

Article

Learning New Technologies Through Everyday Educative Experiences

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Abstract

Most learning across the adult lifespan arises outside the circumstances of formalised educational provisions, such as taught courses, training programmes or professional development interludes. In fact, it occurs through everyday experiences as adults engage in activities and interactions in work, community and family settings. Some of those experiences are inherently educative. They provide forms of indirect guidance and support for learning and sometimes direct assistance in developing further what they know, can do and value (i.e., learning) that would not otherwise be acquired through their own discovery efforts alone. These kinds of experiences can be labelled as ‘educative’, originally coined by Dewey but re-defined here to accommodate the broader array of experiences through which individuals learn than through intentional efforts of schooling. For instance, evidence suggests that adults’ engagement and activities in community, workplace and family settings offer a range of such educative experiences. These experiences are distinct from those availed through formalised educational programmes and acts of teaching. Moreover, these kinds of experiences are distributed across a range of social, cultural and economic activities in which adults engage. They can offer support and guidance when new challenges are being faced in and across communities. The role of educative experiences is examined in the context of older adults’ learning to engage with new technologies in this review paper. It draws upon observations from work life history studies and quantitative data from the Program of International Assessment of Adult Competence. It is proposed that there are close and more distal forms of guidance and support that individuals engage with in becoming competent with new technologies that are increasingly being utilised across all aspects of economic, cultural and social life. This provides a context in which the concept of educative experiences can be appraised as a means for this kind of learning to progress.



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1. Learning Across Adulthood

It seems most learning across the adult lifespan seemingly arises outside the circumstances of formalised educational provisions, such as taught courses, training programmes or professional development interludes (Bauer et al., 2016; Billett, 2025; Dornan, 2012; Eppich et al., 2016; Teunissen & Wilkinson, 2010). Indeed, across the adult lifespan, participation in such provisions decreases and is often reserved for key occupational, family or other kinds of transitions (Billett et al., 2023a). Instead, and unsurprisingly, it is reported as

largely arising through everyday experiences as adults engage in activities and interactions in work, community and family settings (ibid). Some of those experiences are inherently educative as they provide forms of indirect guidance in and support for developing further what these adults know, can do and value (i.e., their learning). This develops further the conceptual, procedural and dispositional knowledge required to engage in and learn through activities and achieve the goals of everyday life. Sometimes, these experiences also provide direct assistance when these adults' discovery efforts alone would be insufficient (Billett, 2025). These kinds of experiences can be labelled as educative as they are generative of bringing about changes in what adults know, can do and value, thereby defining a term advanced by Dewey (1938) to accommodate the broader array of experiences through which individuals learn beyond those afforded through intentional efforts of schooling. He differentiated between two kinds of learning through such experiences: firstly, primary experiences (i.e., those that happen all the time) and then secondary or aesthetic experiences that lead to abstraction and conscious efforts to change or extend what individuals know, can do and value. This second kind is analogous to what he referred to as, and what is defined and conceptualised here as, educative experiences. Importantly, those qualities are not wholly founded within the experience itself, but rather how individuals come to engage with that experience: the process of experiencing, that is, how they construe that experience, engage with it and realise change through it. That requires active constructive efforts.

Here, Dewey's ideation of educative experiences has been re-defined and advanced to explain the range of learning experiences that occur outside of educational settings. Indeed, recent evidence suggests that adults' engagements and activities in community, workplace and family settings offer a range of such educative experiences aligned with Dewey's second kind, albeit arising through processes that are everyday and as such similar to what was proposed as the first kind (Le et al., 2023). These experiences are, in some ways, often distinct from those availed through formalised educational programmes and acts of teaching, as they are more likely to be mediated by individuals themselves, albeit through guidance and support from others. Also, as individuals progress beyond adolescence and early adulthood, their participation in formalised educational programmes diminishes, often restricted to imperatives such as transitions associated with changes to occupations or ways of working and relocations (Billett et al., 2023b). Furthermore, beyond participation in those programmes, educative experiences are deemed to be effective learning for and through a range of social, cultural and economic activities in which adults engage (OECD, 2013, 2016, 2024). This includes processes and outcomes, such as engaging with and learning how to use new electronic technologies. Indeed, there is little evidence to suggest that the widespread adoption of smart phones, online activities and interactions has been mediated by attendance in formalised educational provisions (i.e., lifelong education). Investigations into adults engaging with electronic technologies during COVID-19 lockdowns found that they quickly adapted to the use of these technologies for work and social activities largely through their own efforts, albeit through accessing support and guidance from others (Leow et al., 2023). Moreover, such was the perceived value of these technologies that significant changes in an adult population's views about the greater accessibility afforded their engagement in online continuing education and training and their efficacy as an educational provision (Billett et al., 2023c). That is, when pressed to engage with these technologies, a population of working age adults reported benefits of these two kinds from that engagement. Much of that engagement arose from a need to adopt and adapt those technologies for their work in socially isolated circumstances, to engage with familiars and networks and participate in continuing education and training. So, these kinds of educative experiences should not be viewed as a poor and less worthy substitute for experiences in lifelong education provisions but are salient when new challenges need

