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Knowledge in the Age of Information: Human Values in Science and Higher Education

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Our days are often being referred to as the age of information. The development of information technologies, proliferation of computer devices and spreading of the Internet has led to rather radical transformation of lifestyle and ways of doing the jobs in many areas of human activity, and especially in scientific investigations and higher education. In order to achieve the due and adequate understanding of the processes in question, it is not enough just to follow the general trends of digitalization and computerization, but it is necessary to conduct the philosophical reflection of those issues, in order to review their meanings and senses. In this paper I intend to review the phenomenon of information in its relation to human persons and their knowledge, as well as try to provide philosophical consideration of the impact of the common trends of the development of the ICT technologies on science, education and society in general while referring to the ideas expressed by prominent philosophers.

The phenomenon of knowledge in the age of information and computers

In my opinion, the first problem we encounter while trying to achieve the understanding denoted in the introduction is the meaning of the very notion of information – and particularly the necessity to distinguish between the two different terms: *knowledge* and *information*. While closely related, they are in no way identical in their meaning. Information could be understood as the content of a message transmitted from one person to another and perceived by the latter (see: Mielkov 2006). Accordingly, information is a more generic concept in relation to knowledge: knowledge is personalized information, it is the information that belongs to a certain human subject and could not be separated from its carrier who has assimilated some information in order to transform it into his or her own knowledge. To be more precise, in order to conduct the said act of separating knowledge from its carrier, the knowledge should be transformed back into the state of depersonalized information. That is, information is knowledge taken in the process of its transmission, in its isolation from the subject of knowledge (whether it is a subject who has generated this knowledge in order to transfer it as information – or a subject who has perceived it). Information could be correspondingly presented as alienated knowledge, a knowledge made available not only for transmission, but for sale as well. One cannot literally transfer knowledge at will – being adopted, 'digested' information, information that has been made personal, knowledge is the information processed through the whole complex of human nature including not just the rational mind that has to assert that information as being true, but also human will and human emotions that evaluate it on the basis of desirability and acceptability. In other words, the availability of the vast volume of information in today's world (and World Wide Web) should not lead us to the illusion of the easy availability of knowledge: it requires a lot of personal efforts for a human to transform the

former (or even a little part of it) into the latter, and no one could bear that responsibility except the very subject of the knowledge in question.

Information is not associated with a specific person or with a specific situation. It is true that information could be at disposal of a certain subject, but it is still not connected with that subject in a personal, essential way (until he or she elaborates his or her own knowledge out of it, of course). And therefore, this subject actually acts only as a 'bearer' or 'keeper' of this information, easily separable from him or her. It is difficult to imagine a more abstract concept of human and his or her knowledge! However, the emergence of such a concept can be explained by the objective conditions for the development of scientific and technological progress in modern society – and especially for the development of information technologies. Information is thus an alienated form of knowledge that could be measured and codified – and could be presented as an entity specially adapted for communication between a person and a machine. As argued by Jean-François Lyotard already in 1979, the nature of knowledge is being transformed alongside the general transformation of the technogenic civilization, with knowledge being considered effective only when translated into certain amounts of information – and eventually into the language of machines:

> Dans cette transformation générale, la nature du savoir ne reste pas intacte. Il ne peut passer dans les nouveaux canaux, et devenir opérationnel, que si la connaissance peut être traduite en quantités d'information. On peut donc en tirer la prévision que tout ce qui dans le savoir constitué n'est pas ainsi traduisible sera délaissé, et que l'orientation des recherches nouvelles se subordonnera à la condition de traduisibilité des résultats éventuels en langage de machine (Lyotard 1979, p.13).

An opposite type of knowledge-information could be presented as knowledge-wisdom: it is knowledge uncodified and unmeasurable in bits, personal and concrete knowledge; while the latter is the form of knowledge prevailing in philosophy, the problem and the danger of the contemporary society is that information becomes the standard for the existence of knowledge in general. The information itself is based on the presumption of non-human nature of its recipient: information does not apply to a person in his or her human qualities. The abstract knowledge-information oriented towards communication between human and machine contributes to the self-alienation of human person proper, human transformation into a kind of a similar machine. The role of a person is reduced to a single quality of a carrier of some information. The philosophers have warned the humankind of the possibility of such a threat quite a long time ago: if in 1920s Nicolay Berdyaev talked about the machine pushing itself between the human person and nature while radically transforming their relation and not only helping humans in mastering nature but also in some way enslaving humans, then in 1980s Vasiliy Nalimov expressed similar precautions as for the knowledge and computers following and complementing that warning by Berdyaev:

> Probably, we will now have to say the same about computers acting as artificial intelligence. They must not only free, but also subdue the person. As machines

> have come between nature and man, so computers will stand between man and meanings. And if we now have to defend nature, albeit in vain, then won't we have to defend meanings in the same way – and, probably, just as in vain? (Nalimov 1989, p. 234).

