FORMATION OF A MODEL OF INFORMATION LITERACY IN THE DIGITAL ECONOMY OF THE XXI CENTURY (ON THE EXAMPLE OF EU COUNTRIES)

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Abstract. The *relevance of the study* of information literacy in the 21st century is paramount in the context of education and social development, particularly in light of the prevailing trend of digitalisation. Information literacy has emerged as a crucial skill set for effectively navigating the modern information society, characterised by the exponential growth and accessibility of information. The ability to engage with information critically and proficiently has become indispensable for personal and professional advancement in today's world. The *subject of the article* revolves around the significance of information literacy in the 21st century, particularly in the context of education and social development amidst the digitalisation trend. *Methodology.* Using a variety of methods and approaches, including cross-cultural, systemic, structural-functional, institutional, anthropological and axiological approaches, as well as general scientific methods, the authors aim to identify the strengths and weaknesses of people in information literacy and develop strategies to improve their competence in this area. The study employs a comprehensive approach to investigate both the theoretical and practical aspects of information literacy formation in the modern era. The overarching approach involves integrating information literacy into the educational curriculum, providing support to educators and fostering an environment conducive to the cultivation of these skills among students and the broader populace. This holistic approach recognises the importance of information literacy as a cornerstone of modern education and social progress, ensuring that individuals are equipped to thrive in an increasingly digitised world. In this study, *the primary objective* is to explore both the theoretical underpinnings and practical applications of information literacy in the contemporary era. Information literacy encompasses not only the capacity to effectively interact with information but also the ability to evaluate it critically and leverage it to accomplish specific objectives. The theoretical and practical significance of this study lies in fostering digital competence, which entails not only understanding the digital landscape but also actively utilising technology and problem-solving skills. In *conclusion*, the study emphasises the paramount importance of information literacy in the contemporary era characterised by rapid digitalisation. As society grapples with the challenges and opportunities presented by the influx of information, the ability to navigate, evaluate, and utilise information effectively emerges as a linchpin for personal and societal advancement.

Keywords: informatisation, information literacy model, digital economy, big data, digitalisation, information technology.

JEL Classifications: O33, I21, I22, I23, I28, O38, Z13

1. Introduction

The relevance of the study of information literacy in the 21st century is an important aspect of education and social development. Information literacy covers a set of skills, knowledge, and abilities necessary for the effective use of information in a digital society.

Information literacy is a comprehensive skill and ability to work effectively with information in the modern digital society. The main components of information literacy are: the ability to use various sources to find the information one needs, including web resources, libraries, databases, etc. Developing

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critical thinking skills to analyse and evaluate the quality of information includes identifying reliable sources, understanding the concepts of fraud and manipulation of information. One area is information processing, the ability to effectively process and organise information for further use. This may include the ability to produce structured documents, tables, graphs, etc. Effective communication skills, including writing, speaking and using modern means of communication such as email, social media; understanding the rules of information use, including aspects of copyright, confidentiality and ethical standards.

2. Literature analysis

The research path was aimed at studying the development of the digital education system in the context of the digital economy, with a focus on EU countries, as shown in the paper by Buhaichuk Oksana, Nikitenko Vitalina, and Voronkova Valentyna (2023). Their analysis examines the current landscape of digital education in EU countries, assesses the level of digital literacy among students and educators, and identifies the key skills needed to succeed in the digital economy. Similarly, S. V. Leonov's work on social, economic and educational transformations in the digital age (2022) provides valuable insights into the evolving nature of education in the digital age. Ramaswamy V. and Ozcan K. (2022) further deepen the authors' insights by exploring the demands of the modern labour market and outlining the essential skills and knowledge needed to thrive in the digital economy. Their research extends to the integration of cutting-edge technologies such as virtual and augmented reality, artificial intelligence and others into educational settings to improve learning outcomes. Oleksenko's R. (2017) fundamental work based on the economic model of digital education also played a crucial role in shaping the authors' approach. Aware of the absence of a comprehensive model of information literacy for the 21st century in the literature, this study aimed to fill this gap by developing a strategy that would cover various aspects of digital education. This endeavour required the formulation of a multifaceted approach that included the acquisition of basic digital skills as well as the cultivation of advanced competencies such as programming, data analysis and critical thinking. Furthermore, the importance of adapting to different learning styles and using innovative technologies to optimise the learning process was emphasised. A central element of the work was the establishment of performance indicators for digital education and the development of an evaluation system to determine the effectiveness of the implemented strategies. Additionally, the authors advocate for cooperation with other EU countries to facilitate the exchange of knowledge and best practices in the field of digital education.