to be faced in and across adulthood, including those who are classified as older workers (i.e., over 45 years).

This paper, reviews existing research data to inform the discussion of everyday educative experiences. Here, the role of educative experiences is examined in the context of adults' learning to engage with new challenges such as developing competence in the use of electronic technologies, including those designated as being older workers. It draws upon findings from the above-mentioned project about working-age population adapting to using electronic technologies (Billett et al., 2023c), observations from a study of work life histories (Billett et al., 2023d), and quantitative data from the Program of International Assessment of Adult Competence (PIAAC) (OECD, 2013, 2016, 2024). It proposes that there are both proximal (i.e., close) and more distal or indirect forms of guidance and support that adults engage with to become operably competent with the new technologies increasingly being used across many aspects of economic, cultural and social activities. This focus on technologies offers a context in which these educative experiences can be appraised as means of realising the learning that adults need to achieve their personal and work life goals. Thus, the concepts that have carriage to describe and distinguish what constitutes educative experiences in this paper are grounded in cognitive and cultural psychology. In making this case, consideration is first given to societal sentiments about older adults' learning and development. It is noted, by the way, that these sentiments shape the kind of support and guidance provided for older adults (i.e., 45 years and beyond) and the need for them to sustain their employability through developing competence with new technologies et cetera. Then, population-wide data is used to identify the kinds of everyday experiences and learning outcomes encountered across adults' working lives to emphasise the bases of learning through everyday activities. This includes the degree of their competence in the use of electronic technologies, as an example of emerging challenges. The key point here is that contemporary work tasks have necessarily engaged these informants in the use of technologies, which are often viewed as being beyond older workers' abilities to learn and utilise. The conclusion is that this evidence suggests older workers can work effectively, learning and innovating in and through their work. These findings question societal sentiments that view older workers as being less capable of these activities. Yet, as with any new kind of learning, there would be the need for support and guidance, regardless of age, because discovery efforts alone may be insufficient.

2. Societal Sentiments and Older Workers

Societal sentiments—meaning the prevailing views and beliefs within a community—strongly influence public discourse. They shape how governments prioritise, fund, and support initiatives, how communities interact with these efforts, and how individuals demonstrate interest and commitment. A clear example is the relatively low status of vocational education (CEDEFOP, 2014; Clement, 2014). Such sentiments often portray older workers as having limited capacity for employment, learning, and innovation (Hilsen & Olsen, 2021). Consequently, these adults are frequently seen as poorly suited to modern workplaces and undeserving of investment in their development by enterprises or nation states (von Hippel et al., 2013). Yet, with ageing populations and longer working lives, such propositions are problematic and potentially erroneous, and, indeed, one of the promises of new technologies is that they can extend the range of age-tolerant work (Wirtz et al., 2025). Certainly, the findings from interviews with and surveys of older employees in Australia and Singapore indicate older employees' abilities and willingness for education, work and innovations (Billett, 2011; Billett et al., 2009). The recent PIAAC data provides a strong evidentiary basis for such claims across a range of countries. Such findings indicate how workplaces and communities can support these workers' participation in and

mediation of activities through which they can extend existing knowledge and learn new knowledge. Mediation here refers to the means by which individuals access knowledge and can be supported and guided in the process of adult experiencing but also how individuals elect to engage in construing and constructing knowledge. This involves promoting engagement and agency among all categories of older employees, as prevailing sentiments often undermine their employability:

- (i) Employers frequently perceive older workers as less capable than younger ones in terms of physical strength, learning ability, and adaptability, though they are regarded as more committed, reliable, and knowledgeable about the organisation (Ainsworth & Hardy, 2007; Bittman et al., 2001; McIntosh, 2001).
- (ii) These sentiments can result in employers choosing not to hire, rehire, or invest in the continued development of older workers (Billett et al., 2011).
- (iii) Some mature-age employees internalise and accept these negative age-related stereotypes.

