GENERATION Z STUDENTS' PERCEPTIONS ON THE ABILITIES, SKILLS AND COMPETENCIES REQUIRED IN THE AGE OF ARTIFICIAL INTELLIGENCE SYSTEMS

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Abstract

The knowledge economy promotes the use of information and communication technology and highly skilled labour on a large scale. The past decades have witnessed a continuous fall in the importance of unskilled sectors and a rise in skilled sectors combined with the emphasis on skills and competencies. Being highly familiar with the use of technology, Generation Z students are very interested in raising their chances of employability in the current digital society. The purpose of this research was to identify and analyse Generation Z students' perceptions on the abilities, skills and competencies required in the age of artificial intelligence systems. In this respect, the authors used a quantitative research method through an online survey. A total number of 352 questionnaires from students who graduated from full-time undergraduate programs within a Romanian faculty were validated. The data were processed using the SPSS 17.0 statistical software, the subsequent viability tests and analyses involving the use of Cronbach's Alpha coefficient, the Principal Component Analysis, respectively, the correlational analysis. From a theoretical point of view, the paper contributes to the enrichment of the scientific literature regarding the new relationships between human capital and the era of artificial intelligence systems, offering a new perspective on the structure of the needed abilities, skills, and competencies in the digital society. From a practical point of view, the results of the study provide solutions for improving the educational process by adapting academic programs to the demands of the digital society. The results of the research show that, on the one hand, sensorial, cognitive, and psychomotor abilities, and, on the other

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hand, general knowledge, business and management, and technical skills and competencies, are playing a key role in today's era of artificial intelligence systems.

Key words: students, Generation Z, abilities, skills, competencies, artificial intelligence.

JEL Classification: I20, I23, J24.

Introduction

In their long evolution, humans have made a fundamental step from being mostly illiterate to being educated in a significant proportion. Education, in general, and higher education, in particular, have proved to be critical pillars of economic growth and sustainable development throughout the world. Ensuring inclusive and equitable quality education for all represents one of the Sustainable Development Goals adopted by the United Nations in its 2030 Agenda for Sustainable Development (UN, 2015). Thus, education constitutes an important matter for any country in terms of both quantity and quality. In this respect, education should not only be adequate but also fulfil the needs of various stakeholders, such as society, students, organisations, or markets. This is why the aim of education in the 21st century is to prepare its graduates for life, work, and citizenship.

The roots of the competence-based movement are to be found in the 1920s, but the demand for higher accountability in education emerged only in the 1960s in the United States of America (USA), when an increased emphasis on economic issues was ascertained (Tuxworth, 1990). The assessment criteria and the outcomes were more and more linked to the competencies acquired during the years of studies. It was the period when the so-called "information wave" dramatically impacted humanity and provoked the birth of the information economy (Toffler, 1980)/digital economy (Tapscott, 2014) or the knowledge-based economy (Drucker, 1969). Characterised not only by a deeper reliance on knowledge and information (Aparicio, Iturralde and Rodriguez, 2023), but also on intellectual capabilities (Powell and Snellman, 2004), this knowledge economy promotes the use of information and communication technology (ICT) and highly skilled labour on a large scale. Its expansion was facilitated by the collapse of the communist regime at the end of the 1980s and the beginning of the 1990s when the globalisation process rapidly spread and led to the liberalisation of markets and the free movement of people, capital, and information all over the world. As a result, the labour markets have changed into global ones and have begun to accurately match workers to jobs provided in a specific industry (Davidson et al., 2010) as their needed skills and competencies have become somehow standardised.

From these radical transformations that altered the nature and type of work, the role of human capital has become much more prominent in any organisation, irrespective of its size and sector. As more and more skills are computer-based, the ICT revolution favours knowledge workers because their intellect represents today's primary resource (J. Hope and T. Hope, 1997). The past decades have witnessed a continuous fall in unskilled sectors and a rise in skilled sectors (Jaumotte and Tytell, 2007) combined with the shift from jobs to skills (Deloitte, 2022). Consequently, the skills and competencies-focused approach has become the rule for an increasing number of organisations in the age of automation and artificial intelligence (AI) systems.

The existing rift between people's capabilities and employers' skill requirements represents a major challenge for education. The way education succeeds in providing the needed abilities, skills, and competencies to pupils and students in order to cope with different trends (e.g., social, economic, political, environmental, technological) and respond to multiple risks (e.g., crises, pandemics) is decisive for its future. Innovating and adapting to the new realities of the labour market are important prerequisites for education to meet the demand for skilled people in an increasingly digitalised society. Being highly familiar with the use of ICT and eager to embrace technological advancements, Generation Z (Gen Z) students are very interested in raising their chances of employability in the age of AI by obtaining as many as possible skills and competences during the years of studies.

