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Embracing Thinking Diversity in Higher Education to Achieve a Lifelong Learning Culture

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Abstract: The Fourth Industrial Revolution requires global, structural, and technological changes in all economic and production fields. The most apparent adaptation requirements fall on Generation Z individuals, who will have more and more responsibilities within organizations. The international reports of the World Economic Forum and the Organization for Economic Co-operation and Development indicate that this training will mainly require a strong development of thinking diversity and lifelong learning skills. This study presents an analysis of the education in these future skills that these individuals will need to work successfully throughout their careers, taking into account the evolution of conditions toward the changes expected in the following years. The methodology used in this research belongs to the field of futures studies. Through strategies in the field of foresight, various scenarios are proposed that involve the expected changes in the short, medium, and long term, both in higher education institutions and in industries and companies, to ensure the adaptation of Generation Z individuals to changes in work, workplace, and workforce. The findings show the strong influence that other skills and attitudes, such as self-esteem, self-efficacy, initiative, emotions, and motivation, have on the capacity for self-managed development throughout professional life.

Keywords: educational innovation; higher education; Industry 4.0; future skills; lifelong learning; thinking diversity; Generation Z

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1. Introduction

The Law of Requisite Variety states that the greater the diversity of a system, the more it can control the ambiguities of its environment [1]. This means that whenever it comes to solving highly complex and dynamic situations, there must be at least the same complexity and dynamics as the system. In the case of the ecosystem that makes up the Fourth Industrial Revolution, as the system continues to network, it becomes increasingly important to promote the creation of free networks within the companies that can react concretely to the industry's requirements [2].

Although a hierarchical management style ensures an orderly and calculable approach, the Law of Requisite Variety explains that there are more recommended responses to the complex dynamics of Industry 4.0. Achieving leadership no longer means directing and controlling the activities of employees but rather ensuring that people in the company can develop a thinking diversity and those lifelong learning skills necessary to recognize interrelationships and thus be able to be organized according to the changing requirements of the workplace [3].

Before the emergence of Industry 4.0, it was anticipated that human capital would be so necessary, in addition to and in conjunction with technological advances, that human resources departments would also have to perform employee education tasks. This led

to the emergence of Education 4.0, as the skills and qualifications of the workforce would be key to transferring less responsibility to central management structures [4]. Today, this transfer of responsibilities brought a culture of self-management of the skills of the future learning process, depending on the personal context, which would culminate in the personal successful development into a "network organization" [5]. Although this culture of lifelong learning can be seen as an imposition of industry, and of the new political and economic discourse, the truth is that it not only fulfills an economic and personal function but goes further in achieving a more democratic and just society [6].

Currently, the development of the necessary skills is so volatile and constantly changing that most of the required learning takes place on the job. The traditional training—formal and theoretical—that takes place in higher education plays an increasingly less important role [7]. According to estimates from international reports, 90% of opinions about what employees need and where they can learn the necessary skills take place on their initiative [8,9]. Industry 4.0 requires future workers to have the following:

- An individual and self-organized ability to act efficiently in a network organization, which implies a significant development of their self-esteem.
- Thinking diversity to increase the creative potential necessary to solve complex problems and challenges, which implies the development of their self-awareness through the exercise of initiative, emotions, and motivation.
- A lifelong learning culture to make them capable of acting with self-efficacy in new, unknown, and unprepared circumstances.

Studies on the development of skills for the workforce have been conducted considering the characteristics of millennial workers or even previous cohorts [10,11]. Some studies analyze the arrival of individuals from Generation Z (born from the mid-1990s to early 2010s) to higher education and their learning characteristics and cognitive styles [12–14]. Generation Z individuals (Gen Zers) are characterized by personal and ideological aspects, learning preferences, community engagement, professional aspirations, and unique or particular emotional needs [12]. However, few studies are related to the specific training of Gen Zers in Industry 4.0 skills.

The current demographic composition of society ensures that Generation Z is even more diverse than the previous ones [15]. In addition to their racial and ethnic makeup, Gen Zers also differ in work behaviors, shaped by values and economic circumstances, very different from those of the generations that preceded them. Some measures of economic well-being indicate that Gen Zers are growing up in more affluent circumstances than previous generations. Early benchmarks suggest they are on their way to becoming the most diverse and best-educated generation yet [16].

From recent studies, it is possible to analyze the job profile of Gen Zers, their attitudes, weaknesses, and strengths to joining work teams and how they adapt to job positions [17–19]. It is also possible to distinguish the intragenerational variants within this cohort, and their similarities and differences with millennials, which helps to understand the cohesion and cooperation between generations and plan future efficient environments in the workplace [20,21].

The literature review in the SCOPUS database with the keyword "Generation Z" showed 1567 document results in the period of the last ten years (2013–2022) with a trend of publications that went from only six articles in 2013 to reaching 474 articles in 2022.

Regarding the distribution according to subject areas, it was verified that 24.5% (727 documents) are classified in the social sciences area, 15.6% (464 documents) in the business and management area, and 6.3% (192 documents) in the area of economics. These data demonstrate the strong interest in rigorous research of the factors that characterize the passage of Generation Z individuals from higher education to their incorporation into the labor market [22].

While most of the publications on Generation Z in the period 2013–2017 focused on students, it can be seen that from 2018 the documents present research on the challenge of predicting their behavior in the workplace. Some studies in recent years attempt to provide

organizations and professionals with guidelines to be prepared with the expectations of Generation Z as they enter the workplace [17]. Other studies show that companies' experiences with millennials entering the workforce have not prepared them to address Gen Zers, because Generation Z is different from previous cohorts in its relationship to the workplace [23,24].