Yet, maturation is not necessarily a process of mental and physical decline as is often viewed and accepted. Importantly, the concept of ‘older workers’ is a societal construct. Definitions of ‘older workers’ are shaped by government edicts (that evolved) such as pension entitlement age but shifting to older ages (e.g., beyond statistical 45 years old). There are societal sentiments about ageing and work (i.e., Confucian, diffidence, annoyance), such as being addressed as ‘aunties’ and ‘uncles’ in ways that can be seen as either endearing or demeaning. Then, there is also mandatory retirement in many nation states that limits the duration of adults’ working lives (e.g., commercial pilots, defence, first responders). Other aspects of older workers include their conduct being restricted by the brute fact of ageing (e.g., manual tasks) and differentiated in terms of age tolerance or intolerance (e.g., academic vs. construction worker). Yet, contemporary work practices are likely to be increasingly age-tolerant, as the manual tasks relying upon physical strength tend to be replaced by technologies and equipment, easing the demands of physical work. However, age per se is not always the key variable associated with employability. Instead, the kind of occupations that older workers engage in, their educational levels and work history have been found to be most germane. Put simply, an 80-year-old dentist may have no problem continuing to be employable, whereas a 55-year-old who has engaged in a litany of low-skilled and precarious forms of employment may struggle. But the ability of older adults to engage with and use new technologies is central to their employability.

2.1. Employers’ Perspectives of ‘Older’ Workers

Employer perspectives on older workers are particularly relevant to employability and ongoing learning efforts, such as the use of these technologies. Older employees are frequently regarded as a “last resort” in hiring decisions (Quintrell, 2000). Societal norms often elevate youth over age, fostering a strong youth-centric culture and even disdain for older generations (Gutman, 1987). Age influences the allocation of opportunities, with younger individuals typically favoured (Brunello, 2001; Brunello & Medio, 2001). Employers are often hesitant to invest in skill development for older workers, who in turn report feeling overlooked and underutilised. Some may also avoid seeking guidance for fear of being perceived as a liability. These negative perceptions can lead to socio-psychological consequences, such as stress, anxiety, and poor health.

For example, several widely accepted negative stereotypes about mature-age workers have been documented (Business Council of Australia, 2003). While older employees are often appreciated for their expertise, experience, loyalty, organisational knowledge, commitment, strong work ethic, reliability, and low absenteeism (Bittman et al., 2001), they are simultaneously criticised for lacking motivation and enthusiasm, being resistant to

new ideas and more prone to injury and illness, possessing outdated skills, and showing reluctance toward training or new challenges. They are also perceived as risk-averse and having limited potential for growth. Consequently, employers frequently view them as less adaptable to change, less productive, difficult to train, inflexible, and a poor investment due to possible health issues (Bittman et al., 2001). Additional stereotypes include being less ambitious, energetic, healthy, creative, and physically strong (Gringart et al., 2005). With regard to emerging technological changes, older workers were viewed as being less adaptable to new technology, less interested in technological change and less trainable (Gringart et al., 2005). They were thought to have impaired memory and to be less mentally alert and less flexible and considered inferior to their younger counterparts in their potential for career progression (Gringart et al., 2005). Perhaps these perspectives have changed over time, but they are likely to shape views about these workers and their ability to learn and utilise new technologies.

2.2. Factors Shaping Employability

The employability of older workers is influenced by more than just age. Other contributing factors include the nature of their occupation, their work history and employment status, educational attainment, the demand for their specific occupational skills, gender, and personal characteristics such as interests and intentionalities. For instance, as noted, a dentist in her mid-70s is likely to be highly employable, whereas a manual labourer or even an airline pilot in her late 50s may struggle to be re-employed.

Institutional factors shape prospects for employability. The factors relate to age (and gender) and include (i) kind, scope and nature of employment opportunities available, kind and scale of enterprises, (ii) societal sentiments—views in particular societies about work, age, gender, and occupations, and (iii) occupational requirements—age tolerance. Additional institutional factors include (i) government policies and practices—such as equal opportunity measures, re-employment provisions, access and support programmes, and social welfare or pension schemes; (ii) workplace/occupational policies and practices—covering employment options, in-house training opportunities, the nature of work performed, and responsibility for employment decisions; and (iii) access to continuing education and training (CET)—including opportunities for structured learning opportunities.

