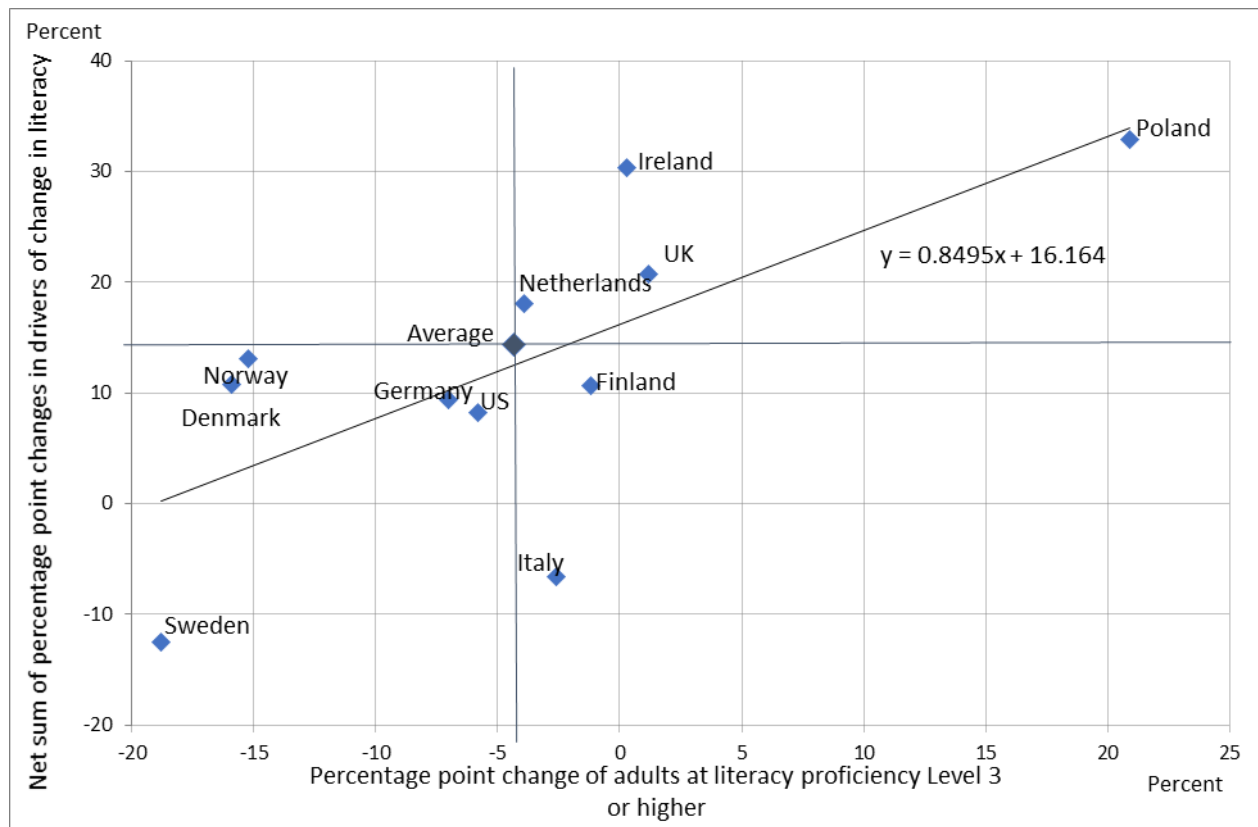


Figure 2 Near-perfect correlation between changes to national literacy profiles and macro drivers affecting profiles

Growth of adult education

Although adult education is a powerful means to promote the development and enhancement of literacy, the sharp increase in participation in the interim period between the 1990s and 2012 (Table 5, column 10) is not included in the calculation for Figure 2, because, as discussed above in the section on education as a micro-level driver, there is an important confounding relationship between adult education and having low vs high levels of skill. In fact, adult education has grown at a much faster rate among those who are already highly skilled – a trend which may in fact be contributing to increased inequality in access to learning opportunities (Desjardins 2017). However, it is worth mentioning that the IALS results prompted several countries, including Norway, Sweden and the US, to implement enhanced adult literacy programmes, but the proportion of adults scoring at Level 2 or below nevertheless increased in those countries.

Discussion and implications

This article has sought to revisit the determinants of literacy proficiency I elaborate on elsewhere (Desjardins 2003). There are two underlying motivations for doing this. The first is to make use of data made available by IALS and PIAAC and to establish a comparative overview of countries that participated in both studies, and whose survey data were made available. The second is to consider why national literacy profiles have stagnated or failed to improve in a number of countries despite the substantial growth in qualifications and skilled occupations in those same countries. The latter are some of the most significant determinants of literacy proficiency at the micro level. Accordingly, a reasonable expectation from a policy and practice perspective is that investment in education and growth in the economy in favour of occupations requiring higher levels of cognitive skills would improve the overall national profile. However, the findings and analysis presented do not support this expectation, suggesting on the basis of evidence that micro-level relationships and results do

not necessarily aggregate into macro-level relationships and results. This phenomenon is commonly known as the “aggregation problem” in the social sciences and is a reminder of the importance of careful assessment of micro-level statistical results, no matter how rigorous they may be, within a macro-level framework of analysis incorporating logical and structural forms of comparison.

