

Psychosocial Approach of Skills Obsolescence in Older Workers: Contribution of Methodological Triangulation

Florence Cros^(✉), Marc-Eric Bobillier Chaumon, and Bruno Cuvillier

Laboratoire GRePS, Université Lumière Lyon 2, 5 Avenue Pierre Mendès
France, 69500 Bron, France

{Florence.Cros, Marc-Eric.Bobillier-Chaumon,
Bruno.Cuvillier}@univ-lyon2.fr

Abstract. Information and Communication Technologies have spread rapidly these last decades. The employment sphere has not been unaffected by these technological developments. One of the greatest risks of computerization is the rise of inequalities between two kinds of workers: those who have knowledge, an easy practice of ICT and those who do not. Older workers constitute a major part of this second kind of workers. They represent a group that is disadvantaged by technological developments. How may the widespread use of ICT in the workplace impact on older workers' activity? In attempting to answer this question, we will focus on the notion of skills obsolescence. The aim of this article is to focus on methodological triangulation to understand the dynamic construction of skills.

Keywords: ICT · Older workers · Skills obsolescence · Methodological triangulation

1 Introduction

Current society is characterized by two major facts. First, since the 2000s, in France, demographic development heads towards a massive aging of population. Indeed, a better access to health care and quality of life leads to an increase in life expectancy [1]. The main consequence on the professional sphere is the necessity of extending people's working lives. Second, Information and Communication Technologies (ICT), implemented in most of companies' services [2], aim to augment productivity: they are expected to make companies more efficient and competitive. ICT require new professional demands [3], practices and skills [4]. However, this demographic observation leads researchers to question relationships between work, aging and ICT. Studies reveal that older workers are disadvantaged when using ICT in the workplace [5–7]. In spite of the available resources, older workers would not be efficient with ICT [8]. Another well-known result refers to older workers' ability to learn. These different facts and stereotypes bring about questioning on the notion of skills obsolescence. It would be a major risk for workers, including older people whose skills have been weakened.

To sum up, the aim of this paper is to bring a psychosocial view on skills obsolescence. Indeed, it would be relevant to consider older workers real activity to bring a new light to this notion, with mainly studies in the field of economics. For this research, we set up various qualitative methods that will allow us to access working situations, in their social, cultural and historical dimensions. Thanks to this methodological triangulation approach, we will try to see if it is really possible to talk about skills obsolescence in the case of older workers activity. If necessary, does a transfer of skills exist between younger and older workers?

2 Aging, ICT and Skills Obsolescence

2.1 Main Characteristics of Aging

Usually, aging is associated with weakening, loss and an ineluctable involution of cognitive and physical performances. This pessimistic perspective presents a deterioration of the individual's different functional abilities (sensory, cognitive, breathing...). In its biological aspect, aging is defined as the degradation of cells functioning. This diffuse and uninterrupted phenomenon [9] manifests itself as a set of stable, abrupt and ineluctable conditions. This slow degradation causes a restriction of human functioning and more precisely of cognitive performances [10]. This decline of cognitive performances influences information processing and especially the ability to inhibit information [11]. Therefore, the capacity to realize produce relevant and coherent complex tasks is limited [12]. This phenomenon reduces a person's resistance and adaptability facing context pressures. However human organism components are not subject to the similar laws. Temporal evolution differs and the body development by cell multiplication provokes an important inter-individual variability, which explains why at the beginning decline is imperceptible. Such changes become detectable at the age of 40/45 and are obvious at 60. Concurrently to these biological phenomena, the individual will develop skills, automatic reflexes and experience [12]. Whenever the situation makes it possible adjustments enable individual to offset, even slow down, the effects of aging. American developmental psychologists supported this perspective and developed the *lifespan developmental psychology* [13]. Conceptual changing occurs with the notion of development: according to these authors, development goes on even during adulthood. In conclusion, aging is defined as a nonlinear developmental process. It results from an immutable interaction between cultural and biological dimensions [14].