Gen Z students' perceptions of the skills and competencies needed in the digital society have begun to be studied in recent years by various researchers (Benítez-Márquez et al., 2022). However, the authors identified a research gap regarding the existing connection among the three above-mentioned research areas- Gen Z students, abilities, skills, and competencies, and AI, that constituted the basis of the literature review. The purpose of this research is to identify and analyse Gen Z students' perceptions on the abilities, skills and competencies required in the age of AI systems. In this regard, the authors used a quantitative research method based on an online survey. This study seeks to contribute to the development of the literature by answering the two research questions and providing other possible directions for researchers. The results show that Gen Z graduates of business and administration specialisations are highly aware of the importance of the new abilities, skills, and competencies specific to the digital society. Also, they highlight the key role played by some types of abilities (e.g., sensorial, cognitive), skills, and competencies (e.g., general knowledge, business, and management) in their opinion. The originality of the paper lies in the new perspective, integrating previous approaches, that it provides on Gen Z students' perception of the skills, abilities, and competencies required by the age of AI systems and how education meets this challenge. The structure of the paper is as follows: the next section displays the literature review. The research methodology is presented in the second section. The results of the study are exhibited and analysed in the third section of the paper. The conclusions are illustrated in the last section of the paper.

1. Literature review

This section of the study shows the theoretical framework that seeks to clarify the meaning in the key concepts of the paper and reveal their relationship. The scientific literature related to the areas of human resources management, education, and economics provides numerous definitions of the concepts of Gen Z students, abilities, skills, and competencies, and the age of AI. As the first generation born in an increasingly digital society and deeply shaped by technological disruptions, Gen Z or iGen encompasses the people born in the period 1997-2012 (Dimock, 2019). Most of today's students are representatives of Gen Z. Gen Z students share several common characteristics as follows (Seemiller and Grace, 2016; Cho, Bonn and Han, 2018; Schroth, 2019):

- They are frequent users of ICT (e.g., smartphones, social media platforms, computers) as they grew up with it.
- Gen Z students embrace the values and principles of sustainable development, human rights, social justice, social responsibility, and volunteerism.
- Being well-informed, they are eager to collaborate with public institutions, corporations, and NGOs to address various challenges of human society, such as climate change, social inclusion, health, and AI.
- Gen Z students possess an innovative entrepreneurial spirit and are open to integrating new ICT into their activities.
- As digital natives and highly Internet-connected, they are rather multitaskers with limited attention spans.
- When it comes to education, Gen Z students want to ensure that what they are learning is both applicable and useful in their everyday lives.

With a high level of technology incorporated into their lives and activities, Gen Z students are pragmatic, career-oriented and skill-focused (Schwieger and Ladwig, 2018).

As natural and long-lasting attributes of a person, abilities represent "the capacity or power to do something" (Ivanovic and Collin, 2006, p.1) and influence individual performance. In their turn, skills are individual abilities to perform something based on education and/or training. They are personal qualities that have three features: productive, expandable, and social (Green, 2011). Both abilities and skills can be improved over time. In order to meet the needs of the age of AI systems, a plethora of taxonomies has emerged in the scientific literature, such as the Global Skills Taxonomy (WEF, 2021) and the O*NET Content Model (O*NET, 2023). Considering that these taxonomies are close one to another, the authors referred to the latter because it is more actual and comprehensive (Table no. 1). In its turn, competence constitutes "the ability to do the tasks required in a job" (Collin, 2004, p.75).

Today's technological disruptions (Dinu, 2022), specific to the age of AI systems, are abruptly modifying the demand for skills and competencies. An AI system is seen as "a machine-based system that is capable of influencing the environment by producing an output (predictions, recommendations, or decisions) for a given set of objectives" (OECD, 2023, p.1) and the age of AI is defined as the one of "the emergence of a different kind of organisation, structured for a business environment shaped by digital networks, analytics, and AI" (Iansiti and Lakhani, 2020, p.ix). Arising from the mixture of big data, cloud computing, Internet of Things, and AI (Siebel, 2019), this continuous digital transformation is more demanding than ever in relation to the qualities an individual should possess to be successful in the labour market. As an information society aiming to provide a sustainable, smart and prosperous human-centered environment for its citizens, today's Society 5.0 accomplishes the fusion between physical and cyber space to address its multiple needs (Fukuyama, 2018). The wide use of digital technologies and the accelerated implementation of AI systems in the Fourth Industrial Revolution impose Gen Z students to possess various abilities and acquire specific skills and competencies, both hard (know how to do) and soft (know how to be), such as programming techniques and personal flexibility (Agolla, 2018). Recent studies show that some authors highlight the fact that Gen Z students perceive the age of AI systems as an era of profound transformations in which success in the labour market is achieved by accumulating knowledge in higher education institutions that will develop their skills and competencies (Toma, 2011), while others emphasise how academic programs respond to the challenges of the digital society (Schwieger and Ladwig, 2018).

