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DIGITAL EDUCATION STRATEGIES

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ABSTRACT

This study analyzes and discusses key strategies for digital education. It begins by examining and defining several key concepts, including global citizenship, digital citizenship, computational thinking, informational thinking, and systemic thinking. Moreover it analyzes the role of leadership in the age of digitalization and advocates for panoramic leadership. Then it compares STEM-based education with STEAM-based education extended by panoramic leadership – STEAMPL.

Keywords: computational thinking, digital citizenship, digital humanities, global citizenship, informational thinking, Internetization, STEAM, STEAMPL, systemic thinking, panoramic leadership.

1. INTRODUCTION

In the late 1990s, Internetization accelerated the global integration processes. The results are staggering. In the 1970s, bicycles were the primary method of transport in China, while now, in the 2020s, China is the largest vehicle manufacturer in the world. Who at that time imagined the use of the Internet would grow exponentially around the world?

The challenge of globalization in the 21st century has reached education, which has the task of preparing graduates for the smooth functioning of the global economy. The concept of training young people has begun to focus on developing *global citizens* based on *digital citizenship*. However, this trend has led to a mismatch, since "the world is flat" (Friedman, 2005). Because globalization is leveling the borders and privileges of developed countries, production, and services (*online*) should be invested where the labor force is cheapest. This has led to a radical reduction in the middle class in Western civilization (Targowski, 2014a) and an increase in the anti-globalization movement, especially during Donald Trump's presidency (2017–2020) in the United States. The 2020 pandemic has reinforced the trend of anti-globalization because the virus has limited international connections. In addition, the blame for the virus's spread is attributed to China, which has caused a rapid reduction in the globalist strategy and has resulted in restricted trade with this World Factory.

The globalization and Internetization of the countries, societies, and organizations of the world have strongly influenced the paradigms of teaching, for graduates need to be prepared in terms of knowledge and wisdom as well as qualifications for the challenges of this kind of world—one in which Western civilization has evolved into a Global Civilization (Targowski, 2014b), which in turn is transforming into Virtual civilization (Targowski, 2015). The repercussions of these civilization processes have impacted the mode of teaching both at primary and secondary schools and at universities. Certain professions are abandoned, new ones are born, and most professions require a new way of thinking and new knowledge, wisdom, and qualifications, which will be discussed in this chapter.

2. GLOBAL CITIZENSHIP

Global Citizenship Education (GCED) is UNESCO's response to these challenges. It works by empowering students of all ages to understand that these are global rather than local problems and by pushing students to become active promoters of more peaceful, tolerant, inclusive, safe, and sustainable societies. GCED is based on three areas of learning – cognitive, socio-emotional, and behavioral:

- *Cognitive*: knowledge and thinking skills necessary to better understand the world and its complexity.
- *Socio-emotional*: values, attitudes, and social skills that enable students to develop affective, psychosocial, and physical traits that enable them to live with others with respect and peace.
- *Behavior*: behavior and performance needed for practical application and commitment.

The key learning outcomes, student attributes, topics, and learning goals suggested in GCED are based on the three learning domains mentioned above. They are linked and integrated into a learning process. UNESCO's work in this field is guided by the Education Agenda 2030 and the framework for action, in particular Objective 4.7 of the Sustainable Development Goals (SDG 4 on Education), which calls on countries to ...

> provide all learners with knowledge and skills to promote sustainable development, including, inter alia, through education for sustainable development and sustainable lifestyle, human rights, gender equality, the promotion of a culture of peace and non-violence, global citizenship and recognition of cultural diversity and cultural contribution to sustainable development.

The concept of GCED pedagogy is given in Figure 1.

Figure 1. Pedagogy model of global citizenship (United Nations Educational, Scientific, and Cultural Organization, 2014)

This pedagogical model of global citizenship should permeate most all school subjects.

3. DIGITAL CITIZENSHIP

The world's first computer science program, the Cambridge Diploma in Computer Science, began at the University of Cambridge Computer Laboratory in 1953. The first department of Computer Science in the United States was founded at Purdue University in 1962. In Poland, the first Management Information Systems (MIS) program was established in 1959 at the Warsaw University of Technology, which was launched by Professor Seweryn Chajtman from the Department of Engineering and Economic Engineering (Industrial Engineering). The first graduates of this program defended their master's theses in 1961. The Department of Numerical Methods (a branch of the department of mathematics) was established at the University of Wrocław in 1961 and at the Warsaw University in 1964.

