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D2.3 Literature review and report on reading skills and other skills

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Introduction

In this literature review and report, we chose to establish a practical review, rather than an analytical one, as our goal is to focus on the most relevant and appropriate articles the iRead4Skills project. Consequently, our final bibliography comprises a limited yet targeted number of scientific references. We prefer to look at a limited number of articles rather than producing too many references. By concentrating on a smaller number of pertinent articles, we aim to maintain a direct and significant connection to the iRead4Skills project.

This literature review prioritizes a practical approach, intended primarily be used by researchers directly involved on the iRead4Skills project. It aims to provide them with ideas and benchmarks, enabling them to utilize the selected references effectively in their work. The references are presented as invitations to read the full texts, which will illuminate various stages of the project. For each selected reference, we provide an abstract followed by a justification in italics explaining its significance to the iRead4Skills project. To further enhance the practical aspect of the review, we categorize the references into a list of global items, detailed in the table in section six.

Our methodology proceeds as follows: first, we identify two fundamental elements from the iRead4Skills project description on its dedicated website (https://iread4skills.com/): "reading skills" and "skills gaps." In sections one and two, we present our primary investigations and provide justifications for each.

Next, recognizing the iRead4Skills project's connection to two major European projects—PIAAC (*Programme for the International Assessment of Adult Competencies*) and ESJS (*European Skills and Jobs Survey*)—we dedicate sections three and four to relevant literature concerning these projects.

In section five, we include additional scientific references that, from a subjective viewpoint, are deemed important and relevant to the overall content and development of the iRead4Skills project.

Section six presents a summary table of our chosen references. In section seven, we correlate the scientific literature review with the results of the second survey on skills and gaps conducted within the project's framework. The final section concerns the list of bibliographic references used in this report.

Our approach favors a focused selection of essential references from current scientific literature to provide comprehensive insights for the iRead4Skills project. We also hope this targeted review will serve as an invitation for all iRead4Skills project members to delve into the included articles, thereby aiding the project's development through direct access to relevant information.

Section 1: Reading Skills

In the description of the project iRead4Skills on its dedicated website, the following statement is made: "Reading is an essential skill to learn, in training contexts and in working practices, but also to acquire other skills that are needed to stay apace with the current changing job market and to lead meaningful and fulfilling lives"[1]. The words "reading" and "skills" are pivotal in this initial description, prompting our investigation into these two elements in the scientific literature.

1.1. A content analysis on articles related to reading skills

Akaydın, Ş., & Çeçen, M. A. (2015). A content analysis on articles related to reading skills. *Education and Science, 40*(178), 183-198.

This study examined articles related to reading skills published in twenty-nine national educational science journals in Turkey. A total of 232 articles were analyzed using the Reading Skills Papers Classification Form (RSPCF) according to subjects, years, number of authors, universities, number of hypotheses, research methods, data collection tools, samples, and data analysis methods.

The data were coded using SPSS 17.0 and analyzed with content analysis methods. Descriptive statistics, including frequencies and percentages, were used. The findings revealed that most articles (20.6%) focused on reading comprehension; 59.9% were authored by a single author; 39.2% tested a hypothesis; the survey method, a non-experimental quantitative research method, was used most frequently (43.5%); attitude and perception tests were the most common data gathering tools (28.1%); middle-school students were the preferred sample (28%); sample sizes were typically between 101-300 (27.2%); the random sampling method was used (44.4%); and quantitative descriptive analysis was preferred (18.3%).

This study is significant for iRead4Skills, for two reasons. First, it examines past articles related on reading skills from 1990 to 2013, offering a historical perspective. Second, it focuses on Turkey, a country not studied in the iRead4Skills project, thus providing a wider comparative view.

1.2 Beginning to read: Thinking and learning about print.

Adams, M. J. (1990). *Beginning to read: Thinking and learning about print*. MIT Press

Adams' influential work examines the cognitive intricacies involved in the initial stages of reading acquisition. Central to Adams' thesis is the assertion that learning to read necessitates a multifaceted

[1] https://iread4skills.com/

cognitive effort, blending the acquisition of decoding skills with an appreciation for the symbolic nature of written language.

Moreover, Adams emphasizes the influence of environmental print and early literacy exposure on children's emergent reading abilities. She argues persuasively that meaningful interactions with print, whether through books, labels, or everyday signage, provide essential scaffolding for literacy growth. Her synthesis of cognitive psychology and educational theory underscores the importance of aligning instructional strategies with the developmental stages of reading acquisition, thereby empowering educators to foster robust literacy skills in young learners.

In practical terms, Adams' research informs educational methodologies that prioritize active engagement with text and the construction of meaning. She challenges conventional notions of reading as a passive skill acquisition process, advocating instead for constructivist approaches that empower learners to derive meaning from text actively. Adams' work remains instrumental in shaping effective literacy instruction, as it elucidates the cognitive processes underpinning reading acquisition and recommends evidence-based instructional practices. Her insights continue to guide educators and policymakers alike in crafting pedagogical strategies that cater to the diverse needs and abilities of learners striving towards literacy proficiency.

We chose to include this work as it provides foundational insights that are equally applicable to adult learners striving to improve their literacy proficiency. Adams presents a cognitive model of reading that resonates in adult education contexts, where learners often bring varied levels of literacy expertise and benefit from structured approaches that build foundational skills while fostering a deeper engagement with written language. These foundational concepts are useful groundwork and provide common concepts for the iRead4Skills project researchers.

1.3. Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy.

Stanovich, K. E. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly*, 21(4), 360-407

This is a seminal article that delves into the concept that early differences in reading ability have profound and lasting consequences on individuals' overall literacy development. The term "Matthew Effects" originates from the Gospel of Matthew and refers to the idea that initial advantages or disadvantages in reading skill acquisition can lead to cumulative advantages or disadvantages over time. This concept is applied to the domain of literacy, arguing that children who begin with stronger reading skills not only progress faster in reading proficiency but also benefit more broadly across academic and intellectual domains.

Stanovich supports his arguments with extensive empirical evidence demonstrating how early literacy skills predict later academic achievement and cognitive abilities. Reading ability as a pivotal factor influencing educational outcomes and intellectual development.