2.2 ICT Effects on Older Workers Activity

ICT are considered as a factor of performance, modernity, progress and growth. They have submerged the various professionals' spheres [2, 15]. Beyond its economical functions, ICT show a potential to improve working conditions and well-being at work by extending human capacities [16]. This optimistic vision, related to new work modalities, is balanced by a pessimistic vision, related to a loss of autonomy and flexibility [17]. Indeed, ICT implementation has disrupted work organizations and constantly requires developing new flexible and innovative professional practices

[4, 18, 19]. Consequently, workers have to adapt their skills [20]. If new ICT do not require specific skills, workers become machine-operators who only have to press a button. He is subjected to a devaluation of qualifications [17]. This is how ICT may also have deleterious effects on workers especially already weakened ones. Indeed, many studies notice the diminution of adaptation abilities of older workers [21]. Beyond the use of ICT, it may appear that organizational changes, inducted by recurrent developments, constitute a threat for the oldest workers [22]. In spite of available resources, implementation of ICT leads older workers to a major negative shock [6–8]. Therefore, qualifications suffer from an “encapsulation phenomenon” [23] and would not protect older workers anymore [8]. This phenomenon causes information to be segregated in particular areas. Skillfulness requirement also reconsiders older worker’s experience [24], which gives them expertise, an advantage compared to flexibility.

All of these analyses show that the risk of skills obsolescence appears to be major among older workers. Continual modification resulted in rapid ICT evolutions, which increased this risk. Workers have to constantly update their skills and knowledge to remain employable [25]. Skills obsolescence is generally associated to deficiency and decrease of human capital. This notion is defined in 1975 [26] « *as negative changes in capital values that are solely a function of chronological time. Obsolescence occurs because stocks of knowledge available to society change from time to time* » (p. 199). Therefore, obsolescence is not only due to aging, innovations also contribute to this process. Two main types of obsolescence have already been distinguished [27, 28]: technical and economic. Technical skills obsolescence refers to the deterioration of physical and cognitive skills associated to disease, weakening or aging. Economic skills obsolescence manifests itself as irrelevance of previously required skills, which lost their market value. Mainly studied in the field of economics, skills obsolescence is evaluated by various methods. Four main methods have been observed [27]. Among these, authors tell the difference between direct and indirect methods. On one hand, direct methods refer to tests and questionnaires [29]. On the other hand, indirect methods aim for productivity measure [28] and probability to be taken out of the workforce. Even if these measures are robust, they do not allow us understanding the dynamic interaction between older workers and ICT. Moreover, the probability to remain employed in spite of skills obsolescence cannot be appreciated.

3 Research Question

As we have seen above, aging is a complex phenomenon that involves interactions between biological and cultural dimensions. These characteristics’ main effect is to increase inter-individual variability. ICT developments and its various repercussions accentuate older workers’ difficulties. As soon as problems occurred, employment retention was threatened. However, it is made possible by skills development. However, the risk of skills obsolescence is considerable, in particular for weakened people such as older workers. Similarly, many studies have shown that aging increases the risk of obsolescence. Developmental approach of aging leads us to question which methods and models should be used to evaluate skills obsolescence. As a result of its biological

and cultural dimensions, aging is a dynamic process. This means that older workers' behavior does not only depend on intrinsic capacities. These workers also take into consideration environment's features, which influence the way they act. This psychosocial approach of older workers defines each individual based on his capacities, cultural affiliations, norms and the role he has in society. So, in this psychosocial perspective, we can formulate our research question as follows: how can we understand the construction of skills obsolescence during older workers' actual activity? This study will focus on the case of train dispatchers to determine whether they are affected by skills obsolescence. Moreover, we will interest in the conditions that enable older workers to continue to work with ICT.

Concerning the model used to give us some elements of answer: activity models developed by Russian psychologists in 1920s appear to be relevant. One of the principal contributions of activity theories is related to the role and place of the individual who is considered as an actor, situated in the social, cultural and historical context of fulfillment of his activity. In line with Vygotski, Leontiev and Luria's research, Engeström [30] developed the "activity system model" or "Engeström's triangle" (see Fig. 1.). Based on Leontiev's notion of activity, Engeström adds a social and collective dimension to the subject-object-instrument relation. According to this model, a permanent and dynamic process of development characterizes activity, which is not limited to a space-time frame. Aiming to understand the developmental perspective of activity, Engeström emphasizes on dialectical contradictions, which he considers as the potential developmental origins of both activity and individual.