Of course, the philosophical consideration of computers and their role in the development of human knowledge and human understanding does not necessarily have to be that pessimistic – after all, the ecological movements all over the world demonstrate that the defense of nature has not been carried out totally in vain. However, on the other hand, just like Berdyaev's cautious and skeptical attitude towards 'machines' at the beginning of the 20th c. could have been justified as a humanist and existentialist reply to then dominant classical scientism, in a similar way a skepticism towards computers and society based on information relates to the one-sided optimism that characterizes the middle of the last century. Particularly we can refer to the discussions of the 1960's, when the technical progress and especially the development of cybernetics and information sciences has led some positivist-inclined researchers to talk about creating machines who could actually 'think' and gradually replace humans in their creative activity.

As argued then by philosophers who had opposed such overly optimistic and positivist views, particularly by Evald Ilyenkov and his co-authors, the computer could indeed model a human brain, but it is not a brain that thinks, but a whole human person with the help of a brain. Any technology (be it cybernetic or non-cybernetic) should be considered only as a means, only as a tool for the fulfillment of human goals, because if it turns into an end in itself, then a person becomes its own means, a kind of raw material. That is why cybernetics is good at designing machines that could quickly free a living person from the burden of monotonous machine labor, from routine jobs, from working according to a standard template or to a hard-coded program. Thanks to computers, a living person can devote all the free time to truly human work – work in terms of scientific, technical, artistic, social creativity (Arsenyev, Ilyenkov and Davydov, 1966).

It would be interesting to remind ourselves that computers actually "were human" – to use the apt title of David Grier's book (2005) – up to the late 1940s: human computers – mostly women, as low-paid workers, but usually more accurate workers than men – performed the simplest calculations, particularly those associated with both military aviation and the development of the atomic bomb in the USA. Moreover, with the emergence of electronic computers, their "operators" have often been recruited from the former human computers who thus became first programmers. Still, such computing is indeed a monotonous routine labor that machines are definitely better at than human persons. In fact, the trends in today's society, particularly in higher education and knowledge transfer, provide good examples on how the ICT can truly augment human persons by empowering them with new possibilities, while still requiring more creativity and more responsibility as well.

Higher education and the transfer of knowledge

As it follows from the noted distinction between information and knowledge, the age of information and the availability of vast volumes of information is not equal to the age and

abundance of knowledge. Thus, it is important to review the situation in the sphere of education as the activity based on the transfer of knowledge, as it is indeed heavily influenced by the noted impetuous development of information and communication technologies. Just twenty or thirty years ago, both undergraduate and postgraduate university students used to study almost in the same way their parents and grandparents did decades or even centuries before, facing some difficulties while accessing new sources, especially those of foreign origin, but being quite good at using traditional libraries. The present generation faces completely different, sometimes even opposite problems. Particularly, those are the problems of successfully distinguishing primary and reliable sources from secondary and dubious ones, due to a virtually limitless information repository of the knowledge of human civilization now being available to anyone with the Internet access. However, having such access, students are being left alone with that ocean of data, not necessarily possessing all the skills required to process information as a source of their own scientific research, easily tempted by plagiarism. There is an easy illusion of identifying information with knowledge: as argued before, in order to transform the information into knowledge it must be mastered, evaluated, 'digested' – that is, a serious work must be done, even while the ready available World Wide Web resources.

Of course, the skepticism towards machines and the doubt of the ready-made usefulness of information does not mean questioning or abandoning technological development and computers and the Internet – it is just a matter of properly understanding these phenomena and recognizing their limitations and inadequacies for science and culture in general. The limitation in question was clearly pointed out in particular by one of the 'fathers' of modern artificial intelligence (AI) technologies, Joseph Weizenbaum, who always emphasized that the operation of an electronic machine is an abstract game that is separated from the real world. Already in the 1960s and 1970s, the researcher has observed with great astonishment the formation of a subculture of computer scientists and hackers – he used to call them *machine addicts* – who are immersed in their artificial world, created by themselves: they possess skills, but they lack knowledge, and could be compared to some illiterate book copyists in a medieval monastery. The traditional engineer, Weizenbaum argues, can come to terms with the fact that there are things he does not know – while a contemporary programmer lives and acts in his own world, blindly believing that this world is completely subject to him. According to Weizenbaum:

> ...an entirely too simplistic notion of intelligence has dominated both popular and scientific thought, and that this notion is, in part, responsible for permitting artificial intelligence's perverse grand fantasy to grow. I shall argue that an organism is defined, in large part, by the problems it faces. Man faces problems no machine could possibly be made to face. Man is not a machine. I shall argue that, although man most certainly processes information, he does not necessarily process it in the way computers do. Computers and men are not species of the same genus (Weizenbaum 1976, p. 203).