Furthermore, the article presents the societal implications of these findings, highlighting the potential long-term consequences of literacy disparities on socioeconomic status and opportunities. It

underscores the importance of early literacy interventions that are evidence-based and targeted towards addressing the specific needs of struggling readers. There's a complex interplay between early literacy acquisition, educational outcomes, and broader cognitive development.

This article was chosen due to its foundational insights into the lifelong impacts of early literacy acquisition. Understanding how early literacy skills predict long-term educational and cognitive outcomes enables educators, researchers and policymakers to tailor instructional approaches that address specific reading deficits effectively. Thus, Stanovich's research continues to inform practices also in adult literacy education, supporting measures to mitigate literacy disparities and foster lifelong learning and skill development among adult learners.

1.4. Impact of ICT on writing and reading skills: a systematic review (2010-2020)

Batanero, J. M. F., Rueda, M. M., Cerero, J. F., & Gravan, P. R. (2021). Impact of ICT on writing and reading skills: A systematic review (2010-2020). *Texto Livre Linguagem e Tecnologia*, 14(2), e34055

The potential of Information and Communication Technologies (IC)T to enhance the development of reading and writing skills has emerged as a significant area of scientific inquiry. This systematic review aims to analyze the scientific literature investigating the impact of ICT on writing and reading skills from 2010 to 2020 across five databases. A descriptive and quantitative methodology was employed to present the key characteristics and findings of 16 selected scientific articles included in the review. The results underscore the significant bibliometric data and affirm the efficacy of ICT in bolstering student proficiency in writing and reading. Despite the field's ongoing developmental stage, digital technologies demonstrate promise in educational contexts for enhancing these essential skills. The review highlights the imperative of enhancing teacher training to ensure the effective integration of ICT into reading and writing pedagogies.

This article is selected for two primary reasons within the literature review. Firstly, it provides a retrospective analysis of development in the field over the specified period, offering insights into the evolution of studies relevant to the broader context of the iRead4Skills project Secondly, the article addresses the use of the ITC, a pivotal component of our investigation.

1.5. Developing reading skills

Grellet, F. (1999). *Developing reading skills*. Cambridge University Press

The book provides a classification and description of exercises aimed at developing various reading skills. While it is primarily designed for teachers of English as a second language, the exercises are equally suitable for teaching of other foreign languages first-language reading skills. The question types range from familiar formats, such as multiple-choice and open questions, to innovative exercises requiring the integration of different skills.

There are two primary reasons for including this reference in our review. Firstly, it is a comprehensive practical resource, rather than a single academic article. Secondly, it offers concrete examples of exercises on reading skills which can be instrumental in understanding some stages of the iRead4Skills project.

1.6. Reinterpreting the development of reading skills

Paris, S. G. (2005). Reinterpreting the development of reading skills. *Reading Research Quarterly, 40*(2), 184-202.

Theories about reading have often overlooked the fundamental differences in the developmental trajectories of skills related to reading. This essay proposes that some reading skills, such as learning the letters of the alphabet, are constrained to small sets of knowledge that are mastered relatively quickly. In contrast, other skills, such as vocabulary, are unconstrained by the amount of knowledge to be acquired or the duration of learning. The essay outlines the conceptual, developmental, and methodological constraints on different reading skills and identifies various types of constraints on reading constructs and measures.

Examples of reading research and assessment are discussed to illustrate how these constraints can help explain temporary correlational patterns among reading data, how proxy effects surrounding constrained skills influence interpretations of reading development, how prescriptions to teach constrained skills can be causal misinterpretations of longitudinal correlations, and why interventions on constrained skills usually result in only temporary gains.

This essay describes implications for theories of reading development, research methods, and educational policies; the "extra" commentary linked to the online version of the article expands on this latter theme.

We consider this article valuable for our literature review because it methodologically significant. It highlights research methods that can be useful in the framework of the developing the iRead4Skills project.

1.7. Vision Anomalies and Reading Skill: A Meta-Analysis of the Literature

Simons, H. D., & Gassler, P. A. (1988). Vision anomalies and reading skill: A meta-analysis of the literature. *American Journal of Optometry and Physiological Optics, 65*(11), 893-904.

This article presents a meta-analysis of studies examining the relationship between vision anomalies and reading skills. Meta-analysis is a quantitative technique for combining the results of multiple studies, reducing the subjectivity of associated with literature reviews. The analysis of 34 studies meeting the inclusion criteria revealed that hyperopia, exophoria at near, vertical phoria, anisometropia, and aniseikonia are associated with below-average reading performance. Conversely, myopia and esophoria and esophoria at far are associated with average and above-average reading performance. Reduced visual acuity, astigmatism, esophoria at near, fusional convergence and divergence, strabismus, near-point convergence, and stereopsis were not found to be associated with reading performance.

This article is deemed important because it addresses a specific aspect that the iRead4Skills project may explore in the future: the impact of certain illnesses and disabilities in reading performance. This reference illustrates that unexpected and previously unconsidered factor can emerge during the analyses.

Section 2: Skills Gaps

The iRead4Skills project, as described on its dedicated website, emphasizes its goal: "The iRead4Skills project aims to improve reading skills in the adult population by creating an intelligent system that assesses text complexity and suggests appropriate reading materials, contributing to reducing skills gaps and to provide access to information and culture". The term "skills gaps" warrants attention within the context of existing scientific literature.

2.1. Bridging the skill gap between the acquired university curriculum and the requirements of the job market: A data-driven analysis of scientific literature

Aljohani, N. R., Aslam, A., Khadidos, A. O., & Hassan, S. (2022). Bridging the skill gap between the acquired university curriculum and the requirements of the job market: A data-driven analysis of scientific literature. *Journal of Innovation & Knowledge, 7*(3), Article 100122

This research offers a pioneering, comprehensive data-driven analysis focusing on "curriculum alignment", examining the nexus between "learned skills" and "acquired skills", across disciplines indexed in Scopus, from 2010 to 2021. With a dataset encompassing 10,214 data points, the study provides insights into prominent themes and contributions over the past decade. It underscores the significance of bibliometric analyses in elucidating overlooked or under-researched issues and fostering informed dialogue between academia and policymakers.

