Assistive technology for an inclusive school for schoolchildren with special needs: autism spectrum disorders

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Abstract

Background: The debate and research over autism spectrum disorders (ASD) encounter a theoretical and interpretive impasse that reflects our inability to provide a coherent definition. This challenge is confirmed by the current description of the condition as a spectrum, and its management stretches the limits of the various relevant fields of knowledge and research, including medicine, psychology, language and communication, education, sociology, human rights, ethics and legal issues, philosophy.

Objectives: In the diagnostic and therapeutic approach to persons with physical disabilities, technology has been tool. In the case of ASD, however, although some lines of research are focused on the study of sensory defects, the cause appears to lie, not only in perception, but also in interpretation of stimuli from the outside world. Since we entered the "digital era", the use of technology as an assistive tool in interpretation of the surrounding world appears to provide a borderline between our knowledge and the dark area of our ignorance. For tackling this, an interdisciplinary approach is required. Which kind of assistive technology (AT) should be employed in the case of ASD, which leads us to an encounter with the theoretical and institutional void that the stormy pace of the digital transformation and evolution has created.

Methods: Searching was through PubMed, National Institute of Health (NIH) publications, the official websites of European Union , Autism Europe, resources were found in the library of the University of Macedonia. Ninety eight papers were identified through the literature review in the period 2000-2021

Results: A features of postmodern society that is taking shape under the influence of the digital technology could be the crossing from the physical reality into the virtual realm. Another feature might be the reference to symbolic language that characterizes the various different fields of knowledge, together with their protocols and communication jargon. This entails the creation of hybrid knowledge which is expanding our physical world, and which makes possible intercommunication between isolated disciplinary fields. People with ASD feel more at ease when dealing with digital entities than in interaction with other people. Also individuals who are involved in the digital realm for long periods present characteristics similar to those of ASD. Could the creation of a virtual realm be possible, which would act as a common locus between the so-called normal and people with ASD.

Conclusion: We conducted a preliminary study to explore the possibility of an interdisciplinary research program with the participation of experts from the various fields involved in the many aspects of ASD.

Key words: Autism spectrum disorders, technology, inclusion, society, education, labor market

Introduction

Autism spectrum disorders (ASD) constitute a range of lifelong developmental disabilities. They are defined by the WHO [1] as "a range of conditions characterized by some degree of reduced social behavior, communication and language, and a narrow range of interests and activities. Both these interests and the activities are typically unique to the individual and take place repeatedly". The fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) [2] classified autism as "Pervasive Developmental Disorders", which included autism, Asperger syndrome, childhood disorder, disorder and disorders and Rett syndrome (American Psychiatric Association, 2000). In the fifth edition (DSM-5) [3], this definition was replaced by the term "Autism Spectrum Disorders" (ASDs), which replaced all previous definitions with a central diagnosis. The rationale for this change was the observation that distinction between subtypes was characterized by a lack of consistency, and that the application of the definitions to diagnosis was difficult and open to challenge. Finally, there were no biological criteria and data to support the distinctions [4].

ASD is therefore a term that covers conditions previously classified as autism, Asperger syndrome, childhood disorganization, diffuse developmental disorders not otherwise defined, and Rett syndrome. ASD falls into the broader category of "neurodevelopmental disorders", which are a group of developmental disorders that affect learning, executive functions, social skills and intelligence in different ways, and to various degrees. These disorders present in childhood, but tend to persist into adolescence and adulthood. Their common feature is a serious deficit in social skills, but also in the ability to empathize, accompanied by varying levels of mental function and behavioral problems [5]. The autism spectrum ranges from the so-called high functioning autism, in which people with an IQ of greater than 70 are classified. At the upper end of the spectrum is Asperger syndrome, in which both intelligence and verbal communication are present but there is a deficit, or even absence, of other characteristics such as the ability to communicate through eye contact and facial expressions, characteristics which are essential for the establishment of implicit social protocols.

At the lower end of the spectrum is the so-called childhood disorganization disorder (Heller syndrome), where young people, after a period of fairly normal development, show a decrease in motor, communication and social skills [5]. It should be emphasized that, although the concept of a spectrum implies continuity between all the characteristic conditions and symptoms, in practice it is often impossible to make accurate classification and diagnosis in the individual cases of persons with ASD. Usage of these definitions has made it possible for researchers to make retrospective diagnosis, and to include in the spectrum well-known individuals identified by studies of their work and their biography as having high-functioning autism or Asperger's syndrome (e.g., Kant, Wittgenstein, Newton, etc.) [6]. Similarly, many people with high creativity and the ability to concentrate could beidentified as belonging to this category. The relativistic nature of the definitions creates alack of consensus among specialists, but these discrepancies have their importance, as they validate the synchronous uniqueness and variety of the phenomenon of ASD.