Although many early studies investigated the expectations of Gen Zers in the workplace without using any solid theoretical underpinnings of human resource management, more recent studies use instrumental frameworks and validated theoretical approaches to help employers rethink how they will design their policies to attract and integrate Generation Z into the workplace [25].

In undertaking this study, the findings about the unique behavioral differences of Gen Zers were considered, and the decision was made to limit the analysis of the behavior of these individuals, their needs to perform successfully throughout their career, and the evolution of the conditions towards the expected changes in the coming years.

Although lifelong learning culture is influenced by all other experiences and other educational levels, this research has focused only on higher education level instead of other educational stages since, after this level, the individuals will face for the first time a professional and personal life, in most cases, which they will require reflection on, and they would have to be responsible about their own future learning. For these reasons, HE is the selected educational stage to equip with the thinking diversity skills and those required to the new professionals.

The present study considers three research questions on the way to identifying the most effective future strategies (in the short, medium, and long term) for Gen Zers to acquire a lifelong learning culture:

RQ1: How can a lifelong learning culture be achieved by 2050 (when the oldest Gen Zers are 55 years old)?

RQ2: What would be the ideal conditions so that in 2030 a higher level of thinking diversity can be achieved among Industry 4.0 workers (when the oldest Gen Zers are 35 years old)?

RQ3: What would higher education institutions need to start doing now and keep doing for five more years (because the youngest Gen Zers will be entering university in 2028) to contribute considerably to the requirements of Industry 4.0?

This study seeks to highlight the importance of thinking diversity in higher education as a means for lifelong learning of Generation Z in the face of the needs of the Fourth Industrial Revolution. The document is organized as follows:

Firstly, the Introduction section describes the context of Industry 4.0 in the workplace, its demands and needs, and the profile of the individuals of Generation Z, which is the youngest cohort that is entering the labor market. At the end of the section, the relevant research questions to be answered in this investigation are defined.

Next, in the Materials and Methods section, the general methodological approach for the research is indicated, and in Section 2.1. and Section 2.2. the analysis of the current approaches related to the culture of lifelong learning and the imperative of thinking diversity in Industry 4.0 are carried out. Section 2.3. describes the methodology used and the way in which data were collected and analyzed in the SCOPUS database. Each subsection tries to answer one of the corresponding research questions.

Finally, in the Findings and Discussion section, the findings of those analyses are also shown in three subsections: the first subsection discusses the main skills required for Gen Zers; the second subsection discusses thinking diversity skills and their relationship with skills related to emotions and motivation; and in the third subsection, emphasis is made on how to achieve this thinking diversity, and the important role of higher education for the development of a lasting culture of lifelong learning.

2. Materials and Methods

The methodology used in this research belongs to the field of futures studies. Futures studies are comparatively new approaches, so it is necessary to distinguish the fundamentals of their theoretical framework [26]. Future-oriented thinking includes the predictions and construction of possible scenarios of future results and, in many cases, has the potential to determine present behavior. Efforts to know the future or "anticipation" allow researchers to reflect on the possible consequences of decisions and evaluate future options. Anticipation encompasses all ways of knowing the "later than now" and focuses on how the later enters reality [27]. Anticipation is a cognitive process associated with exploratory and predictive ways of thinking, and its methodology includes the following actions:

1. Anticipate future situations and their possible impacts.
2. Decide on current actions, taking into account possible future scenarios.
3. Balance short-term and long-term interests to achieve established goals.
4. Determine and control the causes of significant events.
5. Strengthen motivation, assuming it is possible to improve the current situation.

Anticipation allows the future to be represented through a limited number of possible scenarios and end states, since future-oriented agents continuously build and expand the future [28]. Therefore, making sense of these anticipatory processes of future creation would mean that the desired futures can be pursued through planning, reformulation, and redefinition of phenomena through any of the following:

- The proference, or descriptive prognosis, which is the intention to know a future that is possible (the "futurible"), that is, the future that might happen.
- The prospective, which is the intention to know a desirable future (the "futurable"), that is, the future wanted to happen.

Figure 1 shows how each "arm" of the prospective is supported by a specific one of the proference. This is because prospective requires a "futurible" configuration of the phenomena under study, and once the comparison has been made, it guides the result towards a "futurable", that is, a specific objective is achieved in a supposed future.

- The long-term arm of foresight (used for lifelong learning anticipation) is supported by the prediction arm (which gives information about the trajectory of the target, assuming the continuity of the historical pattern).
- The medium-term arm of foresight (used for thinking diversity in Industry 4.0 anticipation) is supported by the "foresighting" arm (which gives an idea of the probable events to which it will be necessary to adapt).
- The short-term arm of foresight (used to anticipate the paradigm in higher education) is supported by the forecasting arm (which represents reasoned judgments about the objective that is believed to be the most appropriate as the basis for an action program).

Proference means to bring forward. This technique is intended to extrapolate the past and present into the future: it looks at the variations that have occurred from the past to the present and then extrapolates those trends into the future [29]. It is a description of the future based on the category of causality and is limited to pointing out latent trends in the present that will be realized in the future. Some of the most-used methods of proference are forecasting, trend analysis, foresight, projection, prediction, environmental scanning, visioning, futures biographies, and Delphi methodology, among others [30]. The main criticisms of the proference method can be summarized in the following aspects [27]:

1. Social reality is constantly changing in a non-repetitive way.
2. Scientific predictions can only be applied to isolated, stationary, and recurrent systems, but social systems are open systems.
3. The prediction is usually derived from present factors that may change or become irrelevant in the future and, as a result, cause false assumptions about the future.
4. Predictions accurately derived from the present are rather synthetic and therefore irrelevant.