In summary, the creation of a robust information literacy model for the 21st century promises to equip the next generation of professionals with the necessary skills to develop the digital economy in the EU and beyond.

The purpose of the study is to analyse the theoretical and practical foundations of information literacy in the 21st century. The objectives of the study are as follows:
1) To develop a model for the formation and development of information literacy in the 21st century;
2) to show the place and role of ChatGPT in education: advantages and disadvantages;
3) to reveal the directions of ICT literacy formation in the study of humanities, natural sciences and technical disciplines and solving problems in education;
4) to display an AI forecast of future trends.

The methodology for analysing information literacy in the 21st century is based on understanding and assessing people's information skills and abilities in the modern world, where information has become extremely accessible and important. This paper identifies the key aspects of the methodology for analysing information literacy in the 21st century:
1) The definition of information literacy in the modern context, which includes the ability to effectively find, evaluate, use and co-create information using different media and tools;
2) evaluation of information sources, which has shown that a key information literacy skill is the ability to evaluate information sources for reliability, objectivity, relevance and authority. Assessment methods include source verification, author research, and bias assessment;
3) information literacy involves the development of critical thinking, which allows to analyse and criticise information and distinguish facts from opinions and lies;
4) information search skills, which involves the ability to effectively search for information on the Internet and other sources. This includes the ability to use search engines, libraries, databases and other resources;
5) data analysis skills, which are based on data processing and analysis. Information literate people should have the skills to analyse numerical and statistical information;
6) ethics of information use: it is important to consider the ethical aspects of information use. Information literate people should understand the issues of confidentiality, copyright and ethical use of information;
7) social media literacy, which is based on an understanding of how to interact effectively in this environment, maintain confidentiality and identify

misinformation. Information literacy requires continuous learning and adaptation to changes in the information environment.

These aspects form the basis of the methodology for analysing information literacy in the 21st century. This methodology evolves with changes in technology and society, allowing individuals to be better prepared for life in the modern information world. Different combinations of these methods can be used, depending on the specific purpose of the analysis and the audience. An information literacy assessment helps to identify a person's strengths and weaknesses in this area and to develop strategies to improve their information literacy.

3. A Model for the Formation and Development of Information Literacy in the 21st Century

The 21st century is characterised by the rapid development of information and communication technologies (ICTs), which has led education to focus on improving ICT literacy. According to Trilling and Fadel, ICT literacy is one of the essential skills for a 21st century society. ICT can facilitate e-learning, online courses, digital libraries, computer-assisted instruction (CAI), mobile learning and virtual reality-based learning. The fidelity between technology, the learning process and what is taught is influenced by the practitioner's knowledge of three things known as TPCK (technology, pedagogy, content and knowledge) (Buhaichuk, Nikitenko, Voronkova, 2023).

According to UNESCO, the model of ICT development in education consists of four stages: 1) nascent – those who are just beginning their educational ICT journey; 2) applied – those who have a new understanding of education; 3) integration – those who are integrating ICT into existing teaching, learning and management practices and policies; and 4) transformation – those who are using ICT to support new ways of teaching, learning and managing. Advanced developed countries are mostly in the implementation phase. They have formulated plans and policies for ICT in education, but due to the urban-rural divide, some aspects are still at the application or development stage. The younger generation, which relies on the Internet and other ICT products, needs to focus on improving the quality of learning and increasing ICT literacy in the learning process.

Learning in the 21st century has changed to equip learners with the skills they need for life in this century. Kereluik et al. describe the structure of 21st century learning as consisting of three main elements: 1) basic skills (knowledge); 2) metacognition (actions); 3) humanistic knowledge (values). The concept of 21st century learning suggests that basic knowledge includes three main components, namely: core content knowledge, interdisciplinary knowledge and digital/ICT literacy. Foundations are what students need to know in order to have a sufficient level of knowledge. Metacognition is knowledge about the process of working with the foundational knowledge. Metacognition skills can be demonstrated through creativity and innovation, problem solving and critical thinking, communication and collaboration. Humanities knowledge includes life and professional skills, cultural competence, moral and emotional awareness. Humanities knowledge provides an understanding of students and their place in society and the global community.