Methods

The literature review was guided by the following questions: 1) what is the role of technology in education and social inclusion of people with special needs? 2) what is the impact of assistive technology in the education, vocational and social inclusion of people with autism spectrum disorders? 3) which kind of assistive technology (AT) should be employed in the case of ASD? 4) could the creation of a virtual realm be possible, which would act as a common locus between the so-called normal and people with ASD? The selection of the studies for the purpose of this paper was based on criteria. Papers should refer on technology, special education, inclusion of people with autism spectrum disorders in education, labour market and open society. Research papers were found by searching through PubMed, National Institute of Health (NIH) publications, the official websites of European Union, Autism Europe. In addition, other resources were found in the library of the University of Macedonia. Ninety-eight(98)papers were identified through the literature review during the period 2000-2021.

Results

The social realm and scientific method and technology

Management of disabilities using technology is not a new concept. People with physical disabilities benefit in a variety of ways from technological advances, and as technological development accelerates, more and more groups of people with physical disabilities are included. Amputated limbs are replaced, visual impairments are treated with lenses, ever more sophisticated hearing enhancement apparatus is employed, and so on. It should be noted, however, that these technical interventions are focused mainly on physical disabilities. In the case of ASD, however, this constitutes the first serious sign of differentiation, since we are not dealing with physical disabilities but rather with impairment in communication that results in absence of a common communication protocol and contact with physical reality. This impairment not only makes social inclusion difficult, but also, more often than not, renders the possibility of self-support unattainable for people with ASD.

It should be noted that the technology applied in the case of people with physical disabilities was determined by the dominant narrative of its period, and obviously delimited in its scope by the theoretical and institutional framework. Any attempt to employ technology outside its limitations often had disastrous results, one example of which was the treatment of behavioral disorders with mechanical technology, as in the case of lobotomy, namely the surgical separation of the hemispheres of the brain. Another controversial attempt at technological treatment of behavioral disorders is the application of electric shocks to patients with psychosis.

It is of note that the practices mentioned in these two examples were carried out in an environment lacking a robust theoretical background, based on abstract assumptions formed through reductive observations, while, on the other hand, they were supported by an institutional framework that had already been consolidated, delineated by the “Great Narratives of Modernity”.

Indeed, “Modernity” constitutes an institutional framework which has been durable for a long period. It was supported by grand narratives and theoretical schemes that set the rules for managing both the technological choices and the resultant social impact. The works of Weber, Durkheim and Marx were the crowning achievement, following the great theorists of the Enlightenment, and succeeded in putting forward various different interpretations,

either directly or indirectly, of the social applications of technology, and control of the technological impact. Any interpretative differences occurred within the framework of the "Nation State", another great institution of Modernity, or in groupings of nation states that adopted similar interpretations, which more or less allowed the unobstructed development of specific social orders and priorities. Regardless of the diversified applications of technology in the social field, the common foundation was the strong belief that "science liberates".

It should be underlined that the dominant idea of the period of Modernity, which lasted roughly up until the 1960s, was the belief that scientific method was well founded, and that technology was a distinct by-product of scientific activity, which was subject to trial and error. Compared to scientific method, technology has distinctive attributes, the first being that it is cumulative. Secondly, technology has two sides, one internal and one external, and divides society (although not in a perfectly distinct way) into three identifiable groups, each with different interests and priorities. These are the producers of technology, working in the internal side, and the consumers, that is the users of technology, on the external side, while the third group includes scientists, regulators, economists, educators, the market and the military.

The latter group is the essential link between technology and society. Indeed, to the members of the first and second groups, namely the producers and the consumers, is not immediately apparent to what degree adaptation of specific technological choices affect not only everyday life, but also the institutional framework and the very fabric of society as a whole. This can be attributed to the gradual and imperceptive ways of introduction of technology, preceded by the creation of social consensus, but after its social establishment and its utilitarian acceptance, a return to the previous state appears unthinkable. Hence, the third characteristic is that technological choices are necessary, and are binding on their adoption. A corollary is that technological choices are made, not only because they are expected to assist in dealing with various problems, real or imaginary, but often simply because they are feasible.