In conclusion, workplace and educational opportunities across working age populations are likely to be mediated by factors of age but more importantly how employers and others view workers classified as being ‘older’. The ironies here are strong. Older workers bring numerous qualities valued by employers, such as reliability, punctuality, productivity, and being problem-solvers (McIntosh, 2001). They tend to have lower turnover rates compared to younger workers, remain effective in most roles until retirement, adapt well to retraining, and can quickly upgrade their skills. While they may experience declines in physical strength, vision, and reaction speed, they often enhance their judgement, sense of responsibility, and overall competence (European Association for the Education of Adults, 2011). Also, evidence about whether older employees face a higher risk of accidents remains unclear. There is clearly a gap between societal views (i.e., older workers cannot learn and innovate) and what the data report. All of this plays out in terms of learning new kinds of knowledge such as those associated with contemporary technologies, including those that are electronic. Age was not (necessarily) the key variable. Yet, occupation, level of educational achievement and work history were important variables.

3. Contemporary Evidence from PIAAC

The evidence here draws on the findings from the recently released PIAAC Second Cycle (OECD, 2024). Conducted by the Organisation for Economic Co-operational and

Development (OECD) (OECD, 2016, 2024), this international survey offers robust and validated data. First, PIAAC includes a large number of participating countries and evaluates multiple domains of knowledge and skills. Second, it is administered individually in one-on-one sessions by trained interviewers and collects a comprehensive range of variables—both independent (e.g., demographic details such as age, gender, education, and work-related factors like employment status and job type) and dependent (e.g., problem-solving ability, work autonomy, learning activities, and ICT skills). Survey items use five-point Likert scales to measure aspects such as work discretion (from Not at all to A very high extent), frequency of learning and problem-solving (from Never to Every day), and the use of ICT skills at work (from None of the time to All of the time). Thus, the data set has rich descriptive potential, including cross-tabulations with variables. Direct comparisons can be helpful if situational factors are taken into account.

The data presented in the following tables are extracted from Second Cycle PIAAC data from four participating countries: France ($n = 6432$), Germany ($n = 4793$), Italy ($n = 4847$) and Switzerland ($n = 6648$). This collection of countries was selected because of the need to secure a sufficient comparable sample of respondents and as these countries have similar rather than contrasting social, educational and economic profiles. Analyses were conducted on work discretion, learning, innovation, problem-solving and ICT skill data. Age groupings were used to compare societal sentiments versus performance evidence.

The analysis of the PIAAC data is shaped by the dualities of affordances (i.e., invitational qualities of work setting—degree by which individuals are invited) and engagement (i.e., how workers elect to engage with what is afforded them) and their abilities to engage effectively. Also, categories of occupations judged as being age-tolerant or -intolerant are used as bases to appraise opportunities provided and bases of engagement. The units and means of analysis include

- (i) Work discretion (4 measures)—ability to change: (i) sequencing of tasks; (ii) how work is carried out; (iii) speed of work; and (iv) working hours—combination of workplace affordances and individuals' agency;
- (ii) Learning (3 measures)—frequency of (i) learning new things, (ii) learning by doing, and (iii) keeping up to date—emphasises engagement and agency;
- (iii) Problem-solving (2 measures): (i) routine and (ii) nonroutine—combination of workplace affordances and individuals' agency;
- (iv) Workplace support (2 measures) and innovation (2 measures) (only France and Italy)—affordances (support) and individuals' agency (innovation); and
- (v) ICT skills (5 measures)—emphasises potential of workers (i.e., ability to engage).

3.1. Age Factors Shaping Affordances and Engagement

3.1.1. Work Discretion

The measures of work discretion presented here provide a foundation for examining the relationships between work, learning, and adaptive practices, such as responses to novel challenges (Billett, 2015). Table 1 outlines the types of task discretion reported by workers—such as choosing work sequences, changing main tasks, and adjusting work pace—shown in the left column. The adjacent columns display age groupings and the proportion of workers in France, Germany, Italy, and Switzerland who reported engaging in these forms of discretion to a High or Very high extent. The degree of discretion exercised reflects the scope of decision-making permitted, which in turn expands opportunities for broader thinking and action, and potentially for learning, including adopting new technologies.