5. The adaptation of future techniques creates the possibility of confusing the analogy with the causal relationship, thus finding a non-existent causal relationship between the variables.

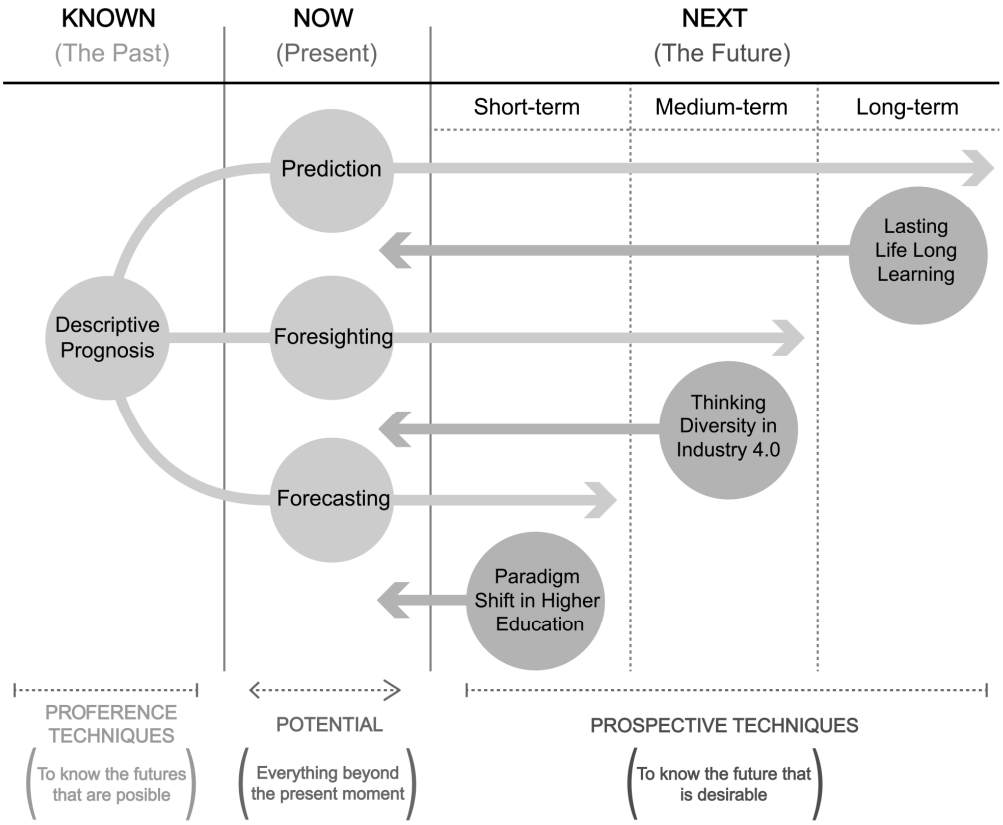

Figure 1. Anticipation options for futures studies, including proference and prospective techniques for the short, medium and long term.

Prospective means to bring back. It is a methodology based on the fact that there is no single determining future, but instead that it is always open to multiple outcomes, which are called future scenarios. Prospective studies aim to identify potential future scenarios to reduce uncertainty conditions to make decisions with the highest probability of success for an organization [30]. Prospective is the effort to make the most desirable future probable, imagining it from the future and not from the present, through a trajectory from the future to the present (to know the *desirable* futures).

The primary purpose of this study is to prepare the path for the future, adopting it as a goal (desirable and possible). Taking into account the proposed research questions, it can be seen that the prospective method can be used "to bring back" three anticipations:

- The first anticipation—related to RQ1—involves achieving a culture of lifelong learning by 2050.
- The second anticipation—related to RQ2—involves how to achieve a thinking diversity suitable for the needs of Industry 4.0, starting in 2030.
- The third anticipation—related to RQ3—implies what strategies should be implemented in 2028 so that higher education Institutions offer Gen Zers the appropriate training (so that anticipations one and two are *possible*).

Voros' taxonomy of potential futures is part of a more generic framework for anticipating uncertain future developments [31,32]. The Voros taxonomy starts with each potentially available future and gradually approaches the most probable and/or desired ones. Their future types are defined as follows:

Potential: Everything beyond the present moment is a potential future. This stems from the assumption that the future is indeterminate and "open," not inevitable or "fixed."
Possible: Those futures that we think "may" happen, based on some future knowledge that we do not yet possess but might one day possess.
Preferable: Those futures that we think "should" happen.

Under this vision, the current research presents a documental analysis through three key aspects or areas in development, which are establishing the trends toward which creative thinking is sought to be oriented, analyzing their central significance, characteristics, and expectations for each one and in consequence the identification of the factors molding the prospective and how it impacts the formation of the futures scenarios. In the following subsections, the necessary conditions are presented so that those potential futures are preferable and possible.

In order to explain what approaches and designs were carried out in this analytical study, Sections 2.1 and 2.2 are included below. There, the descriptive scope of the research is detailed to answer the research questions *RQ1* and *RQ2*, respectively: the dimension of futures studies related to lifelong learning and the dimension of futures studies related to thinking diversity in Industry 4.0.