The technological "apple" that is offered, however, is often "poisoned", since the collateral effects of adoption and social acceptance of specific technological choices often change relationships with the natural environment, but may also affect social hierarchies and productive relationships. A fourth attribute of technology thus, is that corresponding theories and political movements appear whenever a technological choice alters established relationships, either social, economic, or environmental. From the 19th century Luddite movement in England against the adaptation and usage of mechanical looms, to the reaction of the scientific personnel in Los Alamos against the use of nuclear power for military purposes, and the contemporary movements against vaccination, the history of technology is full of such disputes and counter actions. While scientific method was dressed up with the high ideals of Modernity and was considered, for a long period, to have an almost religious status, technology was considered to be its humble follower. Finally, the fifth characteristic is the observation that regardless of the disputes and arguments at the social level, technological evolution follows its own path, governed by dynamics and priorities, and which, although not apparently subject to the scientific method and reasoning, in its passage transforms and reshapes reality, often in unexpected ways. Contrary to the scientific ideals Technology is and always was a mean to control the human environment in any form.

It is interesting that the first voices questioning the context of Modernity originated from concerns about the uses and effects of technological choices. The use, for example, of the

atomic bomb at the end of World War II and the balance of terror during the Cold War were the stimulus for a total challenge to the concept of technological progress. It is true that we observe and perceive only what theory predicts, and in this sense, every adult born before the 1980s was imbued with the principles and values of Modernity which he or she accepted without question, as they constituted the norm. The normative framework of Modernity defines and evaluates both the concept of normality and deviation from it.

But cracks appeared in the robust framework of modernism that became apparent, regardless of the interpretive viewpoint, the cognitive field or the ideology. These cracks may have appeared in the 1960s, when in both major blocs social uprisings took place, notably the Prague Spring, beginning in 1967 and subdued by military intervention in August 1968, almost simultaneously with the end of the Vietnam War, and in the same year, the May movement in France. The collapse of the Soviet Union officially occurred on December 26, 1991. At that time, many analysts attributed the event to the arms race and the economy, but only a few connected it to the phenomenon that is now called the information technology (IT) revolution, which brought about the fatal shot at Modernity and its institutional framework. The first personal computer (PC), with the INTEL 8080 architecture, appeared in 1972, and meanwhile the development of ARPANET, the ancestor of today's internet began in 1970, with the original purpose of preserving critical data from a nuclear attack. This provided the foundations for the unification of information and communication technologies (ICT).

The inability of the institutions of Modernity to cope with the new developments has now been revealed, but the effects of the IT revolution, in addition to exposing aspects of technology that were previously shadowy and did not attract attention, were to expand and popularize our perceptual abilities. Most importantly, digitization made applicable a concept that precedes the advent of the PC, and goes hand-in-hand with analysis of movements challenging the technological choices of late Modernity. A more appropriate descriptive term could, therefore, be the “Digitization Revolution”, which interprets more effectively both the impact and the implications of this technological choice and its enormous transforming capacity on the concept of Modernity. It became possible to store digital information in databases, to search (and extract) and reconstruct it, and for new knowledge to be extracted, and the feats of artificial intelligence (AI) are now commonplace. The point has been reached where technology has dethroned science and the scientific method. Technological activity under a scientific facade and in the absence of a scientific method blurs the boundary between science and technology, and a recurrent term in the current bibliography is “Technoscience”.

The division of knowledge into information units (bits) has been achieved, and consequently it is possible to reduce various different cognitive fields into a common frame of reference, the machine language. This, in turn, enables reconstruction, using elements from various different fields of knowledge that were previously lacking means of communication with each other because of conceptual and language barriers, and the generation of new hybrid forms of knowledge. What should be noted is that, for the first time, technology is invading the symbolic space en masse. Material entities, such as money, are being immaterialized, while imaginary spaces and entities are being made real [7, 8, 9,10, 11, 12, 13, 14, 15, 16].

