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Tamilina, Larysa

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Explaining human capital composition and formation mechanisms: a new conceptual  
framework of analysis<sup>1</sup>

Larysa Tamilina

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Correspondence concerning this paper should be addressed to  
larysa.tamilina@zu.de

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## **Abstract**

This paper summarizes the existing definitions of human capital from theoretical debates and empirical surveys and argues for the need to revise how human capital composition and formation processes are currently understood. A new framework is introduced to present human capital as a complex phenomenon consisting of five main elements: genetics, personality, motivation, knowledge, and skills. According to this conceptual framework, knowledge and skill formation both occur through learning and being exposed to challenging work environments.

**Key words:** human capital, knowledge formation, skill acquisition, human capital formation process

## Explaining human capital composition and formation mechanisms: a new conceptual framework of analysis

This paper reviews the existing approaches for defining and measuring human capital in order to formulate a comprehensive framework that explains human capital composition and formation mechanisms. It consists of three sections and is organized as follows. The first section reviews the theoretical definitions of human capital. The second part analyzes the approaches to operationalizing human capital, as conventionally used in surveys. The final section introduces a new framework for human capital formation by integrating the existing definitions and linking them to the set of operationalizations produced by relevant surveys.

### **Conventional definitions of human capital**

While the role of human capital in an individual's or a country's achievements is widely recognized (Keeley, 2007; Lanzi, 2007; Lee et al., 2010; Messinis & Ahmed, 2009; Roy, 1951; Spitz-Oener, 2006), there is no consensus among social scientists about its exact meaning. Studies usually employ various concepts such as knowledge, skills, or competencies to describe human capital. The terms are often used interchangeably, leading to confusion in this research field. Overall, one can distinguish between broad and narrow approaches to conceptualizing human capital that form two strands. The broad definition is usually used in theoretical studies, while the narrow one is mainly utilized in empirical research.

According to the first strand, human capital is viewed as the capabilities of an organization's employees and managers that are relevant to their tasks, as well as their

capacity to continually add to this reservoir of knowledge, skills, and experiences through individual learning (Dess & Picken, 1999). The structure of human capital is believed to consist of eight highly interdependent elements: (1) motor skills, (2) information gathering skills, (3) information processing skills, (4) communication skills, (5) experience, (6) knowledge, (7) social skills, and (8) values, beliefs, and attitudes. These elements are not of equal importance in the work environment, with the relative role of each depending on the nature and requirements of the task to be completed. They also cannot be managed and developed in the same manner. The first four: motor skills, information gathering, information processing, and communication skills are often task-specific and can usually be enhanced or redirected through education, training, and practice (Dess & Picken, 1999). The remaining groups are considered to be rather generic. They are expected to broadly influence employees' judgment, decision-making, and social behavior, regardless of the specific job requirements, and reflect more general characteristics that were developed over long periods of time both in the workplace and in other settings (Dess & Picken, 1999).

Drawn on the broad approach, the Organization for Economic Cooperation and Development (OECD, 2001) defines human capital as, "the knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic wellbeing." This definition is further extended to include non-economic benefits, such as health conditions, longer life-spans, better lifestyles, and a higher subjective well-being (Liu, 2011). In addition, skills are viewed as a multi-dimensional construct consisting of a set of abilities, such as (1) communication (listening, speaking, reading, writing), (2) numeracy, (3) intra-personal skills (motivation/perseverance, learning to learn and self-discipline, capacity to make judgments based on a relevant set of ethical values and goals in life), (4) inter-personal

skills (teamwork, leadership), (5) other skills and attributes (facility in using information and communication technology, tacit knowledge, problem-solving, physical attributes, and dexterity). The literature emphasizes that all of these elements are interdependent to some extent.

A slightly different definition was developed by European Union institutions. While constructing a European Qualification Framework that facilitates the comparison of qualifications across member-states, the EU conceptualized human capital as consisting of three elements: knowledge, skills, and competences. Knowledge is herein described as theoretical and/or factual information possessed by an individual. Skills are described as cognitive (involving the use of logical, intuitive, and creative thinking) and practical (involving manual dexterity and the use of methods, tools, and instruments). Competences, in turn, are limited to an individual's behavioral features such as responsibility and autonomy.

