

PIAAC: A NEW STRATEGY FOR ASSESSING ADULT COMPETENCIES

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Abstract – At a time when governments face the challenges of maintaining competitiveness in a global economy, it is necessary to have high-quality comparative information regarding the fundamental skills of the adult population. Such information can help governments to evaluate policies and design more effective interventions. This article describes a strategy currently being developed by the OECD for assessing the literacy skills of adults, including familiarity with information and communication technologies and the ability to manage information, construct new knowledge and communicate with others. The work will enhance understanding of the effectiveness of education and training systems in developing basic cognitive skills and key generic work skills.

Résumé – PIAAC: UNE NOUVELLE STRATÉGIE POUR L'ÉVALUATION DES COMPÉTENCES DES ADULTES – À une époque où les gouvernements relèvent les défis du maintien de la compétitivité dans une économie mondiale, il est nécessaire d'avoir une information comparative de haute qualité concernant les qualifications fondamentales de la population adulte. Une telle information peut aider les gouvernements à évaluer les politiques et à concevoir des interventions plus efficaces. Cet article décrit une stratégie actuellement développée par l'OCDE pour évaluer les qualifications en alphabétisation des adultes, y compris la connaissance des technologies d'information et de communication et la capacité de gérer l'information, de construire un savoir nouveau et de communiquer avec les autres. Ce travail accroîtra la compréhension de l'efficacité des systèmes d'éducation et de formation en développant des qualifications cognitives de base et des qualifications génériques professionnelles capitales.

Zusammenfassung – PIAAC: EINE NEUE STRATEGIE ZU BEURTEILUNG DER KOMPETENZEN ERWACHSENER – In einer Zeit, in der sich Regierungen den Herausforderungen ständigen Wettbewerbs in der globalen Ökonomie ausgesetzt sehen, ist es notwendig, über hochqualifizierte Vergleichsdaten über die Grundfertigkeiten der erwachsenen Bevölkerung zu verfügen. Informationen dieser Art können die Regierungen bei der Entwicklung neuer Programme und effektiverer Interventionen unterstützen. Dieser Artikel beschreibt eine derzeit von der OECD entwickelte Strategie zur Einschätzung der alphabetischen Fähigkeiten von Erwachsenen, einschließlich ihrer Vertrautheit mit Informations- und Kommunikationstechnologien und der Fähigkeit, mit Informationen angemessen umzugehen, neues Wissen zu konstruieren und mit anderen zu kommunizieren. Diese Arbeit trägt dazu bei, das Verständnis für die Effektivität von Bildungs- und Ausbildungssystemen zur Entwicklung kognitiver Grundfertigkeiten und Schlüsselqualifikationen für das Arbeitsleben zu vertiefen.

Resumen – PIAAC: UNA NUEVA ESTRATEGIA PARA EVALUAR LAS COMPETENCIAS DE PERSONAS ADULTAS – En estos tiempos, donde los gobiernos deben encarar el reto de mantener la competitividad en una economía globalizada, es

necesario contar con una información comparativa de alta calidad en cuanto a las competencias fundamentales de la población adulta. Esta información puede ayudar a los gobiernos a evaluar políticas y diseñar intervenciones más eficaces. El presente artículo describe una estrategia que está siendo desarrollada por la OCDE para evaluar los conocimientos de lectoescritura de personas adultas, incluyendo la familiaridad con tecnologías de información y la capacidad de manejar la información, elaborar nuevos conocimientos y comunicarse con otras personas. Este programa mejorará la comprensión de la eficacia de la educación y los sistemas de entrenamiento destinados a desarrollar competencias cognitivas básicas y competencias laborales genéricas de importancia esencial.

Резюме – «PIAAC» - НОВАЯ СТРАТЕГИЯ ОЦЕНКИ КОМПЕТЕНЦИЙ ВЗРОСЛЫХ - Когда перед правительством встает проблема сохранения конкурентоспособности в глобальной экономике, возникает необходимость в качественной сравнительной информации относительно базовых умений и навыков взрослого населения. Такая информация позволит правительству лучше оценить политику и предпринять наиболее эффективные меры. В данной статье дается описание стратегии, которая в настоящее время разрабатывается в ОЭСР для того, чтобы оценить уровень грамотности среди взрослых, что включает в себя знакомство с информационными и коммуникационными технологиями, умение пользоваться информацией, получать новые знания и навыки общения. Это должно способствовать повышению эффективности систем образования и подготовки, направленных на развитие базовых когнитивных умений и общих ключевых рабочих навыков.

Background to the strategy

Governments today are facing the challenges of maintaining competitiveness in a global knowledge economy, increasing the flexibility and responsiveness of labour markets, stimulating workforce participation and dealing with issues of population ageing. High-quality comparative information regarding the fundamental skills of the adult population, their distribution in the population and their rate of depreciation as well as the returns to skills and individuals' dispositions concerning skill formation can provide evidence that will assist governments in evaluating policies and designing more effective interventions.

Member countries have asked the Organisation for Economic Co-operation and Development (OECD) to establish a strategy for assessing adult competencies – referred to as the OECD Programme for the International Assessment of Adult Competencies (PIAAC) – that would help them to:

- Identify and measure differences between individuals and across countries in key competencies and other economic and social outcomes believed to underlie both personal and societal success.

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- Assess the impact of competencies on economic and social outcomes, including individual outcomes such as integration into the labour market, employment status and earnings, participation in further learning and education throughout the life cycle as well as aggregate outcomes such as fostering economic growth or creating social equity in labour market outcomes and social participation.
- Assess the performance of education and training systems in generating the required competencies at the levels required by social and economic demands.
- Clarify the policy levers that, once “deficiencies” in key competencies have been identified, lead to enhancing competencies through the formal educational system, in the work-place, through incentives addressed at the general population, etc.