The framework for 21st century learning emphasises that students' knowledge development should include mastery of basic knowledge, skilful application of knowledge and mastery of humanities knowledge. The emphasis on ICT literacy in the framework confirms that 21st century learning should support good ICT skills. ICT literacy has been the subject of research by a wide range of education specialists. ICT literacy is the basic knowledge that demonstrates a person's ability to effectively seek, organise and process information from a variety of digital media, with a good understanding of technological systems and media forms, taking into account ethical and moral values. ICT literacy is part of ICT competence, which is characterised by the ability to use technology effectively. The use of technology includes 1) the use of technology as a tool to find, organise, evaluate and communicate information; 2) the use of digital technologies (computers), networked devices and social media to access, manage, integrate, evaluate and create information that facilitates the acquisition of economically literate information; 3) a basic understanding of the ethics and legality of obtaining and using information through technology. At the heart of ICT literacy is the use of digital technologies, communication devices and networks to access, manage, integrate, evaluate and create information for the benefit of society. ICT literacy combines technical processing skills with cognitive skills, taking into account their social value. The powerful impact of the development of ICT in education has led to the adaptation of ICT literacy in assessment systems in different countries and the development of trends in the assessment of ICT literacy. According to Pernia, ICT literacy assessment is based on three main dimensions: a) knowledge of technology; b) skills to use technology with relevant knowledge; and c) attitudes towards using technology. The ICT literacy assessment framework was developed as a skill that combines:
1) Cognitive skills;

2) technical skills. Measurable ICT literacy skills include access, management, synthesis, evaluation and creation.

Five ICT skills are as follows:

1) Access is the activity of knowing what and how information is collected and produced;

2) management – the activity of implementing a grouping or classification scheme;

3) synthesis – the activity of interpreting and presenting information, including generalisation and comparison;

4) evaluation – the activity of making decisions about the quality, relevance, usefulness or effectiveness of the information produced;

5) creation of tools for information production by adapting, implementing, designing, searching or recording information.

Cognitive skills are related to the basic skills of everyday life at school, at home, and at work. Cognitive skills include literacy, numeracy, problem solving and visual literacy. Technical skills are at the core of digital literacy. This includes basic knowledge of hardware, application software, networks and elements of digital technologies. The integration of cognitive and technical skills builds ICT literacy and enables students to make the most of their technological skills.

At the highest level, ICT skills lead to innovation, personal transformation and societal change. ICT literacy consists of six processes, namely:

1) Management information is the process of organising and storing information for reuse;

2) an assessment that reflects the use of processes to design and build ICT solutions and to evaluate the completeness, relevance and usefulness of information;

3) development of a new understanding that sees processes as the creation of information and knowledge through synthesis, modelling, implementation, design, discovery or writing;

4) communication that is based on the exchange of information through the sharing of knowledge and the creation of information products that are appropriate to the audience, context and media used;

5) appropriate use of ICT, which aims to make critical, deliberate and strategic ICT decisions and to use ICT responsibly, taking into account social issues, the law and ethics.

These processes mainly consist of three parts, namely:

1) Use of information;

2) creation and exchange of information;

3) responsible use of ICT. ICT literacy is the process of using information and communication technologies to obtain, manage, integrate, evaluate and create information that benefits society, taking into account its ethical value and legality (Matviienko, Vytrykhovska et al., 2023).

4. The Place and Role of ChatGPT in Education: Advantages and Disadvantages

The emergence of ChatGPT has attracted the attention of all segments of society, confirming the necessity and urgency of the digital transformation of education, which is becoming the main productive force. Scientific and technological progress is significantly increasing labour productivity and pushing human society towards a new digital stage of 5G. ChatGPT represents a major breakthrough in artificial intelligence technology, reflects the development of a new round of technological revolution, and is capable of optimising education based on new concepts. ChatGPT can provide certain support to educational practice and development with its strong comprehensive functions and easy-to-use advantages. ChatGPT meets the requirements of serious education and training strategies, allows to see different possibilities in the future and inspires to better implement the process of digital transformation of education. Educators should be aware that the evolution of technology is accelerating, new paradigms are being formed, new paths are being built, and education will launch a new model for the formation of digital specialists, which is enhanced by the combination of man and machine, man and computer. Generative artificial intelligence, such as ChatGPT, is likely to redefine the role of ICT in education. Whereas in the past it was more of a tool, in the future it will become a new educational element and technology. Obviously, new technologies will not change education naturally, but must be combined with conceptual transformations, organisational changes and innovative mechanisms to have a revolutionary impact on the development of education (Oleksenko, Fedorova, 2017).