In the United States, the education of non-digital students (those untrained with the use of computer technologies) was limited by the extent to which the university had computing equipment, which at that time was limited to expensive mainframes. However, the university did begin to teach programming and the use of computers for engineering calculations in FORTRAN. To expand the digital education of all students, the timesharing system was developed, that is, the use of a computer by hundreds or even thousands of students at the "same time" with remote online terminals. One of the first timesharing systems was the GE 225 (1961), for which John Kemeny designed an interactive and very easy BASIC programming language for online computing, with the immediate compilation of external instructions into machine language. Over the next 26 years, all students were educated in BASIC programming. As the quiet, creeping revolution of IBM PC/MAC microcomputers began, this type of digital training became based on this new emerging type of equipment.

In the early 2000s, when the use of the Internet became widespread in Western civilization, the concept of digital citizenship was created, which can be used to determine the proper and responsible use of technology among users. Mike Ribble (2020) has developed three principles to teach digital users how to responsibly use technology to become digital citizens: respect, educate, and protect. Each rule contains three of the nine elements of digital citizenship (Digital Citizenship, n.d.):

- *Respect*: ethical elements, access, and the rights of other digital users are promoted.
- *Education*: elements of e-literacy, e-communication and e-trade are used to explore the proper use of the digital world.
- *Protection*: elements of rights and obligations, safety, and health and well-being are used to maintain security in the digital and non-digital worlds

Within these three basic principles, nine elements should be considered regarding digital citizenship (Digital Citizenship, n.d.):

1. *Digital access*: this is perhaps one of the most basic ways of being a digital citizen. However, due to socio-economic status, location, and other disabilities, some people may lack digital access. Recently, schools have become increasingly connected to the Internet, often offering computers and other forms of access. This can be offered in kiosks, cultural centers, and open laboratories. This is most associated with digital exclusion and related factors. Digital access is available in many remote countries via cyber-cafés and small cafes.

2. *Digital trade:* users can recognize that a significant part of the economy is active online. It also deals with understanding the risks and benefits of online shopping, using credit cards online, and so on. As with the benefits

and legal actions, there are also dangerous activities such as illegal downloading, gambling, drug contracts, pornography, plagiarism, and so on.

3. *Digital communication*: this element concerns understanding various means of online communication, such as email, instant messaging, Facebook messenger, application diversity, and so on. Each substrate is bound by a standard of etiquette.

4. *Digital literacy*: this concerns understanding how different digital devices are used, for example, how to search correctly for something in a search engine compared to a database and how to use different logs online. Often, educational institutions shape a person's digital skills.

5. *Digital etiquette:* this is the expectation that different media require a variety of labels. Some media require more appropriate behavior and language than others.

6. *Digital law*: This refers to the enforcement of laws regulating illegal downloads, plagiarism, hacking, virus creation, spam, identity theft, and cyberbullying, among others.

7. *Digital rights and responsibilities*: Just as in the American Constitution where there is a Bill of Rights, there is a basic set of rights extended to every digital citizen. Digital citizens have the right to privacy, free speech, etc. Basic digital rights must be addressed, discussed, and understood in the digital world. With these rights also come responsibilities as well. Users must know how the technology should be used in an appropriate manner. In a digital society these two areas must work together for everyone to be productive.

8. *Digital health and wellness*: digital citizens must be aware of the physical stress that using the Internet has on their bodies. They need to be aware that they cannot become too addicted to the Internet, causing problems such as eye strain, headaches, and stress.

9. *Digital security*: this simply means that citizens must take security measures, practicing the use of secure passwords, virus protection, data backup, etc.

In addition, in a study by Common Sense Media, it was found about six out of 10 American K-12 teachers used digital citizenship curriculum and seven out of ten taught competence skills using digital citizenship. Many of the sections on which these teachers focused included hate speech, cyberbullying, and digital drama. The problem with digital technology, which still exists, is that more than 35% of students do not have the appropriate skills to critically assess information online, and these problems increase as the grade level increases. Online videos such as those found on YouTube and Netflix were used by about 60% of K-12 teachers in classrooms, and educational tools like Microsoft Office and Google G Suite were used by about half of teachers. Social media was used the least (13%) compared to other digital tools of education.

Looking at the differences in social classes between schools, the study found that public schools were more likely to use digital citizenship curricula than teachers in more affluent schools (Vega, Robb, 2019).

Over the past two years, there has been a major shift from digital citizenship to digital leadership having a greater impact on online interactions. While digital citizens take a responsible approach by acting ethically, digital leadership is more proactive and includes "using the Internet and social media to improve the lives, well-being, and situations of others" as part of everyday life (TeachThought, 2019).