The relevance of adult competencies and their assessment does not, of course, automatically suggest that such an assessment should be undertaken in an internationally comparative context. However, countries identified a number of advantages of undertaking such an assessment internationally:

- Assessing cross-country differences in the level and distribution of competencies – and relating these to economic, social, policy, and contextual conditions – will permit policy-makers to assess the comparative strengths and weaknesses of their skill development policies. Such data can facilitate the work of decision-makers in pushing forward necessary policy reforms aimed, for instance, at improving the level and distribution of competencies.
- Because cross-country variation in policies and institutional settings is greater than intra-country variation, an international assessment can in principle provide more policy-relevant data and analysis than a compilation of national assessments (if the latter were not strictly comparable).
- Synergies and economies of scale can be generated by international collaboration in the development and use of new assessment instruments. For instance, all countries can draw on institutional capacities and expertise in other participating countries. Thus, PIAAC is a cost-effective and viable option for assessing competencies, especially for countries that do not have sufficient institutional capacity to conduct such a survey alone.
- Many countries adhere to national and multi-national statements of intent regarding the achievement of economic performance targets relative to international norms. An example is the declaration from the March 2000 meeting of the European Council in Lisbon. This established strategic goals for the European Union, in a global context, in order to strengthen employment, economic reform and social cohesion as part of a knowledge-based economy. Monitoring of progress in meeting such international targets necessarily requires international comparisons.

This article sets out the PIAAC strategy which the OECD developed in response to the request from its members. PIAAC is currently being

implemented with a view to undertaking a first PIAAC assessment in 2011. The paper is based on material developed by the OECD for an international expert group that designed the PIAAC strategy.

What the PIAAC strategy offers

At the core of PIAAC is an assessment of adult populations for their literacy skills, understood as the interest, attitude and ability of individuals to appropriately use socio-cultural tools, including digital technology and communication tools, to access, manage, integrate and evaluate information, construct new knowledge, and communicate with others. In addition, PIAAC collects information from respondents concerning their use of key work skills in their jobs – a first for an international study.

Data from PIAAC will allow an investigation of the links between key cognitive skills and a range of demographic variables, economic and other outcomes as well as the use of skills in the workplace and other settings. This will constitute a rich evidence base for policy-relevant analysis.

By providing a direct measure of key cognitive skills in addition to measures of formal educational attainment, PIAAC will offer a far more complete and nuanced picture of the stock of human capital than has yet been available to policy-makers in most countries. In particular, PIAAC will give a picture of the distribution of the proficiency of the population according to the types and level of cognitive tasks they can perform together with the levels of formal education and training achieved. PIAAC will also have links to previous international adult skills assessments. Some analysis of change over time will be possible for countries which participated in either the International Adult Literacy Survey and/or the Adult Literacy and Life skills Survey.

PIAAC will enhance the understanding of the effectiveness of education and training systems in developing basic cognitive skills and key generic work skills. For older cohorts, PIAAC will allow examination and analysis of the processes of skills loss and maintenance and the effectiveness of education and skill formation systems in supporting skills development over the lifecycle.

Last but not least, as an international cooperative venture, PIAAC provides participating countries with access to high-quality expertise in the measurement of adult skills. By sharing the costs of development and pooling resources participating countries will have access to a greater level of expertise than will otherwise be the case.

Design of the PIAAC strategy

PIAAC surveys representative samples of the adult populations, including the non-employed, in a household context. PIAAC also provides an international

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option for over-sampling a cohort of young adults, and of following this over-sampled cohort in subsequent cycles. Doing so will permit greater analytical insight on issues relevant to school-to-work transitions and the acquisition and loss of competencies into early mid-life, even if a direct longitudinal survey following up cohorts over time is not foreseen. PIAAC also provides an international option for oversampling older adults, to examine in more detail the acquisition and loss of competencies or the extent to which the skills of older workers are up to date.

Direct assessment of adult competencies

Limitations in the response time that adults are willing to devote to a low-stakes assessment such as PIAAC require a choice between: (a) the breadth and (b) the depth with which the competencies to be measured are covered. Previous international assessments, such as the International Adult Literacy Survey (IALS) have sought to maximize the coverage of cognitive competency areas, at the price of assessing each competency area with limited resolution, particularly at the low and high end of the performance distributions. This has been done by restricting the complexity with which each competency area is defined and assessed, and by limiting the extent of contextual data collected to explain observed differences in the competencies and their impact at individual and aggregate levels. Furthermore, empirical results from these assessments suggest that the competency areas that were measured were generally so highly interrelated that taken separately they offered limited additional value for policy analysis (for example, when used to assess the impact of the competencies measured on economic and social outcomes).

Considering the emphasis countries had placed on policy analysis, PIAAC takes a different route, and shifts the balance from the assessment of competencies towards the collection of information on other social and economic outcomes as well as contextual data that can be used to examine the development, functioning and impact of competencies.

Furthermore, PIAAC limits the competencies to be surveyed using cross-nationally and cross-culturally comparable reporting scales to an assessment of “literacy in the information age”, where an assessment is methodologically feasible and cost-effective and can be covered with sufficient depth. PIAAC likewise provides for the indirect assessment of the utilisation of a broader range of competencies that may not initially provide results in metrically comparable scales, but that could still provide useful information for policy purposes and provide the basis for the longer-term development of direct assessments of competencies in subsequent PIAAC cycles. The following describes the approach to the direct assessment of competencies. The indirect measurement of the use of competencies is described later in this chapter.