Table no. 1. Abilities and skills taxonomy

Level 1	Level 2	Levels 3+4
Abilities	Cognitive Abilities	Verbal abilities: Oral Comprehension, etc.
		Idea Generation and Reasoning Abilities: Fluency of Ideas, etc.
		Quantitative Abilities: Mathematical Reasoning, etc.
		Memory: Memorisation, etc.
		Perceptual Abilities: Perceptual Speed, etc.
		Spatial Abilities: Spatial Orientation, etc.
		Attentiveness: Selective Attention, etc.
	Psychomotor Abilities	Fine Manipulative Abilities: Finger Dexterity, etc.
		Control Movement Abilities: Control Precision, etc.
		Reaction Time and Speed Abilities: Reaction Time, etc.
	Physical Abilities	Physical Strength Abilities: Static Strength, etc.
		Endurance: Stamina, etc.
		Flexibility, Balance, and Coordination: Dynamic Flexibility, etc.
	Sensory Abilities	Visual Abilities: Near Vision, etc.
		Auditory and Speech Abilities: Hearing Sensitivity, etc.
Skills	Basic skills	Content: Reading Comprehension, etc.
		Process: Critical Thinking, etc.
	Cross-Functional skills	Social: Social Perceptiveness, etc.
		Complex Problem Solving: Problem Identification, etc.
		Technical: Operations Analysis, etc.
		Systems: Systems Analysis, etc.
		Resource Management: Management of Financial Resources, etc.

*Source: O*NET, 2023*

As in most cases Gen Z students have entered or are just entering the labour market, they are highly interested in the abilities, skills, and competencies that can be acquired during their education. This is why numerous higher education institutions worldwide have understood the need to reinvent themselves to face the continuous changes provoked by ICT in the age of AI systems and to adapt to the demand for skilled people in the labour market (Hernandez-de-Menendez et al., 2020).

2. Research methodology

This paper investigates Gen Z students' perceptions of the skills, abilities, and competencies required in the age of AI systems. Starting from the results of the specialised literature review and considering the contributions that the authors wish to make to its development, they formulated the following four research hypotheses:

- **H1**: Gen Z students consider sensorial, cognitive, and psychomotor abilities to be the most important in the age of AI systems.

- **H2**: Gen Z students consider that general, Business and Management, and technical skills and competencies are important in the age of AI systems.
- **H3**: Gen Z students consider that academic programs provide the general skills and competencies, those in the fields of Business and Management, as well as the technical ones needed in the age of AI systems.
- **H4**: Gen Z students consider that the study program followed exerts certain influences on the consolidation of abilities, skills, and competencies needed in the context of the age of AI systems.

To achieve the purpose of the research, the authors used a quantitative research method based on an online survey because it gave them the opportunity to investigate a large sample of Gen Z students to obtain the information needed for the statistical analysis. The survey was conducted online because it does not involve considerable human resources, its costs are low, and its duration is short (Hague, 2022).

The authors developed a structured questionnaire, starting from the specialised literature review and based on the O*NET Content Model (O*NET, 2023). It comprised closed questions with single and multi-response questions. The attitudinal questions sought to understand what actual Gen Z graduates from full-time undergraduate programs think in relation to the needed abilities, skills, and competencies in the age of AI systems. The structure of the questionnaire contained 19 questions, grouped as follows:

- 7 questions regarding Gen Z current graduates' perceptions toward the abilities, skills, and competencies required in the age of AI systems.
- 12 issues related to socio-demographic data (e.g., gender, specialisation).

The measurements were made through the use of a five-point Likert scale (where 1 = strongly disagree and 5 = strongly agree).

The target population (Table no. 2) and the sample (Table no. 3) were selected from the graduates of the five undergraduate programs of the Faculty of Administration and Business (FAB), University of Bucharest (UB). The following main reasons were the basis of the authors' choice:

a) The field of higher education was chosen as most of its graduates belong to Gen Z. The graduates represent the main stakeholders of the age of AI as they will be tomorrow's employees, entrepreneurs, and businessmen. Moreover, some of them already accumulated work experience during their study years.

b) The target population comprised the graduates from the FAB, UB, one of the leading Romanian higher education institutions. Only two public higher education institutions located in Bucharest provide both Business and Administration specialisations.

c) As graduates, the respondents were highly familiar with the key concepts of the research (e.g., skills, AI). These concepts were subjects of various disciplines (e.g., Human Resources Management, Informatics).

Sampling was done starting from Gen Z students who graduated from bachelor's programs, full-time education, the sample being composed only of graduates aged between 21-23 years. Due to the fact that its size was quite small, the sample included the entire graduate population. The fieldwork research was deployed in the period 6-27 June 2023. In this sense, an online questionnaire was applied to the whole population of graduates within the day-course undergraduate programs. Initially, the questionnaire was tested on a small sample of 28 respondents, consisting of employees working in human resources departments, entrepreneurs, and businessmen, mostly graduates of the FAB, UB.