This article is pertinent to the iRead4Skills project as it can facilitate post-project dissemination activities, fostering dialogues between universities and policymakers. It serves as a crucial bridge between two often-distant domains: researchers and decision-makers.

2.2. Skills Gaps: A Review of Underlying Concepts and Evidence. CRS Report R47059.

Donovan, S. A., Stoll, A., Bradley, D. H., & Collins, B. (2022). *Skills gaps: A review of underlying concepts and evidence.* CRS Report R47059. Congressional Research Service.

Commissioned to explore workforce skills gap discourse, this report synthesizes diverse perspectives and evidence on skills mismatches. It acknowledges the multifaceted nature of the skills gap concept, highlighting varying interpretations and implications across different contexts. While broad indicators suggest inconclusive evidence of widespread skills misalignments, the report identifies specific sectors experiencing shortages, underscoring challenges in attributing hiring difficulties solely to skills deficiencies amid multifaceted economic dynamics.

With regards to a narrower examination of skill shortages affecting particular occupations or fields in which there is an undersupply of credentialed workers, or in which work demands may be changing rapidly, the report notes there is more agreement about the existence of some misalignments. The report highlights examples of fields in which evidence points to shortages. Also discussed is the complexity associated with isolating the causes when occupations, employers, and regions face difficulty in filling positions. That is, it is difficult to attribute hiring challenges to a skills shortage when there are often many other plausible explanations for hiring challenges.

Throughout the report, persistent challenges complicating policymaking in this field are extensively discussed. One challenge arises from the multifaceted nature of the skills gap concept, which encompasses several distinct yet interconnected issues. It remains unclear whether there exists a unified problem definition or consensus on the specific areas requiring attention. Moreover, establishing agreement on the respective responsibilities of workers, employers, and government in fostering skill acquisition proves to be challenging. Despite significant federal investments aimed at cultivating a skilled workforce, there remains ambiguity regarding whether and to what extent various skills-related challenges addressed by federal policies should be viewed as part of a cohesive continuum and approached in an integrated manner.

This report is valuable for the iRead4Skills project as it addresses policymakers' concerns, offering insights into navigating the nuanced landscape of skills gaps and their implication across sectors. It elucidates the complex interplay between research findings and policy imperatives.

2.3 MOOCs, Graduate Skills Gaps, and Employability: A Qualitative Systematic Review of the Literature

Calonge, D.S. & Shah, M. A. (2016). MOOCs, Graduate Skills Gaps, and Employability: A Qualitative Systematic Review of the Literature. International Review of Research in Open and Distributed Learning 17(5), 68-90.

Amid rising costs of higher education, evolving learner demographics, and the prevalence of technology as a means to up-skill in a competitive job market, this review examines the role of Massive Open Online Courses (MOOCs) in addressing graduate skills mismatches. Specifically, it critiques existing literature on higher education, graduate employability, and the impact of MOOCs on skills development, identifying gaps and underscoring the potential of MOOCs to mitigate skills discrepancies.

Scholarly discussions on Massive Open Online Courses (MOOCs) have predominantly focused on aspects such as their development, retention rates, institutional policies governing their implementation, and related considerations. However, broader examinations exploring their varied applications, advantages, and potential drawbacks remain relatively sparse in current literature. Therefore, the primary objective of this study is to conduct a comprehensive analysis of existing literature pertaining to the use of MOOCs as a strategy to address mismatches in graduate skills. Specifically, this review encompasses critical areas including the higher education landscape, the skills gap among recent graduates and their employability, as well as the role of MOOCs in augmenting graduate skills. By scrutinizing literature across these domains, this paper aims to pinpoint gaps and deficiencies within the existing body of knowledge.

This study is pertinent to the iRead4Skills project for its focus on a specific intervention – MOOCs - that addresses the mismatch between graduate skills and market demands. It provides a framework for assessing alternative approaches to skill enhancement.

2.4. Using the DSRM to Develop a Skills Gaps Analysis Model

McKenney, M. J., & Handley, H. A. (2020). Using the DSRM to develop a skills gaps analysis model. *IEEE Engineering Management Review, 48*(4), 1-13

This article introduces a Design Science Research Method (DSRM)-based model, the Skills Gap Analysis Model (SGAM), aimed at quantifying and comparing required skills with existing worker qualifications. By integrating elements from previous models, SGAM offers a structured approach to identify and address skills gaps across domains, facilitating targeted workforce planning and training initiatives.

A composite skills gap model was developed using the design science research method (DSRM) to integrate components from previous models and ensure that the resulting model adhered to predefined criteria. Known as the skills gap analysis model (SGAM), it underwent evaluation with demonstration data to establish a unified taxonomy encompassing both job position prerequisites and employee qualifications. This evaluation confirmed that the model's resultant descriptions were measurable and comparable, with accurate and actionable data. The SGAM framework is designed to be adaptable across various domains, emphasizing ease of use and efficiency. The theoretical foundation provided by the SGAM facilitates rigorous skills gap analyses, enabling more analytical research in this domain. Employing SGAM to assess job requirements and employee competencies enables organizations to optimize workforce deployment or implement targeted training interventions in identified areas. As technology advances towards increased automation, robotics, and artificial intelligence, such a model plays a crucial role in identifying the requisite skills for workforce adaptation to support these evolving systems.

This reference is selected for its methodological contribution, as it offers the iRead4Skills project a framework to conceptualize and measure "skills gap" systematically. Moreover, it enriches the project's toolkit for analyzing and addressing skills mismatches in diverse contexts.

2.5. Investigating the Data Science Skill Gap: An Empirical Analysis

Mikalef, P., & Krogstie, J. (2019). Investigating the data science skill gap: An empirical analysis. In *Global Engineering Education Conference (EDUCON)*. Dubai.

