TYPES OF INDICATORS FOR MEASURING COGNITIVE SKILLS FOR A PROFESSIONAL CAREER IN IT SECTOR

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Abstract. **What are cognitive skills and how do we measure them? Cognitive skills manifest in different ways depending on the regulations, practices and general principles and are related to perception, memory, learning, attention, decision making, language abilities, etc.**
Indicators are statistical tool used to measure current state or level as well as to forecast trends within the relevant field of application.

Keywords: indicators, cognitive skills, soft skills, hard skills, employability

I. INTRODUCTION

The assessment of students' knowledge and skills has always been relevant and is of particular importance for the effectiveness and quality of the educational process. Practice shows that in order for evaluation to be objective, it is necessary to have clear, precise and measurable criteria.

Measuring the quality and effectiveness of the learning process is an essential part of the set of indicators for determining this process as successful, meaningful and promising.

II. COGNITIVE SKILLS

In theory, there are many definitions of cognitive skills, and each may be influenced by a different context. Cognitive skills manifest in different ways depending on the norms, practices and general principles in a given field of human activities. It is known that cognitive skills are related to knowledge and abilities, as well as the motivation to apply these abilities.

Cognitive skills are the core skills our brain uses to think, read, learn, remember, reason, and pay attention. Working together, they take incoming information and move it into the bank of knowledge we use every day at school, at work, and in life. Each of our cognitive skills plays an important part in processing new information. [1]

Cognitive function is a broad term that refers to mental processes involved in the acquisition of knowledge, manipulation of information, and reasoning. Cognitive functions include the domains of perception, memory, learning, attention, decision making, and language abilities. [2]

Some researchers highlight key groups of cognitive skills important to professional careers, such as critical thinking, problem solving and creative thinking. [3]

Cognitive skills significantly affect employment outcomes.

III. EMPLOYABILITY AND IT SKILLS EMPLOYERS LOOK FOR

Cognitive skills are closely linked to the educational process and subsequently to the labor market.

In the workplace, cognitive skills help us interpret data, remember team goals, pay attention during an important meeting and more. These skills help us recall previous information that may relate to our organization's goals and help us make important connections between old and new information so we work more effectively. [4]

Considering the varying definitions of success in academic and workplace settings, there is no surprise that the term employability also has multiple meanings and implications dependent on the context and environment within which the term is applied. [5]

Yorke and Knight have devised a framework known as the USEM model, which is an acronym for understanding, skills, efficacy, and metacognition which attempts to identify alternative methods of defining employability and to categorize specific employability skills that can be integrated into the higher education curriculum.

The USEM model proposes that there are four essential interconnected domains that link skills sought by employers and those learned within an individual's academic experience:

• Understanding, connected to concepts and content;

• Skills, concerning practical application of content in specific contexts;

• Efficacy beliefs, students' self-theories and personal qualities. Of critical importance is the extent to which students feel that they might be able to make a difference – not every time, but in a probabilistic way;

• Metacognition, encompassing self-awareness regarding the student's learning, and the capacity to reflect on, in and for action. [6]

A survey of Peter Draus, Sushma Mishra, Kevin Slonka and Natalya Bromall in 2021 showed that employers expect proficiency in fundamental topics such as programming logic and debugging and a basic understanding of advanced topics. However, the employers also showed a high preference for skills and competency in the new and emerging technology domain.[7]

Information technology skills are the skills employers look for when hiring employees for an IT position. They include both hard skills and soft skills. Technical skills are very often referred to as 'hard' skills, which are usually obtained through training or education and are related to technical knowledge or abilities. Hard skills are also job-specific skills. These types of skills can be acquired through education, training, courses and on-the-job training.

Nowadays, most of employers in digital sector look for IT professionals having 'hard' skills such as coding and programing skills, software and mobile development, knowledge of computer networks, Big Data Analysis, Cloud Computing, Cybersecurity, Machine learning, Blockchain, and more.

In addition to 'hard' skills in 21st century in work environment additional 'soft' skills are needed, such as adaptability, team working, analytical thinking, critical thinking, problem-solving skills, communication skills, self-awareness, self-learning, accountability, time management, emotional intelligence, helpfulness, patience, strategic thinking, etc. Soft skills are subjective. They are very difficult to measure and prove. Soft skills are related to the ability to understand other people and communicate with them.

Success within IT companies is possible when individuals show commitment to the growth of the business, ensure high quality services, have high quality expertise and contribute to the overall satisfaction of customers.

IV. SKILLS AND COMPETENCES

It is worth mentioning that in some academic studies and in regulatory documents there is a certain difference between competencies and skills.

The European Norm (EN) 16234-1 European e-Competence Framework (e-CF) provides a reference of 41 competences as applied at the Information and Communication Technology (ICT) workplace, using a common language for competences, skills, knowledge and proficiency levels that can be understood across Europe.

The European eCompetence Framework (eCF) expresses ICT competence using the following definition: 'Competence is a demonstrated ability to apply knowledge, skills and attitudes for achieving observable results'. This is a holistic concept directly related to workplace activities and incorporating complex human behaviours expressed as embedded attitudes. Attitudes are the glue which keep knowledge and skills together. Soft skills are the attitudes' components that can be made explicit, trained and developed.

Skill is the ability to apply knowledge and use know-how to complete tasks and solve problems, from managerial to technical.

In the context of the standard, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments).