A total number of 352 questionnaires were validated from graduates (80 out of 432 graduates were not Gen Z members, sent incomplete responses or did not answer), with a response rate of 81.48%, confirming the quality of the survey (Hox and De Leeuw, 1994). The rather small size of the population allowed the authors to obtain a higher response rate and greater reliability of the data (Wu, Zhao and Fils-Aime, 2022). The gender structure of the respondents (61.93% female and 38.07% male) was very close to the gender structure of the total population (62.73% female and 37.27% male), ensuring the representativeness of the sample. In the end, the authors centralised and systematised all the information in a database. Then, they were processed through the SPSS 17.0 statistical software.

Table no. 2. Total number of graduates and their gender within the full-time undergraduate programs, at the end of the academic year 2022-2023

Specialisation	Number of Graduates	Gender	
		Male	Female
Business Administration (in Romanian)	125	54	71
Business Administration (in English)	40	13	27
Marketing	71	19	52
Economic Cybernetics	62	37	25
Public Administration	134	38	96
Total	**432**	**161**	**271**

Table no. 3. Total number of respondents and their gender within the full-time undergraduate programs

Specialisation	Number of Respondents	Gender	
		Male	Female
Business Administration (in Romanian)	100	43	57
Business Administration (in English)	32	10	22
Marketing	61	19	42
Economic Cybernetics	50	30	20
Public Administration	109	32	77
Total	**352**	**134**	**218**

In order to understand the grounds of the present analysis, it is necessary to provide some pieces of information relating to the data collection and processing, as well as to the econometric methods and techniques used so as to test the hypotheses formulated, for reaching the pre-established goal of the research.

Considering that this study deals with three very large datasets grouped around three ordinal variables, based on common characteristics, namely: (1) abilities potentially necessary in the age of AI systems, relating to cognitive, psychomotor, physical issues etc. (Q1.2) (41 items); (2) skills and competencies potentially necessary in the age of AI systems, relating to contents, processes, systems, complex problem solving, resource management, knowledge, technical aspects, etc. (Q2.2) (76 items); (3) level of contribution of the study programme undergone to the strengthening of the skills and competences potentially necessary in the age of AI systems, relating to contents, processes, systems, complex problem solving, resource management, knowledge, technical aspects etc. (Q3.2) (76 items), the authors decided to check for the reliability and internal consistency of each series of items on the associated scale, by resorting to Cronbach's Alpha coefficient, so as to open the road, in case of validation of the same, for the Principal Component Analysis (PCA), meant for reducing the number of such items, while preserving reasonably high the information level, therefore facilitating any further analysis. Provided that Cronbach's Alpha is validated, PCA, a statistical process used for converting some correlated items, by virtue of an orthogonal transformation, into a reduced series of linearly uncorrelated ones, becomes applicable, being useful for outlining different constructs that might be generated based on the series of interest.

Several steps, consisting of the standardisation of the related items, the computation of the arising covariance matrix or the determination of the eigenvalues and of the explained variance, precede the identification of the pertinent principal components. The communalities, also called herein, reflect how much information is extracted from each initial item. Specifically, the initial communalities indicate the total initial variance of each variable used in PCA (having a unitary value, unlike the Exploratory Factor Analysis case), while the post-extraction communalities reveal the share of the total initial variance of each variable explained by the deriving components. Having in mind that variance means information, higher the values provided, more consistent the information package generated as result of the analysis.

Last but not least, the rotated component matrix, based on the rotation of the factorial axes, helps in easily construing the retained variables, namely, the principal components or, otherwise said, the synthetic or condensed variables. In this specific case, we resorted to Varimax, a rotation method that preserves the factors fully uncorrelated, this allowing for using such arising items (factors) as explanatory variables in regressions, without fearing that they might be characterised by multi-collinearity.

Once PCA finalised and any further process facilitated by virtue of the decrease of the consistent number of variables, the correlational analysis is taken into consideration. As the collected data are ordinal and given the specificity of the same, the recommended correlational techniques are the rank-based Spearman coefficient (ρ), respectively Kendall coefficient (τ), both revealing the bivariate correlation between variables. Such an approach helps the authors to identify the relationships existing among the principal components of the related items and to construct the said aspects from a theoretical perspective.

3. Results and discussions

The arising output, involving the testing of the internal consistency of data, based on Cronbach's Alpha coefficient, the identification of the principal components for the large series of items, grouped around the above-mentioned three variables considered, and the analysis of the possible correlations between the same, provided us with a series of information of interest for our study.

