Evaluation of traditional and online learning in artificial intelligence

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Abstract

The digital revolution is underway, and artificial intelligence is governing developments in every field. The worlds of finance, entertainment, welfare, health, and especially education are overwhelmed by the potential that such devices, through human ingenuity and technology, can express to lead society toward a prosperous and better modernity. In this regard, the following position paper, through a nonformal exploratory literature review, will assess the benefits brought by artificial intelligence in distance learning, in-presence, and administrative organization within educational settings. With the intention of analyzing the peculiarities and potential of such technological devices in educational settings, we will proceed with an initial definition of artificial intelligence. The use of artificial intelligence in traditional education as a tool to support and enhance educational intervention will be examined. The middle section of the paper will analyze the characteristics, usefulness, benefits, and sometimes critical issues associated with the use of AI-based educational platforms prevalent in international educational systems. The final section of the paper will describe the potential of artificially intelligent devices in the management, organization, and optimization of educational and management resources and interventions of faculty and administrative staff. The ultimate goal of this research is to demonstrate how artificial intelligence can provide the world of education with important support in all its dimensions. As a useful tool for achieving optimal management and organization of educational institutions and aimed at the dissemination of knowledge in school and academic contexts.

Keywords

Artificial Intelligence, Ruangguru, Embibe, Packback, Canvas, Human Artificial Intelligence, Stanford HAI, Oxford AIxSDGs.

1. Artificial Intelligence and new perspectives in traditional education

In recent decades, the emphasis of the relationship between man and machine becomes increasingly evident. In the age of software culture, the conscious use of technology becomes a fundamental component of society. Its use shapes languages, outlines new scenarios for social interaction, influencing the totality of dimensions that characterize human doing and thinking, challenging the classical categories with which individuals interpret the world [1]. The use of technologies significantly affects most aspects typically considered relevant to the human dimension. Thanks to communication technologies, online modes of interaction "deconstruct localized space, of Cartesian conception, redetermine and delocalize it globally" [2]. Technologies, which have now become intelligent, have invaded all fields of knowledge, creating new ways of perceiving reality by bringing about an enhancement of physical and psychic processes [3]. In this age of technology, media represent an extension, a walkable bridge to reach others, enabling us to realize and consolidate meaningful relationships. Such tools are artifacts of ingenuity and are subservient to the human propensity to perfect one's abilities, skills and possibilities. The social function that such tools are called upon to perform in the community is to indulge a need, as overt as it is intimate,

that is typical of man, namely to communicate. The concept of communication is encapsulated in the human dimension. Man communicates, consciously and unconsciously, ideas, concepts and knowledge, "pooling" information processed according to the rules of a given code [4], to satisfy that need to feel an integral and functional part of a community made up of one's fellow human beings, united by common goals, such as the sustenance and survival of the species [5]. The potential expressed by technologies in satisfying man's atavistic need for communication has made their use indispensable in any context, especially in education. Their use has caused a communicative revolution that challenges the world of teaching and education [6]. So-called "digital communication" has caused an orderly and virtuous reversal of educational patterns through the integration of media devices capable of making dialogic exchange highly interactive in the educational context. Thanks to the use of technological devices in educational practice, the learner is no longer a simple passive terminal of the communication system; he also becomes a user and producer of services [7]. It is in this scenario that educational informatics, that branch of research in which information technologies meet educational theories, is situated. The digitization of learning has led to the spread of IT-based educational solutions such as: virtual reality, social robots, MOOCs, cloud computing, and Internet of things (Iot). Students' interaction with e-learning platforms has generated a considerable amount of data. This information thanks to Learning Analytics can be organized and managed in order to: personalize educational interventions, build better pedagogical interventions, enhance students' active learning, support at-risk students, and assess the motivational and psychological factors that affect students' completion [8]. Artificial intelligence (AI) is used to accomplish this. This is defined as: "The discipline that studies the theoretical foundations, methodologies and techniques that enable the design of hardware systems and systems of software programs designed to provide the electronic processor with performance that, to a common observer, would appear to be the exclusive domain of human intelligence" [9]. Artificial Intelligence (AI) allows cybernetic systems to recreate thoughtful behaviors such as selecting from a multitude of data those useful in performing a complex and seemingly cogitated task. The ability of intelligent technologies to solve advanced problems is due to analytical models that generate predictions, rules, responses and recommendations [10]. These tools thanks to Machine Learning (ML), or a subset of techniques, theories, methods and technologies in AI, can learn automatically [11]. Over the past decades, the field of Machine Learning has produced a number of remarkable and sophisticated algorithms and preprocessing techniques to efficient machine learning capabilities. Among the most notable advances is Deep Learning (DL), which is an architecture of artificial neural networks, similar in structure and function to biological neural networks (ANNs), with improved and high-performance data processing and learning capabilities. [12]. Deep Learning allows computational models equipped with multiple levels of processing, to produce representations of data with greater abstraction capabilities [13]. All this makes it possible to predict with extreme accuracy and precision the outline of a wide range of phenomena, human behavior included. Despite some concerns, it is possible to see a general perception of the usefulness of AI in teaching and that the ethics of using virtual assistants play an important role in social reality [14]. The philosophy behind the use of artificial intelligence for social and educational purposes sees humans as the ultimate recipients of meaningful interventions mediated by intelligent devices. This approach to AI is called Human Artificial Intelligence (HAI) and there are two different conceptions of it. The first sees AI technologies as totally subservient to human control, with a view to collaboration between parties aimed at enhancing social productivity, with a high level of reliability, efficiency and security [15]. The second meaning sees AI applied to the human condition and dimension for the purpose of improving the quality of life. This can be ascertained from the page of the "HAI Stanford University" website, where a report on the incidence of artificial intelligence within modern society is periodically prepared and published [16]. Stanford University reflects on the possible use of intelligent technologies in the most diverse areas of knowledge, dwelling on how they affect social change, human behavior, the economy, and the worlds of education and industry. HAI Standford's mission is to "Promote AI research, education, policy and practice to improve the human condition" [16]. It is according to this human-machine synergy-based perspective that smart learning environments are being set up, centered on people as recipients of AI benefits. Smart learning environments are set up focusing not only on educational performance, they are also organized in order to protect the emotional and affective dimension of