While structural changes to the immigration and language profiles of countries help to account for this contradiction between micro- and macro-level results, the evidence suggests that such changes are not sufficient to explain the stagnation and decline of literacy proficiency at a macro level. This is particularly the case for countries that experienced significantly worse literacy profiles in PIAAC compared to the earlier IALS survey (see Table 5), namely Norway, Sweden and the US.

Norway and Sweden experienced substantial declines in a uniform manner across the distribution. Declines at the *lower* end are consistent with the substantial increase of immigrants in those countries who are typically disadvantaged in terms of literacy proficiency in the local language. But declines in the *middle and upper* end appear to be related to declines in proficiency among advantaged categories such as those with higher levels of education, higher levels of SES, and who are working in skilled occupations.

Patterns for the US are similar, but there is less change to the lower end of the distribution. This is partly because the US had substantially fewer immigrants who scored at lower levels of proficiency than Norway and particularly Sweden (see Table 5). Instead, the sharp drop in the proportion of adults who scored at Level 3 or higher in the US (–9%) appears to be driven – as in Norway and Sweden – by declines in proficiency among *advantaged* categories. In addition, however, the declines are accompanied by a fall in some of the disadvantaged categories, in some cases exacerbating inequalities. While this is apparent for Norway and Sweden in the case of immigrants, in the US, it appears to be concentrated among lower SES categories. Specifically, the decline in average scores of adults neither of whose parents completed upper secondary school – an indicator of lower SES – is sharper than the decline of those with at least one of whose parents had completed post-secondary education – an indicator of higher SES –, leading to a net increase in the impact of SES in the US. A similar pattern can be seen for Sweden and to some extent Norway, but this is more attenuated.

The results of this analysis suggest that educational and occupational quality may be an issue which could partly explain why micro-level results do not necessarily translate into macro-level results. In other words, there is now more variation in proficiency among people in advantaged categories such as having higher-level qualifications and working in skilled occupations, particularly as these become more prevalent or saturated. Moreover, this increased variation may be related to SES, whereby advantaged SES plays an increased role in the positional competition for quality education and quality jobs. For the US, the increase in the predicative capacity of parents’ education, an indicator of SES, combined with the rise in the direct effect of SES from IALS to PIAAC is an indication that as educational systems are expanding access, they are having difficulties redressing socioeconomic inequalities emanating from the home background. In other words, educational systems are becoming *more stratified* according to socioeconomic background. The decline in the relative importance of occupation may suggest a similar phenomenon in relation to skilled occupations.

However, the results of this analysis suggest other possibilities such as changes to the literacy-related practices involved among skilled occupations. This is consistent with the decline in the predicative capacity of occupation in a number of countries as well as the observed decline in levels of literacy practice in many countries. One interpretation is the

possible deskilling of many occupations previously considered to be skilled. This brings into question the rejection of American political economist Harry Braverman's deskilling hypothesis. In a book entitled *Labor and Monopoly Capital: The Degradation of Work in the 20th Century* (Braverman 1974), Braverman questioned the notion that upskilling goes hand in hand with technological progress. Instead, he suggested that it will lead to deskilling. He noted the division of work tasks, stronger control by the employers through scientific management resulting in de-qualification, and the use of computer technologies to routinise and mechanise non-manual work.

Despite intense debates among scholars, evidence regarding tendencies for deskilling or upskilling remains ambiguous. This is partly due to varying understandings of skills and considerable variation in the way the demand for skills has been assessed. While there is little evidence of widespread deskilling as postulated by Braverman, deskilling cannot be ruled out. It is likely that *some* deskilling is occurring as technological change affects production and work processes. It may even be happening just enough to offset otherwise expected improvements over time in literacy skills profiles at the country level.

An alternative interpretation of the results of this analysis is that the measures of literacy-related practices made available in IALS and PIAAC are insufficient for predicting proficiency. For example, the measures of literacy practices in IALS and PIAAC can only detect frequency and variety, but not intensity and criticality. The latter are likely to become more important for interpreting variations in proficiency in the future, particularly as the high-skill sector continues to grow in several advanced industrial countries. One recommendation is therefore to encourage the development of more reliable and complex measures of literacy-related behaviours as part of future rounds of PIAAC. Arguably, the same attention should be given to producing such measures and scales as the measure of literacy proficiency, particularly if there are deskilling processes that are emerging in different economies.

Finally, it should be noted that any analysis is limited by the quality of the data and any trend analysis is limited by the quality of each dataset. While efforts were made to ensure comparability between the IALS and PIAAC literacy scale, whereby approximately 60% of the assessment items in the literacy domain in PIAAC were drawn from these previous surveys (OECD 2013c), it is impossible to ascertain the extent of non-survey-related errors associated with each survey. The next round of results of PIAAC (new data are being collected for PIAAC in 2020–2021) will provide a third set of observations to revisit the micro and macro drivers of literacy proficiency which should help considerably to ascertain trends and impacts of different drivers over time. Separately, as the number of countries with comparable data on literacy proficiency over time grows, it may also become feasible to conduct multilevel modelling.

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