The second strand isolates skills from the collective human capital term and uses them as an adequate alternative. Skills are usually defined as an ability to perform certain tasks. Again, there are many approaches to classifying skills. The simplest one presupposes the existence of only two broad types of skills: generic and occupation-specific, for instance. Generic skills are described as skills that can be used in many occupations and can be further divided into cognitive and non-cognitive. By contrast, occupation-specific skills encompass skills that can be used or performed in only one or a few occupations or occupational groups (Zuckersteinova et al., 2012).

An alternative classification proposes to distinguish between hard and soft skills. As in the previous case, there is disagreement over what kind of skills belong in each group (Zuckersteinova et al., 2012). The most conventional approach is to associate soft skills with the ability to carry out interactive tasks, that is, forms of communication or

cooperation, while ascribing the remaining abilities to the group of hard skills (Zukersteinova et al., 2012). Autor et al. (2003) propose another two-group typology that distinguishes between routine and non-routine tasks (juxtaposed with manual and non-manual activities). This approach defines non-routine tasks as tasks for which the rules are not sufficiently well understood to be specified in computer code and executed by machines. The tasks that can be subjected to rules-specification are dubbed as routine.

A more detailed categorization of skills was introduced by Dickerson and Green (2002). By applying a factor analysis to task-related data derived from the British Skills Survey, the authors reduce 35 skills to 10 broad groups. Accordingly, one can describe skills usually used in the workplace as belonging to one of the following categories: (1) literacy (ability to read, write, etc.), (2) physical skills (ability to use physical strength or stamina), (3) number skills (ability to add, subtract, divide, etc.), (4) technical knowhow (knowing how to use or operate equipment, knowing details about products or services, etc.), (5) higher-level communication (ability to persuade or influence others, make speeches, etc.), (6) planning skills (ability to plan or organize your own work or the work of others), (7) client communication (ability to deal with people or sell a product), (8) horizontal communication (ability to teach or train, or work in a team), (9) problem-solving skills (ability to detect, analyze, and solve problems), and (10) checking skills (noticing and checking for errors).

In anticipation of changes in the kinds of skills demanded by the labor market, the European Centre for the Development of Vocational Training (CEDEFOP) proposed an alternative classification of skills. Skills are expected to be reduced to six groups: (1) cognitive (reading, writing, math, problem-solving, ICT, foreign languages), (2) interaction/social (speeches, presentations, persuading, instructing, self-direction,

teamwork, interaction), (3) physical (manual dexterity), (4) learning (new ideas, adapting), (5) green (anti-pollution, and understanding environmental regulations), and (6) self-direction (task discretion) (Zukersteinova et al., 2012).

Overall, there is a wide range of definitions for human capital with differences in how the term is specified and formulated. They all have two major drawbacks, however. The first is that they lack a precise definition of what human capital is and how many elements it consists of. The second is that the existing definitions rarely elaborate on the internal structure of human capital, thereby providing little insight into associations between its different components and preventing an explicit understanding of causal links between them. It is not clear, for instance, whether knowledge is a driving force of skills or vice versa.

### **Measuring human capital**

The confusion concerning the way human capital is defined leads to another problem – the problem of operationalizing human capital constructs. The literature usually distinguishes between two key approaches that approximate individual stocks of knowledge and skills. The first is to use educational attainments as a proxy for human capital, which includes either the number of years an individual spends in formal or regular education (school, vocational training, university, etc.) or the type of educational qualification obtained by a respondent. This is the most common approach in empirical research, but it suffers from several deficiencies. For one, educational records are a poor approximation of what people actually know (OECD, 1998). In addition, most qualifications assess academic competencies, not work-related skills and are therefore unable to measure the kind of skills that are actually used in workplaces (Felstead et al., 2007). Finally, education systems may differ considerably across countries, which



makes it hard to compare educational attainments internationally (Felstead et al., 2007; Zugersteinova et al., 2012).