Table 1. Work discretion by age groups.

Statements	Age	High + Very High Extent (%)			
		France	Germany	Italy	Switzerland
Sequence of tasks	≤24	42.5	46.6	21.7	43.4
	25–34	56.6	65.2	29.3	66.9
	35–44	59.8	70.4	32.1	68.7
	45–54	59.9	72.0	37.7	69.8
	55+	58.2	68.8	36.6	72.0
How you do your work	≤24	42.9	45.1	23.6	46.1
	25–34	56.3	70.0	32.0	67.7
	35–44	57.7	73.9	33.6	70.1
	45–54	57.9	74.4	38.3	71.8
	55+	58.1	74.0	41.1	73.8
Speed of work	≤24	28.5	60.7	32.6	37.6
	25–34	41.7	65.8	32.9	56.7
	35–44	39.4	64.5	35.0	59.6
	45–54	43.8	67.1	41.8	63.0
	55+	42.0	60.7	36.9	62.6
Working hours	≤24	13.0	27.3	10.4	30.7
	25–34	27.2	38.6	13.2	38.2
	35–44	26.0	40.2	14.5	44.2
	45–54	28.6	44.7	18.7	46.5
	55+	31.9	41.0	15.9	48.3

The combination of workplace affordances and individuals' agency in what they report being able to change to a High or Very high extent indicates that workers 45+ are still being afforded and exercising discretion in their workplaces across these four countries. For instance, discretion to change task sequencing is reported most highly by the 45–54 age group, declines slightly for 55+ in France, Germany and Italy, but is upheld in Switzerland. In all four countries, the extent of changing main tasks (i.e., how you do your work) is reported most highly by the 45+ group. In terms of changing pace of work, it is reported to be highest among the 45–54 age group but declines slightly among the 55+ group. Regarding changing working hours, the highest extent is reported by the 45–54 age group; it declines slightly among the 55+ group in France, Germany and Italy but is upheld in the Swiss data. What these data suggest is that, despite what is reported in some of the literature, there is no sudden or discernible change in the kinds of discretion that working-age adults can exercise as they mature past the age of 45. Perhaps most noteworthy is the data on the speed with which work is undertaken, and this indicates no significant decrease in time beyond that age. Importantly, aspects of this discretion are those afforded by the workplace and, contrary to some accounts, what the data here suggests is that older workers are afforded levels of workplace discretion that are not wholly distinct from those of younger workers.

3.1.2. Learning

Working-age adults also reported on how their workplace learning is constructed—highlighting when their own initiative and capabilities are central and when support or guidance from others is needed. These two aspects are key in understanding how learning can be enhanced, especially given ongoing changes in occupational and workplace requirements and the need to respond proactively to new challenges. With frequent changes, such as learning to use digital technologies, these findings may reflect the development of such skills. The PIAAC survey addresses these issues by asking respondents how often

their job involves (i) learning new things, (ii) learning by doing (through job tasks), and (iii) keeping up to date. Responses are categorised as Never, Once a month, Once a week, or Every day. This data reveals how workplaces provide access to knowledge essential for both occupational capacities and situational performance. Table 2 summarises the frequency of respondents from four countries who engage in these learning processes at least weekly (aggregated ‘Once a week’ and ‘Every day’ responses).

Table 2. Learning by age group.

Statements	Age	At Least Once a Week + Every Day (%)			
		France	Germany	Italy	Switzerland
Learning new things	≤24	65.7	73.2	41.5	73.2
	25–34	62.1	60.9	34.9	71.9
	35–44	53.1	59.4	35.5	65.3
	45–54	47.2	55.4	30.1	65.5
	55+	45.5	51.7	26.8	62.5
Learning by doing	≤24	72.6	75.6	44.4	72.8
	25–34	69.3	62.2	36.0	65.4
	35–44	61.0	58.2	34.1	60.8
	45–54	55.1	53.0	32.8	59.4
	55+	54.1	49.5	30.1	54.7
Keeping up to date	≤24	52.8	34.0	24.6	32.8
	25–34	45.9	32.0	21.4	38.6
	35–44	45.2	29.6	17.5	36.3
	45–54	42.6	30.5	18.9	38.9
	55+	41.9	29.2	16.8	35.9