PIAAC seeks to focus the component for the direct of assessment competencies on reading literacy, which previous national and international

assessments have shown to be an essential foundation for individual success and the development of other competencies, and which can be considered a sufficiently stable trait to remain policy relevant over time as PIAAC progresses and monitors change in the development, use and impact of competencies.

However, PIAAC takes the traditional concept of literacy forward to adapt it to skill requirements in the information age. It defines reading literacy broadly as the *interest, attitude and ability of individuals to appropriately use socio-cultural tools, including digital technology and communication tools, to access, manage, integrate and evaluate information, construct new knowledge, and communicate with others in order to participate effectively in society.* The key concepts underlying this definition are defined as follows:

...socio-cultural tools, including digital technology and communication tools...

Literacy, once seen from the perspective of minimum competence, is defined here as a continuum of knowledge, skills and strategies that individuals acquire over the course of their lives. It includes the requisite set of skills and knowledge across a variety of domains including reading literacy and numeracy.

Literacy is also considered as an evolving concept that recognises that the literacy skills needed for individual growth, economic participation and citizenship a generation ago were different from what is expected today. Then, individuals with basic skills in reading, writing and math could be expected to function well in society. Now, increased demands resulting from technological growth and change and the growing acceptance of lifelong learning within that context have changed views of literacy. For this reason, PIAAC expands the notion of literacy to include the skillsets and knowledge that will enable individuals to function in an increasingly technological world. This integrates the management of information technology with communication technologies (ICT). ICT is associated with unprecedented global flows of information, products, people, capital and ideas. These flows are enabled by ICT. Their sheer scale and rapidity will not be possible without the ability to connect vast networks of individuals across geographic boundaries at negligible marginal cost. ICT competencies are highly relevant to key items on the policy agendas of many countries, from e-learning to the impact of new technologies on competitiveness and growth, to the social inequities associated with the digital divide, to the role of ICT in the delivery of healthcare services. The economic and social importance of ICT competencies is likely to increase over time. ICT competencies are also feasible to assess with technology that is currently in development, and their assessment is likely to have high and swift policy yields.

With regard to the ICT component, the emphasis of PIAAC is on the cognitive processes underlying literacy, such as dealing with dynamic and interactive problems as well as non-linear information structures, rather than

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on aspects of the use of specific information technologies. Indeed, an in-depth assessment of technology aspects would be difficult to undertake given the high context specificity in which technologies are utilised. Moreover, considering the rapid changes in technology, an assessment of technology would have made PIAAC highly time-bound and thus made it difficult to monitor changes over successive assessment cycles, which is one of the main objectives of PIAAC.

While PIAAC underlines the relevance of the ICT dimension in an assessment of literacy, it is equally concerned with measuring basic reading competencies that serve as the essential foundation for the development of literacy in the wider sense outlined above. It therefore provides for a focussed assessment of literacy component skills – such as vocabulary and word recognition. In doing so, it provides policy-makers with a sense of the extent to which key literacy components skills are being provided by their respective education systems. Policy-makers will also gain insight on how they might adjust their adult literacy instruction to better address the needs of struggling adult readers. Furthermore, the possibility exists that different population subgroups exhibit different component profiles, knowledge of which could facilitate the targeting of programmes of remediation. Assessment of component skills could also facilitate policy-relevant estimations of the resources required to effect a fundamental improvement in individuals' literacy performance. Indeed, as noted earlier in this paper, just creating well-normed vocabulary and word recognition tests will represent a pedagogical advance in a number of countries.

...is the interest, attitude and ability of individuals...

In this phrase, the PIAAC definition emphasises that ability alone is not sufficient for developing literacy proficiencies. To develop literacy and to continue to improve and update that knowledge as lifelong learners, individuals also need motivation, interest and a belief that literacy makes a difference in their lives. In particular, interest and attitude will most likely be reflected in the time students spend engaged in literacy activities and the range of those activities.

...to appropriately use...

The term 'use' includes the idea of fluency. That is, as an individual progresses beyond basic and routine reading skills, the goal is to be able to use literacy with some level of automaticity and fluency. 'Appropriate use' encompasses using, understanding and reflecting on literary material. In particular, with a view to the ICT dimension, individuals must understand the potential of technology and then make strategic choices about whether or not to use it, and how best to use it.

...to access, manage, integrate and evaluate information, construct new knowledge and communicate with others...

PIAAC identifies six processes that it considered as critical components of literacy. These processes reflect the wide range of uses for which information and communication technologies apply today. This list reflects that literacy as defined here is *not* about specific technical skills, but rather it is about information gathering, knowledge construction and communication. As such, these processes reflect the integration of technical knowledge and skills with more traditional cognitive skills such as literacy and numeracy. Each of the processes is defined below:

- *Accessing*: Knowing about and knowing how to collect and/or retrieve information.
- *Managing*: Organising information into existing classification schemes.
- *Integrating*: Interpreting, summarising, comparing and contrasting information using similar or different forms of representation.
- *Evaluating*: Reflecting to make judgments about the quality, relevance, usefulness, or efficiency of information.
- *Constructing*: Generating new information and knowledge by adapting, applying, designing, inventing, representing or authoring information.
- *Communicating*: Conveying information and knowledge to various individuals and/or groups.

...in order to participate effectively in society.

This statement of the PIAAC definition reflects the idea that literacy allows people to engage in the social, economic and cultural aspects of society. “Participate” is used because it implies that literacy allows people to contribute to society as well as to meet their own needs. The idea of effective participation includes the notion of people regulating their own learning and goals using literacy skills as defined here. The term “society” includes economic, political, social and cultural life.