4. COMPUTATIONAL THINKING

In education, *computational thinking* involves expressing problems and solving them in ways that can be assisted by computers. This involves mental skills and practices in:

1) Designing calculations that force computers to perform tasks for us,
2) Explaining and interpreting the world as a complex of information processes, including computational processes (Denning & Tedre, 2019).

Computational thinking includes ideas such as abstraction, data representation, and logical data ordering, which are also prevalent in other types of thinking, such as scientific thinking, engineering thinking, systemic thinking, design thinking, model thinking, and the like. This new term was preceded by others, such as "scientific thinking," "algorithmic thinking," "procedural thinking," and "computational skills." After all, scientific thinking was defined by René Descartes 385+ years ago in the book *Discourse de la Method* (1637), where scientific problem solving was divided into: 1) denial, 2) the division of the problem into smaller ones, 3) the solution to smaller problems and 4) the integration of partial solutions into a holistic solution.

Computational thinking is designed to develop analytical thinking based on methods of computer science. It was defined by the International Society for Technology in Education (ISTE) and the Computer Science Teachers Association (CSTA) in 2011 as a recommended approach for most subjects taught in schools and was characterized in the following way (ISTE & CSTA, 2011):

1. Formulating problems in a way that they can be solved using computers and other techniques,
2. The logical organization and analysis of data,
3. Representing data by abstraction in models and simulations,
4. Automating solutions by algorithmizing thinking into a series of orderly procedures,

5. Identifying, analyzing, and implementing possible solutions with a view to applying the most efficient combination of procedures and resources,
6. Generalizing received solutions to various other problems.

Computational thinking should not be equated with the simple use of computers or mathematical calculations. It should not be limited to inputting data into mathematical formulas to compute them in a mechanical way. For example, the use of a "whiteboard" on a computer screen may involve students in interactive problem solving, especially with the graphical modeling of the problem and its elements. For example, graphically modeling the relationship between plants and animals should lead to generalizations and algorithmic thinking and abstractions. Eventually, students will learn to formulate problems for the computer to solve them, which will require planning a program flowchart and then coding it in a programming language. The resulting software can then be used for other computational tasks. Consequently, the student can learn to use a spreadsheet to computerize his/her budget. Thanks to this, the barrier of mathematics, which is the bane of many students and sometimes an insurmountable impediment to progress in their educational careers, can be broken. Therefore, computational thinking should be learned and applied by every student in school.

Computational thinking can be taught in the classroom and through various interest groups, such as:

- The interest-oriented circles of robotics, computer games, and simulating processes in nature and economy,
- Creative writing for newspaper articles or imaginary stories that are analyzed down into elements and then put together,
- Simulating the chorography of a planned dance performance at a school event by planning the figures and then harmonizing them,
- Others.

Teachers with limited digital practice are the critical link in implementing computational thinking among pupils.

5. INFORMATIONAL THINKING

With respect to computational thinking as proposed by American (and copied in other countries) computer scientists in 2011, it is surprising that the development of mass MIS systems in business and administration (since the 1960s) and the rapid development of Internetization since the 2000s (including e-mail, e-commerce, e-press or e-books, as well as digital libraries and communication platforms, including social networks such as Facebook and Twitter) have left no trace in what is supposedly modern thinking recommended to every pupil/student. The reason for this is that the socalled computer scientists are machine-oriented computer introverts, while IT professionals are "extroverts" oriented towards what is processed "outside" the computer.

The limited amount of computational thinking is due to the roots of computer science, which is oriented towards programming syntaxes (although the 2011 recommendation suggested expanding beyond the limits of computer coding). This extension, however, completely ignores the rapid development of the Digital Revolution in the 2020s. While numbers are information, not every piece of information is a number. Hence, computational thinking cannot be the only way of thinking required to computerize modern civilization.

It is worth recalling that communication strongly impacts the success of our civilization. Communication has proceeded and developed on three levels through the ages:

1. *Syntactic level* — determining how to communicate, as exemplified in the grammar of human and programming languages.
2. *Semantic level* — determining what the subject of our communication is (e.g., spoken or written).
3. *Pragmatic level* — determining why we communicate. At this level of communication, the wisdom of action is essential. This means that the "data" itself and the current fashionable data science will not lead to this level of knowledge and wisdom in the form of a wisdom-based science. After all, not only are experts wise, but children can also be wise if they know what wisdom is (Figure 2).