The second approach deals with the self-assessment of skills through surveys. This method's advantage is that it enables investigating a wide range of skills. Its disadvantage is that responses might be subject to considerable social esteem biases and be prone to measurement error if respondents cannot objectively judge their own abilities (Felstead et al., 2007; Zugersteinova et al., 2012). An alternative approach that attempts to correct the deficiencies of this measurement methodology is to focus on asking people which skills are required in their workplace instead of how good their own skills are. The main disadvantage here is, however, that skills used in jobs may not be equal to skills possessed by the respondent (Felstead et al., 2007). In addition, an individual may not be fully informed about his or her job to objectively report about skills needed or used in the workplace (Felstead et al., 2007).

There are five main surveys utilizing the conventional measurement approaches to human capital:

- (1) The Employer Survey on Skill Needs in Europe (CEDEFOP),
  - (2) The British Skills Survey,
  - (3) The Program for the International Assessment for Adult Competencies (PIAAC),
  - (4) BIBB<sup>2</sup> /BAuA Surveys on Qualifications and Working Conditions (BIBB),
- and
- (5) The Survey of Skills, Technology and Management Practice (STAMP).

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<sup>2</sup> BIBB stands for the Federal Institute for Vocational Education and Training, Germany

To some extent, they overlap in the way questions are formulated to measure skills, but their questionnaires differ in the range of skills covered. A concise overview of the questions is provided in Attachment 1. In trying to capture changes in the labor market's demand for skills, the CEDEFOP conducts an employer-level survey. The information about skills is collected from employers' reports about job requirements, that is, skills that are required in the workplace. The main assumption here is that tasks required by an employer are indicative of skills that must be used and therefore are possessed by an individual (Zukersteinova et al., 2012). The CEDEFOP survey focuses on both kinds of skills: generic and occupation-specific, where generic skills are composed of six types: (1) cognitive (reading, writing, math, problem-solving, ICT, foreign language), (2) interaction/social (speeches/presentations, persuading, instructing, self-direction, teamwork, interaction), (3) physical (manual dexterity), (4) learning (new ideas, adapting), (5) green (anti-pollution tasks, understanding of environmental regulations), and (6) self-direction (task discretion).

The British Skills Survey relies on a similar assumption that skills used in the workplace are indicative of skills possessed by jobholders. Unlike the CEDEFOP, it however provides information from the supply side of skills by asking individuals to estimate the importance of different tasks in their workplace. The range of questions covers the following generic skills: literacy, numeracy, technical knowhow, high-level communication skills, planning skills, client communication skills, horizontal communications skills, problem solving, checking skills, and physical skills, as well as two measures concerning the importance and sophistication of computer use in jobs. Responses are based on a five-point scale from one "not at all important" to five "essential." In addition, measures are obtained for a small number of generic managerial skills.

In line with the British Skills Survey, the PIAAC (PIAAC, 2010) largely focuses on generic skills. While working with the conventional assumption that skills needed for a job are a reasonable proxy for the skills a jobholder has, the survey asks respondents to assess how often they need to deal with certain tasks. In formulating questions, the PIAAC hence shifts the emphasis from the importance of certain skills/tasks in the workplace to the frequency with which the respondent has to utilize particular skills/tasks on their job. The range of skills includes: (1) cognitive skills such as reading, writing, or calculating, (2) instructing, training, or teaching people, individually or in groups, (3) making speeches or giving presentations, (4) selling a product or service, (5) advising people, (6) planning your own activities or the activities of others, (7) organizing one's own time, (8) persuading or influencing people, and (9) negotiating with people either inside or outside of one's company or organization. The responses to these questions are based on a five-point scale ranging from one "never" to five "every day."