All of the above developments have been taking place over a very short time period, compared with the pace of technological development in previous periods. The theoretical and institutional framework is unable to keep up, and as a consequence these developments take place in an institutional vacuum. One factor that contributes to the deconstructive

power of technological development over the previous institutional framework is that the ability to control this development is completely absent. A second factor is that the possibility of instant, direct communication, through social networking platforms, creates pressure on the central institutions of Modernity, such as, for example, representative democracy, while the notion of the nation-state is also being shaken, as geographical borders become invisible to the dematerialized economy and irrelevant to the internet. An additional factor is the collapse of the Great Narratives, which were a central tool of Modernity in creating a sense of belonging, and their replacement by ever-shrinking narrative forms, which tend to look more like personal confessions. The shaking of the central pillars of modernity due to digitization is also creating an identity problem for individuals [17, 18].

Accepting the view that an individual's identity is determined by his or her ability to belong to a community, real or imaginary, then, with the redefinition of communities in the age of digitalization, they are tending to become more and more imaginary. In the virtual world, the notion of gender or nationality appears to be diminished in importance, and, consequently, any pattern of previous normality is becoming degraded, so that the boundary between “normality” and any kind of divergence is becoming blurred. Hence, we are witnessing the creation of social movements that reflect technological digitization at the societal level. If, for example, the rhetoric of the debate on individual rights is consistently followed, recognition of the uniqueness of the individual is decisively concluded, which, however, may imply an absolute social division. Similarly, delving into the debate over identity politics and their theoretical underpinnings, we might find that the choice of a dominant identity is intertwined with many alternatives, which must all be taken into account. This, also, appears to lead to social fragmentation and to a focus on the individual. If all of the above is true, it becomes clear that the concept of digitization, as an interpretive tool, can be employed for the analysis and explanation of both technological and social developments.

It is apparent, however, that the creation of institutions to regulate social digitization processes are lagging behind the cumulative technological development, but we will not deal here with the ideological implications of social digitization, at the individual level, for the structure, cohesion and future of today's societies. As history shows, the interaction of technology with society is inescapable, leading to the assumption that when the cycle of social digitization is complete, a new cycle of social reconstruction must follow, giving rise to new, different social forms. These in turn demand new institutions and theoretical schemes, which, however, are not yet visible [19].

Focusing on the individual social unit moving into the new reality, we should consider its form and its mental state, its fragmented identity and its isolation, resulting from the difficulty in identification and integration into social groups, in the absence of a central narrative that could act as a reference point for self-determination or heterodesignation.

In conjunction with the above developments, the increasing deficiencies in linguistic manipulation should also be mentioned, which result from the new forms of communication imposed by the social media. Several trends are emerging, including a strengthening of information over knowledge, which may entail diminished judgmental capacity, the necessity of the social unit to alienate itself from the “real” and to live increasingly in the imaginary, virtual world, and an acceleration in social timing, which leads to the hallucinatory state of living either in the ephemeral or in the eternal present. Preliminary evidence points to a change in the behavioral and communication practices of social units that are exposed over long periods of time to the virtual world. Discussions and research

projects deal increasingly with the phenomenon of dependence on the internet, which affects in particular younger age groups.

The observed characteristics of this dependence show similarities with those of ASD. This does not mean that everyone exposed to the virtual-imaginary space falls within the autistic spectrum, but rather that the regularity of that space drastically differs from the regularity of the physical space, in ways that resemble the experience of ASD. Accepting this hypothesis, it follows that, in this particular space the distinction between normality and impairment becomes obscure. In this context, in the ongoing debate on education, professional rights and inclusion, it might be necessary to focus on how the transformation, under the influence of digitization, affects the form and the scope of educational systems and production processes, rather than attempting to converge to a norm the authority of which is being shaken.

Returning to the definitions of ASD and the difficulties in its diagnosis, the effects of the moving boundaries between normality and disorder, and the transformation of social and institutional functions by technology are powerful, leading to convergence of social units that undoubtedly belong in the autistic spectrum, with those living within the virtual/imaginary world. Hence, a major challenge is how to find a common locus, with the possibility of intercommunication between these units, within the dominant physical and social reality.

Discussion

Assistive technologies in ASD

A strong possibility for such an attempt at bridging could be by the use of digital technology. In order to address these apparently insurmountable difficulties, the search for supportive solutions could be combined with research efforts and developments in the field of IT. Setting aside the influence that the mass communication media, namely radio and television, exerted in shaping the norm in Modernity, which, however had little effect on our ASD target group, it should not escape our attention that, for the first time in the history of technological advances, it appears that there is now the possibility, through technological intervention, to influence the mental and cognitive states of people with ASD and to open new communication channels for them.