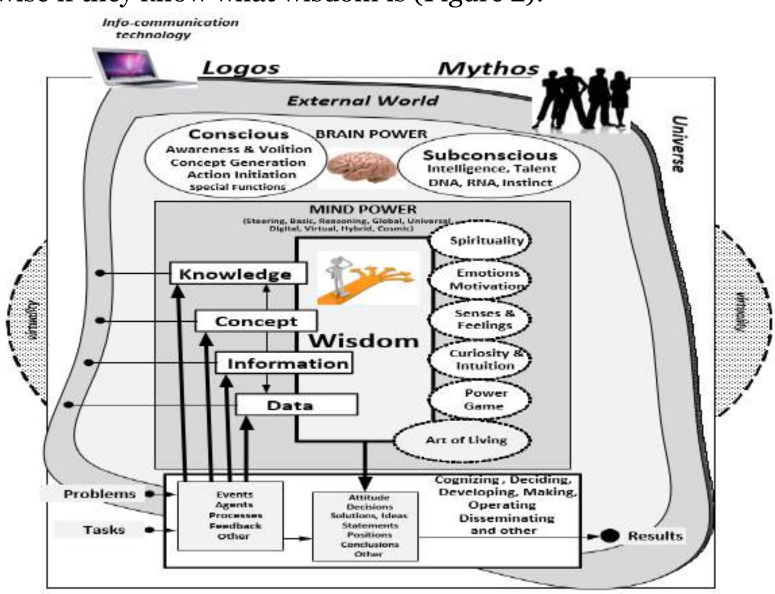

Figure 2. The role of wisdom in human cognizing, thinking, and deciding (Krawczyk, Targowski, 2019).

In the age of the digitization of data and knowledge, the first goal is to understand what we are curious about and what we want to convey in speech or writing to others. Therefore, informed people must be able to use a full cycle of cognizing, which consists of the following areas of semantics (Figure. 2):

- Cognitive units (Table 1) (Targowski, 1990; 2017):
  - *Data*: recording and measuring events such as the Dow Jones index of the New York Stock Exchange measuring at 20,000 points.
  - *Information*: the amount of change, e.g., the index fell 2,000 points, or 20 percent, the next day. This information generates options.
  - *Concept:*
    - Option 1 to buy more shares as they fall.
    - Option 2 to sell shares as they could drop even more.
    - Option 3 to hold stocks and ride out the stock market fluctuations.
  - *Knowledge*: having knowledge about the rules of conduct for these options in the context of the state of the national and global economy.
  - *Wisdom:* a choice of options supported by the subject's knowledge of a given decision-making situation in the context of the art of living of the decision-maker.
- Critical thinking, including analysis, interpretation, openness to different views, and solving socio-economic problems,
- Presenting ideas in ways that are conducive towards brainstorming, teamwork, discussing, arguing, and communicating,
- The ethics of computerization, including development trends and their challenges as well as the attitudes of IT professionals and users.

Understanding the characteristics of the units of cognition (Table 1) is as important as computational thinking, in which algorithmizing the problem makes it more understandable and easier to solve. It can be concluded that the modern user of information commonly deals with these units of cognition, while the algorithmization of problems is more appropriate for the application of artificial intelligence.

Table 1. Example of cognition units in the daily press

Cognition Units	Paradigm	Example
Data	Measuring the fact	Sports reports, obituaries, voting results, cinema, and theatre programs
Information	Detection of a change	Stock report; epidemic reports
Concept	Solution options	Election programs; development plans of the country or companies

Knowledge	Detected rules and patterns	Statistical assessments of the functioning of the economy or companies
Wisdom	Correct rating and selection of options	Editorial with editorial opinions for current events

Figure 3 lists the Model of Computational and Informational Thinking (MCIT) as one of the types of modern thinking in the 21st century.

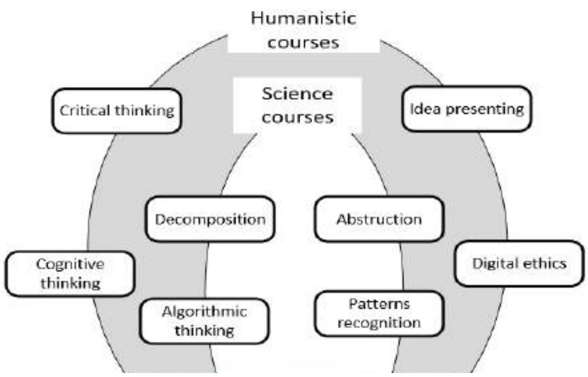

Figure 3. The Model of Computational and Informational Thinking (MCIT)

The degree of possibility for informational thinking in the 21st century determines the possible exclusion of information from society and determines entry into the information elite, as illustrated by the model in Figure 4.