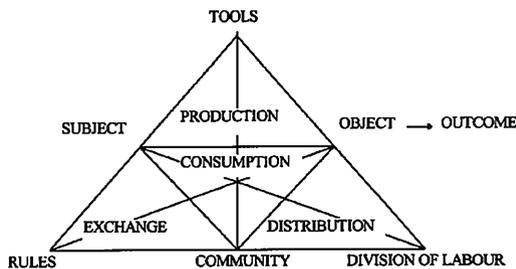


Fig. 1. The basic structure of human activity (Engeström, 1987, p. 78)

4 Methodology

4.1 Context of the Study

The current demographic context leads French companies to wonder about older workers. Our study focuses on the case of the French railway company, which deals with this situation in an intergenerational cooperation perspective. Moreover, massive and continual deployment of ICT defines this company as an innovative one.

More precisely, this research (*currently under development*) concentrates on train dispatchers and ticket inspectors. In this paper, we will focus on train dispatchers.

These agents' profession is about making sure that the train traffic is safe in the area. The underlying objective to this activity is to avoid incident. For this purpose, their work is based on knowing a set of very precise security rules. Agents do not have any room for maneuver, which reduces with successive technical evolutions. We observe that three ways to fulfill the required tasks are identified. The first consists in train shunting. An agent is on the rails and turns the point to run the train. His or her job designation is pointsman. The second way is automated shunting. In this case, agent is situated in the signal box and has to press buttons to open railroad crossing and allow train traffic. A certain number of railroad stations are still fitted with these two systems in France. Finally, computerized shunting has been implemented in the earliest 2000s. Train dispatchers have to enter codes, called "dialogs", to realize inherent tasks of train traffic. Using this system makes the work more complex but the physical load of the profession has significantly reduced.

Therefore, we can see that technical developments lead to many changes in the profession. Both naming and contents have evolved.

During our observations, we noticed that agents use four different tools. All of them belong to computerized shunting. The perimeter extends on three other railroad stations, which are operated by remote control. Each tool has a particular function and completes the others to insure the safety of the traffic. Agents must have to successively juggle with these tools. The first one is an assistance computer. It allows agents to see the time departure of trains in railroad stations on the two ends of the line. Another computer enables agents to deal with a remote control station. To manage two remote control stations and the one they are located in, agents use three other computers that are equipped with system more recent than the other one. Finally, a computer enables agents to enter stops, departures and arrivals of trains. Using these tools, agents have an overall view of the traffic coming from and to their area. Once the train goes inside the area, it can be accurately located. This way, agents may anticipate the opening of signals to make the traffic easier.

Concerning our study's population, it is constituted with six train dispatchers, a unit director and a manager. The six agents work in two different railroad stations that are similar in term of functioning. All of them are men and aged from 25 to 55. The choice to question a unit director and a manager is related to complement agents' profession view.

4.2 Description of the Methodological Triangulation

Many authors have already proved the contribution of methodological triangulation in social sciences [31]. Described as "methods crossing" [32] rather than merely juxtaposition, triangulation enables researchers to understand the complexity of work situations. The various methods used lead to a certain level of quality and subtlety for data. Triangulation confers qualitative methods scientific validity and, *in fine*, precision, spread and depth [33]. Consequently, the originality of our study can be found in the choice of methods that we will make triangulate. The objective is to combine prescribed work and real work.

Research process has been thought in three phases. During each of them, we use different methods.

The first consists in the meeting with train dispatchers. *Semi-structured interview* seems to be the most relevant to get to know well agents. This type of interview has been chosen thanks to the possibility it opens about what thematic to broach. The second decisive element in this choice is the freedom offered to the interviewee. Topics proposed deal with agent's career path, profession, difficulties and ICT connections. Finally, this interview enables researcher to access to prescribed work.

Direct observation of activity and *verbalizations* [34] are at the heart of the second phase. The interests of these methods combination can be found in the access offered to the two parts of activity. On one hand, what is observable in activity and, on the other hand, a part of mental activity leading to tasks realization. Researcher gave agents instructions: he had to do his job as usual and if he wanted, he could clarify what he was doing-. Beforehand, we checked the possibility to interrupt his activity to ask about some actions or points that seemed relevant. These verbalizations are respectively called simultaneous and interrupting. Therefore, real activity of agents, that means what they really do in their work, is understood thanks to these three methods.