In order to simplify the analysis output rendering and interpretation process, we resorted to their progressive organisation, by stages, at the level of the three groups of items. After a brief description of the case processing summary, with 352 observations, all of them validated, the reliability statistics is considered, indicating a coefficient of 0.952 for the first group of items, 0.979 for the second one, respectively 0,980 for the third one (> 0.7) for Cronbach's Alpha, confirmed by its values computed when based on standardised items, and, therefore, standing for a significant internal consistency of the items in the related scale. It is to be mentioned that the values of the scale mean / variance / Cronbach's Alpha if the related item is deleted reveal the high contribution of each element in the list to the above-mentioned overall consistency, none of them having to be removed from the group. The corrected item total correlation (> 0.4), also provided by item total statistics, supports the significant relationship between the items of interest, at the level of all analysed groups.

Once the reliability test has been validated, the authors proceed to the Principal Component Analysis, identifying the specific constructs to be considered in this research. The arising correlation matrix reveals the positive relationships between items, medium to high in average, statistically significant, with a p-value < 0.01, in most of the cases. The value of the correlation matrix determinant, amounting to 1.34E-012, 3.81E-032, respectively 3.38E-038 (> 0), shows the absence of multi-collinearity for the three groups of items considered.

The KMO and Barlett's test reveals, by virtue of the former, with a value of 0.928 for the first group of items, respectively, 0.955 for the second and third group of items (> 0.6-0.7), the adequacy of the database, the samples being fit for analysis in terms of PCA, while, by virtue of the latter, testing the sphericity, with a statistical p-value < 0.01, the inequality between the correlation matrix and the unitary matrix, namely, the existence of a significant correlation among at least two initial items. In terms of communalities, as the arising extracted variance is large enough (> 0.3-0.4), the authors assume that all items are adequate and should be preserved for finalising PCA.

Knowing that the eigenvalues, representing the variances of the factors, should exceed 1 for the principal components extracted from the series of items to be considered, according to the Kaiser Rule (Kaiser, 1960), the authors conclude that they are going to select, out of the series of 41 items relating to the first group, 7 newly generated elements, standing for a cumulative variance of 63.82%, out of the 76 items specific to the second group, 11 components synthesising the information comprised by the initial variables, cumulating a significance variance of 69.42%, respectively 10 components rendering the information incorporated into the 76 initial items, for the third group of items analysed, cumulating a very high variance, amounting to 73.15%. The high number of arising principal components is due to the exhaustive initial approach, with an increased level of originality, not encountered by authors at the level of other studies treating similar topics, resulting in the cumulation of an impressive volume of variables (according to the previously specified issues).

An interesting aspect is that the first three components contain 50.37% out of the information incorporated in the initial set of 41 items for the first group considered, 52.34% for the second one, out of the 76 initial items, respectively 58.1% for the third group, with eigenvalues clearly detached in relation to the ones of the remainder of components, for each and every separate case (> 2.4 in relation to 1.6, for the fourth component, > 4.3 in relation to 2.8 for the next component, respectively > 4.1 relative to 2.7, specific to component no. 4), suggesting their significant consistency in revealing the essence of the preliminary sets of variables. The number of such components might be also detected by visualising the scree plot, relevant in this regard (Cattell, 1966), generated by SPSS, strengthening the previously mentioned aspects, namely the dimensionality of the significant factors for the current analysis, the first three of them outstanding before the remainder of the graphically rendered elements. In this context, given the consistent informational concentration at the level of the first three components, aspect identified also from a graphical perspective, considering the bi-dimensional or tri-dimensional representation and, especially, the fact that an increased number of factors might excessively complicate the related structure, generating the so-called "bloated specifics", representing factors generated as result of the artificial superposition of variables, due to the phrasing of similar items (Cattell, 1961), the authors decided to retrain the newly detected items (Braeken and Van Assen, 2017) exclusively to the first three factors for each group of analysed factors.

Given the association of the related components with the initial items, deriving based on the rotated component matrix output (table no. 4), the authors might name the three arisen factors in the most convenient and suggestive way, such as: *PC_1.1 – Sensorial abilities*, *PC_1.2 – Cognitive abilities*, and *PC_1.3 – Psychomotor abilities*, this reflecting the abilities deemed necessary in the age of AI systems. The results of this research show that Gen Z students perceive sensorial, cognitive and psychomotor abilities as the most important abilities in the age of AI systems, thus validating hypothesis H1. In this sense, they consider qualities, such as peripheral vision, depth perception, written comprehension, fluency of ideas, finger dexterity, manual dexterity etc. as essential in the current digital society. In the scientific literature, there are other studies that confirm this statement (Iorgulescu, 2016; McKinsey, 2022; Mahajan, Gupta and Misra, 2022; Deloitte, 2023).