2.1. Futures Studies for a Culture of Lifelong Learning

In this subsection, the answers to RQ1 will be sought by applying the Voros taxonomy to find the futures scenario of the first anticipation. Until a few years ago, millennial graduates considered that a degree awarded by recognized universities in their countries was a guarantee of success in professional life. The value of education was given by the reputation of the university that awarded the degree, which lasted throughout their professional careers [33]. The Fourth Industrial Revolution caused the workplace to develop in an environment where the problems to be solved are more complex; the solutions can have multiple connotations; therefore, it is necessary to have a creative outlook to face these new challenges. The challenges of Industry 4.0 involve, in many cases, ethical aspects that confront the professional to give a social and not only economic response.

The current workforce situation means that the training of Gen Zers is immersed, like never before, in the uncertainty of a changing world [34]. It is not only technology that drives change but also the global culture, the awareness of business sustainability, and the agents' diversity. This change generates an innovative vision in which what has been learned ceases to be valid in increasingly shorter periods, and the culture of lifelong learning becomes essential for action. This cultural shift to reimagine people as eternal learners has profoundly changed societies worldwide to become more flexible and resilient [35].

During the last two decades, it was considered that technological reskilling was enough to continue updating in a career. However, it is recognized that the most significant contribution in organizations is in innovation, both in production processes and in product development, since both include the ability to work as a team. The level of sophistication of the development implies managing a variety of knowledge that cannot be possessed by a single individual but requires the participation of diversified creative teams that work in the culture of lifelong learning [36]. Therefore, developing social and emotional skills such as advanced communication and negotiation, interpersonal relationships and self-esteem, leadership, and self-efficacy must be ensured in higher education [37].

In 1996, Kuhn described a paradigm as a set of practices that define a scientific discipline over a given period, resulting in a widely accepted conceptual model of best practice [38]. Currently, lifelong learning represents one of Industry 4.0's paradigms for professional intervention: obtaining a university degree does not represent an eternal certificate of knowledge of a discipline or the permanent acquisition of a skill. The challenge is how to motivate Gen Zers today to envision a long-term future (which in this study has been considered in 2050) in a new paradigm that is not yet established.

The challenge of promoting a culture of lifelong learning among Gen Zers is possible through experiences (formal and informal) that strengthen curiosity, transfer, independence,

initiative, and reflection [39,40]. Futures studies conducted using prospective techniques show that Gen Zers' expectations of happiness and satisfaction are not only related to performance in the workplace or making retirement plans but are feelings that can be exercised and acquired gradually. Opinion polls and the conclusions of international reports also show that the strategies for promoting the lifelong learning culture in Industry 4.0 no longer fall solely on companies and governments but can be trained individually through the exercise of related skills such as self-efficacy and self-esteem [20]. For this, Gen Zers must be convinced that acquiring these new skills is a driver of change to make better personal and family futures possible [17]. An example of a rubric for assessing lifelong learning dispositions is shown in Table 1. The rubric is based on that developed by the Association of American Colleges and Universities (AAC&U) as part of the VALUE initiative (Valid Assessment of Learning in Undergraduate Education) [41].

Table 1. Skills for lifelong learning VALUE rubric.

Lifelong Learning Dispositions	Capstone	Milestone	Benchmark
Curiosity	Explores topics in depth, generating high self-awareness and indicating intense interest and motivation.	Explores a topic with some evidence of depth, providing a perspective with a mild interest in the topic.	Explore a topic at a superficial level, showing little understanding beyond very basic facts.
Initiative	Generates and seeks opportunities to expand knowledge, skills, and abilities.	Identifies opportunities to expand knowledge, skills, and abilities.	Completes only required works.
Self-efficacy	Organize activities beyond those required in the workplace.	Seeks additional knowledge beyond job requirements.	Occasionally shows interest in independent pursuit of knowledge.
Thinking Diversity	Explicitly uses prior learning and applies in an innovative (new and creative) way that knowledge in novel situations.	Shows evidence of attempting to apply previously acquired knowledge in new situations.	Makes vague references to prior learning but is unable to apply different knowledge in novel situations.
Reflection	It reviews previous learning in depth to reveal significantly different perspectives on experiences and strengthen growth and maturity over time.	It reviews previous learning in some depth, revealing unclear meanings about past events.	Reviews prior learning at a superficial level, without revealing clarified meanings about past experiences.

2.2. Futures Studies for a Thinking Diversity in Industry 4.0

In this subsection, the answers to RQ2 will be sought by applying the Voros taxonomy to find the futures scenario of the second anticipation. Industrial revolutions in human history are synonyms of significant transformations. A common feature of all industrial revolutions is the emergence of new technology. Industry 4.0 is characterized by integrating value chains and digitizing the entire production process [42]. With Industry 4.0, the execution of non-routine tasks will be widespread, and an additional concept differentiates it from the rest: the innovation ecosystems [43,44]. Industry 4.0 is characterized by the consolidation of emerging technologies, including artificial intelligence, the Internet of Things (IoT), advanced data analytics, cloud computing, virtual and augmented reality, blockchain, and many other digital technologies [2]. The massive adoption of these technologies in all industrial processes (administrative, management, and production) offers potential growth opportunities. It can even help companies in difficult times: providing competitive advantages, creating new sources of income, and accelerating product research and development. In recent years, and especially during the COVID-19 crisis, the impact of Industry 4.0-related technologies has increased the value of products and services and provided new possibilities in the customer experience [45]. However, not all companies are prepared for

the workforce implications due to the need for an employee skills transformation strategy, including upskilling and reskilling [37].