The significance of big data analytics in contemporary organizations is rapidly increasing, underscoring the growing demand for skilled professionals. A pivotal challenge emerging in this era of data-centricity is the scarcity of individuals equipped with the requisite skills to translate raw data into actionable insights. Addressing this pressing issue, the objective of this paper is to assess the current state of technical and business-related data analytics skills across diverse industries and to forecast the critical skills anticipated in the near future. This study draws upon a survey of 202 responses from key executives in Norwegian firms, analyzing the adequacy of technical and business-oriented skills among employees in pivotal

industries. Additionally, insights are gleaned from survey data obtained from an additional 27 executives, supplemented by interviews with 6 managers, which collectively provide a ranking of the perceived importance of data analytics-related skills across three categories: technical skills, business and project management skills, and soft skills.

The study concludes by highlighting existing skill gaps in the field of data science and offers recommendations to address these gaps, emphasizing specific subject areas that are deemed particularly crucial moving forward. These findings serve to illuminate the ongoing challenges in skill acquisition within the realm of data analytics and provide strategic insights into bolstering capabilities in this rapidly evolving domain.

Chosen for its forward-looking insights, this study informs the iRead4Skills project on emerging skill demands in specific industries, guiding future research and interventions to address skill mismatches effectively.

2.6. A Gap Analysis Approach to Marketing Curriculum Assessment: A Study of Skills and Knowledge

Davis, R., Misra, S., & van Auken, S. (2002). A gap analysis approach to marketing curriculum assessment: A study of skills and knowledge. *Journal of Marketing Education, 24*(3), 218-224.

This study employs a gap analysis framework to assess marketing curriculum outcomes vis-à-vis alumni perceptions of skill and knowledge preparation. Part of the assessment process includes a monitoring of the relevance of a marketing curriculum to a graduate's work environment. This article describes a process for conducting outcomes assessment and the results of an actual alumni assessment encompassing skill and knowledge areas. Specifically, a gap analysis approach was employed in which the importance of key skill and knowledge areas to one's current employment were contrasted with perceptions of their own academic preparation in these areas. The results indicate that marketing alumni perceive that they are underprepared in skills and over-prepared in designated knowledge areas. The implications of the findings are discussed as well as the utility of the gap analysis in outcomes assessment.

Included for its findings on alumni perceptions of skills preparedness, this study offers insights into real-world skill mismatches. Confronting two specific perceptions, this study is relevant for future comparative analyses within the iRead4Skills project.

Section 3: Programme for the International Assessment of Adult Competencies – PIAAC

The Programme for the International Assessment of Adult Competencies (PIAAC), detailed at https://www.oecd.org/skills/piaac/, is a programme of assessment and analysis focused on adult skills. The major survey conducted as part of PIAAC is the Survey of Adult Skills. The Survey measures adults' proficiency in essential information-processing skills, such as literacy, numeracy and problem solving. Moreover, it collects data on how adults utilize these skills in various contexts, including home, work and broader community settings.

This international survey spans over 40 countries/economies and evaluates critical cognitive and workplace skills needed for societal participation and economic prosperity. Findings from PIAAC have provided evidence for countries seeking to enhance their education and training systems to foster these skills.

Conducted every decade, the Survey has completed two cycles thus far. The first cycle involved three rounds of data collection, between 2011-2018. In 2018, the second cycle of the survey has begun, with results anticipated for publication in 2024.

The Survey involves interviewing adults aged 16 to 65 in their homes, with 5,000 individuals per participating country, using computer-assisted methods. Additionally, it can be implemented via traditional pencil-and-paper formats, assessing literacy, numeracy skills and problem-solving skills, including proficiency in technology-rich environments. Beyond skills assessment, the Survey captures extensive data on skills utilization across work, home and community settings.

Designed for cross-cultural and international validity, the Survey allows countries to administer it in their national languages while ensuring comparability of results. It facilitates comparative analysis of skill formation systems and their outcomes, benchmarks international adult skills, and serves as a longitudinal tool for policymakers to monitor human capital development in their countries.

The first cycle of PIAAC comprised three rounds conducted between 2011 and 2017 in various countries.

- Round 1 (2011-2012): Australia, Austria, Belgium (Flanders), Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Italy, Japan, Korea, Netherlands, Norway, Poland, Russian Federation, Slovak Republic, Spain, Sweden, United Kingdom (England and Northern Ireland), United States.

- Round 2 (2014-2015): Chile, Greece, Indonesia, Israel, Lithuania, New Zealand, Singapore, Slovenia, Turkey.

- Round 3 (2017): Ecuador, Hungary, Kazakhstan, Mexico, Peru, United States.

The second PIAAC cycle knew a single round (2022-2023) with the following countries: Austria, Belgium (Flanders), Canada, Chile, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Netherlands, New Zealand, Norway, Poland, Portugal, Singapore, Slovak Republic, Spain, Sweden, Switzerland, United Kingdom (England), United States. A new round of data collection during the Second Cycle is planned to be implemented in 2024-2029.

Data from the Survey of Adult Skills allows investigation of the links between key information-processing skills and a range of variables, constituting a rich evidence base for policy-relevant analysis. In particular, it offers valuable insights into educational and training systems performance, literacy levels, workforce-education mismatches, educational equity levels, intergenerational mobility, and transitions from education to employment. Additionally, it explores at-risk populations and correlations between cognitive skills and demographics, educational background and health.

The PIAAC background questionnaire includes information on the factors influencing skill development and maintenance, including education, social background, literacy, numeracy, ICT engagement, and language proficiency. It also captures outcomes related to respondents' current activities, employment status, income levels, and non-economic indicators, such as health, volunteering, political efficacy and social trust. The Second Cycle introduces two additional components: Socioemotional Skills and Quality of Work Environment, enriching the questionnaire and deepening insights into respondent characteristics.

The Survey of Adult Skills utilizes an innovative "job-requirements approach" to assess adult's use of generic skills in the workplace. The survey asks adults how intensively and how frequently they use these skills at work.

Information is also collected about four broad categories of generic work skills, including cognitive social, physical and learning skills. Along with cognitive skills, social and emotional skills are commonly identified as an element of the set of 'key competencies' required for success in the labor market and in life more generally. This approach underscores the importance of social and emotional competencies alongside cognitive abilities in labor market success and broader life achievement. Since social and emotional skills display elements of continuity and elements of change over time and with age, this module tries to assess the extent to which these types of skills feature in the public and official discourse regarding skills, skills development and the desired learning outcomes of education and training systems.