Table no. 4. Rotated Component Matrix[a] for the group of items (1)

Items	PC_1.1	Items	PC_1.2	Items	PC_1.3
Peripheral Vision	0.791	Written Comprehension	0.715	Finger Dexterity	0.832
Sound Localisation	0.784	Fluency of Ideas	0.715	Manual Dexterity	0.807
Depth Perception	0.784	Written Expression	0.669	Arm-Hand Steadiness	0.797
Hearing Sensitivity	0.763	Selective Attention	0.645	Multilimb Coordination	0.657
Auditory Attention	0.760	Originality	0.608	Control Precision	0.544
Night Vision	0.745	Problem Sensitivity	0.599		
Visual Color Discrimination	0.719	Mathematical Reasoning	0.583		
		Information Ordering	0.573		
		Deductive Reasoning	0.521		

Note: a. Rotation converged in 7 iterations.

Source: Authors' computation in SPSS

The rotated component matrix (Table no. 5) facilitated the clear delimitation and interpretation of the arisen factors. As mentioned above, out of the number of components proposed by the SPSS output (11), only the first three were considered, specifically: *PC_2.1 – General knowledge skills and competences (Engineering and Technology, Mathematics and Science, Arts and Humanities)*, *PC_2.2 – Business and Management skills and competences*, respectively *PC_2.3 – Technical skills and competences*, these ones consistently covering the information contained in the initial set of 76 items. The related components stand for the skills and competencies deemed necessary in the age of AI systems.

These findings reveal that a plethora of general knowledge, business and management, and technical skills and competencies, such as AI, Big Data, Programming Languages, Computer Knowledge, Machine Learning, Data Analysis, human resources management, business administration, and equipment/tools installation, maintenance, use, and control etc. are considered as valuable in the age of AI systems by the respondents. These outcomes confirm the validity of hypothesis H2 and are in line with previous research that highlight their importance, especially digital skills and competencies (Deloitte, 2019; Meister, 2020; Mărginean, 2021; Benítez-Márquez et al., 2022).

Table no. 5. Rotated Component Matrix[a] for the group of items (2)

Items	PC_2.1	Items	PC_2.2	Items	PC_2.3
Artificial Intelligence	0.862	Human Resources Management	0.701	Equipment/Tools Maintenance	0.785
Big Data	0.851	Customer Relationship Management	0.686	Equipment/Tools Use and Control	0.779
Programming Languages	0.832	Sales	0.669	Equipment/Tools Installation	0.775
Geography	0.814	Leadership	0.659	Equipment/Tools Operation Monitoring	0.760
History	0.813	Economics	0.652	Equipment/Tools Repair	0.752
Physics	0.797	Accounting	0.651	Equipment/Tools Failure Cause Identification	0.723
Machine Learning	0.788	Financial Resources Management	0.629	Equipment/Tools Selection	0.693
Computer Knowledge	0.797	Management of Products and/or Services	0.619	Technology Design	0.572
Philosophy	0.730	Material Resources Management	0.616	Quality Control Analysis	0.551
Theology	0.726	Management	0.599		
Programming Competencies	0.660	Marketing	0.584		
Law	0.625	Business Administration	0.568		
Psychology	0.611				
Sociology	0.576				
Data Analysis	0.549				

Note: a. Rotation converged in 9 iterations.

Source: Authors' computation in SPSS

The rotated component matrix (Table no. 6) outlines the arising factors, helping us in identifying their overall meaning. Thus, the number of components, indicated based on the eigenvalues by SPSS (10), is finally reduced to three of them namely: *PC_3.1 – General knowledge skills and competences (Engineering and Technology, Mathematics and Science, Arts and Humanities) acquired during higher education studies*, *PC_3.2 – Technical skills and competences acquired during higher education studies* and *PC_3.3– Business and Management skills and competences acquired during higher education studies*, such items covering the information contained in the initial set of 76 items, at a minimum individual level exceeding 5%. These components reveal the level of contribution of the study programme undergone to the strengthening of the skills and competences deemed necessary in the age of AI systems, validating the hypothesis H3.

Table no. 6. Rotated Component Matrix[a] for the group of items (3)

Items	PC_3.1	Items	PC_3.2	Items	PC_3.3
Artificial Intelligence	0.901	Equipment/Tools Use and Control	0.832	Financial Resources Management	0.751
Geography	0.893	Equipment/Tools Operation Monitoring	0.830	Customer Relationship Management	0.720
Big Data	0.886	Equipment/Tools Failure Cause Identification	0.821	Marketing	0.682
Programming Languages	0.885	Equipment/Tools Maintenance	0.811	Management	0.673
Public Policies	0.875	Equipment/Tools Installation	0.806	Material Resources Management	0.670
Physics	0.866	Equipment/Tools Selection	0.777	Management of Products and/or Services	0.668
Philosophy	0.845	Equipment/Tools Repair	0.768	Economics	0.659
Computer Knowledge	0.840	Operations Analysis	0.731	Human Resources Management	0.658
Machine Learning	0.819	Equipment/Tools Testing	0.580	Business Administration	0.652
Programming Competencies	0.801	Technology Design	0.565	Leadership	0.586
History	0.762			Sales	0.585
Sociology	0.712			Time Management	0.562
Psychology	0.668			Accounting	0.522
Law	0.615				
Mathematics	0.596				
Data Analysis	0.595				

Note: a. Rotation converged in 18 iterations.