The strength of the innovation ecosystem is directly connected to the close collaboration between academics, research institutes, and commercial businesses. In this premise, it is expected that Gen Zers require thinking diversity (creativity and critical thinking) to integrate themselves productively and integrally into new work situations or non-routine job activities. But, proving that these are included in the demands of Industry 4.0 must first be checked. Expected skills of future employees may be reviewed in the literature related to Industry 4.0 needs and prospection analysis of the World Economic Forum. Different studies agree that the new technological challenges of Industry 4.0 are causing deep gaps in the soft skills that exist in the current workforce, especially in those skills related to thinking diversity and higher cognitive skills [46], such as:

- Advanced literacy and writing.
- Quantitative and statistical skills.
- Critical thinking and decision making.
- Project management.
- Complex information processing and interpretation.

The Programme for the International Assessment of Adult Competencies (PIAAC) is a program of assessment and analysis of adult skills [47]. The Survey of Adult Skills is a major survey conducted as part of PIAAC. One of the most interesting findings from the PIAAC was that the demand for higher cognitive skills, including thinking diversity and complex information processing, will grow through 2030 at cumulative double-digit rates. Based on currently observed baselines, demand for these skill categories is estimated to increase by 19% in the United States and 14% in Europe. These data confirm the hypotheses of this study related to the Law of Requisite Variety and, at the same time, validate the use of prospective techniques to find the answer to RQ2.

2.3. Future Studies for Training Gen Zers Using the Education 4.0 Framework

In this subsection, the answers to RQ3 will be sought by applying the Voros taxonomy to find the futures scenario of the third anticipation. This is what higher education strategies, as preferable, should be implemented now and for five more years so that in 2028 Gen Zers receive appropriate training to contribute considerably to the requirements of Industry 4.0.

Today, the term Education 4.0 is shouted from the rooftops. It is a common term that has penetrated the literature in the educational field. However, it is not easy to know its meaning, having many definitions in the literature. The simplest definition of Education 4.0 is: preparing students for the 4th Industrial Revolution [48]. The framework is all that constitutes this preparation.

To identify what comprises the Education 4.0 framework, a mapping of the related literature was made, using the SCOPUS database, since it is the literature search engine with the largest number of curated publications in the world (https://www.elsevier.com/solutions/scopus/how-scopus-works/content, accessed on 1 November 2022). The search term used until 1 November 2022 was "Education 4.0", obtaining 423 results. We limited results to empirical and conference articles (no reviews (n = 25), book chapters (n = 26), notes (n = 1), or books (n = 2)) and discarding non-English articles (n = 19). Those articles that did not correspond to the theme related to Industry 4.0 or Education 4.0 (n = 1) were eliminated. We worked with the remaining 347 results, of which the keywords (author and index) were exported to an Excel document. This document was manipulated using Microsoft's Notepad, removing white space and placing one keyword per cell. Using Excel's data analysis tool, a pivot table was generated with the number of keyword counts. About 1850 keywords were obtained, of which, in this document, the first Top40 are presented, without considering the words Education 4.0 (251 counts) or Industry 4.0 (102 counts).

The first mention in the literature of the Education 4.0 framework, according to our search in SCOPUS, was in 2017, in the proceedings of the International Conference on Flexible Automation and Intelligent Manufacturing. At that time, there was a lack of

qualified employees for Industry 4.0 [4]; some of the characteristics of what Education 4.0 would bring at that time were:

- Enhancement of higher education.
- Increase in the cost of this type of education.
- Privatization of some institutions of higher education.
- Establishing high schools by big companies.
- Combine real- and virtual-world information.
- Virtual resources used for teaching.
- Implementation of augmented reality in the real environment.
- Virtual learning environments (VLEs) are used for the transfer of developed knowledge and skills.

Today, many of them are already true, which happened in just five years. As observed in Figure 2, each industrial revolution has lasted shorter and employed more resources than the previous one (vertical axes are not shown in Figure 2). As is represented, the intensity of the use of resources has passed from one revolution to another, being that today is the time to anticipate a *5th Industrial Revolution*, whether resource intensive.

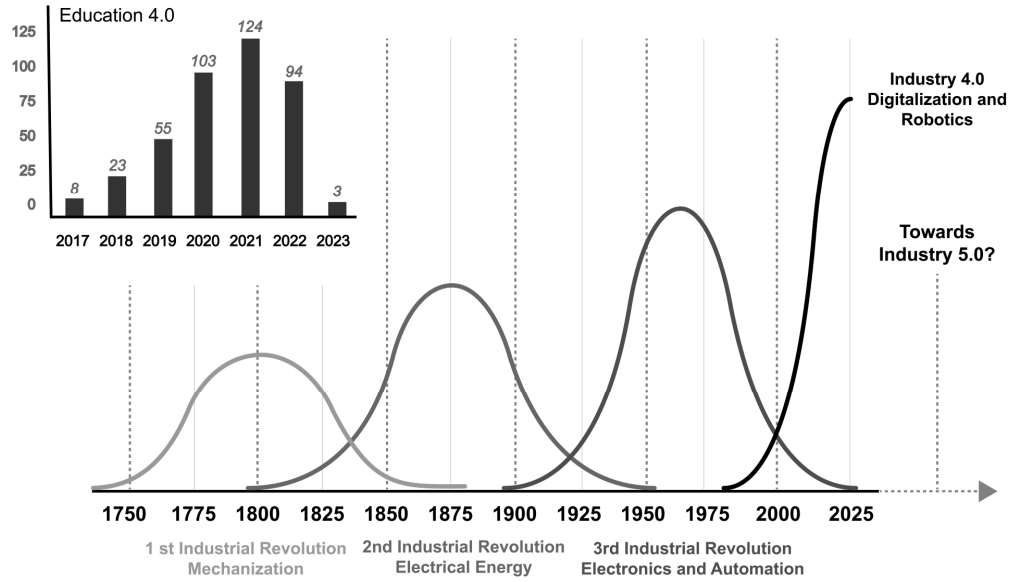

Figure 2. Diagram of tentative dates of the rise of the four industrial revolutions: the First Industrial Revolution (1760–1840), the Second Industrial Revolution (1870–1914), the Third Industrial Revolution (1970–2006), and Industry 4.0 (2011–2023). The graph inserted represents the number of documents (347 in total) found in SCOPUS with the search term "Education 4.0" related to Industry 4.0.