The frequency with which these workers engage at least weekly in ‘Learning new things’, ‘Learning by doing’ and ‘Keeping up to date’ indicates interest in, ability in, and exercising of agency in learning. Across four countries, such learning agency declines slightly as workers become older. Part of this reported decline can be explained by younger-aged adults being likely to encounter new processes for the first time, whereas for older workers, it may well have been a long time since they came to be competent in those tasks. Yet, it is noteworthy that the 45–54 age group in Germany, Italy and Switzerland reported a higher frequency of engagement than the younger 35–44 group in keeping up to date (i.e., continuing to learn new concepts/processes). These findings indicate that these older workers engage in intentional efforts to maintain workplace currency and exercise agency in doing so. Likely, much of the learning associated with changes in occupational competencies and workplace requirements will be associated with changes in technologies, including the digitalisation of work activities, as has been evidenced in observational studies of changes in health care settings (Ajjawi et al., 2020; Noble et al., 2025). Beyond those broad measures of learning is that which arises in and through workplace activities that provide access to opportunities and support for that learning. One such measure is the kind of problem-solving that these workers report engaging in.

3.1.3. Learning Through Problem-Solving

There is a long-standing recognition of the strong link between problem-solving and learning (Anderson, 1993; Chi et al., 1982; Voss, 1987) and for good reason. The processes of identifying disruptions or new challenges, evaluating possible solutions, and implementing and monitoring responses are naturally conducive to changes in individuals’ thinking, acting, and dispositions—that is, learning. Although problem-solving is not always explicitly considered as a learning activity, its potential to generate learning should

be acknowledged. This learning may involve reinforcing and refining existing knowledge through routine problem-solving or extending what individuals know, can do, and value through nonroutine problem-solving involving novel tasks. Importantly, what counts as routine or nonroutine varies by individual, depending on their prior knowledge and experience—a task that is routine for one person may be nonroutine for another.

PIAAC data indicates that workers of all kinds and classifications engage frequently in nonroutine problem-solving, which not only promotes new learning but is also generative of adaptive practices in response to novel challenges (OECD, 2013). These distinctions are analogous to Dewey's concepts of primary and secondary experiences. Routine problem-solving tends to strengthen conceptual, procedural, and dispositional knowledge, sustaining and refining existing workplace practices. In contrast, nonroutine problem-solving demands higher-order thinking and acting and fosters new learning, often leaving legacies such as the adoption of new technologies.

In the PIAAC survey, respondents report how often they engage in problems that take up to five minutes to find a solution (i.e., simple problems or routine problem-solving) and those taking between five and thirty minutes (i.e., complex problems or nonroutine problem-solving) (see Table 3). These data highlight two kinds of learning: one that refines, reinforces and hones existing knowledge and skills and another that transforms them. Notably, nonroutine problem-solving is closely linked to innovation and the introduction of new practices in the workplace.

Table 3. Problem-solving by age group.

Statements	Age	At Least Once a Week + Every Day (%)			
		France	Germany	Italy	Switzerland
Simple problems	≤24	67.1	77.3	54.1	81.3
	25–34	75.0	81.1	58.5	86.1
	35–44	69.2	79.2	57.3	82.2
	45–54	68.9	79.2	59.6	81.7
	55+	64.9	75.6	59.9	78.2
Complex problems	≤24	31.1	34.1	29.4	34.7
	25–34	43.5	48.8	32.0	52.9
	35–44	40.3	48.8	36.3	51.6
	45–54	39.8	46.5	37.5	50.0
	55+	35.9	44.9	34.0	46.9

As presented in Table 3, the frequency of workers reporting engaging in routine and nonroutine problem-solving and combination of workplace affordances and individuals' agency (i.e., person-dependence in problem-solving) indicate that 45+ workers are engaging in learning anew, refining what they know, can do and value and extending existing practices. The data presented here is an amalgamation of what they report as engaging in either Daily or Weekly. In all four countries, workers aged +45 report engaging in both routine and nonroutine problem-solving, in some cases at a higher frequency and elsewhere a lower frequency than workers aged under 45. The point here is that these workers are still involved in workplace activities that respond to new challenges and are analogies for generating innovations at work (i.e., nonroutine problem-solving). Inevitably, these kinds of problem-solving activities will involve the advent of new technologies being utilised across work settings. So, these data again, whilst broadly cast, indicate the degree by which working-age adults across all age categories are demonstrating the capacity to learn, including extending what they know, can do and value, and this is still evident in workers aged over 45.