Source: Authors' computation in SPSS

Interesting enough is the fact that, when it comes to the academic curricula, Gen Z students consider that they provide in a high proportion the skills and competencies required in the age of AI systems in accordance with their opinions already mentioned. These results are consistent with those of other studies that emphasise the need for permanent skilling and reskilling (OECD, 2019; BCG, 2021; Tamayo et al., 2023).

The detection of the principal components helped us in easily testing the possible correlation between the variables of interest for this study. Therefore, the authors selected the first three components for each such variable, specifically: *PC_1.1*, *PC_1.2* and *PC_1.3* (abilities deemed necessary in the age of AI systems), *PC_2.1*, *PC_2.2* and *PC_2.3* (skills and competences deemed necessary in the age of AI systems), respectively, *PC_3.1*, *PC_3.2* and *PC_3.3* (level of contribution of the study programme undergone to the strengthening of the skills and competences deemed necessary in the age of AI systems).

Hereinafter, are rendered the correlational analysis output, got based on Spearman and Kendall coefficients, for which statistically significant values were obtained. This selective aspect is due to the irrelevance of construing results for which the statistical validation is null. As the declared intention was to determine the effective impact of the study programme undergone to the strengthening of the abilities, skills and competences deemed necessary in the age of AI systems, the authors resorted to the study of the behaviour of *PC_1.1*, *PC_1.2* and *PC_1.3* in relation to *PC_3.1*, *PC_3.2* and *PC_3.3* (Table no. 7), respectively of *PC_2.1*, *PC_2.2* and *PC_2.3* in relation to *PC_3.1*, *PC_3.2* and *PC_3.3* (Table no. 8), elements exhaustively rendered during the previous stages of the current research.

Thus, there is, as expected, a quite low correlation between *PC_1.1* and *PC_3.1*, respectively, *PC_3.3*, between *PC_1.2* and *PC_3.1*, respectively, *PC_3.3* and between *PC_1.3* and *PC_3.2*, such values being statistically significant, at a significance level of 1%, respectively, 5%, the results being similar for both coefficients, with slightly higher values for Spearman's rho. This means that there is a correlation, although not strong or even medium, between specific sensorial abilities and general knowledge skills and competences (Engineering and Technology, Mathematics and Science, Arts and Humanities) acquired during higher education studies, respectively Business and Management skills and competences acquired during higher education studies, on one hand, and between psychomotor abilities and general knowledge skills and competences (Engineering and Technology, Mathematics and Science, Arts and Humanities) acquired during higher education studies, respectively Business and Management skills and competences acquired during higher education studies, on the other hand, the same kind of relationship being encountered when coming about cognitive abilities in relation to technical skills and competences acquired during higher education studies.

Table no. 7. Correlation between PC_1.1, PC_1.2, PC_1.3 and PC_3.1, PC_3.2, PC_3.3

			PC_3.1	PC_3.2	PC_3.3
Kendall's tau_b	PC_1.1	Correlation Coefficient	.122**	-	.113*
		Sig.	.010		.016
	PC_1.2	Correlation Coefficient	-.143**	-	.144**
		Sig.	.003		.002

			PC_3.1	PC_3.2	PC_3.3
	PC_1.3	Correlation Coefficient	-	.107*	-
		Sig.		.021	
Spearman's rho	PC_1.1	Correlation Coefficient	.137**	-	.132*
		Sig.	.010		.013
	PC_1.2	Correlation Coefficient	.162**	-	.164**
		Sig.	.002		.002
	PC_1.3	Correlation Coefficient	=	.124*	-
		Sig		.020	

*Notes: * Correlation is significant at the 0.05 level (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed).*

Source: Authors' computation in SPSS

Table no. 8. Correlation between PC_2.1, PC_2.2, PC_2.3 and PC_3.1, PC_3.2, PC_3.3

			PC_3.1	PC_3.2	PC_3.3
Kendall's tau_b	PC_2.1	Correlation Coefficient	,310**	-	-
		Sig. (2-tailed)	,000		
	PC_2.2	Correlation Coefficient	-	-	,221**
		Sig. (2-tailed)			,000
	PC_2.3	Correlation Coefficient	-	-	-
		Sig. (2-tailed)			
Spearman's rho	PC_2.1	Correlation Coefficient	,350**	-	-
		Sig. (2-tailed)	,000		
	PC_2.2	Correlation Coefficient	-	-	,249**
		Sig. (2-tailed)			,000
	PC_2.3	Correlation Coefficient	-	-	-
		Sig. (2-tailed)			