The BIBB BAuA Surveys on Qualifications and Working Conditions stands out in their measurement approach to skills by broadening their spectrum of coverage. The survey's questions can be grouped into three categories. The first contains questions about the main job tasks applicable to many occupations. Most items in this group fall under the category of generic tasks. The second refers to questions about job characteristics which can again be compared to questions about generic skills used in the previously mentioned surveys (consulting, negotiating, making speeches, etc.). The third contains questions that collect information about fields or subjects to which a respondent's workplace tasks can be ascribed. As in the case of the PIAAC, the BIBB survey's measurement approach is based on asking respondents about the frequency with which they handle certain tasks in their workplace. It however uses a narrow

measurement scale for responses consisting of only three categories: one “frequently,” two “sometimes,” and three “never.”

Finally, the STAMP focuses on skills and task requirements that are, again, generic. No questions about occupation-specific skills are asked. Unlike previous surveys, the STAMP covers only three categories of skills: cognitive, interpersonal, and physical. The questions are formulated in a way that asks whether or not the respondent has to deal with certain tasks in his or her job.

Overall, the vast majority of surveys use a similar approach to human capital measurement by asking questions about educational attainments and tasks that a respondent has to accomplish at a workplace. The range of tasks overlaps to a great extent. The surveys only slightly differ in how their questions are formulated and in the range of measurement scales that are used for responses.

### **A new framework to model human capital formation mechanisms**

This paper does not attempt to introduce a new definition of human capital. Instead, it aims at combining the already existing approaches in order to provide new insights into human capital composition and formation mechanisms.

As a point of departure, I adopt Romer’s proposition to regard human capital as acquired knowledge and skills of individual workers (Romer, 2006). One can expand this simplistic definition by adding three attributes that, according to both economic and managerial studies, are important determinants of the process of knowledge accumulation or skills acquisition: genetics, personality, and motivation (Mincer, 1997; Mumford et al., 2000). The internal structure of human capital is therefore described along three dimensions: attributes, knowledge, and skills, with attributes including genetic cognitive abilities, personality, and motivation (see Table 1).

Table 1: Human capital categories

<b>Human Capital Components</b>	<b>Definitions</b>	<b>Sources</b>	<b>Potentiality to change</b>	<b>Potentiality to dissociate</b>
<b>Genetic cognitive ability</b>	Genetic/neural structures predefining effectiveness of learning	Innate	Fixed	Non transferable
<b>Motivation</b>	Psychological features predefining an individual's willingness to learn	Innate	Quasi-fixed	Non transferable
<b>Personality</b>	Psychological features predefining an individual's propensity to develop certain skills	Innate	Quasi-fixed	Non transferable
<b>Knowledge</b>	Theoretical principle-based schematic structures containing factual information or conceptual frameworks about processes, procedures, and relationships	Acquired	Changeable/learnable	Transferable
<b>Skills</b>	An ability and capacity acquired through a deliberate and sustained effort to use acquired knowledge in practice for carrying out activities or job functions	Acquired	Changeable/trainable	Transferable

A genetic cognitive ability is defined as a genetic feature that predefines the effectiveness of a learning process. It is assumed to be determined at the moment of conception and hence is a fixed level. Since it is an individual's personal innate attribute, it cannot be dissociated from her or him. Transferring genetic abilities from one individual to another is hence assumed to be impossible.

Motivation is regarded as a psychological feature predefining a person's willingness to learn. Similar to genetic cognitive abilities, it is considered to be an innate property, although it can be influenced by external stimuli to a certain extent (quasi-fixed). Motivation levels are also highly unlikely to be transferred from one individual to another.

Personality can be described as a psychological feature predefining an individual's propensity to develop certain skills. Good examples of such skills can be leadership or communication abilities. An individual's personality is the key part of their mental organization and it is, to a great extent, innate. However, its development can be suppressed or enhanced by external factors, as a result of which its level can be considered quasi-fixed. It is also highly unlikely that one individual's personality can be transferred to another individual.

Knowledge is defined as theoretical principle-based schematic structures containing factual information or conceptual frameworks about processes, procedures, and relationships (Byrnes, 2001). The stock of knowledge is not given but accrues as a result of the learning processes undertaken by an individual. Hence, knowledge is not an innate feature but rather a variable and it can be formed through learning. The distinctive feature of knowledge is that stocks of knowledge can be easily dissociated from the individual and stored outside of their mental structures, which makes knowledge easily transferable from one person to another.