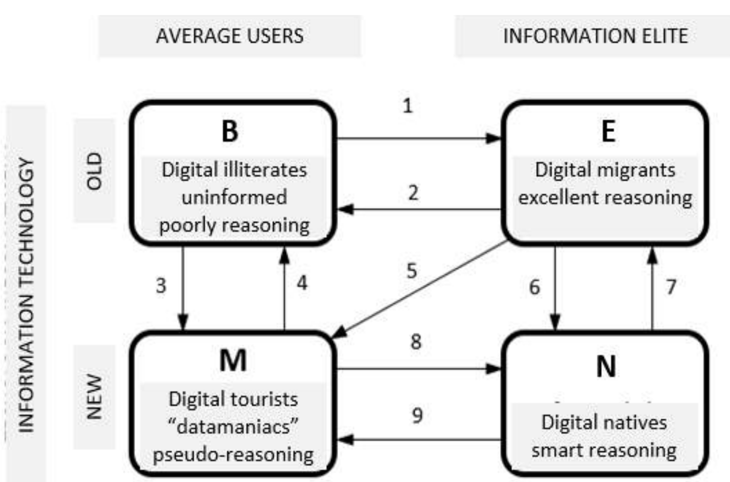

Figure 3. Categories of information users

The categories of membership in society regarding the use of information (according to the model in Figure 4) can be characterized as follows:

M — Digital tourists are good "internet users" (mainly the younger generation) who spend hours using the Internet; however, their knowledge and ability to use and understand cognitive units are shallow, as is their reading level. They collect large amounts of data and become "datamaniacs," but their reasoning is pseudo-reasoning—sometimes it is effective, but for the most part it is questionable. If they improve their knowledge and information skills, they can become "digital natives" (path 8). Thus far, their knowledge can even be characterized as negative, and their wisdom is questionable.

- *B — Digital illiterates* use traditional (old) information and communication technologies. They are misinformed and have only their own non-digital reasoning capacities; however, if they raise their knowledge and skills, they can move on to become digital immigrants (path 1), which involves working to adapt to the new conditions for processing information. They can improve the ability to use the Internet and its resources as digital tourists (path 2). Their knowledge is limited due to a lack of digital and virtual minds, and their wisdom is at a commonsense level.
- *E — Digital migrants* have excellent knowledge and skills in information handling, but they mainly use old information technologies. Only from time to time do they use new technologies, usually with the help of other people. They can improve digital skills by becoming digital tourists (track 5) or digital natives (track 6). They can reason well; however, they struggle with the use of digital and virtual minds. Their wisdom is mainly based on traditional criteria.
- *N — Digital natives* are part of the information elite and use new ICT technologies. They understand and reason very well. They have good digital and virtual minds, so their knowledge is constantly updated, and their wisdom is based on global criteria.

If specialists do not use their knowledge and skills, they may lose them (paths 2, 4, 7 and 9). Furthermore, it is wrong to say that, since the information elite can understand best, we should only educate these kinds of graduates. It must not be forgotten that, not only are these individuals good at digital thinking, but they also belong to those well-educated more broadly in information. This kind of elite has a comprehensive education in the humanities as well as good professions, and their knowledge and skills in information and communication technologies are the second layer of their education. It is wrong to think that only great digital skills and qualifications make a human being a member of the information elite, for such a master of digitization lacks the ability to correctly interpret information, which can lead to one becoming a data maniac and to developing misconceptions of situations and the world.

6. SYSTEMIC THINKING

The thinking of modern human beings cannot be based merely on computational and informational thinking because this would narrow one's perception of a situation and the world, and it would limit one's ability to function in modern Global-Virtual civilization. Because this civilization is a system of systems and subsystems that entangles all of humankind, whatever a person touches is, in some way, connected with the "system." For example, e-mail belongs to the super-internet system, as does Facebook as well as MS Word editor, in which one can write, say, an appeal against the decision of a tax office or write a letter to one's bride. If you want to fly from Warsaw to Nice for a holiday, then you need to purchase a ticket in the great booking system of the airline. Modern cars have large mechanical and electronic systems that cannot simply be repaired with a screwdriver. Similarly, a modern residential building is a large physical structure with an electronic system. Working online, in a virtual school, or in an online store like Amazon involves being a part of a great system in which one must be able to function. Furthermore, what are robots and drones? These are complex systems used for "simple" operations.