The emergence of ChatGPT digital technology is an opportunity to improve the quality of education to reconstruct a new ecology of intelligent education that is knowledge-based, skill-oriented and value-driven. In the 5G era of the Fifth Industrial Revolution, educators must coexist with artificial intelligence technologies, be designers, implementers and evaluators of learning activities, and digital artificial intelligence technologies must serve as a tool for learning activities. ChatGPT can greatly empower educators and help to realise the goal of "educators having assistants and students having partners in learning". At the level of pedagogical practice, the coexistence of educators and artificial intelligence includes three aspects that are intended to be achieved:

1) The study of artificial intelligence and related courses using artificial intelligence technologies, so educators need to keep up with the times and use artificial intelligence technologies to improve their

teaching skills, ability to develop learning resources and analyse learning data;

2) the use of artificial intelligence for learning, assessment and management, aimed at replacing some of its own functions, performing knowledge transfer functions in memorisation, understanding and application. Therefore, the focus should be shifted more towards teaching skills, literacy, psychological counselling and personal development to provide more emotional support;

3) AI-assisted learning focuses on improving learning effectiveness, providing more personalised learning solutions, enhancing learning outcomes, and implementing personalisation in large-scale learning;

4) chatGPT can be a transactional assistant for educators that can generate various texts, help educators with standard tasks such as knowledge search, text creation;

5) as the integration of intelligent technologies and education deepens, the role of educators will change, with more focus on developing students' higher-level thinking and complex problem-solving skills, and becoming mentors for student growth. Educators need to learn how to create complementary, collaborative and innovative relationships with intelligent technologies, provide basic knowledge and implement the principles of artificial intelligence;

6) expand learning opportunities by using artificial intelligence to improve cognitive subject matter abilities; optimise education to reveal the real impact of artificial intelligence on education and teaching.

In the face of AI, educators have to coexist with machines; with the iterative progress of technology, educators have to take on three roles: that of a doctor, a coach and a guide, mobilising students' learning initiative through innovative digital experiences. Despite the fact that artificial intelligence technology has powerful algorithms and computing capacity, it is up to educators to cultivate students' innovative thinking and emotional values. Educators should clearly build skills in the age of intelligence, properly understand and accept the technical advantages of artificial intelligence, and cooperate with it. On the one hand, educators should actively introduce the concept of AI-based smart learning and learn how to use AI technologies to perform certain professional work; on the other hand, they should use intelligent technologies and promote intelligent education. Thus, the ability to use AI technologies to solve problems (even homework) is a kind of information literacy and the ability to demonstrate the potential of a "smart learning assistant" that can effectively improve students' learning experience. Naturally, educators are concerned that students will use such technologies to find shortcuts and to the detriment of knowledge building and skills development. To avoid such problems, it is necessary

to develop new technologies, to introduce good design of regulatory systems to limit the occurrence of such situations as much as possible, and to introduce pedagogical concepts and ethics of educational technologies. If this acquisition of knowledge, improvement of certain skills and thinking through independent homework is linked to plagiarism, decisions about further education, ethics and other issues, then the supervision of the technology and guidance to students on how to use it should be strengthened.

Technological developments tend to outpace educational changes, so that educational needs may not be fully matched with technological availability. Educational governance, including academic ethics, needs to be improved so that students can avoid the potential risks of technology misuse, while enjoying the convenience of technology and enhancing their development opportunities. Specific generative AI technologies, such as ChatGPT, have had a huge impact on the existing learning system, mode and content of challenges. Faced with new generative AI technology, universities do not yet have a deep enough understanding and experience to support it. In many parts of the United States, for example, its use is temporarily banned. The challenge is to facilitate the legal, compliant and ethical integration of ChatGPT and other AI technologies into education and teaching, to ensure their integration and trust, and to effectively enhance educational effectiveness (Nambisan, Zahra et al., 2019). Therefore, with the support of relevant national departments, educational institutions should develop generative AI technologies that are suitable for educators and students, and ensure that data privacy and security are protected. Current research is mainly based on the application of big data and focuses on the security of public information, while there is little research on the risk analysis of intelligent technologies in education. The digital transformation of education is an important part of building a digital society, and it plays a fundamental role in advancing the process of modernising the educational space.