Instruments for the direct assessment

PIAAC directly assesses literacy through the following instruments (all of which will position individuals on a single scale, to the extent such a scale can be psychometrically validated):

A locator test establishes the familiarity of individuals with ICT and whether they possess the minimum technical reading skills to effectively participate in an assessment of reading literacy in the broad sense defined above.

Individuals whom the locator identifies as not possessing minimum technical reading competencies are administered an assessment of basic reading components that positions them on the lower end of the literacy scale. As mentioned before, this assessment of the fundamental building blocks of reading fluency aims at providing in-depth information on individuals who

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are unable to use literacy to fully participate in today's information-intensive economies or to take full advantage of the labour market, cultural and educational opportunities that might be available to them. This assessment thus directly informs analyses relevant to the situation of the most vulnerable groups in society who were identified as a target group of special importance in the national ratings of policy relevance of many countries.

All individuals whom the locator identifies as possessing minimum technical reading skills are administered a brief paper-and-pencil assessment of literacy. Individuals whom the locator identifies as also familiar with ICT are afterwards administered a tailored computer-based assessment of literacy. Individuals who are technically literate but whom the locator identifies as not familiar with ICT are administered an extended paper-and-pencil assessment of literacy instead. The latter will, however, not cover the literacy concept described above comprehensively, since a paper-and-pencil assessment does not allow problems to be posed to respondents in a dynamic way and thus not allow for dynamic problem-solving tasks.

An indirect assessment of other individual outcomes

Another component of PIAAC provides an assessment of outcomes in multiple life domains, including labour market status, earnings, health status, and behaviours related to citizenship and the broader area of "social capital", based on individuals' self-reports. This component is presented to respondents as part of a background questionnaire, but it is conceptually and methodologically specific in that it seeks cross-nationally comparable and scaled measures of outcome variables, rather than contextual information that will help to explain outcomes.

A background questionnaire to contextualise and analyse determinates of competencies and their use

PIAAC also collects basic data on the demographic and educational background of individuals, as well as retrospective information on employment, career interruptions, job changes, status vis-à-vis welfare programmes, and participation in both formal and informal training – which allow an assessment of the mechanisms through which skills are acquired and lost.

Another value added of PIAAC is to systematically assess policy and institutional information of participating countries. This will help to establish how the level and distribution of competencies, as well as school-to-work transitions, the situation of at-risk adults vis-à-vis welfare benefits and patterns of adult learning relate to differences in policy and institutional settings across countries.

In order to facilitate international comparisons, a common policy typology is used for all country assessments – though of course the specific nature of the questions will vary across countries to reflect the specific context and

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institutional settings. It is indeed planned that, through a well-designed background questionnaire, PIAAC will strengthen considerably the policy relevance of the data vis-à-vis existing international surveys.

An indirect assessment of the utilisation of competencies at the workplace

PIAAC also seeks to capture how skills are used in the workplace, through a job-requirement survey. Such information, when compared with that obtained through the direct test, will help analyse the extent of skill mismatch, and how this varies across groups and across countries. More generally, the job-requirement survey will help understand developments in skill requirements, which is so important for the design of education and training policies. Subsequent PIAAC cycles could also examine the possibility of an employers' survey in the second cycle. Although some experience with job-requirement approaches exists, further research is currently undertaken to assess to what extent such methods yield reliable and cross-nationally valid data.

A survey of employers

In the longer term, it may be possible to integrate a survey of employers into the PIAAC design. Such a survey could throw new light on linkages between competencies, productivity and technological change, as well as on policy settings that affect enterprise-level investment in human capital. Inclusion in PIAAC of an employers' survey could significantly enrich analyses of policy issues relevant to skills shortages and mismatches. Such a survey could also be used to obtain additional indicators of skills demand.

Information and communication technology in the PIAAC strategy

This section provides the rationale for the expansion of a literacy assessment to incorporate ICT aspects. Policy-makers need reliable information on the true distribution and application of a comprehensive set of literacy skills by industry and occupation in order to inform a broad array of education, labour market, human resources development, tax and other policies. Such an assessment will yield information on issues that are of an urgent nature for many countries. The competencies of individuals and populations in accessing, managing, integrating, evaluating and constructing information, using the technologies of the information age, will have far-reaching micro- and macro-level economic and social impacts. Such impacts will range from the individual's ability to fully exploit the learning and employment opportunities that modern economies offer, to the ability of these economies to maintain and increase levels of productivity and growth.

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An assessment of literacy in the information age should not be confused with an assessment of computer use or the use of any particular digital technology. As noted earlier, such technologies are highly context-specific. In contrast, the comprehensive set of literacy competencies assessed by PIAAC shape patterns of ICT use across individuals and populations. Indeed, as discussed below, recent empirical evidence demonstrates a positive association between cognitive competencies and greater use of ICT. Therefore, it is relevant to outline a number of stylised facts about how ICT use is related to macro-economic performance, labour market outcomes, enterprise performance and the use and delivery of critical public services.

ICT and the macro-economy

The use of ICT is tightly tied to product, process and organizational changes that underpin productivity growth. Countries that manage to achieve high rates of adoption of these technologies will gain competitive advantage in global markets. Research shows positive linkages between the use of ICT and macro-economic performance. For instance, ICT usage was found to account for as much as 0.4% points difference in GDP per capita growth rates between the US, Germany, France, and Italy for the period 1995–2002 (EIU 2004). From a growth accounting perspective, for the OECD countries for which data are available, it is estimated that investment in ICT accounted for between 0.3 and 0.8 percentage points of growth in GDP per capita over the period 1995–2001 (OECD 2004b, c).