Indeed, modern computerization can serve as a visual embodiment of the ancient philosophical idea of *mathesis universalis*, universal computability, that is, it serves as the basis for what Hannah Arendt called "irrational belief in the computability of reality," and Joseph

Weizenbaum – "transforming our world into a computer." But what was just the idea of a narrow circle of university programmers in the 1960s, has now become a Weltanschauung for millions of computer and World Wide Web users who have gained access to new technologies without having any time and urge to form an idea of the limitations of these technologies, to grasp the difference between information and knowledge. In fact, even in 2021, just like in the 1960s, it turns out to be necessary to stress out the very idea that a computer can never duplicate human intelligence, as shown by Adriana Braga and Robert Logan:

> The notion of intelligence that advocates of the technological singularity promote does not take into account the full dimension of human intelligence. Human intelligence... is not based solely on logical operations and computation, but rather includes a long list of other characteristics that are unique to humans... ...no computer can ever duplicate the intelligence of a human being because of the many dimensions of human intelligence that involve characteristics that we believe cannot be duplicated by silicon-based forms of intelligence because machines lack a number of essential properties that only a flesh and blood living organism, especially a human, can possess (Braga and Logan 2021, p. 133).

Perhaps the most dangerous issue that hinders the formation of an educated personality of a student who has access to a huge amount of information is the illusion of omniscience: why should we learn and acquire knowledge at all, losing a lot of time, energy, and even money, when any ready-made 'knowledge' (of course, identified in this case – due to the lack of philosophical culture – with simple information) can always be obtained without any effort, in particular, from a relevant article in Wikipedia or other freely available Internet sources? Moreover, why conduct one's own research, if almost any text, course paper or even a dissertation thesis on virtually any topic could be downloaded from the World Wide Web for free or for a relatively small fee? After all, doesn't a Prime Minister, who reads a speech written by somebody else, or a boss who signs a document prepared by his subordinates, do exactly the same? Such are in fact some opinions expressed by university students while trying to provide a kind of justification for plagiarism (cit. by: Eats 2006, p. 22).

However, it is not so difficult to refute such a belief, which owes its existence to misunderstanding the essence and purpose of research, by demonstrating an extremely negative attitude to the violation of academic integrity, proving that cases of plagiarism are clearly unacceptable. After all, only the acquisition of knowledge and education can help students to get rid of the 'illusion of omniscience' and the blind trust in the texts of Wikipedia and other similar sources. By the way, it should also be noted that the mentioned trend (or, one might even say, ideology) of mathesis universalis has certain negative effects for the professional scientific community as well – in particular, due to the idea of a possibility to measure human intelligence – for example, by the so-called IQ (Weizenbaum has already admitted that this idea caused untold damage to society and education), or even the popular idea of measuring the significance and effectiveness of scientific activity. The latter, as is it believed, can be accurately measured by calculating the citation index: hence the orientation on the publication of

scientific results in academic journals indexed in international databases. This idea, in contrast to the IQ measurement, is indeed rational at its core and allows to single out certain publications by their popularity among the today's scientific community – but, being a pragmatic indicator of efficiency in general, such a separation makes sense mostly for applied disciplines only. The fundamental research, and especially research conducted in social science and humanities, and even more so in philosophical and cultural disciplines, is almost impossible to be measured for its 'efficiency' by simply calculating the citation index – especially if it is limited to only a few most commercialized databases. Even checking texts for plagiarism could be better done by human scholars and not by machines, as the latter can't recognize some forms of plagiarism (with paraphrasing or translating used etc.), while the presence of quotations with references can't yet indicate a violation of academic integrity, especially in the field of humanities and social sciences. Luckily, the movement of *open science* that becomes more and more influential in today's European educational and scientific community, serve as a solution for humanization and democratization of scientific activity in opposition to its standardization.