Skills are defined as an ability to use acquired knowledge in practice for performing job-related tasks or carrying out job functions. The definition stresses that skills are not in-born features but rather a result of learning processes and their stock can be changed through practice or training. Skills can also be transferred from one individual to another through observing, demonstrating, and other forms of intentional learning.

Combining information on human capital provided by theoretical debates and surveys may allow the identification of links between its various components. The relationship between the five components of human capital can briefly be described as depicted in Figure 1. Attributes (genetics, motivation, and personality) are expected to

influence the accumulation of knowledge and skills. Skills are also expected to be a function of the stock of knowledge and can hence be generated through learning. One's work experience might further promote or suppress skills formation, depending on the nature of tasks that individuals handle in their workplace and properties of their work environments in which these tasks are performed. The concept of the nature of tasks suggests that a wider range of tasks or a greater complexity of tasks offer individuals more chances to acquire new knowledge and learn new skills in their workplace. The concept of work environments refers to one's workplace flexibility or levels of independence in managing job tasks. Such properties of a workplace should in theory predetermine the intensity of the learning process that occurs through executing job functions.

Figure 1 near here

This approach hence argues that the human capital formation process is a complex phenomenon. It can broadly be modeled as being channeled through two main sources: learning and work circumstances (Autor & Handel, 2009, Gathmann & Schönberg, 2010; Keane & Wolpin, 1997; Mincer, 1997; Todd & Wolpin, 2003; Willis, 1986).

Figure 2 near here

Linking the existing surveys to the model of human capital formation provided above may help identify possible operationalizations for the two sources. Lifelong learning instances can be captured by the conventional questions about an individual's participation in formal, non-formal, and informal learning. One can measure the nature

of tasks in the workplace through task-related questions provided by surveys or through already existing indexes of occupations' complexity levels recently derived from survey data on tasks (Autor & Handel, 2009; Becker et al., 2009; Gathmann & Schönberg, 2010; Kampelmann & Rycx, 2010; Robinson, 2010). Finally, many surveys offer a wide range of questions that attempt to capture properties of work environments, such as workplace flexibility, the modes of workplace task organization or levels of independence in managing job tasks.

### **Conclusion**

The paper therefore argues that human capital is a complex phenomenon and consists of five main elements: genetics, personality, motivation, knowledge, and skills. Its formation occurs both through learning and one's exposure to challenging work environments. The existing surveys can be utilized to measure each dimension of the human capital formation mechanism.