Soft skills are personal attributes that enable someone to interact effectively and harmoniously with other people. Within the standard the meaning of soft skills include skills such as communication, ability to work on multidisciplinary teams, etc. These skills should be distinguished from technical, or "hard skills".

This standard allows straightforward expressions and maps of ICT professional skills and competences.[8]

The Organization for Economic Cooperation and Development provided firstly in 2005 its conception of 21st century skills and its measurement, dividing them in three big categories: using tools interactively, interacting in a heterogeneous group and acting autonomously.

The EU has also developed the Digital Competence Framework for Citizens — known as DigComp — and a related self-assessment tool. These resources provide people with the opportunity to assess their digital competence and identify gaps in their knowledge, skills and attitudes. Using DigComp will help citizens to achieve goals related to work, employability, learning, leisure and participation in the digital society. [9]

V. INDICATORS

Indicators are statistical tool used to measure current state or level as well as to forecast trends within the relevant field of application.

The Organization for Economic Cooperation and Development defines an INDICATOR as "a quantitative or qualitative factor or variable that provides an easy and reliable means of measuring achievement reflecting changes in intervention or helping to assess the implementation of a development participant".

In other words, an INDICATOR is a collection of raw or processed data that helps us quantify a phenomenon under study. It is also a tool that helps us understand complex realities.

Indicators could be categorized as quantitative and qualitative indicators, on the other hand as performance indicators, impact indicators, success indicators, composite indicators, etc.

Quantitative indicators are reported as numbers, such as units, prices, proportions, rates of change and ratios.

Qualitative indicators are reported as words, in statements, paragraphs, case studies and reports.

Note that it is not the way in which an indicator is worded that makes it quantitative or qualitative, but the way in which it is reported. If an indicator is reported using a number then it is a quantitative indicator. If it is reported using words then it is qualitative. A popular misconception is that a qualitative indicator measures the quality of a change. This is not true.

Both quantitative and qualitative indicators have strengths and weaknesses, and usually both are needed within a project or programme. [10]

Impact indicators are tangible and measurable pieces of evidence that help you.

Measure and track the change that occurred as a result of your intervention; Show if the goals you set out to achieve with our impact projects have been achieved or if your intervention is making progress towards the goals; Show and communicate the impact created to stakeholders and donors. [11]

The key performance indicators represent a quantitative index which can measure and assess the

IT competencies, thus defining success factors of organizations. Selection of the key performance indicators should depend on the context in which the organization will carry out the assessment process, each indicator must be consistent with the organizational objectives and must be quantified. The key performance indicators have an important role to identify, analyse and evaluate the IT professional competencies, but also provide data and actual information about the current state for the competency assessment process. [12]

Success indicators are related to the students' perception of the learning outcomes.

Success is said to be the answer or the action in which the person reaches the goal, or, success is a definitive step towards the goal, but in terms of education and educational situations, success is defined as the degree to which the individual In recognition of his abilities, he deserves satisfaction in his advancements. [13]

A composite indicator is formed when individual indicators are compiled into a single index on the basis of an underlying model. The composite indicator should ideally measure multidimensional concepts which cannot be captured by a single indicator.

The quality of a composite indicator as well as the soundness of the messages it conveys depend not only on the methodology used in its construction but primarily on the quality of the framework and the data used. [14]

In recent years there has been a growing understanding of the importance of indicators for measuring and hence improving education systems. Everyone agrees that indicators for measuring the quality of education are key tools for managing and improving the quality of education. They are necessary for the good management of qualifications structures and a necessary part of any evaluation mechanism designed to ensure continuous progress in improving quality.

The role of indicators is:

- To describe the current state from which the efforts to increase the quality of education begin;

- To provide detailed information on the extent to which the set goals have been achieved;

- To offer ideas for improving the results and achieving higher goals

In long-term use, indicators can provide valid information and measurement methods, but they can also give an idea of the most specific change in quality.

Indicators are not values in themselves. When defining the indicators, the goals to be achieved for quality improvement should be clarified in advance. The selection of indicators is not a technical task and is preceded by the formulation of objectives and final results through regulatory systems and requirements issued by governments, educational institutions, boards, etc.

VI. MEASUREMENT TOOLS

In order to find a unique tool for measurement of cognitive skills, in the recent international literature could be identified many types of framework and/or tools with an appropriate aim, i.e., STELEM (Socio-Technical E-learning Employability System of Measurement), self-perceived employability (SPE) scale, work ability index (WAI) or the single-item work ability score (WAS), standardized competence assessment procedure, data mining techniques being in fact the single tool that it shows their weaknesses that they need to overcome for being employable in various companies, extra and co-curricular activities (ECCAs assessment) , novel methodology for assessment of transverse and specific competences in civil engineering, pilot tests, CAT (Competency Assessment Tool), WIL–Work-integrated learning, fuzzified expert system for employability assessment, CBT (competencies-based training systems) or assessment tool for sustainable employability. [15]

VII. CONCLUSION

Adequate measurement of the quality of education requires a methodology in which a set of indicators to be applied, as well as an evaluation procedure that will help to assess the quality of education, identify its weaknesses and improve it in terms of impact, which it renders on the quality of education and skills of students.

Indicators as measurable statistical tools characterize individual phenomena or ongoing processes in education and are objective criteria which represent a real basis for measuring the level of competencies and skills of students. Proper formulation of indicators determines the objectivity of the results of the evaluation of education and skills.

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