Therefore, systemic thinking is a necessary complement to computational and informational thinking. The definition of this type of thinking is as follows:

> Systemic thinking is a holistic approach to analysis and design that focuses on how system components work interconnectedly, how systems evolve overtime, and how systems work in the context of larger systems.

About 2400 years ago, Aristotle stated that "the whole is greater than the sum of its parts" (IEP Aristotle). Many centuries later, Georg Wilhelm Friedrich Hegel added the following properties to describe a system (IEP Hegel):

- The whole determines the nature of the parts.
- Parts cannot be understood in isolation from their entirety.
- Parts of the whole are in mutual relations.

At the beginning of the 20th century, the concept of a living organism began to be discussed, the complexity of which cannot be determined based on the characteristics of its isolated elements. In the 1920s, a German biologist Ludwig von Bertalanffy (1951) proposed a theory of systems for analyzing organisms. This theory was supported by cybernetics approach with feedback proposed by Norbert Wiener (1948). The contemporary definition of a system can be is as follows:

> The system is a purpose-controlled structure of interconnected elements in pursuit of benefits outside the system despite adversity.

For example, a car is a transport system to drive from Warsaw to Cracow, that is, to overcome the 300 km that lay between the vehicle and its destination, despite the snowfall and icing.

The literature on systemic thinking is enormous. Here we will recall the principles of systemic engineering, which indicate the method of systemic thinking, formulated by Targowski (1990):

1. *Cybernetization*: the feedback and self-organization of the complexity of elements to return to the basic state of the system, based on homeostasis,
2. *Systematization*: the clearly and deliberately organized structure of elements,
3. *Consistency*: the harmonious relationships of elements to effectively achieve goals,
4. *Categorization*: the complete organization of elements without redundancy,
5. *Primitiveness*: the hierarchy of complexity of elements in a structure, based on the simplest elements at its base.
6. *Completeness*: the system containing all necessary elements,
7. *Value engineering*: the system containing only necessary elements and interconnections for a deliberate result.
8. *Open structure*: the structure of the system making it possible to supplement it as the system develops.

The ability to use system engineering principles is an effective way of preparing graduates to work in the fields of computer science, engineering, sociology, and others, fields where he/she will be a user of information systems.

In systemic thinking, it is very important to understand the complexity of systems. It is known that most graduates of schools and universities will not work in the government but in companies and organizations that require public administration. The complexity of such systems is illustrated in the model in Figure 5.

For example, business and administrative organizational systems can be designed based on 13 business perspectives, 6 behavioral perspectives, and 4 context perspectives of the world (Fig. 5), that is, 23 perspectives in total. Of course, the number of perspectives one chooses depends on the analyst or system designer. For the given example, the average system has 7 elements, shown in Table 2.