I would argue that the illusion of mathesis universalis acts as an illusion of the possibility to set standards for scientific activity, although strict and legally unambiguous formulations, in particular, of the same academic integrity, cannot fully correspond to scientific culture – as the latter is based largely on implicit knowledge, on the transfer of unarticulated skills and worldviews from a teacher to a student within informal scientific schooling and collaboration. As early as 1958, Michael Polanyi has shown in his book "Personal Knowledge" (2005) that every act of knowledge possesses a passionate contribution of the knowing person – and for science such a presence is a necessity, not a sign of some imperfection. Personal here means just the affiliation of knowledge to a particular person – that is, the inseparability of knowledge from the human person we have noted above, and its human dimension – from science in general.

Michael Polanyi calls this knowledge a kind of fusion of objective and subjective in science – a whole set of phenomena that were previously left out of the attention of researchers, from the implicit knowledge of unwritten rules and skills passed exclusively from teacher to student that could nowhere be recorded in writing with sufficient adequacy, and up to the said 'passionate contribution of the knowing person' present in every act of cognition. Passion and conviction are both indicators of the scientific value of a problem and even an expression of its truth: the personal involvement of the knowing subject is therefore the process of cognition carried out in a fit of passion. According to Polanyi, the very idea of truth is something that can be thought of only by those who are personally convinced:

> I can speak of facts, knowledge, proof, reality, etc., within my commitment situation, for it is constituted by my search for facts, knowledge, proof, reality, etc., as binding on me. These are proper designations for commitment targets which apply so long as I am committed to them; but they cannot be referred to non-committally. You cannot speak without self-contradiction of knowledge you do not believe... (Polanyi 2005, p. 319).

The idea of personal, tacit knowledge is reflected in the conception of post-non-classical science proposed by Vyacheslav Stepin (2005) as a definition for the contemporary new type of

scientific rationality. According to Stepin and his followers, currently we experience the fourth global scientific revolution leading to the formation of the new type of scientific rationality that features introduction of human cultural values into the very core of scientific knowledge as science turns its attention toward complex objects that are found to be *human-commensurable*. While classical scientific knowledge was thought to be free of any values, under the paradigm of post-non-classical type of scientific rationality it is revealed that knowledge is actually value-ridden, both by the norms of the scientific ethos and by the much broader cultural value background. The knowledge of science becomes now more close to that of humanities and philosophy, it is the Weltanschauung generative knowledge, consisting not of ready-made information about the world, even if it is accepted and personalized by scientific community or individual persons, but of certain premises, scientific and philosophical basis that enables human person to constantly create one's own knowledge by applying an interpretation taken out of the set of personal senses to the objective empirical data.

That in turn leads to some core changes in the methodology of scientific investigations and in the strategies of the contemporary higher education. Particularly, it is no longer sufficient to have a set of 'competences' as a final result of the educational process at today's university – it is actually impossible to define some specific knowledge and skills that a graduate must acquire in accordance with the ideas of the 20th century. Instead of it, we now have to aim at a holistic personality endowed with certain human qualities, certain values and modes of existence that would allow a person to deal with the challenges of the new, constantly changing circumstances in the word of complexity and uncertainty (commonly designated as *VUCA*). From the paradigm and methods of 'informing', as in the classical 'teacher to student' one-way interaction, where the former used to transfer knowledge and skills to the latter, we now move not so to the subject-subject communication (where two democratically equal subjects exchange knowledge and opinions), but to a kind of moderation. Instead of being a mentor who possesses unique knowledge and is able to pass it on to the next generation, the university professor becomes a supervisor who is to help his or her undergraduates to navigate through the boundless ocean of available and accessible information in order for them to choose and create their own, personal knowledge out of such information. And that's what enables us talking about values as the main problem of the contemporary education.

Human values and creative knowledge: Open Science and online education

Due to the transformation noted above, it becomes clear that the current task of the education system is to constitute a different form of thinking. In the 2018 report by the Club of Rome, particularly, in the section of this document that concerns 'education for a sustainable civilization', the head speakers of this respectable international organization state that the contemporary educational objectives "require a fundamental shift – from learning how to memorize and understand – to learning how to think in new, systemic ways. The real challenge is to develop in all students a capacity for problem solving, as well as critical, independent and original thinking. Education that focuses exclusively on the mind alone is no longer sufficient" (Weizsäcker and Wijkman 2018, p. 196).