3.1.4. Workplace Support (Affordances)

Table 4 presents the frequency with which workers were provided with support from within their workplaces from supervisors and co-workers. It was only for French and Italian working-age adults that this data was available, and the evidence here is that in these two countries, workplace affordances are still positively inclined toward older workers, in terms of the level and assistance from supervisors and peers, although they are declining. Potentially what this data indicates is that as workers age, there is less need for direct assistance from their supervisors and co-workers. That deduction is well represented across the data from these two countries.

Table 4. Workplace support by age group—France and Italy.

Statements	Age	Always (%)	
		France	Italy
Assistance from supervisor or manager	≤24	44.5	38.4
	25–34	34.2	37.6
	35–44	33.3	33.7
	45–54	31.2	31.0
	55+	27.5	22.7
Assistance from co-workers	≤24	64.7	44.4
	25–34	54.4	41.2
	35–44	49.8	40.2
	45–54	45.1	37.7
	55+	42.6	30.7

Note: 3-point Likert-scale: Always–Sometimes–Never.

Such a deduction also suggests that rather than being helpless and overwhelmed by changes, these workers can be quite self-directed in terms of their learning and development. From these two countries, data is also available regarding the frequency with which working-age adults report engaging in activities associated with being innovative and bringing about innovations in work settings.

3.1.5. Innovation (Engagement)

Items within the PIAAC survey also provide data about workers' engagement in innovations in work settings and the ability to be innovative in their practice for these two countries. The informants' data here is about the frequency (i.e., Always or Most of the time) with which they were involved in improving work organisation or work processes and the frequency of their ability to innovate and apply their own ideas in and through their work. Table 5 shows the frequency with which workers were involved in workplace innovations and indications of high levels of engagement in bringing about change in the workplace. For France and Italy, worker engagement is still strong across the age groupings and highest for "Able to apply own ideas in work"—supported by affordances in the workplace.

These data indicate that rather than being liabilities who are unable to learn and respond to new challenges, working-age adults of all age categories participate in those activities and those aged over 45 are still both bringing about changes in work settings and being innovative in and through their work. All of the analysis then leads the discussion to how these more general findings on workplace discretion, learning, problem-solving and participating in work activities relate to competence with contemporary technologies, including electronically mediated processes and artefacts that are reshaping all kinds of work settings. So, it is helpful to gauge the frequency with which these workers engage with and use electronic technologies.

Table 5. Workplace affordances—engagement (innovation) by age group—France and Italy.

Statements	Age	Always + Most of the Time (%)	
		France	Italy
Involved in improving work organisation or work processes	≤24	37.5	33.0
	25–34	55.4	38.0
	35–44	54.6	46.7
	45–54	57.4	41.9
	55+	53.2	42.2
Able to apply own ideas at work	≤24	43.3	29.6
	25–34	61.0	35.4
	35–44	61.1	45.9
	45–54	61.8	42.7
	55+	57.9	47.0

3.1.6. ICT Competences

In the PIAAC survey (OECD, 2024), ICT skills for work are assessed through items on the use of digital technologies for tasks such as communication and information access, as well as the use of various applications, including spreadsheets, word processors, specialised software, and programming languages. These skills are measured based on workers' self-reported frequency of use, as shown in Table 6. This provides insights into how often and in what ways working-age adults engage with digital tools and technologies. Presented in Table 6 are a series of responses to those measures. This table indicates the combined frequency with which informants from all four countries reported utilising these skills At least once a week or Every day.

Table 6. ICT skills for work by age group.

Statements	Age	At Least Once a Week + Every Day (%)			
		France	Germany	Italy	Switzerland
Communicate with others	≤24	73.8	41.0	75.1	86.4
	25–34	89.6	88.2	80.9	95.3
	35–44	89.7	87.8	86.0	95.1
	45–54	87.4	91.0	87.4	95.0
	55+	87.0	86.6	88.6	93.8
Access information	≤24	77.8	82.2	67.5	83.2
	25–34	90.2	89.5	74.2	94.0
	35–44	89.3	87.9	78.8	93.8
	45–54	86.5	88.3	78.0	93.2
	55+	84.7	86.4	80.7	89.9
Create electronic documents, spreadsheets or presentations	≤24	52.6	48.9	46.9	57.4
	25–34	71.1	70.8	55.9	79.0
	35–44	65.9	66.4	59.0	76.2
	45–54	63.4	65.1	58.9	73.2
	55+	56.5	58.0	57.0	65.4
Use specialised software	≤24	54.6	44.0	38.5	57.6
	25–34	60.9	51.8	39.1	69.8
	35–44	58.6	50.6	38.6	69.4
	45–54	55.2	51.1	38.2	66.2
	55+	47.7	41.0	36.4	57.4