The Direct-Assessment component of the Survey evaluates adults' proficiency in three foundational domains: literacy, numeracy and digital problem-solving skills. These skills not only underpin higher-order cognitive abilities, but also serve as prerequisites for understanding and accessing specialized knowledge domains across educational, professional and everyday contexts.

Here are the key findings we identified as most significant in the scientific literature concerning PIAAC:

3.1. Skills of U.S. older adults: program for the international assessment of adult competencies (PIAAC)

Soroui, J. (2017). Skills of U.S. older adults: Program for the international assessment of adult competencies (PIAAC). *Innovations in Aging, 1* (Suppl 1), Article 643

This presentation is based on the results of the PIAAC conducted in 2012 and 2014 in the U.S. and 33 other countries. In the U.S., the study was administered to a nationally representative sample of 8,670 adults, aged 16–74. As a large-scale study, PIAAC focuses on measuring adults' key cognitive skills, including literacy, numeracy and digital problem solving, as well as the relationships between these skills and individuals' backgrounds and demographic characteristics. This session provides an overview of the study and compares results in the U.S. with those from other countries by demographic characteristics including age groups, with a focus on skills gaps between younger and older generations both in the U.S. and internationally. The PIAAC results indicate that the skills gap between older and younger generations in the U.S. is smaller than in other countries, which may have significant policy implications.

This article was selected to help researchers involved in the iRead4Skills project better understand international comparisons based on a single characteristic (age group). Moreover, it facilitates international comparisons between European countries (iRead4Skills) and the USA.

3.2. Educational program for older adults: outcome analysis and country comparisons using PIAAC data

Cummins, P., & Kunkel, S. R. (2017). Educational program for older adults: Outcome analysis and country comparisons using PIAAC data. *Innovations in Aging, 1*(Suppl 1), 643-644.

Continuous learning over the life course is essential to effectively compete in a knowledge-based global economy. Shifts in the age structure of the U.S. labour force, combined with increased labour force participation among older adults, underscore the importance of understanding how adult education and training (AET) influences labour market outcomes for middle-aged and older workers. This study used U.S. data from PIAAC to examine the relationship between participation in AET programs and employment, labour force participation, and income for adults aged 45 to 65. Participation in an AET program significantly improved the log odds of both employment and labour force participation, as well as the log odds of moving up one income quintile. The study also compared outcomes of AET participation in the U.S. with those in Germany, Japan, Sweden, and the U.K..

This reference was chosen because it highlights the connections between AET programs and employment, labour force participation, and income. From a methodological point of view, these connections are valuable for the next steps of the iRead4Skills project and can constitute a source of inspiration for future analyses.

3.3. Broadening Our Perspectives on Adult Literacy, Numeracy, and Problem-Solving Skills with PIAAC Data: A Commentary on The Centre for Literacy's 2014 Summer Institute

Tighe, E. L. (2014). Broadening our perspectives on adult literacy, numeracy, and problem-solving skills with PIAAC data: A commentary on The Centre for Literacy's 2014 Summer Institute. *Journal of Research and Practice for Adult Literacy, Secondary, and Basic Education, 3*(3), 63-69.

The author attended the annual Summer Institute sponsored by The Centre for Literacy, which convened in Montreal, Canada, in June 2014. This event provided a unique opportunity to interact with multiple adult education stakeholders and initiate a dialogue to understand and evaluate global trends and issues in adult literacy and numeracy. The event focused on exploring and developing avenues for research, practice, and policy using PIAAC data. To accomplish this, over 85 adult education experts participated in a three-day interactive PIAAC forum featuring panel discussions, quantitative and qualitative-based research presentations, guest speakers, roundtable-guided conversations with colleagues, and a plethora of networking opportunities.

The event broadened the author's perspective in several ways: (a) facilitating the awareness of translating research to align with practitioner and policymaker needs; (b) understanding culturally specific issues and considerations in adult education; and (c) deepening the knowledge of PIAAC data for policy use in the U.S. as well as internationally.

After a brief commentary describing PIAAC, and a summary of how the results from the U.S. factor into a broader international context, the author identifies and provides insight into the three key themes that emerged at the event. Finally, she concludes by discussing her reflections on the value of PIAAC data and considerations for future directions in the field of adult education.

This reference was chosen because it highlights a specific way to develop analyses and scientific reflections within the global framework of PIAAC. It is useful for researchers involved in the iRead4Skills project in preparing future events and developing similar analyses.

3.4. Factors That Promote Innovativeness and Being An Innovative Learner At Work – Results From PIAAC

Støren, L. A. (2016). Factors that promote innovativeness and being an innovative learner at work – Results from PIAAC. *European Journal of Education, 51*(2), 176-192.

This article considers innovative activity in the light of broader conceptualizations of innovativeness and what it means to be innovative. Central to the definition of innovativeness used in the analysis is the active seeking and application of new knowledge for work-related tasks. Based on previous research emphasizing learning-by-doing and learning organizations, innovativeness is analyzed for Denmark, Finland, The Netherlands and Norway. Data from the PIAAC survey of adult skills are examined to identify key factors promoting innovative behaviors at work. Significant country differences are found, suggesting that workers' profiles, the work environments, and the intensity of training and learning are critical for innovative capabilities of the workforce.

The current reference was chosen because it demonstrates the possibility of using PIAAC data to develop analyses focused on one specific concept (innovativeness in this case). It demonstrates how it is possible to use data from PIAAC to develop analyses after having chosen one concept. This article could be a source of inspiration for future works and analyses in the iRead4Skills framework.