Indeed, creative thinking refers not just to rational side of human person, but to all other qualities as well. Evald Ilyenkov used to name such creative quality imagination: "A person who

lacks imagination – more precisely, who has an undeveloped imagination – sees in the world around him only what he already knows beforehand, what is registered in verbal form in his consciousness, in his mind" (Ilyenkov 2007, p. 81). That is, any situation in a real world that such a person is faced with could result only in activating some readymade verbal stereotypes in his or her consciousness. The power of imagination, according to the philosopher, can therefore be defined as the ability to see things through the eyes of another person, through the eyes of other people, through the eyes of the humankind in general, and to see not from the point of view of one's individual interests, needs, and desires, but from the position of the long-term interests of humanity as a whole.

A sad but illustrative example of the lack of imagination and general culture of a specialist in a situation where 'linear machine-like thinking' is clearly insufficient is the 1986 accident at the Chernobyl nuclear power plant in Ukraine (which is actually a case that shows general problems that arise when humans are facing with tasks of operating complex modern equipment). More than three decades later, neither the unambiguous causes nor the individual culprits of the accident have been identified: as stated in the 1986 report by the International Atomic Energy Agency, the root cause of the catastrophe was an unlikely coincidence, and to draw any conclusions regarding the legality of the actions of personnel in such an unpredictable situation is impossible given the contradictory requirements of the regulations for the operation of a reactor of this type. In my opinion, the most successful general picture of the factors that led to the accident was outlined by academician Valeriy Legasov (1988): RBMK-1000 reactors (the type used in Chernobyl) were historically the first to be put into operation in the field of nuclear energy in the USSR, when safety requirements and instructions were still almost absent. Due to military origins of nuclear technology in general, the personnel of the first nuclear power plants, consisting almost exclusively of servicemen accustomed to working in the situations of constant risk and experimentation, was extremely highly qualified, but also careful and disciplined. Over the years, the unspoken requirements for strict reactor maintenance procedures have been eased, and new generations of engineers, for all their professional competence, have been uncritical of the equipment they were to operate and of the safety systems in their operation. That is, it is not surprising that the main thing that was needed in order to prevent accidents, is not competence in a particular area and not the ability to follow instructions in a mechanical way (even if those instructions exist at all, they do not and cannot describe any unpredictable and abnormal situations by definition!), but the general 'creative thinking' and 'imagination' of the individual, including the culture of safety and the ability to assess existing and possible risks.

In other words, there is no ready-made knowledge in today's complex world that could be taught or even gathered from the available amount of information. Of course, we can't talk today about a kind of abandonment of the professional essence of higher education and the widespread reorientation of universities to training some utopian universal personalities with imagination and creative thinking who, with equal success, are able to acquire knowledge and work in any field of professional activity. The ability to imagine, to think creatively and to work outside the frameworks of existing standards and rules, that is, to think and act in a non-mechanical way, still largely relates to really complex and unregulated situations – such 'creative and critical' approach rather complements and improves professional skills and abilities than replaces them. Accordingly, the methodological task of today's education is to find the right

balance between the breadth and the depth of educational programs – and to help students to acquire the necessary knowledge and skills for specific professions and disciplines, while providing them with information about other fields of science, art, philosophy etc. and helping them in developing a broad outlook, a significant level of general culture – that is, to acquire everything they would need for further independent development of their own personality. British authors Stephen Gough and William Scott talk about such dialectics of training and learning, about the transition from information methods to the synthetic paradigm of higher education (mediation: multi-vector, multifaceted learning, which has as its priority and its purpose in promoting self-learning and the organization of such self-learning) when they see in such a methodological program successful implementation of the basic principles of higher education for the future of human civilization under the paradigm of sustainable development (Gough and Scott 2007, p. 118).

Of course, it is much easier for a university professor just to inform the students about, say, the threat to the environment – and it is much more difficult to help them form values and general culture that would enable students to act towards preventing the threat in question. Is it possible to 'teach values' at all, especially in universities? On the one hand, it is easy to understand the somewhat cautious attitude to the value foundations of education as that may seem to be an echo of excessive ideology of the former modernist age. On the other hand, the task of education, and especially higher education, cannot be accomplished without changing the behavior of the student; moreover, it is the absence of such practices in university education, often explained simply by the reluctance of teachers to change their archaic views on teaching activities and to move from 'teaching knowledge' to 'teaching values'.