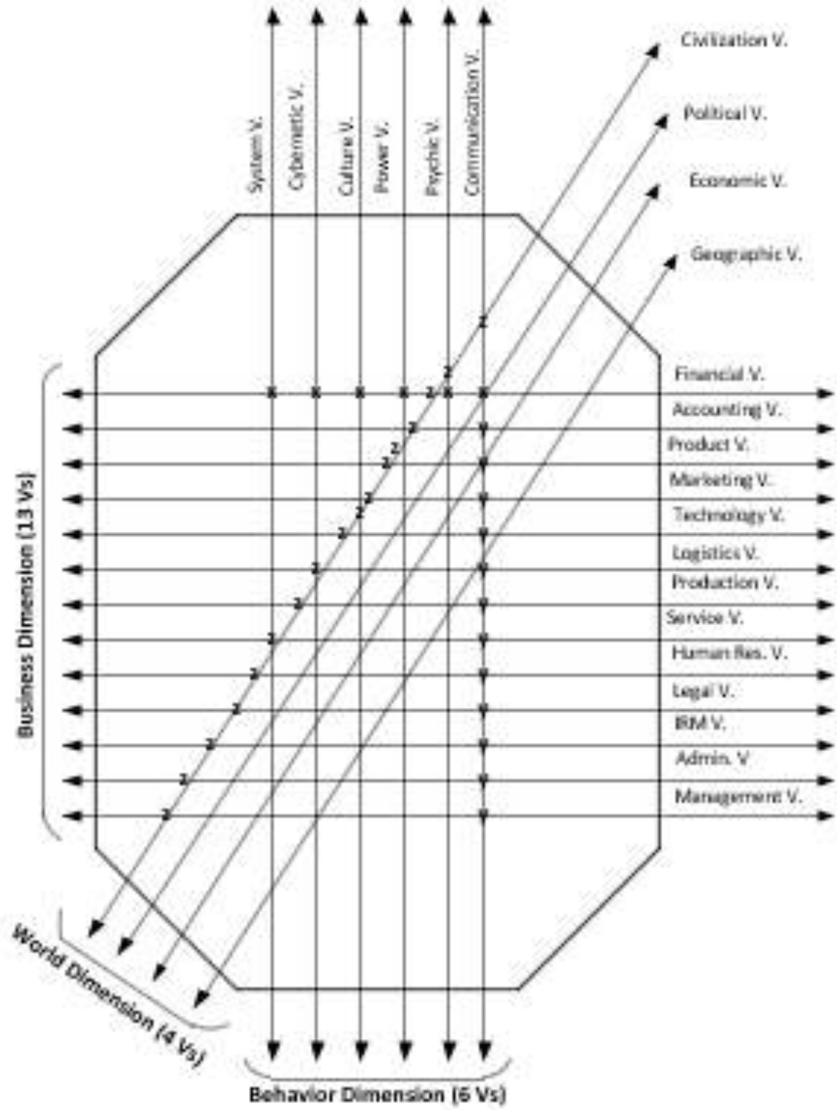

Figure 4. Model of complexity for business and administrative type organizational system (V-view)

Table 2. The complexity of an organizational business system

System Level	Number of Ele-ments	Number of Rela-tions	Number of States	Number of Views	Number of Elemenets	Number of Rela-tions	Number of States
Intra-view	7	21	128	23	161	483	2,944
Inter-view	23	2,553	8,388,608	1	23	2,553	8,388,608
Total				24	184	3,036	8,391,552

In Table 2:

- Number of relations [r] among elements € of a system r = (e-1) e :2
- Minimum number of states (s) (active and not active) s =2^e

This 23-elements-based system model shows that the company's chief executive officer (CEO) should assess and make decisions about the state of his/her organization's 8,391,552 situations, which, of course, is not possible; however, thanks to IT systems, one's attention can be focused on several elements and their critical states, assuming the remaining components function under established boundary conditions monitored by the computer.

The concept of systemic thinking based on the number of elements considered leads to the methodology of student training and student education. Table 3 shows the expected ability to think system-wise depends on the number of system elements.

Table 3. The ability to think system-wise according to the number of elements concerned

Level of Analysts	Ability to Analyze the Number of Elements	Examples
Graduate of elementary school	1	Knows the health effects of smoking cigarettes
Graduate of high school	2	Knows the health effects of smoking cigarettes and drinking sweetened "refreshing" drinks
Graduate 3-4 year-based studies	3-4	Knows the effects of coal imports on the national coal industry
Graduate 5-6 year-based studies	5-6	Knows the effects of a pandemic on the national economy
Ph.D holder	6-7	Knows the effects of a pandemic on the global economy
Professor	7-10	Knows the effects of his/her specialization on the development of civilization
CEO	7-11	Knows the effects of a pandemic on the development of the company
Secretary, prime minister, president	11-12	Knows the effects of global warming on a targeted area/country
Designer of info-decision based systems	12-13	Knows how to design a climate warming IT system
Analyst of intelligence	13-15	Knows the reasons for the 2020 pandemic

It is necessary to plan the pedagogical methodology of a school, university, and professional training activities based on the given number of elements that a person needs to use effectively in his/her problem-solving profession.

7. PANORAMIC LEADERSHIP IN THE AGE OF DIGITALIZATION

Computerization at the time the widespread use of the Internet, social networks, and various digital platforms as well as the fascination and dependence of young people on smartphones has limited real, F2F (Face-to-Face) communication and has made it possible to live through virtual communication. Of course, this is a disadvantage for people, both in terms of health and socialization. That is why *digital citizenship* and *global citizenship* as well as *computational*, *informational*, and *systemic thinking* cannot be focused on merely observing and getting to know what is happening in the world. A person with this type of thinking and skills should be active and, as far as possible, should lead in situations in which he/she finds himself/herself and which require intervention, thanks to the social resonance possible through computerization.

For years, people were raised in steep social hierarchies, as was the case, for instance, for those in the military, where the soldier was a small "cog" in a great military machine. Today, however, soldiers do not fight in the trenches as in World War I. In the wars in Iraq and Afghanistan, for example, soldiers faught in small units of several people, were mobile, and had to cope with unexpected situations and the adversaries themselves. The most help one could get in critical situations was to call a helicopter for support. In addition, in the hierarchical military tradition of the 19th century, children were raised to be "polite and sit quietly." They behaved in a similarly passive way in adulthood.