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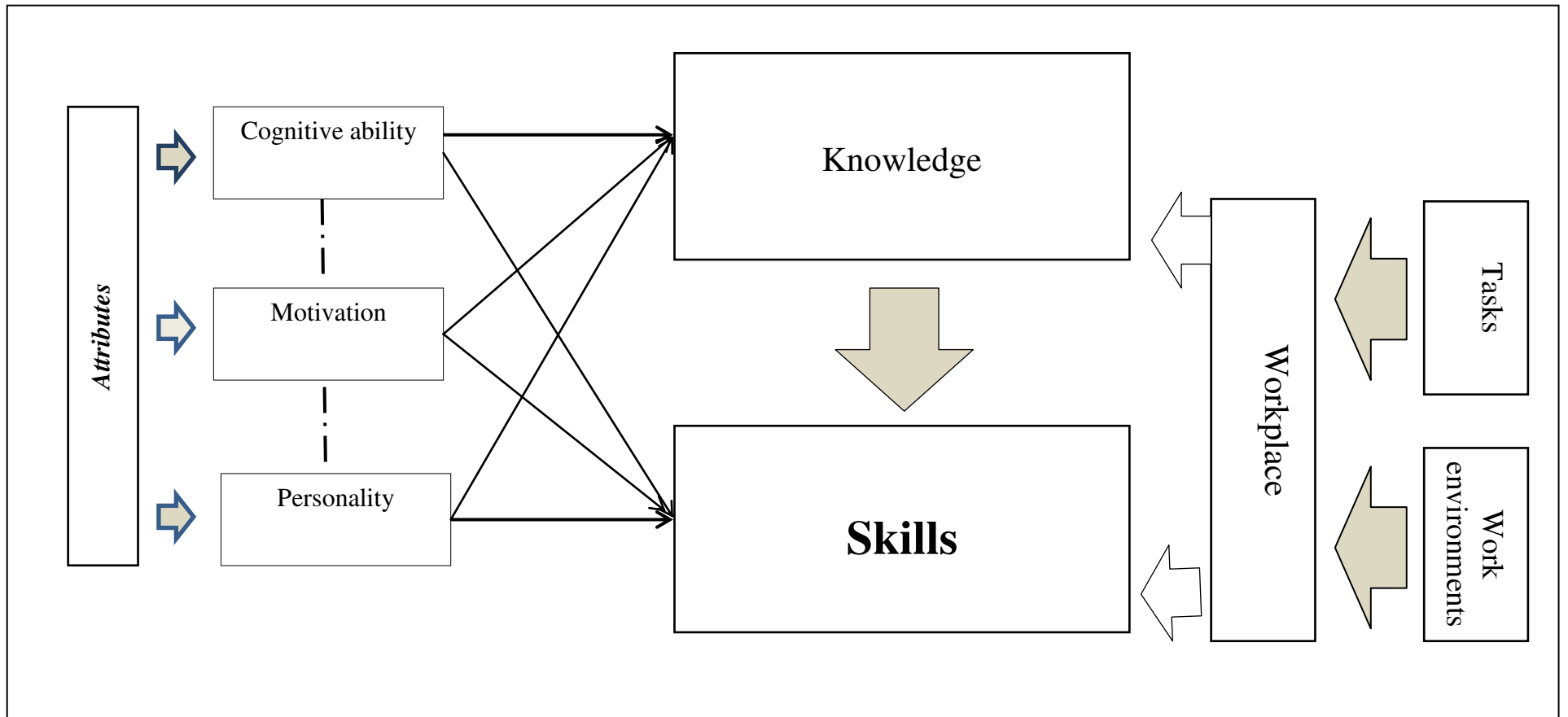