However, I would argue that it is self-organization and democratization of human society in general and education system in particular that could lead to the formation of values being the most important issue of today's social life and activity. With the on-going digitalization of education process, its transition to online forms and the growing trend of open science that has its impact on all forms of studies and investigative activities, both students and teachers are to become true subjects of their own life activities, thus demonstrating the need to pay more close attention to the formation of values and cultural background as the necessary pre-condition for the further successful usage of informational and computer technologies. Moreover, the democratization in question refers not only to the formal autonomy of student (and teacher) personality from the constraints of formalized forms of research and education activities, but also to the very cultural background of those activities, to the acknowledgement of their both right and responsibility to serve as a subject of their own personal and professional life (Mielkov et al. 2021).

While the rights in question closely relate to that vast amount of the available information we have due to the development of the ICT sphere, the responsibility point is somewhat less evident. However, it refers just to those qualities that are needed for a student to be able to accept all those digitalization and democratization trends. An excellent example are the changes in contemporary practices of higher education under the situation of the COVID-19 pandemic that forced many HEIs to adopt various kinds of distant learning in a very short time, and it did reveal some core problems peculiar to the existing forms of education process. Many of us are

still accustomed to linear methods of work and study of the Modernity age, and even now the government and the administration are sometimes inclined (at least, in Ukraine) to regulate and formalize the educational process down to the last detail in a command way – but according to the paradigm of post-non-classical scientific rationality, the need to achieve the autonomy of the personality of each student and each teacher, with the formation of an appropriate level of self-awareness, self-discipline and self-organization eliminating the need for any external regulation, is now immanent. It is also the urgent issue of emergent forms of individual learning and direct interpersonal communication (paradoxically enough, the latter could be absent while attending classes in person – and present in communication on a remote online basis).

And it is just the personal values and the cultural background that could manifest itself as means for the successful self-organization of the online education as well. In particular, I can refer to the example of e-learning, which has its origins in the forms of distant learning courses known already since the 19th century, but popularized by asynchronous "Massive open online courses" (MOOC) that started to propagate during the 2010s. The term 'asynchronous' means the ability for a student to study the materials of a chosen discipline at any pace, without having to follow the mode of operation of the educational institution, even remotely. Such courses are truly 'democratic' and accessible to everyone, as theoretically they have no limits on the number of participants and almost no deadlines for the finals. Most importantly, they allow people to gain high-quality knowledge anytime, anywhere on the Internet.

At the same time, the online learning in general and MOOC in particular demonstrate some difficulties that relate to forms of communication between classmates and between students and teachers, which are not yet optimal and personal enough, and what is even more important – to the motivation of 'part-time' online students who have no external or Modernity-like administrative impetus to force them to engage in and complete a course besides their own inner self-organization and self-consciousness. Low success rates were already peculiar to non-electronic forms of distant learning, and the online situation did not improve it at all, supplemented by a large number of "self-disengagement". Statistics show that if a course for high school students is completed by an average of only 27% of its enrolled participants, then for undergraduate university students that completion rate does not exceed 8%, and among graduate students it is even lower – just 5% (Kizilcec, Piech and Schneider 2013, p. 3). That is, if traditional education relies – at least partly – on external organization, then while studying online, we are to rely mostly on our own self-organization instead. That's why such statistics, in my opinion, provides us a good example of the insufficiency of just technical means for the success of any activity – and the need for it to be grounded on personal values, as well as for the democratic self-organization of all the subjects engaged in the open environment of science and education.

Conclusions

As a summary of this short investigation, let us repeat the main points of the arguments. Philosophical comprehension of the phenomenon of information that plays an important role in today's society leads to drawing a strict distinction between information and human knowledge: information could be presented as alienated knowledge, knowledge deprived of its subject-carrier. Thus, the vast volume of information in today's world made available thanks to the ICT

sphere, should not lead us to the illusion of the availability of knowledge, as it requires a lot of personal efforts in order for information to become actual knowledge. That in turn implies the new understanding of the education process, which consists – amongst other things – in the formation of implicit personal knowledge, or in the transfer of unarticulated skills and values from a teacher to a student within informal scientific schooling and collaboration.

And that leads to some specific changes in the methodology of scientific investigations and in the strategies of the contemporary higher education. Particularly, it is no longer sufficient to have a set of specific 'competences' as a final result of the educational process at today's university – instead of it, we now have to aim at a holistic personality endowed with certain human qualities and values that would allow a person to deal with the challenges of the new, constantly changing circumstances in the word of complexity and uncertainty. In fact, the trends in today's system of higher education provide good example on how the ICT can augment the human person by empowering him or her with new possibilities, while still requiring more responsibility as well. With the on-going democratization of education process, its transition to online forms and the growing trend of open science that has its impact on all forms of studies and investigative activities, both students and teachers are to become true subjects of their own life activities.

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