It should be emphasized that the application of AT for individuals with ASD is not free of disputes and diversified approaches, which have different starting points depending on the research field and the theoretical standpoint. The majority population currently diagnosed with ASD consists of minors in the prepubescent and adolescent age groups. Consequently, from a legal perspective, they are indirectly represented by their guardians. Hence, when referring to the autistic community we should bear in mind that this includes both people with ASD and non-autistic people with a legitimate interest. The latter form communities, which having accumulated experience through political lobbying might be in a position, not only to exercise influence on policy makers, but also to introduce policies themselves, but there is at present a lack of consistency regarding both the theoretical starting point and the ways in which to approach the phenomenon.

The policies adopted by different interested bodies are thus contradictory, and even diametrically opposed [20]. For instance, “Autism Europe” stands for the intensification of scientific research, state care and support, and is in favor of the introduction and use of AT. On the other side, the Autism Rights Movement rejects the connection of ASD to any form of illness or disability [16]. Their main thesis is that individuals with ASD should be

considered as perfectly normal and healthy beings who should be proud of their "neurodiversity" [21], their only requirement is the provision of tools to address the difficulties imposed on them by the dominant non-autistic culture. The movement not only rejects the use of AT and associated research efforts [22] but also advocates that people with ASD should be treated as belonging to a minority community [23].

If, in a digitized society there is, in practice, a convergence of social units, then perhaps the debate should focus rather on how some of the power generated by the technological evolution can be redirected to ensure that this convergence can occur under the most favorable terms and conditions for people with ASD. In this context, the use of supportive technology should be studied and applied, so that this population can gain appropriate education, vocational training and employment, and the capacities for independent living.

People with ASD face special problems in their interpersonal communication and social interaction, which vary from person to person, but with a common feature of a deficit in social skills. Specific features include non-understanding of the accepted communication protocol, absence of emotional feedback during social contact, and distraction of attention, or, conversely, intense attachment to specific activities or objects. For management of these characteristics, it is possible to use intelligent programmable devices, including computers and other devices with the ability to perform algorithmic processes. Parenthetically, it should be mentioned that, regardless of the technological generation of the devices performing the algorithm, these are characterized as either low- or high-tech, depending on the type of support provided. Thus, for example, digitization of cards, symbols and images are classified as low-tech, while programs that simulate situations, contain heuristic algorithms and have the ability to record and process data are classified as high-tech.

Devices of this kind can be a tool for practicing social skills, as through continuous repetition of the same process individuals with ASD can be trained in facial recognition, expression discrimination and emotion comprehension, and their eye movements, responses and other data are recorded. The data are then used to optimize the parameters of the algorithm, so that it better meets the personal needs of the trainee. For this purpose, digital entities (avatars) are often used, which makes interaction easier for people with ASD characteristics, as the human factor, which is often associated with increased anxiety in the learner, is absent. Such systems are described as social robotics. In addition, applications corresponding to video games can be used to simulate social situations in the virtual environment, which can then be reproduced in the physical realm [24]. Research efforts are also underway to build anthropomorphic robotic devices with features similar to those used in social robotics [25].While current evidence suggests that these applications attract the interest of people with ASD, their clinical and educational usefulness has not yet been confirmed [26].

Mention should be made of the two current basic assistive technology (AT) approaches for people with ASD. The first approach opts for the design and use of specialized programs and digital entities created specifically for people with ASD, and the other favors using commercial technology. It is expected that this dispute will be resolved through technological evolution, evaluation, and eventual social consent. Although the first approach rightly points out the need for personalized programs and applications, based on the nature, the complexity and the uniqueness of the symptoms of ASD, they are made for a rather limited market, and their development is retarded by the economic factor. The second approach, that of using ready-made commercial applications, is affected by lack of optimization of the application parameters. The fact that specialized applications are scarce,

due to their development costs, while the commercially widely available devices are non-specialized, may explain the dearth of serious clinical outcome evidence.

Commercially available applications, in addition to their availability and price, derive their power from their ability to connect with the internet, which is associated with a variety of the negative aspects of online browsing. These include visiting websites with inappropriate or malicious content, websites designed to deceive browsers, with the goal of embezzling money or intercepting personal data. People with ASD are more vulnerable to these kinds of risks, because of their limited social knowledge and difficulty in understanding malicious intent. Some people with ASD may trust information provided on the internet, follow instructions and satisfy requests which may be injurious to them, or illegal. An additional factor of concern for parents and specialists arises, paradoxically, from the eventual success of the digital entities which are developed in social robotics.