ChatGPT is just a wave of a new round of technological revolution and ICT adoption in education, but there are more technological breakthroughs to come. In this regard, the education sector needs to develop educational strategies that combine tolerance and prudence with creative and critical thinking for generative artificial intelligence such as ChatGPT, as well as the need to develop digital education strategies.

The first strategy is to actively interact with new technologies, deeply understand the technical nature of generative artificial intelligence, understand the advantages and disadvantages of technologies,

Table 1
Chatbot functions

Function name and role	Contents and characteristics of the function	Positive/negative
Assistance in studying Reduced costs	Chatbots can assist students in the learning process by answering questions and providing necessary information. They can also help students complete assignments and check for correct answers. The use of chatbots in education can help reduce the cost of education. For example, chatbots can replace traditional educators in certain tasks, such as checking answers, which can significantly reduce the cost of educator salaries.	Accessibility: Chatbots can be accessed anytime and from anywhere, providing continuous access to information and problem solving Limitations: Chatbots cannot always provide a complete and accurate answer to a user's request, especially if the request is complex or requires additional information.
Personalisation of learning Convenience for educators	Chatbots can be configured to work with each student individually, taking into account their level of knowledge and individual needs. This allows students to learn the material at their own pace and level of difficulty. Chatbots can make educators' tasks easier, for example, by automatically checking assignments and generating reports on student progress. This allows educators to focus on the most important tasks, such as planning lessons and curriculum.	Efficiency: Chatbots can handle a large number of requests simultaneously and quickly provide answers and resolve problems. Training requirements: Chatbots require training and configuration before use, which can be time-consuming and costly.
Instant feedback Scalability	Chatbots can provide immediate feedback to students, helping them to quickly assess their progress and correct mistakes. Chatbots can serve a large number of students simultaneously, making learning more scalable and allowing for more efficient use of resources.	Saving time: Chatbots can serve many users simultaneously, which reduces waiting time and improves service quality.
Convenience Analytics	Chatbots can be used anywhere and anytime, making learning more accessible to students who have limited access to educators or resources. Chatbots can collect data on student behaviour and resource usage, which allows to analyse the effectiveness of one's curriculum and make the necessary changes to improve the learning experience.	Convenience: Chatbots can be used in different formats and on different devices, ensuring ease of use and accessibility for all users.
Saving time: Improving the learning process	Chatbots can process large amounts of information and perform routine tasks automatically, allowing educators to focus on more important tasks. Chatbots can provide students with additional information and materials, which helps to improve the learning process and expand students' knowledge.	Automation: Chatbots can automate routine tasks and operations, which increases productivity and reduces costs. Limitations of interaction: Chatbots cannot completely replace human interaction, especially in cases where empathy, compassion, or detailed explanations are required.
New opportunities Skills development	Chatbots can provide learners with access to new learning formats such as games and interactive programmes, making learning more interesting and engaging. Using chatbots can help students develop skills such as independence, responsibility and confidence in their knowledge.	Interactivity: Chatbots can provide an interactive experience that can increase engagement and improve the learning process/support needs: Chatbots require ongoing support and updates to ensure proper operation and user satisfaction.

Source: compiled by the authors

implement them in building a new educational infrastructure, optimise the functions of smart education, and integrate digital education and technologies.

The second strategy is to develop and implement recommendations for the use of generative artificial intelligence in education to protect the educational security line, orient educators and students to the use of generative artificial intelligence, and prevent modern homework and exam cheating and academic misconduct.

The third strategy is to foster transformation for own use, combine generative artificial intelligence with education and teaching reforms, expand access to high-quality educational resources, support and manage new teaching and learning models, and promote effective linkages between education, technology and innovation chains. A new form of digital education that combines virtual reality, human-machine collaboration, and the organic integration of digital education with personalised learning.