Labour-market returns, social inequality and ICT

The diffusion of ICT throughout the production process will have a marked impact on inequality in economic outcomes, most particularly as regards wages and employability. Empirical analysis of the ALL ICT familiarity assessment indicates that heavy use of ICT depends on high levels of cognitive skills and greatly increases the probability of an individual holding a high-wage job (Statistics Canada/OECD 2005). Wage disparity will grow rapidly as skilled workers reap some of the productivity gains associated with these technologies. Policy-makers worried about social inequality and exclusion have a need to know the size of these effects and which population sub-groups are most at risk.

Knowledge workers comprised the fastest-growing occupational category in the United States and the European Union between 1992 and 1999 (OECD 2001, 2002a). There is evidence of high labour market returns to ICT competencies (Dolton and Makepeace 2004). And ICT is increasingly considered a generic competence that all adults and workers need to possess. Rather than being confined to a relatively small sector of highly-skilled information technology experts, the direct impact of computers has now spread across a diverse range of jobs. For instance, about 70% of employees

in the United Kingdom use some type of automated or computerised equipment, and around 40% of employees judge computerised equipment as essential to their work (Felstead et al. 2002).

New ICT uses can also permit certain forms of employment to develop more easily in locations distant from customers. For instance, many forms of advisory services in which the self-employed are prevalent lend themselves to provision through new telecommunications technologies. Indeed, in the United States, over half of all business tax returns filed in 1999 were from home-based enterprises (Phillips 2002), many of which rely on electronic media.

ICT and enterprise performance

Using some of the earliest plant-level data to become available, Atrostic and Nguyen (2001) found strong positive links between labour productivity and the presence of computer networks. OECD (2000a) cites research by France's National Institute for Statistics and Economic Studies (INSEE) showing that Internet usage is associated with superior performance in small firms. Small industrial firms using the Internet grew twice as fast and exported twice as much of their output as non-users. Internet-using firms also reported higher revenue per salaried person, higher added value, superior job creation, and a proportionately greater number of registered patents (however, it is unclear whether Internet adoption caused superior performance or vice-versa). Anecdotal evidence from the United States suggests that small firms that use the Internet have higher revenues than non-users (Phillips 2002). And robust evidence exists for positive enterprise-level productivity effects in the Netherlands and Germany, although some of these effects are sector-specific (OECD 2004b, c).

Many studies reveal strong complementarities between enterprise-level adoption of ICT and expenditure on skills development and organisational change. Studies also show that computers raise demand for skilled workers and lower demand for unskilled workers. In turn, shortages of skilled workers may hinder the implementation of the organisational changes that facilitate ICT adoption (OECD 2004b, c). Using wage levels as a proxy for skills, Krueger (1993) showed that in the United States workers who use computers were better paid than those who do not (indeed, a number of studies have found that firms that use ICT tend to pay higher wages). In France, Entorf and Kramarz (1998) found that ICT-related technologies are generally used by workers with higher levels of skills, with the introduction of new technologies leading to a small rise in wage differentials within firms. And in Canada, Baldwin et al. (1995) found that the use of advanced technology was positively correlated with an increased demand for higher levels of skill, and was often associated with increased spending on education and training.¹ In Germany, the use of electronic commerce has been shown to be a positive function of both skills and firm size (OECD 2004b, c).

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ICT and critical public services

Many public services could be more efficiently provided using electronic media, from the provision of administrative information to the collection of tax returns.

ICT and healthcare

On average, across OECD economies, spending on healthcare amounts to close to 10% of GDP, a figure that is forecast to increase. As yet, and relative to its potential, ICT has had only a small impact on healthcare delivery, research, teaching and evaluation. For instance, in the United States, in 2003, an estimated \$380 million were devoted to telehealth technologies. This compares with \$71 billion spent on healthcare technologies overall. Nevertheless, OECD (2005d) cites a study from the United States conducted by Medmarket Diligence (2003) which observes that: “Healthcare providers – at all sites of service, including hospitals, health networks, physicians offices, clinics, homecare providers and others – are steadily adopting telemedicine applications as routine parts of healthcare delivery.” The same study argues that telemedicine is “soon to be a routine part of cardiology, dermatology, teleradiology, ENT, emergency medicine, gastroenterology, home care, neurology, oncology, ophthalmology, mental health, telerehabilitation, telepathology and eventually even telesurgery.

The digitization of health-related services and knowledge offers many potential economic and social benefits.² These benefits include:

Improving efficiency: For instance, ICT holds the prospect of being able to: more easily deploy health resources to where they are most needed; reduce the need for transportation for patients and health professionals; augment administrative efficiencies, for instance by creating a single electronic record of all medical interventions experienced by any given patient; facilitate monitoring in postclinical care and new chronic disease management initiatives; reduce errors (as has occurred with the reduction of medication errors through the operation of barcode systems); facilitate and lower the cost of research and evaluation, for instance through easily accessed biomedical databases, enhanced international research collaboration (such as has occurred with genome research) and the more efficient outsourcing of research services.

Improving access: For instance, ICT-enabled technologies can augment access to medical services for populations living in isolated areas. This potential is of particular interest to countries that contain large regions of low population density, such as Australia, Canada, Finland and Sweden. ICT can also facilitate the general public’s access to current health-related information and advice. Indeed, obtaining health-related information is already a major objective of Internet information search. Such health-related

information search is likely to grow as OECD populations age and the demands on standard means of health delivery rise. If greater access to information and advice leads to more healthy behaviours then the implications for population health and the overall magnitude of health-related spending might be significant.