Finally, the last phase corresponds to *clarifying interview technique* [35]. It aims to lead the individual to conceptualize his actions. However, conceptualization is not an immediate process; this type of interview assists the individual in awareness. At this moment, he is in an "invocation situation". This enables him to access to implicit dimensions relative to a pre-reflective level. Clarifying techniques allow researcher to understand reasons and meanings of actions and make them comprehensible. More precisely, a few days after observations, we met agents again. We suggested discussing about some situations previously chosen. The selection was made regarding some relevant standards and interests compared to the research question. In this case, we focused on some tasks that involved distinct ways of doing according to agents. These situations could reflect technical, practical or theoretical expertise. They also referred to different types of incident. For example, it could be lateness, an opening of railroad crossing that failed or even point's dysfunction because of the frost.

5 Expected Results

5.1 Main Expectations

In a general way, the objective of this study is to understand the development of older workers' activity, using ICT. This study's expectations are positioned at different levels. Firstly, analysis of data should allow us to identify skills involved in activity. Thanks to the crossing of methods, we will determinate three types of skills: prescribed skills, skills we think we have and real skills applied. The first goal is related to an individual perspective. Secondly, we aim to observe in what way the use of the computerized system does not only depend on the agent, but also on interactions he may have with other individuals in the company. This is a more collective perspective. Finally, the third level is related to the impact using a computerized system on the agent's experience. It refers to a developmental dimension. These expectations should be fulfilled by the methods we use in triangulation.

5.2 First Analyzes

We can add some reflections based on the first analyzes made on the collected data. Firstly, the objective of this research is to understand how skills obsolescence builds up. This developmental approach leads us to consider the older worker as an actor of his working situation. Aging is not intrinsically endured; it is the product of a continual interaction between biological and cultural components.

Older workers may have at their disposal resources that enable them to work in ICT-reliant environments. Considering older worker real activity, can we talk about skills obsolescence? If not, what are the conditions that enable them to be skillful in their profession, including through the use of ICT?

In spite of technical changes and aging, preliminary analyzes suggest a lack of skills obsolescence. Two main dimensions appear to be relevant conditions to prevent this process. Firstly, intergenerational cooperation is shown in a collective activity form. It will lead us to explore more fully the role of the collective dimension in skills development. The second factor refers to an abstract notion: “due course”. This subjective characteristic defines the good time to enter dialogs to enable train traffic. Differences observed between train dispatchers show in what way experience and sense of activity is important in skills development.

As a consequence, these two dimensions seem to enable older workers to remain employed in these ICT-reliant working situations. It must be noted that these results emerged from preliminary analyzes. Confirmation of these results will depend on finalization of data collection and an extensive analysis.

Intergenerational Cooperation. The first element that seems favorable towards skills development is *intergenerational cooperation*. Few indicators have been noticed during observations in railroad stations. The oldest workers know practical skills thoroughly while the youngest ones have theoretical skills, which are related to absolutely necessary and rigorous safety rules. Experiential knowledge, mainly possessed by older workers, refers to technical and complex cases. Moreover, we observed that the oldest also possess theoretical skills. However, their ways of doing are more often based on their experience than on safety rules. Indeed, during a complex situation, Mr. H., aged 55, had to regulate train traffic because of a delay. Therefore, he must enter the correct dialogs to enable trains to cross each other. MR. H.’s verbalizations indicated that the situation was problematic. There is a negligible risk of incident. He adds he already had to face this case a long time ago. We assumed that he possesses the solution to the problem. Mr. D., aged 39, interrupted his older colleague’s action by saying “*are you sure of this?*” and checked security rules before approving his colleague’s decision. Therefore, the skills necessary to traffic system’s use seem to depend on an interaction between practical and theoretical dimensions. We can observe that the knowledge of context variables is not sufficient for actions. The skills acquisition related to the use of traffic system depends on interaction between these two dimensions. We could say that a collective organization allows workers - young and older – to become more skillful. On one hand, older worker’s skills are accentuated and approved by current safety rules; on the other hand, younger worker’s skills are expanded and illustrated by a real situation. Skills are constructed during the use of this

technological traffic system. More precisely, collective skills [36] seem to take a major role in the efficient use of the system. It would be relevant to look into collective skills in depth in our further analyzes.