Our limited knowledge of both the effects of the applications and the diversity of the characteristics of individuals with ASD may lead to an undesirable dependence on this digital entity and to results contrary to what is expected, i.e., to increased social isolation instead of the desired goal of social inclusion. It should also be emphasized that individuals with ASD are just as vulnerable as the rest of the population to the phenomenon of addiction and dependence on the virtual world, which can aggravate their isolation and other characteristics of ASD.

Another interesting aspect of the use of digital applications and social robotics for individuals with ASD is to elucidate their interests and their views of what is important, which may differ radically from the expectations and objectives of their parents, teachers and institutions. This dimension raises a more general dilemma for consideration, which is of concern for all educators, parents and institutions, and is independent of the specific population to whom it is addressed, that is the distinction between encouragement and guidance on the one hand, and persuasion and manipulation on the other. For a population with ASD, it is possible that the use of programmable digital technology can take a direction contrary to legal and ethical rules, since aspects of this dilemma can be involuntarily integrated in the programming of the device.

Finally, we will refer briefly to two additional issues arising from the use of supportive digital technologies. The first issue concerns the collection of personal data, and their processing, management and storage. The practice starts with good intentions, related to research of the phenomenon of ASD and the more effective parameterization of the digital systems applied in its management. In the general population, the collection of such data presupposes the consent of the participants/users. When applied to people with ASD, some of whom may be, besides other characteristics, minors, the question is who is authorized to provide consent, and to what extent access to the data is permissible, without the risk of violating the legal status of the person under consideration.

The benefit of using AT in the education of people with ASD is twofold in nature, being applied for the education and training of individuals with ASD, and also for the training of teachers in the use of this technology. The teacher training component emphasizes convergence between two different groups, those with and ASD, and those of typical development (TD),who lack a common communication protocol. In a sense, this approach appears to vindicate the position of the Autism Rights Movement, in terms of educating the “normal” in understanding and interpreting autistic culture, which may seem an exaggerated and extreme assertion.

It is also found, however, in another form, namely the inclusion of people with disabilities in the working environment. The dependence of people with ASD on this digital application may have results contrary to what is expected, that is, more intense social isolation rather than the desired goal of social inclusion. Also, as noted above, individuals with ASD are just as exposed as the rest of the population to dependence on applications of the virtual world, which can lead to further isolation.

It should be noted that the relationship between instructor and trainee is inherently asymmetrical, since the former possesses the theoretical and empirical knowledge and the authority and institutional power to carry out his/her task, namely to direct the trainees towards the desired learning goal. The underlining assumption is that the teacher masters and commands the problems, and knows the correct ways of tackling them.

However, given the inherent asymmetry, it is possible that the instructor might involuntarily contribute to the problem, in the belief that the pursued line of educational policy a non-negotiable position, thus creating false expectations. The trainee and his or her guardians, due to lack of information on alternatives, may be forced to consent to participation in a research project or an educational project that does not serve their interests or may even lead to undesirable results for the trainee. The solution to the problem of asymmetry in the educational relationship lies in the continuing education and self-assessment of the teachers, and raising of the awareness of parents and institutions.

The solution to the problem of asymmetry in the educational relationship lies in the continuing education and self-assessment of the teachers, and raising of the awareness of parents and institutions.

In their enthusiasm for technological developments, those who are active in the internal aspects of technology may have little interest in the impact of technology on the social field. The developers are already proposing the replacement of the human factor in many areas by heuristics and artificial intelligence systems, which at present constitute a huge area of research. Due to the creation and use of digital technology and social robotics, delving into the unexplored space of the virtual raises the possibility of reinforcing false expectations and influencing people in ways that may be non-controllable, both theoretically and institutionally. There is a future danger, as far the ASD is concerned, of using AT applications to replace the human educator, who possesses the three attributes noted above, to which another, that of the healer, should be added, which may lead to a new type of idolatry.

Since the educational intervention in ASD concerns the reconstruction of cognitive fields, the rules and dynamics of which are neither perfectly understood nor controllable, efforts must be made to ensure that it is carried out within a rigid framework and under the strict supervision of personnel qualified in ASD management. This is too serious issue to be left in the hands of those who work on the internal side of digital technology, and regardless of the benefits of technological evolution, the fundamental components of our beliefs regarding the concept of humanity should be the stable point of reference.

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