Improving quality: For instance, telemedicine can allow expert but geographically remote practitioners to participate in providing treatments. Telemedicine might also facilitate education and training for medical staff.

E-learning and tertiary education

While currently rather limited, the use of ICT to enhance and/or support learning in tertiary education is growing in importance. Provision with at least “web dependent” online presence accounted for less than 5% of total enrolments at the tertiary-level institutions sampled in a recent OECD/CERI report (OECD 2005a). However, typically, from 30% to 50% of students were found to be enrolled in at least one course with high online presence. While e-learning has not yet significantly changed the predominant mode of face-to-face classroom instruction, almost all tertiary institutions sampled in the OECD/CERI survey either possessed or were developing an e-learning strategy. The potential advantages of e-learning include the following:

- *Cost reduction:* Cost savings might be realised through less expensive programme delivery, lower levels of facility use, a decrease in staff/student ratios, use of pre-existing software, increased material re-use and sharing, and greater course standardisation. However, it is also evident that on-line learning will require significant infrastructure costs.
- *Improved teaching and learning:* Most respondents in the OECD/CERI survey considered that e-learning has a positive pedagogic impact, although this view is not as yet substantiated with systematic research evidence. Aside from permitting easier access to information, and alleviating some constraints of time and space, new forms of ICT-enabled teaching and learning are still generally at an incipient stage.

The analytic potential of the PIAAC strategy for public policy

When establishing the PIAAC strategy, emphasis has been placed on being able to inform policies relevant to the following overarching themes:

- adult competencies and their individual as well as aggregate economic and social outcomes;
- the design and quality of education systems and levels and distributions of adult competencies;
- enhancing the prospects of adults at risk;

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- improving school-to-work transitions and reducing youth unemployment;
- population ageing and lifelong learning;

This concluding section outlines the ways in which the assessment will provide data and analyses relevant to each of the above five themes. Emphasis is placed on describing the scope of the issues on which PIAAC could facilitate policy analysis and design.

Adult competencies and their individual as well as aggregate economic and social outcomes

Data and analyses will become available on the ways in which a comprehensive set of literacy competencies in adults affect individual and aggregate economic, labour market and social success. By being implemented over more than one cycle PIAAC could also examine how relationships between competencies and key outcomes are changing over time.³

Among the many aggregate-level issues that could be addressed, PIAAC will permit the development of *a more precise quantitative analysis of the role of education in generating economy-wide increases in productivity*. Measurement of how skills affect labour productivity is hindered by insufficient variance in key parameters (Heckman and Vytlačil 2000). This problem could be addressed through an assessment that covers a sufficiently large number of individuals. Furthermore, and critically, PIAAC will permit more accurate measurement of the stocks of human capital than is possible using the standard indicators of educational attainment, years of work experience and occupational classification.⁴ As economies become increasingly knowledge-based, the importance of having accurate measures of human capital can be expected to rise. PIAAC could thus help to identify where the greatest growth returns are likely to be had for different overall education/training investment strategies.

Over a number of assessment cycles, evidence could be constructed relevant to how growth is affected by countries' investments in different stages of education (from pre-school to advanced tertiary education and work-related training), as well as *the growth returns to expanding higher education access*. And, over time, PIAAC data will allow exploration of such issues as: whether, at the margin, it is preferable to allocate resources to expanding tertiary education, or whether the economic and social returns to these resources will be higher if allocated to increasing participation in learning among some cohort of older adults; and the appropriate share of national wealth dedicated to education systems.

The background questionnaire collects information on individuals' labour market status, health status, and behaviours relevant to citizenship and social capital. These data will allow evaluation of the relationships between assessed competencies and these critical outcomes.

The design and quality of education systems and levels and distributions of adult competencies

Evidence is gathered on how key features of education systems relate to the level and distribution of literacy competencies throughout the adult population and its sub-groups (e.g. by level of income, occupation, gender, immigrant or non-immigrant status, minority or non-minority grouping). Such key features include the education system's stratification, segregation; standardisation and stability.⁵ Findings indicating that certain combinations of the features of education systems were consistently associated with superior levels – or preferred distributions – of adult competencies would, at the least, provide a robust agenda for policy-oriented research aimed at elucidating causal links that PIAAC could not explain.

Among many analytical possibilities of relevance to policy, data will become available for examining the relative importance of initial education quality in the development of key competencies. In a related manner, by using a background questionnaire to collect information on participation in continuing education and training, it will be possible to examine the relative contribution to adult competencies of initial education, on the one hand, and adult education and training on the other. Furthermore, over a number of assessment cycles, evidence could begin to be gathered on the duration over which the quality of initial education exerts a significant influence on adult competencies, competency outcomes, and other variables such as learning behaviour.

Policy-relevant insight could also be obtained on curriculum content in initial education. For instance, patterns of learning throughout life, school-to-work transitions, and the level and persistence of literacy competencies could be examined in the light of curriculum content. With the administration of an instrument for assessing the literacy skills of low-skilled individuals, PIAAC could also help to identify curricula appropriate for at-risk groups, based on socio-economic characteristics and assessed competencies. In the United States, skills assessment using a literacy components approach is now being explored as a means to designing remedial adult education (see, *inter alia*, Chall 1994; Sabatini 2002; Snow and Strucker 2000).