For the above reason, higher education must acquire a more accelerated form of adaptation. Returning to the Law of Requisite Variety, the only way is to allow students to be responsible for their learning. In this regard, hints may be obtained from the trends marked by the keywords of the literary documents (insert of Figures 2 and 3) that speak of artificial intelligence, innovation, digitization, personalization, adaptation, and sustainable development, among others.

The accomplishment of an education framework in higher education allows the anticipation of the future industry in a transversal way. For example, there are currently so-called schools of the future [43], in which children from the age of 6 are served, teaching them about topics such as programming, robotics, sustainability, global citizenship, or inclusion (Table 2).

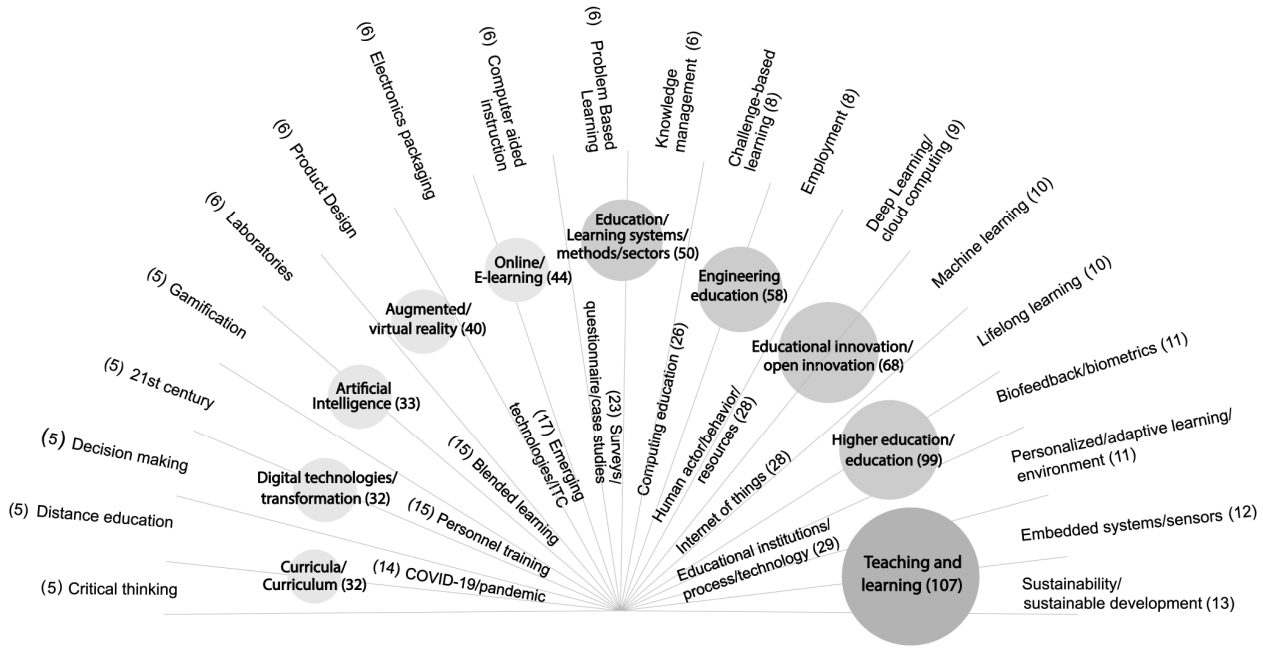

Figure 3. The top 10 (balloons) and top 11 to 39 (radial axes) out of 1884 keywords from the 347 documents obtained from the search for Education 4.0 in the SCOPUS database. In parentheses, the keyword frequency is indicated. The highest frequency is 107 and the lowest is 5.

Table 2. Example of schools of the future, according to the World Economic Forum.

Initiative	School Design	Curricular Focus
The Green School (Indonesia)	Wall-less, open-air	Sustainability and real-world application
The Kakuma Project, Innovation Lab Schools (Kenya)	Lessons via Skype	Based on the Sustainable Development Goals
The Knowledge Society (Canada)	After School Program	Mirroring learning and working environments of technology companies
TEKY STEAM (Vietnam)	Network of labs	Offers children ages 6–18 courses in STEM fields
iEARN (Spain)	A global platform for exchange	Projects promoting global citizenship through a digital platform
Prospect Schools (USA)	Network of schools	Inclusion
Tallahassee Community College, Digital Rail Project (USA)	Eight-meter-long trailers fully equipped with the latest technologies	Digital skills passports connecting the skills learned with future careers
Innova Schools (Peru/Mexico)	Education via online and physical spaces	Blended learning model to tailor education for each student

According to the World Economic Forum, the framework of Education 4.0 is amid the content (construction of mechanisms for the adaptation of skills) and the experiences (balancing innovative pedagogies) that will allow a change in the educational paradigm (model) through four main elements of learning and four groups of skills [43] (Figure 4).