Figure 1: Model of human capital composition and formation mechanisms

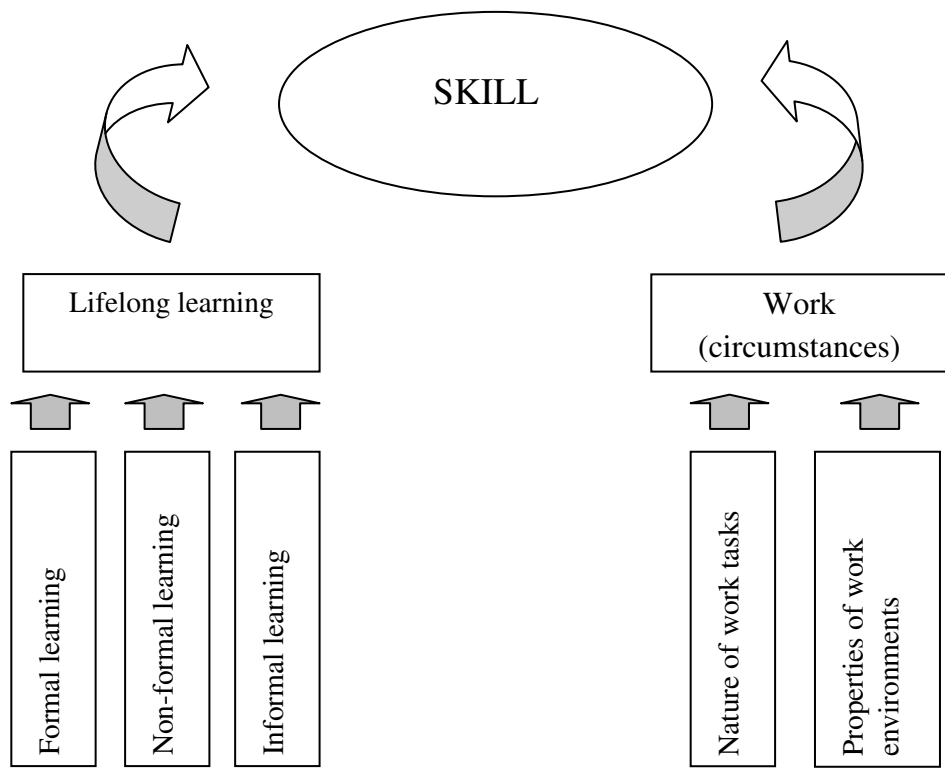


Figure 2: Sources of skill formation

Appendix 1: Examples of task-related questions used in surveys to measure an individual's stock of skills

Skills/Tasks Groups	Cedefop	British Skills Survey	PIAAC	BIBB BAuA Survey	STAMP
<b>Generic skills</b>	<p>In their job how important is...</p> <ol style="list-style-type: none"> <li>...reading and comprehending instructions, guidelines, manuals or reports?</li> <li>...writing instructions, guidelines, manuals or reports?</li> <li>...using and understanding numerical or statistical information (for example, in graphs, charts and tables)?</li> <li>...solving complex problems? (complex problems are problems which take you <b>at least 30 minutes</b> of thinking time to find a good solution)</li> <li>...communicating in a foreign language?</li> <li>...manual dexterity (for example, to mend, repair, assemble, construct or adjust things)?</li> <li>...making speeches or presentations to internal or external audiences?</li> </ol>	<p>In your job how important it is</p> <ol style="list-style-type: none"> <li>... paying close attention to detail ?</li> <li>...dealing with people?</li> <li>... instructing, training or teaching people individually or in groups?</li> <li>...making speeches or presentations?</li> <li>...persuading or influencing others?</li> <li>...selling a product or service?</li> <li>...counselling, advising or caring for customers or clients?</li> <li>...working with a team of people?</li> <li>...listening carefully to colleagues?</li> <li>...physical strength (for example to carry, push or pull heavy objects)?</li> <li>...physical stamina (to work for long periods on physical activities)?</li> </ol>	<p>How often does your job usually involve</p> <ol style="list-style-type: none"> <li>...sharing work-related information with co-workers?</li> <li>...instructing, training or teaching people, individually or in groups?</li> <li>...making speeches or giving presentations in front of five or more people?</li> <li>...selling a product or selling a service?</li> <li>...advising people?</li> <li>...planning your own activities?</li> <li>...planning the activities of others?</li> <li>...organising your own time?</li> <li>...persuading or influencing people?</li> <li>...negotiating with people either inside or outside your firm or organisation?</li> <li>How often you</li> </ol>	<p><i>Please remember your current job as a &lt;&gt;. I will name some selected job tasks. Would you please tell me how frequent these tasks appear in your job?' (random order of items)</i></p> <ol style="list-style-type: none"> <li>Manufacturing of goods;</li> <li>Measuring, testing, quality control;</li> <li>Operating, controlling machines;</li> <li>Repairing;</li> <li>Purchasing, selling;</li> <li>Transporting, storing, shipping;</li> <li>Promoting, marketing, public relations,</li> <li>Organizing, making plans, working out operations;</li> <li>Research, development;</li> <li>Teaching, training;</li> <li>Gathering information, investigating,</li> </ol>	<p><i>At your job, do you:</i></p> <ol style="list-style-type: none"> <li>use math or numbers in any way (e.g., measure or weigh things? count things, work with money)</li> <li>use addition or subtraction?</li> <li>use multiplication or division?</li> <li>do math using fractions, decimals, or percentages?</li> <li>use simple algebra to solve for unknown values?</li> <li>use more advanced algebra to solve complex equations?</li> <li>use geometry or trigonometry?</li> <li>use probability and statistics, such as correlations and regressions?</li> <li>use calculus or other advanced mathematics?</li> </ol> <p><i>As part of your job, do you read:</i></p> <ol style="list-style-type: none"> <li>anything at work, 20</li> </ol>