In general, chatbots can be very useful tools in education, helping students access information and knowledge, facilitating the learning process and increasing its efficiency. Chatbots can make a significant contribution to education by helping students learn efficiently, making educators' jobs easier and improving the learning process in general. Overall, chatbots have many advantages and can be useful in various fields, but they also have limitations that should be taken into account when using them in business and education (Oleksenko, 2017).

5. Formation of ICT Literacy in the Study of Humanities, Natural Sciences and Technical Disciplines and Problem Solving in Education

Learning is a change in behaviour, or the ability to perform in a certain way over time, when the behaviour is acquired through practice and experience. Learning has three main characteristics: change, duration and experience. The study of a particular science promises to be a tool for students to learn about themselves and their environment. Some scientists explain that academic learning should provide knowledge (cognition), skills (psychomotor), scientific views, habits and competences. Learning that provides meaningful experiences through exploration and understanding of the environment should be used to achieve the integrated goals of the humanities and technical sciences.

Learning in support of these goals can be achieved through the use of various student-centred learning models. Learning models that support 21st century learning include:
1) Project-based learning (PjBL);
2) problem-based learning (PBL);
3) project-based research (PBR). To achieve digital learning, it is necessary to create a 21st-century learning structure.

Learning requires interaction between educators, students and digital technologies. The introduction of learning technologies is supported by the proposed ICT-TPCK thinking framework. ICT-TPCK is interpreted as knowledge of devices and capabilities, pedagogy, content, learning and context, synthesised to understand how specific learning topics that are difficult for learners to understand or for educators to communicate are translated and communicated through ICT. ICT literacy assessment is important because not all young people learn to use digital technologies on their own. The skills included in ICT literacy assessments should be integrated into the learning of humanities, engineering and science. Information management and the creation and communication of results is a skill that is central to the learning process in science, as it helps students to master concepts. Hawland et al. support the process of inquiry through the use of technology, from searching for references on the Internet, to online discussions, to the assessment of student work.

Inquiry-based learning is actually one of the models of science learning that can be integrated with ICT. ICT literacy is an important competence in the 21st century learning system. ICT literacy is becoming something that needs to be mastered and assessed with the help of certain tools.

ICT literacy assessment can take the form of scientific studies. Due to rapid technological changes, ICT literacy assessment tools need to be developed and constantly updated with the following objectives in mind 1) research for the development of holistic skills of primary and secondary school students; 2) scientific literacy and effective ways to develop it; 3) digital literacy of students.

The use of ICT in education includes four challenges facing the education sector:

First, education for everyone. In 1990, the international community proposed the Education for All movement. International organisations have made great progress in promoting education for all, and the number of children attending school has increased across the board. But now that more students are attending school and learning less effectively, this may not help them prepare for the future.

Second, educational equality – there are learners who can make the best use of technology and resources such as ICT. To achieve social equality, this needs to be done carefully.

Third, technology is changing rapidly, it has changed people's entire lives, for example, mobile phones and many online services.

Fourth, educational measurement and assessment, which shows that it is important to evaluate learning activities in a new way with the use of new technologies.

6. Future Trends Forecast

Thanks to ever-changing technology, tablets and mobile phones are increasingly being used by students these days. ICT technology is changing all aspects of education, and many of the high-tech technologies and tools used in everyday life are also used by students outside of school. It is predicted that people will spend more time with mobile phones in the next ten years. In fact, one should welcome innovation in education and fully absorb the energy that start-ups bring to the table. Sooner or later, technology will become ubiquitous in the world, and people will be able to use it to the fullest to influence teaching and learning outcomes on an individual level. The use of open platforms helps to ensure inclusive access to digital educational content, the recognition of open platforms in different countries in the promotion of open digital learning platforms and access to digital content, and the development of digital skills for educators and students (Social, economic and educational transformations in the digital era, 2022).