Enhancing the prospects of adults at risk⁶

“At risk” adults are understood here as persons having a high propensity to experience unemployment, poverty, ill-health, being a victim of crime, social isolation and related desiderata. As described previously, the PIAAC assessment will use a locator test to identify respondents with the lowest levels of literacy skills. Such individuals are likely to belong to the population subgroup facing greatest socio-economic risk (i.e. as individuals with the lowest levels of autonomy in exploiting available economic, social and educational opportunities). These respondents will then take a test of document literacy

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and literacy component skills. In addressing issues relevant to at-risk adults, PIAAC could provide data and analyses pertinent to such critical questions as:

- What is the relationship between literacy competencies and socio-economic risk?
- How do gender, skills and socio-economic risk interrelate?
- What are the socio-economic characteristics of the at-risk adult population in each country?
- Is there a pattern of literacy component skills most closely associated with socio-economic risk?
- For young adults at risk, what policies appear most likely to increase or decrease risk over time?
- Which institutional and policy conditions are most successful in diminishing the size of the at-risk sub-population?

PIAAC could also compare how, across countries and over time, the competencies of at-risk adults, and the changes in their competencies, are related to different policy and institutional settings. In this way, combinations of policies could be identified that appear most effective in mitigating known risk factors – e.g. social class, parents' education, and educational attainment (particularly the non-achievement of upper-secondary education). The relevant policy and institutional settings are numerous. By way of illustration, they could include:

- The overall level of funding for initial education and adult learning targeted towards at-risk adults.
- The existence of inclusive schools or special schools for students with disabilities, difficulties or disadvantages.
- The volumes of additional resources in pre-primary/primary/lower secondary/upper secondary education for students with disabilities.
- The operation of introduction programmes for immigrant populations that involve language instruction and/or vocational training aimed at adapting or supplementing qualifications/training/experience obtained abroad to local requirements.
- The existence and level of financing schemes that target low skilled individuals (e.g., vouchers for the low-skilled, individuals learning accounts, etc.).
- The existence of labour market training programmes and other labour market programmes targeted to the at-risk adults (e.g., for those with disabilities).

In assessing literacy components skills – such as vocabulary and word recognition – among individuals with the lowest levels of literacy skills it will be possible in many countries to reframe policy thinking about reading. Policy-makers will obtain a sense of the extent to which key literacy

components skills are being taught by their respective school systems. Policy-makers could also gain insight on how they might adjust their adult literacy instruction to better address the needs of struggling adult readers. Furthermore, the possibility exists that different population subgroups exhibit different component profiles, knowledge of which could facilitate the targeting of programmes of remediation. Assessment of component skills could also facilitate policy-relevant estimations of the resources required to effect a fundamental improvement in individuals' literacy performance. Indeed, as noted earlier in this paper, just creating well-normed vocabulary and word recognition tests will represent a pedagogical advance in a number of countries.

An analysis of the characteristics of individuals with the lowest levels of competencies during the first assessment could then also lead to their utilisation for the purpose of oversampling in subsequent assessments. In this way, the picture of adults at risk could become increasingly solid and detailed as PIAAC progresses.

Improving school-to-work transitions and reducing youth unemployment⁷

The assessment will provide data on how a comprehensive set of literacy competencies relate to patterns of youth transition. For instance, such fundamental questions could be examined as:

- What role do literacy competencies play in facilitating or hindering youth transitions?
- To what extent do literacy competencies reduce the probability of access to work, or determine school-to-school transitions?
- What effect do literacy competencies have on wage differentials?

More generally, and across a number of assessment cycles, PIAAC could examine how and why patterns of youth transition have changed over time. PIAAC will also improve understanding of the impact on school-to-work transitions of a range of factors outside the individual's control (such as a person's parents and their home background). Moreover, long-standing limitations in the international comparative analysis of transition processes could be addressed.⁸

PIAAC could also shed light on how, across countries and over time, transition probabilities, transition duration and transition outcomes (in terms of a range of employment conditions) – for young people of different ages, genders and levels of educational attainment – are related to the following policy and institutional settings⁹:

- The presence of institutionalised pathways connecting initial education with work and further study.
- The existence of national institutional arrangements governing employer participation in school-organised workplace experience programmes.
- The level of development of the vocational education sector.

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- The variety of general, technical and vocational education options available.
- Curriculum content (e.g. mandatory inclusion of career education).
- The existence, scope and *modus operandi* of information career guidance services, including whether services are designed for individual needs.
- The existence of opportunities to combine education with workplace experience (encompassing apprenticeships and work-oriented learning in schools).
- The extent of employer involvement in the design of occupational qualifications.
- The existence – and management modes – of organised safety nets for early school leavers.

Contrasting such policy-settings with measures of competencies and transition outcomes across countries will provide clues for policy-makers about *which policies – or combination of policies – best facilitate effective transitions*. Furthermore, PIAAC could provide evidence on the extent to which different policy settings contribute to successful school-to-work transitions *via improvement in competencies*.

*Population ageing and lifelong learning*¹⁰

In relation to population ageing and lifelong learning, across a number of assessment cycles, PIAAC could examine such key questions as:

- What is the role of a comprehensive set of literacy competencies in driving skills accumulation over the life-cycle?
- Responding to fears of growing mismatches between the skills of older workers and the demand for skills – how is the level of literacy competencies distributed across younger and older age cohorts?
- In what ways do literacy competencies matter for the employability and social integration of older adults?
- How do different policy settings relate to equity in the distribution of adult learning, including equity between genders?
- How do the qualifications of labour force entrants relate to learning opportunities and skills formation later in life?
- How does learning behaviour over the life-cycle relate to attitudes, beliefs and values about learning (possibly complementing efforts to develop diagnostic and instructional methods for children and young adults)?¹¹

PIAAC will also allow the comparison across countries of the competencies, learning behaviours among older adults and outcomes associated with different policy and institutional settings. PIAAC could also gather evidence on the relative importance of initial, work-based and informal learning in the production of different competencies.¹² The relevant policy and institutional settings are numerous. By way of illustration, they could include:

- The level of financing of adult learning by type of institution and mode of instruction.