8. ...working as a member of a group or team?	12. ...skills or accuracy in using your hands or fingers?	usually face more complex problems that take at least 30 minutes to find a good solution? The 30 minutes only refer to the time needed to THINK of a solution, not the time needed to carry it out.	documenting; 12. Consulting, advising;	even very short notes or instructions?
9. ...persuading or influencing others, whether co-workers, clients or customers?	13. ...knowledge of how to use or operate tools, equipment?		13. Consulting of colleges, external customers or other target groups?;	2. anything at least one page long (e.g., notes, memos, reports, or letters)?
10. ...learning new ideas, methods or techniques?	14. ...knowledge of particular products or services?		14. Entertaining, accommodating, preparing food;	3. anything at least 5 pages long?
11. ...adapting to new equipment or materials?	15. ...specialist knowledge or understanding?	12. To what extent can you choose or change the sequence of your tasks?	15. Taking care, healing;	4. articles or reports in trade magazines, newsletters, or newspapers?
12. ...instructing, training or teaching people, individually or in groups?	16. ...knowledge of how your organization works?	13. To what extent can you choose or change how you do your work?	16. Protecting, guarding, observing, controlling traffic;	5. articles in scholarly, scientific publications, or professional Journals?
13. ...implementing practices to reduce the use of raw materials, energy or water?	17. ...spotting problems or faults?	14. To what extent can you choose or change the speed or rate at which you work?	17. Working with computers;	6. instruction manuals or other reference materials?
14. ... implementing practices to limit pollution, waste, environmental degradation or biodiversity loss?	18. ...working out of problems or faults?		18. Cleaning, recycling, waste disposal;	7. work-related books?
15. ...determining their own tasks, working methods and speed of work without consulting managers or supervisors?	19. ...thinking of solutions to problems?		19. Did we miss a relevant task?	8. bills or invoices?
16. ...co-ordinating co-workers and their tasks?	20. ...analyzing complex problems in depth?		<i>Please tell me for each of these how frequent they appear in your job?</i>	<i>As part of your job, do you write:</i>
17. ...setting objectives and planning	21. ...checking things to ensure that there are no errors?		1. Having to react to and solving unforeseeable problems;	1. anything at work, even very short notes or instructions only a few sentences long?
	22. ...noticing when there is a mistake?		2. Notifying / communicating difficult issues in an intelligible to all way;	2. anything at least one page long (e.g., notes, memos, reports, letters)?
	23. ...planning your own activities?		3. Convincing others, compromising;	3. anything at least 5 pages long?
	24. ...planning the activities of others?		4. Making tough choice on your own responsibility;	4. articles or reports for
	25. ...organizing your own time?			
	26. ...thinking			

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human, financial and other resources?

18. ...increasing level of computer use?

19. ...performing physically demanding tasks

ahead?

27. ...reading writing information such as forms, notices or signs?

28. ... Reading short documents such as reports, letters or memos?

29. ...Reading long documents such as reports, manuals, articles or books?

30. ...writing material such as forms, notices or signs?

31. ...writing short documents?

32. ...writing long document with correct spelling and grammar?

33. ...adding, subtracting, multiplying or dividing numbers?

34. ...calculating using decimals, percentages or fractions?

35. ...calculating using more advanced mathematical or statistical procedures?

5. Recognizing and closing own knowledge gaps;

6. Speechmaking, giving talks;

7. Having contact to customers, clients, patients;

8. Dealing with a range of duties and responsibilities;

9. Being responsible for the well-being of others, e.g. patients, kids, clients, staff.

magazines, newspapers, or newsletters?

5. books or articles for scholarly, scientific, or professional journals?

6. fill out bills or invoices?

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**Occupation specific skills**

- pilot: pre-selected occupations with prepared occupation task lists; (in a full survey, occupations
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would not be pre-selected)  
• task lists obtained  
and adapted from ISCO  
group definitions and task  
lists available for 3-digit  
and 4-digit occupations

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