Do the Things in “Due Course”. The second piece of information that tends towards a lack of skills obsolescence is the notion “due course”. Indeed, various ways of doing have been observed during computerized traffic system’s uses. The expedient moment to enter a dialog in the system is the origin of these differences. That is why we observed three main ways to proceed. First, certain agents entered dialogs gradually. Second, others got the dialogs ready and confirmed in “due course”. Finally, some of them pre-empted by entering dialogs in a period of time considerably superior to trains arrivals. This notion of “due course” emerged during interruptive verbalizations. We aim to extend our understanding of this notion thanks to clarifying interview techniques. The definition of this notion is different for each train dispatcher. It comes under a subjective reading of security rules. Indeed, agents explained that these rules only prescribe to enable train traffic. Being skillful in this profession means to be able to line up a train without incident. This involves opening signals at the good moment, allowing trains to cross each other, inserting delays in traffic ... Since situations are complex and variable, the expedient moment will be different, depending on the agent’s interpretation of the situation.

For the most part of older workers, dialogs are entered gradually. According to Mr. D, aged 52: “this way of doing allow us to avoid providing a safety procedure in case of incident”. On the contrary, younger workers’ practices depend on two modalities. The first one refers to an anticipated input of dialogs. In this case, the validation is done only few seconds before train passage. The second corresponds to the complete input during a specific timeframe. This method is used more often when there is not much traffic. As Mr. C., aged 29 explains: “It is 3 PM o’clock, I enter until 5 PM o’clock like that I can work on other things”.

Rooms for maneuver given by the safety rules allow worker to develop appropriate skills to achieve their activity. Their ways of doing will depend on the knowledge that one specific agent has of the system and variables of the situation. These ones are not stuck in time; they progress thanks to their room of maneuver. From these observations, we highlighted the interest of the “due course” notion. Some authors studied the role of these entities that allow professional activities to be effectively organized. They are called “pragmatical concept” [37]. It would be interesting to question more precisely the role of this concept in older workers’ skills development in further analyzes.

References

1. United Nations, Department of Economic and Social Affairs. <http://esa.un.org/wpp/>
2. Bobillier Chaumon, M.E.: Evolutions Techniques et Mutations du Travail: Emergence de Nouveaux Modèles d’Activité. *Le Travail Humain* **66**, 163–194 (2003)
3. Vacherand-Revel, J.: Preface. In: Vacherand-Revel, J., Dubois, M., Bobillier Chaumon, M.E., Kouabenan, D.R., Sarnin, P. (eds.) *Nouvelles Pratiques de Travail: Innovations Technologiques, Changements Organisationnels*, pp. 7–10. L’Harmattan, Paris (2014)