Today, civilization is facing many crises, and this requires a timely response aimed at securing the common good from every section. Therefore, the aforementioned "citizenships" and ways of thinking should be integrated and activated to ensure that the individual user is able to conduct themselves, as illustrated by the model of panoramic leadership in Figure 6.

After all, it should be recalled that one of the most dangerous crisis-producing factors of our time is the lack of conflict-free communication between people, between cultures, and between civilizations. Even in families, a significant crisis, divorce, is caused by a lack of good, friendly communication.

Hence, pupils and students as well as participants in professional development courses need, above all, to learn to communicate and distinguish the following qualities of this process:

• Transinformation • Pseudoinformation • Missed information • Parainformation • Misinformation • Information about data	• Metainformation • Debating • Argumentation • Conflict resolution • Conducting meetings • Others

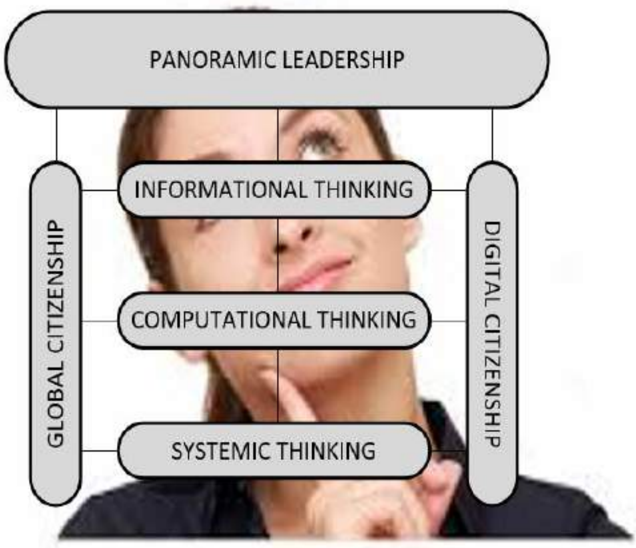

Figure 5. Panoramic (all-inclusive communicating) leadership in the 2020s

It is not being proposed that the teaching of panoramic (all-inclusive and communicating) leadership should occur in a single lecture from a silo of the school and university; rather, as illustrated by Table 3, this depends on the level of teaching and the number of elements of the system being considered. This kind of leadership is illustrated in Figure 7.

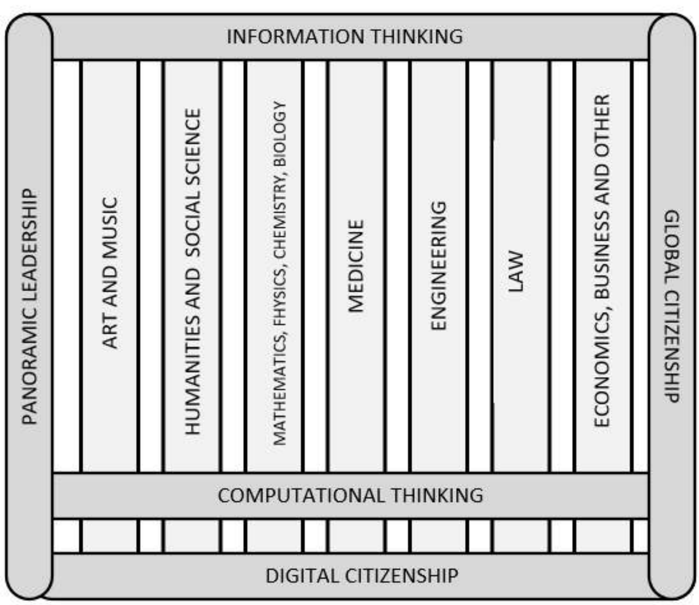

Figure 6. Infiltration of inclusive leadership into education programs

8. CONCLUSION

1. STEM (Science, Technology, Engineering, Mathematics) training and learning (popular among pragmatic educators) should be transformed into the STEAMPL (Science, Technology, Engineering, Arts, Mathematics, Panoramic Leadership) approach that involves panoramic leadership supported by humanizing technology.
2. However, for this to be possible, teaching must not be limited to merely increasing the resources of knowledge because the most important unit of cognition is wisdom, that is, correct judgment and correct choice of options for either thinking or solutions in the context of the art of life. However, wisdom is not yet the subject of systematic teaching and learning. It cannot be substituted by Big Data.
3. Panoramic leadership to be successfully implemented in education requires an intensive education-training of the teaching faculty.

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