*Note: ** Correlation is significant at the 0. 01 level (2-tailed).*

Source: Authors' computation in SPSS

In this case, the authors identify a medium, statistically significant correlation, at a significance level of 1%, between *PC_2.1* and *PC_3.1* and between *PC_2.2* and *PC_3.3*, while, surprisingly, no statistically significant correlation is encountered between *PC_2.3* and *PC_3.1*, *PC_3.2*, respectively, *PC_3.3*, situation confirmed by both coefficients used in such respect. This reveals that there is a reasonable correlation between required general knowledge skills and competences (Engineering and Technology, Mathematics and Science, Arts and Humanities) and general knowledge skills and competences (Engineering and Technology, Mathematics and Science, Arts and Humanities) acquired during higher education studies, respectively, between required Business and Management skills and competences and Business and Management skills and competences acquired during higher education studies. However, this type of connection is not statistically validated for the assumed relationship between the required technical skills and the competences and technical skills and competences acquired during higher education studies.

Therefore, overall, the authors state that there is some statistically confirmed connection, ranging from low to medium, between the perceived level of contribution of the study programme undergone to the strengthening of the abilities, skills and competences deemed necessary in the age of AI systems and the effective abilities, skills and competences deemed necessary in the age of AI systems. Otherwise said, even if the correlational analysis is not a cause-effect type of test, we understand that the idea behind this result stands for the fact that the study programme undergone exerts some influences on the strengthening of the abilities, skills and competencies deemed necessary in the age of AI systems, thus confirming the validity of hypothesis H4.

Conclusions

The appearance and expansion of AI have profoundly changed the way human society, in general, and the economy, in particular, have functioned in the last decades. This has led to significant changes in the labour market that have imposed education to adapt in order to provide pupils and students with the required abilities, skills and competencies in the age of AI systems. From a theoretical point of view, this paper contributes to the development of the scientific literature related to the new relationships that emerged between human capital and the needs of a digital society, increasingly based on AI. It provides fresh insights into the current concepts of abilities, skills and competencies by considering updated taxonomies. Moreover, this study identifies and analyses the perceptions of Gen Z students on these concepts in the age of AI systems and on the way academic curricula cope with these new and challenging requirements. Also, it demonstrates that, on the one hand, sensorial, cognitive, and psychomotor abilities, and, on the other hand, general knowledge, business and management, and technical skills and competencies, are playing a key role in today's digital society.

From a practical point of view, students' abilities, skills and competencies are interconnected and their development should constitute a top priority for any higher education institution. This is why academic curricula must be designed and implemented in full accordance with the needs of the labour market. In this respect, other stakeholders, such as society, governmental authorities, companies, public institutions, and NGOs, should be involved in the educational process in order to better face the challenges of the age of AI systems. Through higher investments in ITC and its deeper integration into the activities of higher education institutions, students may become better prepared and raise their employability in an increasingly competitive and turbulent labour market. Therefore, policymakers, together with decision-makers from higher education institutions should collaborate and analyse the results of this study that may provide solutions aimed at improving the educational process.

The research results can be extended to other specialisations because, on the one hand, AI has practically penetrated all fields of activity, and on the other hand, the questionnaire can be successfully applied not only to the already mentioned specialisations (Business Administration, Marketing, Economic Cybernetics, Public Administration), but also to other specialisations because it also contains items specific to them (for example, Informatics, Mathematics, Physics, Engineering, Sociology, Psychology, Finance, Accounting, Management, etc.). However, the outcomes of this paper should be interpreted by considering some of its limitations. First, in spite of the great number of items considered, the research does not analyse all of them as presented in various taxonomies. Thus, future research could integrate other new and relevant items that influence the employability of graduates. Second, another limitation of this study is given by the size and structure of the sample. It is highly representative at the faculty level, but it is rather difficult to assert that its results may be generalised in other Romanian or foreign higher education institutions. Future research may use larger and, therefore, more representative samples. Therefore, these results may constitute starting points for other research on Gen Z students from other specialisations and/or other higher education institutions located in Romania or abroad. Third, another limitation is the lack of a qualitative research involving specialists and experts from higher education institutions, human resource management departments, businessmen, and entrepreneurs. This type of research may be beneficial in order to better understand the challenges of the age of AI systems in future studies. In this regard, the inherent risks associated with the expansion of AI systems in all fields of activity for Gen Z students can also be considered.

The originality of this research is twofold. Firstly, it provides a new perspective on the structure of abilities, skills and competencies in the digital society. Secondly, it analyses Gen Z students' perceptions towards these concepts and the way education addresses them in the age of AI systems.

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