Table 6. *Cont.*

Statements	Age	At Least Once a Week + Every Day (%)			
		France	Germany	Italy	Switzerland
Programming language	≤24	7.9	8.3	11.4	8.5
	25–34	11.0	10.7	13.8	10.7
	35–44	9.4	6.4	11.9	8.1
	45–54	7.4	6.9	12.4	6.8
	55+	4.9	4.1	10.1	4.7

Overall, there is a slight decline in workers' reports of their use of technologies, but there are still relatively high levels of engagement in activities that require ICT competence for the 45+ population in all aspects of digital utility across all four countries. Interestingly, their level of engagement is higher than the <24 group in the use of digital technologies to communicate with others, assess information, and create electronic documents, spreadsheets or presentations. So, the analyses of these data point to the use of ICT processes as being exercised across the age categories of workers in these four countries.

4. Implications for Policy and Practice

Across measures of discretion, learning, problem-solving, support and innovation, the PIAAC data indicates that, whilst often a little less than younger workers, those over 45 (i.e., older workers) continue to be afforded opportunities in work settings and are able to exercise agency and further develop their capacities. So, age alone is not the key determinant in how workers aged over 45 can come to engage in work, participate in workplace innovation, problem-solve and learn. The key point here is that these tasks in contemporary work would have necessarily engaged these informants in the use of technologies, which are often seen as being beyond the capacities of older workers to learn and utilise. All of this reinforces evidence that older workers can work effectively, learning and innovating in and through their work. These findings question societal sentiments that view older workers as being less capable of these activities. But, as with any new kind of learning, there would be the need for support and guidance, regardless of age, because discovery efforts alone may be insufficient.

Thus, it is essential to understand the diverse needs, readiness and goals of older workers and design CET provisions accordingly. First, assessing readiness is a critical starting point for any intentional educational experience. For example, programmes that suit those in their 50s might not be appropriate for those in their 70s. Second, alignment between workers' preferences and CET offerings, as well as their accessibility (e.g., dialogue forums) must be evaluated. Third, approaches should account for older workers' need to balance family, work, and study commitments. Fourth, mechanisms for recognising prior learning, granting credit, and enabling progression beyond CET programmes need to be explicit and seamless. Importantly, CET provisions should not be limited to educational institutions but also include initiatives within community or workplace settings.

Given the enduring societal sentiment privileging youth over age, older workers may well have to exercise greater agency in maintaining their workplace competence (i.e., their epistemological agency). They will need to develop an effective personal epistemology as a bulwark against both societal sentiments and brute facts of ageing. Here, the development of active personal epistemologies includes how individuals' ways of knowing and acting arise from their earlier experiences and negotiations with the social and brute world across their life histories. These epistemologies are required to be exercised agentially to compensate for the limitations of affordances from the social world. So, there is an

emphasis on older workers as individuals in all of this and how they construe, construct and exercise their knowledge.

5. Conclusions

Taking a cognitive and cultural psychological orientation, this paper has provided a review and discussion of existing research associated with adults and, in particular, older workers' learning, including that associated with new technologies, through everyday educative experiences. The concept 'educative experiences' coined by the philosopher Dewey (1938) has been re-defined and developed through published empirical work (Billett, 2023), which forms part of the discussion in this paper, with that explanation is illustrated and elaborated through referencing the PIAAC data. The evidence suggests that in contrast with societal sentiments that privilege youth over age, workers aged 45+ report exercising discretion, learning, problem-solving and innovating in ways required for contemporary work performance, including those associated with their engagement and competence with new technologies. Consequently, related initiatives could include

- (i) Revising or reducing the emphasis on current classifications of "older workers" to better reflect the diverse needs of individuals aged roughly 45 to 70;
- (ii) Exploring ways and practices in which workplace environments, government policies, and workers themselves can enable longer, more productive careers for those aged 45 and above.

It is also essential to account for nation-specific factors, such as generational differences in education levels, legacy of age-based pay structures, patterns of occupational participation, and variations in employer support.

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