4. Aubert, P., Caroli, E., Roger, M.: New technologies, organization and age: firm-level evidence. *Econ. J.* **116**, 73–93 (2006)
5. Caroli, E.: Internal versus external labor flexibility: the role of knowledge codification. *Nat. Inst. Econ. Rev.* **201**, 107–118 (2007)
6. Daveri, F., Maliranta, M.: Age, Technology and Labour costs. Discussion Paper, 1010, The Research Institute of the Finnish Economy (2006)
7. Friedberg, L.: The impact of technological change on older workers: evidence from data on computer use. *Ind. Lab. Relat. Rev.* **56**, 89–120 (2003)
8. Czaja, S., Sharit, J.: Age differences in the performance of computer based knowledge, personality and motives. In: Cooper, C.L., Robertson, I.T. (eds.) *International Review of Industrial and Organizational Psychology*, vol. 16, pp. 1–36. Wiley, Chichester (1993)
9. Millanvoye, M.: Le Vieillessement de l'Organisme avant 60 ans. In: Marquié, J.C., Paumès, D., Volkoff, S. (eds.) *Le Travail au Fil de l'Âge*, pp. 175–209. Octarès, Toulouse (1995)
10. Salthouse, T.A.: What and when of cognitive aging. *Cur. Dir. Psychol. Sci.* **13**, 140–144 (2003)
11. Hasher, L., Zacks, R.T.: Working memory, comprehension and aging: a review and a new view. In: Bower, G.H. (ed.) *The Psychology of Learning and Motivation*, pp. 193–226. Academic, New York (1988)
12. Welford, A.T.: Changes of performance with age : an overview. In: Charness, N. (ed.) *Aging and Human Performance*, pp. 333–369. Wiley, New York (1995)
13. Goulet, L.R., Baltes, P.B.: *Life-span Developmental Psychology: Research and Theory*. Academic Press, New York (1970)
14. Lecerf, T., de Ribaupierre, A., Fagot, D., Dirk, J.: *Psychologie Développementale du Lifespan : Théories, Méthodes et Résultats dans le Domaine Cognitif*. Gerontologie et Société. **123**, 85–107 (2007)
15. CAS: *L'Impact des TIC sur les Conditions de Travail*. La Documentation Française, Paris (2012)
16. Oosterlaken, I.: Design for development: a capability approach. *Design Issues* **25**, 91102 (2009)
17. Vendramin, P., Valenduc, G.: *Technologies et Flexibilité. Les Défis du Travail à l'Ere du Numérique*. Liaisons, Paris (2002)
18. Caroli, E.: *New Technologies, Organizational Change and the Skill Bias: What Do We Know?* Economics Paper from University Paris Dauphiné (2001)
19. Greenan, N.: Organisational change, technology, employment and skills: an empirical study of french manufacturing. *Camb. J. Econ.* **27**, 287–316 (2003)
20. Marquié, J.C., Thon, B., Baracat, B.: Age influence on attitudes of office workers faced with new computerized technologies. *App. Ergon.* **25**, 130–142 (1994)
21. Teiger, C.: *Penser les Relations Âge / Travail au Cours du Temps*. In: Marquié, J.C., Paumès, D., Volkoff, S. (eds.) *Le Travail au Fil de l'Âge*, pp. 15–72. Octarès, Toulouse (1995)
22. Molinié, A.F., Gaudart, C., Pueyo, V.: *La Vie Professionnelle: Âge Experience et Santé à l'Epreuve des Conditions de Travail*. Octarès, Toulouse (2012)
23. Rybash, J.M., Hoyer, W.J., Roodin, P.A.: *Adult Cognition and Aging*. Pergamon, New York (1986)
24. Volkoff, S., Molinié, A.F., Jolivet, A.: *Efficaces à Tout Âge? Vieillessement Démographique et Activités de Travail*. Centre d'Etudes de l'Emploi, Paris (2000)
25. Pazy, A.: Updating in Response to the Experience of Lacking Knowledge. *App. Psychol.* **53**, 436–452 (2004)
26. Rosen, S.: Measuring the obsolescence of knowledge. In: Thomas Juster, F. (eds.) *Education, Income and Human Behavior*. pp. 199–232. McGraw Hill, New York (1975)

27. De Grip, A., Van Loo, J.: The economics of skills obsolescence: a review. In: De Grip, A., van Loo, J., Mayhew, K. (eds.) *The Economics of Skills Obsolescence. Research in Labor Economics*, vol. 21, pp. 1–26. JAI Press (2002)
28. Neuman, S., Weiss, A.: On the effects of schooling vintage on experience-earnings profiles: theory and evidence. *Eur. Econ. Rev.* **39**, 943–955 (1995)
29. Van Loo, J., De Grip, A., De Steur, M.: Skills obsolescence, causes and cures. *Int. J. Manpower* **22**, 121–137 (2001)
30. Engeström, Y.: *Learning by expanding: an activity theoretical approach to developmental research*. Orienta-Konsultit, Helsinki (1987)
31. Leplat, J.: De l'Etude de Cas à l'Analyse de l'Activité. *Pistes* **4**, 2 (2002)
32. Yin, R.K.: *Case Study Research. Design and Methods*, 2nd edn. Sage Publications, London (1994)
33. Denzin, N.K., Lincoln, Y.S.: *Collecting and Interpreting Qualitative Material*. Sage, Thousand Oaks (1998)
34. Newell, A., Simon, H.: *Human Problem Solving*. Prentice-Hall, Englewood Cliffs (1972)
35. Vermersch, P.: *L'entretien d'explicitation*. ESF, Paris (1994)
36. Montmollin, de M.: *Sur le Travail. Choix de Textes (1967-1997)*. Editions Octarès, Toulouse (1997)
37. Samurçay, R., Pastré, P.: La Conceptualisation des Situations de Travail dans la Formation des Compétences. *Éducation Permanente*. **123**, 13–31 (1995)