To survive in an increasingly competitive and global marketplace, companies need graduates who can lead change, and this is the challenge facing 21st century engineers. Engineering graduates in the new digital age must be able to move from technology to solutions, from solutions to operations. This requires a broad range of skills. Universities

should use interdisciplinary education to address the challenges posed by the "megatrends" of the fifth industrial revolution, 5G. However, it is impossible to make quality higher education accessible to all with the current model. A multi-dimensional approach involving universities, content providers, hosting companies, testing services, regulatory bodies and accreditation is proposed to achieve this goal. A series of industrial revolutions since the 18th century have led to changes that have shaped the political, environmental and cultural spheres of the world. These general technological improvements have led to new machines, new sources of energy and new ways of organising work that have made existing industries more productive and efficient. While Industry 4.0 promises to harness cyber-physical systems by increasing the integration of information and communication technologies in production and automation, the fifth industrial revolution, 5G, is shaping key trends/influences that will fundamentally impact engineering education. After analysing the needs for next-generation skills, the research identified four strategies that can help universities rethink their programmes. These strategies are as follows:

1) Lifelong learning and transdisciplinary education;
2) modules on sustainable development and human-centred design;
3) practical courses on speed and data management;
4) systematic search and classification of productivity and human factors in the context of 5.0 G.

Future digital education should focus on three aspects:

1) Transformation of educational concepts, disrupting standard education and teaching, facilitating the transition from "industrial education" to "smart education" and implementing individualised and personalised learning throughout the process;
2) educational changes in organisational practices that transcend classrooms, disciplines and campuses to promote community learning that spans classrooms, disciplines, schools, time and space, creating a new educational paradigm;
3) innovative operational mechanisms and implementation of data-driven decision-making in education, creation of a group intelligent decision-making system based on human-machine interaction.

Thus, foresight refers to the process of systematically exploring, predicting and anticipating future trends. The use of foresight in the field of information literacy may be a future trend as modern society is faced with rapid changes in the information environment. The use of foresight makes it possible to anticipate both technological and socio-cultural trends that affect information literacy, for example by analysing future technologies or changes in the media environment. Foresight can help to create flexible information literacy strategies that can easily adapt to rapid changes in the information environment. Introducing foresight into the process of information literacy education can lead to the development of innovative curricula that take into account future challenges and needs, promote critical thinking among individuals, help them to distinguish between important and unnecessary information, and develop analytical skills. Foresight in information literacy can engage the public, helping them to understand and influence the shaping of future information standards and practices.

7. Conclusions

Through a multifaceted exploration of information literacy, encompassing both theoretical analysis and practical implications, this research sheds light on the nuanced dynamics that shape individuals' competence in this domain. Using a variety of methodologies, the study provides valuable insights into the strengths and weaknesses of information literacy, paving the way for targeted interventions

Table 2

Big Data as a strategic resource for education in the context of the 5G

The role of Big Data	Development direction
Big Data as explosive growth and massive accumulation	To build a digital economy with data as a key element, to make the digital economy bigger and stronger and to expand new space for economic development
Big Data as a new type of production factor	A factor of production that reflects that with the accelerating digital transformation of economic activity
Big Data as a new impetus for development	Use of data as a key element to promote digital industrialisation and the digitalisation of industry
Big Data as a factor of competitive advantage	The economy is favourable for seizing opportunities, taking the lead in future development and creating new advantages in national competition.
Big Data as a decisive factor in the market	Actively promote the development of information resources, elements and marketing, and ensure the optimisation of information resources
Big Data as a crucial factor in production	To develop strategic resources and the innovative element of digital globalisation

Source: compiled by the authors

aimed at improving levels of competence. The study also argues for the holistic development of digital literacy, emphasising not only technological proficiency but also the cultivation of critical thinking and problem-solving skills. By integrating digital literacy into educational frameworks and societal initiatives, stakeholders can work together to empower individuals to thrive in the digital age. Ultimately, the findings of this research underscore the need for concerted efforts to promote information literacy as a cornerstone of education and social development. By embracing this ethos and fostering a culture of lifelong learning and digital empowerment, societies can navigate the complexities of the digital age with confidence and resilience. In light of the findings of this research, policymakers, educators and stakeholders are encouraged to prioritise the integration of information literacy initiatives into educational curricula and institutional frameworks. By fostering an environment that promotes critical thinking, digital literacy and ethical information practices, societies can equip individuals with the tools necessary to navigate the complexities of the digital age responsibly and effectively. In conclusion, the study serves as a clarion call for collective action to promote information literacy as a fundamental skill for the 21st century. By embracing the principles outlined here and committing to sustained efforts in education and social development, societies can harness the transformative potential of information and technology to promote inclusive growth, empower individuals and build a better future for all.

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