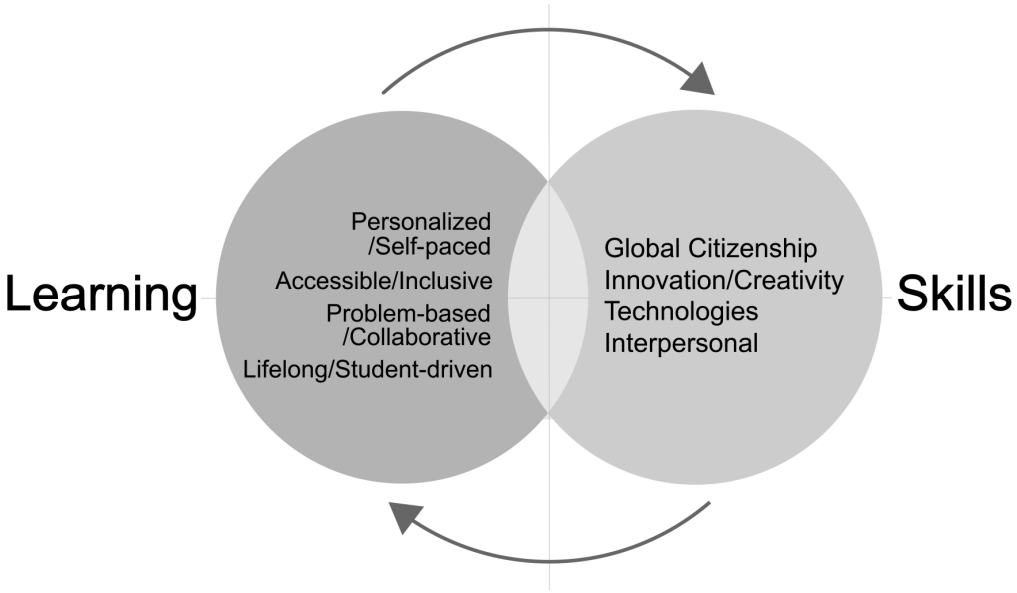

Figure 4. Constituents of the World Economic Forum's Education 4.0 framework.

Figure 4 constitutes one framework for Education 4.0. However, multiple frameworks arise from iterative discussions between governments, companies, educators, learners, and society. There is, for example, the Organization for Economic Co-operation and Development Learning Framework 2030 [49], which represents the changes that must occur in education so that not only a few can access job opportunities in the context of a changing economy based on Industry 4.0. This framework is represented by a compass in which the core is basic (health, data, and digital literacy and numeracy) and transformational competencies (taking responsibility, reconciling tensions and dilemmas, creating new value), which change according to the times. Therefore, they are within an educational model that acts, reflects, and anticipates iteratively and considers stakeholders with a view to individual and social well-being [49]. Thus, the Education 4.0 framework applicable to each case may depend on each university or setting [50], each country [51,52], or each area of knowledge [53,54]. However, elements such as diversity in personality and individual differences have been left behind in the study of the Education 4.0 framework. The most-studied topics are [55]:

1. Application of modern technologies.
2. Effects of Industry 4.0 on teaching and learning activities.
3. Engineering education.
4. Education innovations.
5. Empirical research and quantitative analyses using questionnaires on aspects of Education 4.0.

To achieve lifelong learning, learning must first be meaningful, allowing adequate critical thinking that seeks the construction of new ideas [56]. In addition, it should have real-world content and not pursue skill attainment as a stylized fact [57]. Finally, it must promote curiosity, motivation, and perseverance; for this, it must be accompanied by feedback in a way of reflection and confidence [58]. None of this would be possible without acknowledging, embracing, and, why not, celebrating the diversity of thinking in society and higher education students, particularly. Only in this way can education be personalized.

Based on the above, today more than ever, it is necessary that the education frameworks consider thinking diversity so that Generation Z students can be properly trained in Industry 4.0, and the uncertain steps towards Industry 5.0 can be given in a sustainable way.

3. Findings and Discussion

3.1. The Role of Self-Esteem and Self-Efficacy for Gen Zers

Self-esteem, self-efficacy, self-confidence, autonomy, and commitment are skills individuals will need to perform successfully in this changing society [7]. Self-efficacy is a competence that enables individuals to face emergencies and uncertain environments. To decide on solutions for a problem, a learner or worker must be able to execute the actions required to solve it successfully. Self-efficacy alludes to the belief and confidence in being able to master tasks relying on one's abilities and taking responsibility for one's decisions [59]. Self-esteem is understood as the awareness of the significance and value of one's individuality; it is an emotional assessment of one's value.

Present and future education must promote self-esteem, self-efficacy, and other self-competences since they are personal characteristics required for creative problem solving, goal achievement, and adaptability [60]. People who believe in their strength also show self-regulation, are more persistent, and develop a lower risk of anxiety disorders. Self-efficacy determines how people feel, think, motivate, and perform professionally, socially, or personally.

The future demands define a new paradigm of education as the interconnection of three elements that continuously redefine and build an individual: a relationship to oneself, a relationship to the surroundings, and an object.

The process of emotional development as forming a relationship with oneself, i.e., self-competences, evolves along different life stages, including parental education, formal, non-formal, and informal learning. Schools and families promote learners' self-efficacy and self-esteem during early childhood and adolescence by creating environments with increasingly difficult tasks and recognizing their achievements. Formal education promotes these and other subjective abilities through student-centered learning. By making learners responsible for their learning and continuously exposing them to increasing uncertainty, educational experiences such as learning by doing, inquiry-based learning, problem-based learning, challenge-based learning, and research-based learning improve self-competences [5]. Organizations also promote the development of these competencies by training their employees in collaborative work, innovation tools, and problem-solving strategies, e.g., design thinking or growth thinking.