- The existence of national co-ordinating institutions to promote adult learning.
- The mode of provision of adult learning (for instance, adopting part-time provision has been shown to have a major effect on cost-benefit calculations).
- The different forms of skills recognition and accreditation (given the impact that recognition of skills acquired outside of formal learning may have in encouraging some groups to participate in formal learning).
- Schemes to offer counselling to students on possible study paths (available, for instance, in all upper comprehensive schools in Finland).
- Programmes to counter gender imbalances in learning motivation.
- School-based schemes to increase motivation for lifelong learning.
- The existence and funding of financing schemes that target individuals (e.g., individual learning accounts, loans, tax-deduction schemes, and training vouchers).
- The existence and funding of financing schemes that target firms (e.g., tax deduction schemes, tax levy-based schemes, and grants).
- The existence of schemes that reduce time constraints (e.g., statutory training leave, training time accounts, and rotation schemes).

From an analytical perspective, the examination of lifelong learning will ideally be addressed through a longitudinal survey design. However, for reasons of cost and capacity constraints a longitudinal design is not for PIAAC.

Notes

1. Krueger (1993), Entorf and Kramarz (1998) and Baldwin et al. (1995) are all cited in OECD (2004b, c).
2. To date, evidence on the overall impacts of ICT on healthcare is limited. For example, studies of telehealth have usually been limited by the absence of control groups. However, the US General Accounting Office found evidence for efficiency gains from ICT applications in clinical care and administration (OECD 2004a). Improvements were found principally in administration, as well as in the reduction of errors, waiting and processing times.
3. For example, Murnane et al. (1995) show that in the United States, basic cognitive skills had a larger impact on wages for 24-year-old men and women in 1986 than in 1978.
4. Average educational attainment is the usual proxy for human capital in analyses of macro-economic outcomes. However, many individuals possess a level of skills that differs from that indicated by formal education. Studies sometimes complement data on educational attainment with data on years of work experience. However, there is large qualitative variation in experience. Some studies also employ occupational data. But these data are again a poor proxy for human capital, as they pertain to jobs rather than the jobholders.
5. Stratification refers to the degree of differentiation between academic and vocational streams. Segregation signifies the extent to which different types of students are separated among different organisational units. Standardisation concerns the

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- degree to which school quality is uniform across the school system. And stability refers to the extent to which different elements of the school system are stable over time.
6. Policies that cater to the needs of at-risk adults are important for at least three reasons. First, addressing the needs of the most vulnerable is an obvious social equity objective. Second, if market failures hinder the acquisition of competencies, these failures are most likely to represent binding constraints for at-risk adults. Third, research suggests that the impacts on macro-economic growth from improving competencies among those with low levels of skill might be high. For instance, using IALS data, Coulombe et al. (2004) found that even small increases in the middle of the literacy skills distribution, where most workers are, will yield sizeable growth effects. Still more significant economic gains could be had from raising literacy among those with the lowest literacy skills.
 7. Youth unemployment has increased substantially in recent years, reaching an OECD average in 2003 of 13.6% among youth between the ages of 15 and 24 (OECD 2004b, c). Such high, and in some countries persistent, youth unemployment raises important questions about possible mismatches between the skills possessed by young people and the skills required by employers.
 8. For example, in many studies, the distinctions between inactivity and unemployment among young people are uncertain. This poses a particular problem when comparing different national analyses, as inactivity may be a choice rather than a result of some labour market or non-economic constraint. For instance, in some countries, levels of inactivity among young adult males, associated with military service or foreign travel, can be significant. PIAAC could ensure that findings across countries are genuinely comparable by identifying the sources of different types of inactivity through a background questionnaire.
 9. There are other policies and programme practices that affect transition outcomes (as well as lifelong learning and at-risk adults) but which are not readily examined in an international context. This is either because the policies and programmes concerned are designed and implemented by small subnational authorities, or because they do not lend themselves to quantification.
 10. The skill-intensity bias in labour demand in OECD economies – associated with new technologies, globalisation and organisational change – and population ageing, are among the key reasons why adult competencies and lifelong learning occupy an especially prominent position in today's policy foreground. Many observers also hold that changes in workplace organisation have led to shifts in the demand for different types of skills. It is often claimed that the new workplace requires workers with multiple skills, particularly general skills in such areas as problem solving and communication, as well as inter- and intra-personal competencies and the ability to work autonomously. At the same time, and as noted earlier in this paper, the rapid ageing of OECD populations raises critical skills-related concerns. For instance, while life expectancy is rising, falling birth rates mean that Europe's workforce will begin to contract from 2010 onwards. At current employment rates, the number of workers in the 15 countries that were members of the European Union prior to 1 May 2004 could fall by 14 million over the next 25 years. Were this projected contraction to occur, the region's economic output could decline by around 7%, absent a major increase in immigration (see "Europe's costly resistance to foreign workers", International Herald Tribune, Friday July 23, 2004, p. 2).
 11. For instance, Crick et al. (2004) describe the initial results of a study designed to develop and test an instrument to identify individuals' capacity for lifelong learning. This work is based on learners' perceptions of learning, rather than an external measure of learner orientation.

12. For example, assessed competencies could be compared in individuals who have similar initial education but who have experienced different durations and types of work-based and informal learning. This will make it possible to estimate how the latter forms of learning relate to incremental increases in different types of competencies.

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