3.5 Returns to skills around the world: Evidence from PIAAC

Hanushek, E. A., Schwerdt, G., Wiederhold, S., & Woessmann, L. (2015). Returns to skills around the world: Evidence from PIAAC. *European Economic Review, 73*, 103-130

Existing estimates of the labor-market returns to human capital provide a distorted picture of the role of skills across different economies. International comparisons of earnings analyses primarily rely on school attainment measures of human capital, with evidence incorporating direct measures of cognitive skills mostly restricted to early-career workers in the U. S. Analyzing the PIAAC survey of adult skills across the full lifecycle in 23 countries shows that focusing on early-career earnings underestimates the lifetime returns to skills by about one quarter. On average, a one-standard-deviation increase in numeracy skills is associated with an 18 percent wage increase among prime-age workers. However, this masks considerable heterogeneity across countries, with returns ranging from 12 to 15 percent in Nordic countries to 28 percent in the U.S. Estimates are robust to different earnings and skill measures, additional controls, and various subgroups. Instrumental-variable models that use skill variation from school attainment, parental education, or compulsory schooling laws provide even higher estimates. Returns to skills are systematically lower in countries with higher union density, stricter employment protection, and larger public-sector shares.

This article was selected as it offers potential ideas for future analysis within the context of the iRead4Skills project. It combines concepts of earnings analyses, school attainment measures, human capital and cognitive skills serving as an inspiration for future developments in iRead4Skills.

Section 4: The European skills and jobs survey – ESJS

The European skills and jobs survey – ESJS (https://www.cedefop.europa.eu/en/projects/european-skills-and-jobs-survey-esjs) is a periodic EU-wide survey conducted by Cedefop. It aims to collect comprehensive information on the skill requirements, skill mismatches and initial and continuing education of adult workers in EU labor markets.

Carried out in all EU Member States, the ESJS serves as a valuable resource for informing EU policy development on vocational education and training, particularly in alignment with the European Skills Agenda. The first wave of the ESJS took place in 2014, with the second wave following in 2021. The survey collects data from representative samples of adult workers on a range of core variables, including sociodemographic characteristics, job characteristics, job-skill requirements (literacy, numeracy, digital, analytical, manual, and interpersonal skills), skill mismatches (vertical, horizontal, mismatches in specific skills, skill gaps and deficits, skill mismatch transitions), vocational education and training participation, and labor market outcomes (wages, job insecurity, job satisfaction).

The ESJS provides a flexible instrument for generating timely estimates on issues of significant policy interest, by adding or improving modules in individual survey waves. The first wave of the ESJS, conducted in the context of the 2008 Global Financial Crisis, provided detailed contextual information about the incidence and reasons underlying causes of skill mismatches in EU job markets. The second wave aims to inform policy debates on the impact of new digital technologies and technological change on the future of work and skills, especially in the context of the Covid-19 pandemic. This wave focus on the relationship between technological change, evolving job-skill requirements and skill mismatches among EU adult workers, as well as their adaptability through vocational education and training.

Cedefop develops the ESJS primarily with in-house expertise and resources, in collaboration with technical and policy expert groups, including leading skills experts from EU universities and institutions such as the European Commission (DG EMPL), JRC, Eurofound, OECD and EIB.

Cedefop intends to conduct the ESJS at regular 5-6-year intervals, to capture structural developments at the intersection of work and education. The first wave surveyed about 49,000 adult employees, across all EU27 Member States and the UK, examining drivers of skill development and the dynamic evolution of skill mismatches of adult employees in relation to changing task complexity and skills requirements. The first ESJS collected information on education and skill needs in different occupations and sectors, accessing the value of basic, digital and transversal skills in the job market, and evaluated the capacity of vocational education and training to mitigate skill mismatches.

The first wave of the ESJS was instrumental in informing the development of the European Commission's 2016 'New Skills Agenda for Europe'.

Here are our most important scientific findings in the literature concerning the ESJS project.

4.1. Measuring work activities and skill requirements of occupations: Experiences from a European pilot study with a web-survey

Tijdens, K. G., De Ruijter, J., & De Ruijter, E. (2012). Measuring work activities and skill requirements of occupations: Experiences from a European pilot study with a web-survey. *European Journal of Training and Development, 36*(7), 751-763

This article evaluates a method for measuring work activities and skill requirements of 160 occupations in eight countries, used in EurOccupations[2], an EU-FP6[3] project. It explores how the internet can be utilized for this purpose through a multilingual web-survey involving occupational experts and jobholders.

For the 160 occupations, work activities were described in approximately ten tasks. Occupational experts and jobholders were invited to rate these tasks and to indicate the skill requirements, using a multilingual web-survey. Experts were recruited through networks of project partners and jobholders through frequently visited websites in the eight countries. The effectiveness of the drafting of tasks descriptions, the recruitment of raters, and the measurement of skill requirements is evaluated.

The project showed that tasks descriptions for a wide range of occupations and countries can be drafted relatively easy, using desk research. Conducting a web-survey with a routing for 160 occupations and eight countries is feasible. Recruiting experts used more resources than recruiting jobholders using the internet. Measuring skill requirements necessitated substantial resources due to major variations within and across countries.

The article addresses several areas that are potentially worthy of further empirical investigations for a Europe-wide library of occupational titles, work activities and skill requirements. The paper outlines the potential of a future method for a European library of work activities and skill requirements for occupational titles, thereby facilitating European industrial training efforts. Insight in the work activities and skill requirements of occupations will facilitate labor mobility and related training across EU member states. This paper explores the potential for a Europe-wide empirical underpinning of work activities and skill requirements, using a web-survey and the internet.

This article is valuable for the iRead4Skills project as it provides methodological comparison, highlighting the use of web surveys and the internet for data collection.

[2] The EurOccupations project aimed to build a publicly available database containing the most common occupations for use in multi-country data-collection, through the Internet or otherwise. It covered eight EU countries, notably Belgium, France, Germany, Italy, Netherlands, Poland, Spain, and United Kingdom. The database includes a source list of 1,594 distinct occupational titles within the ISCO-08 classification, country-specific translations and a search tree to navigate through the database.

[3] The FP is the EU's main instrument for research funding in Europe. The FP is proposed by the European Commission and adopted by Council and the European Parliament following co-decision procedure. FPs cover a period of five years with the last year of one FP and the first year of the following FP overlapping. FPs have been implemented since 1984. The 6th FP (FP6) has been fully operational as of January 1, 2003.