3.2. The Imperatives of Initiative, Emotions, and Motivation for Gen Zers

In response to RQ2, the transversal competencies above the disciplinary ones have attracted the attention of labor demands in recent years. These competencies are considered the ones that allow effective communication, negotiation, critical thinking, collaborative work, and decision making within the complexity of today's competitiveness [61,62]. To clarify the demand of Industry 4.0 on the most important competencies to be developed by citizens, in the literature, there are some proposals for identification, definition, and hierarchical ranking for competencies and areas of interest [63,64]. The various classification proposals point to some of the most relevant ones: active learning and learning strategies, analytical thinking and innovation, attention to detail and trustworthiness, complex problem solving, coordination and time management, creativity, originality and initiative, critical thinking and analysis, and emotional intelligence, to mention the most relevant. These competencies are visualized as highly important to cover the work involved in the following areas of high interest in the Industrial Revolution 4.0: 3D-printing manufacturing and production, agile governance, artificial intelligence and robotics, arts and culture, behavioral sciences, biotechnology, blockchain, and circular economy. Creativity and critical thinking, which integrate thinking diversity, are essential to consider.

In this same line, resilience, stress tolerance, and flexibility are skills that the World Economic Forum has included as part of the most critical job skills in the self-management of tomorrow [60], which are widely correlated to the emotions of Gen Zers. These last would be desired to be present in the oldest Gen Zers as active workers for 2030 and may help achieve the thinking diversity expected in those professionals simultaneously.

As a complement of these preferred skills, self-esteem, self-efficacy, self-confidence, autonomy, and commitment skills of future professionals are secondary skills supporting the first and encouraging motivation. This element should be noticed since there is a whole complex process that must be understood from the educational formation and continue being exercised during labor life.

Figure 5 shows a summary of desired skills for Industry 4.0 workers. These multiple skills are not isolated, many are related to each other, and even some are complementary. For example, critical thinking is very related to analytical thinking and problem solving, while creativity is very close to originality and innovation. In counterpart, trustworthiness, self-esteem, self-efficacy, and self-confidence are linked between them, and their joint development may help to achieve creativity. On the other side, communication, decision making, commitment, and emotional intelligence may promote collaborative work.

Figure 5. Conclusive map about expected skills for Industry 4.0 workers according to this prospective analysis, showing their interrelation.

3.3. The Paradigm Shift in Higher Education

A concept that will lead to embracing a dynamic thinking diversity in Industry 4.0 is the paradigm shift in future education. Education and society have intensified the dynamics of change due to the current challenges and the new skills required by employers. In many cases, university programs have remained a solid base without granting all the necessary and existing skills. Undoubtedly, the paradigm of learning not only based on content and specialization in a single field of study has been left behind, and increasingly transversal skills that require multidisciplinarity are more in demand [65]. The concept of lifelong learning began to gain ground approximately 60 years ago when UNESCO, in the early 1960s, declared "lifelong learning" to be the central concept of all its planning, policy formulation, and educational practices for the future, whose aim was to reconceptualize

education in its entirety as a lifelong process when, in modern times, it has been commonly associated with and even defined as schooling. However, today the idea of schooling has been identified as a mere constitutive phase of a systematic education within a classroom or "schooled" system. In this way, the concept of lifelong learning was established by reconceptualizing education in terms of a learning society. From now on, sites other than the school (home, church, workplace, neighborhood, etc.) would be recognized as educationally relevant or potentially educational sites and different modes of learning other than schooling, including informal learning, as academic modes of learning [49,66,67].

A culture of lifelong learning can be defined as a set of beliefs, values, and attitudes and the resulting behaviors that promote learning shared by a group throughout life. A strong culture of lifelong learning is essential for a nation to thrive in an increasingly complex world, changing and exposed to unexpected challenges such as the COVID-19 pandemic [68–70]. While the exact skills needed for the future are unclear, a strong culture of lifelong learning ensures that people are prepared to upgrade existing skills or learn new skills to adapt to new challenges and opportunities. New information and communication technologies (ICTs) have increased the speed of information exchange. They also allow users to actively participate in virtual networks that can be quickly mobilized to shape public opinion. Globalization means that large numbers of individuals and families move across national borders. They and the societies that accept them must learn new ways of living together that consider cultural differences. These changes emphasize the importance of general learning and require adults to continue to acquire more information, improve their skills, and re-examine their values. The crucial role of adult education in social development has long been recognized. Thus, education is no longer necessarily related to teachers and teaching or formal teaching/learning situations but can be acquired through experience in the environment. One of the most recent approaches is to take education out of society or insert society into educational programs in schools through an innovative scheme of the combination of an educational strategy of experiential learning called "Challenge-Based Learning" and the theoretical framework for "Socially -Oriented Interdisciplinary STEM Education" [71,72]. The paradigm has changed, and it is necessary to develop increasingly complex, more technological skills to the demands of Industry 4.0.

4. Conclusions

The Fourth Industrial Revolution places essential training requirements on Generation Z individuals, mainly in thinking diversity and lifelong learning skills. This study analyzed the characteristics of this training in futures skills, considering the possible scenarios in the coming years. The methodology of futures studies allowed the identification of potential and possible scenarios and the proposal of strategies for desirable futures in the short, medium, and long term. The issues discussed and analyzed in this study include different recommendations for monitoring the development of Generation Z individuals during their time in higher education, their incorporation into labor markets, and the full development of their careers in Industry 4.0 to contribute to a considerable impact on the development of the skills of the future of the students of Generation Z for the requirements of Industry 4.0. The final discussions raise the relevance of the approaches to the paradigm shifts involved in achieving a culture of lifelong learning.

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