4.2. Setting Europe on course for a human digital transition: new evidence from Cedefop's second European skills and jobs survey

Cedefop. (2022). Setting Europe on course for a human digital transition: New evidence from Cedefop's second European skills and jobs survey

About a decade ago, debates on the future of work emphasized the negative consequences of automation by robots and machine algorithms. Initial research indicated that nearly half of all jobs in developed countries could be automatable, which led to bold claims making headlines. However, later analyses revealed that digital technology typically automates parts of job tasks rather than entire jobs or occupations, leading to a more balanced perspective among experts and policymakers. Despite this, many workers remain concerned, with 40% of EU+ (EU-27, Norway, and Iceland) workers, and 46% of those in high digital intensity jobs, fearing job loss within the next 12 months due to digital technology.

Evidence-based[4] insights into digitalization and its impacts on European jobs and workers is essential for policymakers. Understanding how digital technology shapes and reshapes the labor market requires analyses that blend labor demand trends (such as changing digital skill demands) and labor supply aspects (such as digital skills development and use in the workplace). Factors such as job complexity, routinization, job quality, skill mismatches, and workers' and employers' perceptions of digital tools must also be considered.

The second wave of ESJS2 analysis sheds new light on digitalization in the context of the COVID-19 pandemic, changing skills demands, skills mismatches, digital skills and other continuing skills development. These findings reflect the innovative measurement approaches employed, capturing the dynamics of labor markets and workers adaptability to digitalization, while providing better insights into the interlinkages between jobs, tasks, skills and learning.

This article is crucial for the iRead4Skills project as it addresses contemporary issues, such as the negative consequences of automation, machine algorithms and the Covid-19 pandemic. The reference can be a source of inspiration for next developments of the iRead4Skills project due to its capacity to take into consideration some elements of the current period we live in with all its different and unexpected problematics as a pandemic.

4.3. Digital technologies, employment, and skills

Reljic, J., Evangelista, R., & Pianta, M. (2021). Digital technologies, employment, and skills. *Industrial and Corporate Change*. Advance online publication.

This article investigates the relationship between digital technologies, employment, and skills, using industry-level data from six major European economies (Germany, France, Spain, Italy, the Netherlands, and the UK) over the 2009–2014 period. It analyzes two dimensions of digitalization: industries'

[4] Evidence-based practice is the idea that occupational practices ought to be based on scientific evidence. The movement towards evidence-based practices attempts to encourage and, in some instances, require professionals and other decision-makers to pay more attention to evidence to inform their decision-making.

consumption of intermediate inputs from digitally intensive sectors and investment in ICT tangible and intangible assets, considering demand patterns, education, technological change, and offshoring.

The results indicate that job creation is positively associated with an increasing share of digital goods and services in total intermediate inputs, but negatively linked with ICT capital deepening. The authors then explored how these two different patterns of digitalization are related to the evolution of four occupational groups (managers, clerks, craft, and manual workers), based on International Standard Classification of Occupations classes — finding a positive link between ICT consumption and managerial jobs, but negative ones between digital variables and mid-skill occupations.

This article was selected for its focus on ICT and its implications for employment and skills, offering valuable insights for the iRead4Skills project.

Section 5: Additional references

Following a comprehensive review of the scientific literature pertinent to the iRead4Skills project, we have identified several additional key sources that offer valuable insights relevant to our research objectives.

5.1. Developing e-skills for competitiveness, growth and employment in the 21st century: The European perspective

Singh, S. (2012). Developing e-skills for competitiveness, growth and employment in the 21st century: The European perspective. *International Journal of Development Issues, 11*(1), 24-47

The purpose of this paper is to identify e-skills shortages, gaps and mismatches in e-skills across Europe, and the reasons behind these. In this light, the paper explores some key issues/aspects related to development of e-skills, while attempting to provide some benchmarking tools for European countries to assess their current and future challenges regarding e-skills.

The paper begins with an overview of the problem as highlighted in existing literature, followed by an analysis of measures already implemented by European countries. It offers several policy recommendations to address the issue of e-skills shortages, gaps and mismatches.

Significant recent developments in e-skills are discussed, along with the various dimensions and issues of e-skills from a European perspective. The paper provides innovative policy options to mitigate e-skills shortages, gaps, and mismatches in Europe, facilitating policy-related discussions and suitable policy formation.

The paper provides a detailed analysis e-skills' related issues, supported by a comprehensive survey of literature and an existing framework. It also prescribes some alternative ways to mitigate the problems of e-skills shortages, gaps, mismatches in Europe. The methodological aspect makes this reference relevant to our project.

5.2. Digital divide, skills and perceptions on digitalisation in the European Union—Towards a smart labour market

Vasilescu, M. D., Serban, A. C., Dimian, G. C., Aceleanu, M. I., & Picatoste, X. (2020). Digital divide, skills and perceptions on digitalisation in the European Union—Towards a smart labour market. *PLOS ONE, 15*(4), e0232032

This research investigates how new technologies, digitalization and automation are transforming business, work and daily life. It addresses the significant challenges posed by digitalization to the labor market, affecting authorities, companies and individuals.

The objective of this research is to analyze the EU citizens' perceptions of digitalization, and to highlight the differences among various socio-demographic groups. The analysis is grounded on a composite methodology, comprising several statistical and econometric methods, providing scientific support to achieved conclusions: statistical analysis (with the primary goal of understanding EU citizens' perceptions of their digital technology skills), TwoStep Cluster Analysis (TSCA) (with the purpose of identifying digital vulnerable groups and then digital vulnerable countries in terms of the exposure to digital divide) and logistic regression (with the main aim of quantifying the impact of relevant factors on citizens' perceptions of digitalization).

The study reveals a group of respondents evaluating themselves as having low digital skills, with fear of job displacement by robots, and limited internet use. They are elderly, with a low level of education, manual workers or not working, with a relatively low level of income and rare internet use.

The originality of this approach lies in investigating whether the digital divide creates vulnerable groups (citizens and/or countries) and examining patterns in perceptions of digital skills and job displacement by robots. The study aims to identify labor market factors for targeted measures to better match supply and demand, fostering a smart labor market. Increasing confidence in digital skills is essential in maximizing the benefits of digitalization. The latter will have a meaningful impact on the economy and the society in the European Union in the close future.

We selected this article for its innovative approach in exploring the digital divide and its implications for vulnerable groups. This perspective is crucial for the next phases of the iRead4Skills project.

5.3. How computerisation is transforming jobs: Evidence from the Eurofound's European Working Conditions Survey

Bisello, M., Peruffo, E., Fernández-Macías, E., & Rinaldi, R. (2019). How computerisation is transforming jobs: Evidence from the Eurofound's European Working Conditions Survey. Joint Research Centre, *Working Papers Series on Labour, Education and Technology No. 2019/02*

This paper investigates changes in the task content, methods and tools of European jobs from 1995 to 2015. Drawing on the taxonomy of tasks proposed by Bisello and Fernández-Macías (2016), it seeks to understand whether changes in average task performance intensity result from employment share changes shares of employment across jobs are, or changes in the task content within-jobs, or both.

The main findings from a combined analysis of the European Working Conditions Survey (EWCS) and European Jobs monitor data (EJM) suggest that jobs with more social task content have grown relative to others, despite a decline in the actual number of social tasks performed. Similarly, routine tasks show an increase in total levels, despite marginal compositional declines. The implications of these findings in the context of the current debate on the impact of technological change on employment are discussed.

We chose this article due to its focus on the implications of technological changes on skills, providing a valuable perspective for general debates around the iRead4Skills project. It serves as an excellent resource for researchers within the iRead4Skills framework, offering insights into a substantial period from 1995 to 2015.

Section 6: Summary of the justification for the selection of literature references

The literary references cited in the preceding sections can be categorized into 11 distinct thematic groups. It is important to note that some references may be applicable to multiple categories.

Content and grouping of the references	**References**
International comparisons	1.1 3.1 3.2 3.3 3.4 3.5 4.1 4.3
View on the past (past data, past surveys and past analyses)	1.1 1.4 2.1 3.1 5.3
Use of the ICT	1.4 4.2 4.3 5.2 5.3
Practical and concrete exercises	1.3
Research methods/ methodology	1.6 2.4 2.5 3.2 4.1 5.1 5.3
Unexpected and unsuspected elements and considerations	1.7 4.2
Confrontation between research and policies	2.1 2.2
Definition of some words and of some concepts	1.2. 1.3. 2.4 3.4
Prospective aspects	2.5
Specifications and perceptions of definitions	2.6

Source of inspiration for future developments on iRead4Skills	3.2 3.3 3.4 3.5 5.2 5.3

As stated in the introduction, we opted for a practical approach to the literature review rather than an analytical one. This decision allows researchers involved in the iRead4Skills project, as well as other interested individuals, to access the articles in two distinct ways.

First, brief italicized summaries following each reference can be read, to identify the keywords that highlight the reasons for selecting each reference. Second, the table above can be referred to, which categorizes the references according to their thematic focus, providing a broader overview of the themes covered in the literature review.

Section 7: Connection between literature references and analyses of iRead4Skills survey 2

The analysis of the *iRead4Skills D2.2 Overall skills and gaps* survey, an ad-hoc quantitative survey of individuals who have undergone reading training in four countries, Belgium, France, Portugal and Spain, in which a total of 455 individuals participated between October and November 2023, aims to explore the relationship between reading skills and the broader skill sets of former learners of reading, yielding several key findings.

Firstly, respondents demonstrate an adaptative approach to their reading levels, with a minority perceiving their reading skills as inadequate compared to their requirements.

Secondly, among respondents who discussed the interplay between their reading skills and other domains, two out of five indicated that difficulties in reading hindered their acquisition of skills in mathematics or in information technology, and one out of three reported challenges in building self-confidence.

Thirdly, while 40% of learners perceived that their training had improved their reading abilities, the majority noted persistent difficulty in reading the types of documents assessed in the survey. This finding, in line with other studies (e.g., Vorhaus et al., 2009[5]; Wolf and Jenkins, 2014[6]), suggests a moderate impact of reading interventions on adult literacy.

Lastly, the majority of respondents indicated that the enhancement of their reading abilities had improved their proficiency in certain professional skills.

These four elements highlight areas that are currently underrepresented in the existing scientific literature. This underscores two significant implications. Firstly, initial analyses from the iRead4Skills project reveal emerging developments in addressing these issues. Secondly, these emerging insights warrant further exploration within the framework of scientific literature in the future.

It is important to acknowledge that our literature review serves as a foundation for inspiration, particularly in methodological insights and conceptual frameworks that these publications offer to researchers engaged in iRead4Skills.

It is pertinent to note that our review of practical literature directly correlates with the fundamental components of iRead4Skills and the underlying frameworks of two European programs informing survey 2. Despite the limited response rate to survey 2, it is crucial to contextualize our findings accordingly.

[5] Vorhaus, J., Howard, U., Brooks, G., Bathmaker, A-M. & Appleby, Y. (2009) The impact of the 'Skills for Life' infrastructure on learners: A summary of methods and findings, in: S. Reder, J. Bynner (Eds) Tracking adult literacy and numeracy.

[6] Wolf, A., and Jenkins, A. (2014). Do 'learners' always learn? The impact of workplace adult literacy courses on participants' literacy skills. British educational research journal, 40(4), pp.585-609.

To date, comprehensive studies examining the spill-over effects of enhanced reading skills on both hard and soft skills among adults remain scarce. Existing research predominantly focuses on effective reading instruction methodologies, the efficacy of ICT tools, and training outcomes.

These observations underscore the necessity for continued investigation and scholarly publications on these findings in the future development of the iRead4Skills project, particularly in relation to WP7 dedicated to disseminating results.

At this stage, the iRead4Skills project has illuminated deficiencies in current scientific endeavors addressing its thematic focus, thereby underscoring opportunities for future research advancements. Anchored in European initiatives such as PIAAC and ESJS, iRead4Skills underscores the imperative for further scholarly inquiry in this domain.

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