students. To make this possible, it was necessary to explore in depth the impacts of smart learning environments and AI platforms, on the community [17]. The concept of precision education is introduced within this scenario. This presents itself as a new challenge in the application of AI, machine learning and deep learning within educational settings [18]. The intent is to improve student learning by helping them develop effective learning strategies, subject to the use of smart technologies [19]. Of note, precision education makes use of smart learning, i.e., education based on the application of big data and AI, to identify at-risk students and provide them with personalized educational interventions in a timely manner aimed at improving their academic performance. This is the case with Intelligent Tutoring Systems (ITS), which aim to provide immediate and personalized instruction or feedback to students without necessarily involving a human teacher. The purpose behind the use of such devices is to provide meaningful and effective learning using information technology. Within ITS there are four different components: the domain model, the student model, the teaching model and a learning environment or user interface. These systems are able to vary the complexity of the exercises in relation to the intelligence and abilities of the user. Because of their ability to process large amounts of data in real time, they can personalize instruction, administering increasingly complex and researched exercises to proficient students and providing less sophisticated content that does not require high processing capacity to struggling students [20]. This ability and that of automatically grading tests administered to students make them optimal for significantly reducing teacher workload. A key aspect in intelligent tutoring systems is student interaction with User Interfaces (UIs). These adaptive, digital devices not only serve as excellent attention catalysts, but also collect and classify input and data obtained from student interaction. Intelligent technologies are currently being used to recognize learners' attention levels and emotions, adjust conversational dynamics in computer-supported learning, manage and develop courses, generate optimal groups for cooperative learning activities, and recognize patterns that predict school dropout to limit the devastating effects of school dropout [21]. In 2016, an AI study at the Georgia Institute of Technology introduced Jill Watson, the first artificial tutor in a university course [22]. The 'artificial assistant, developed on the IBM Watson platform, was experimented on students without their knowledge. Some of them had guessed, given the speed with which they received answers to their questions, that they were interfacing with a machine; others found out at the end of the semester when Prof. Goel revealed it to them, causing a stir in the student community. Currently, the virtual assistant is still in use, but to allow him or her anonymity he or she is often renamed, sometimes resorting to female pseudonyms. The teacher shortage has become a global emergency according to the United Nations Educational, Scientific and Cultural Organization [23]. The U.S. Education Commission has also commented on this emergency, pointing out that the interest of young people in pursuing teacher education programs has declined [24]. At the same time, an increase in student enrollment of 0.4 percent in public elementary and secondary schools is evident, with a projected growth of 5.2 percent from 2011 to 2023 reported by the National Center for Education Statistics [25, 26]. This situation portends the emergence of a clear educational problem with extremely devastating effects both for students, who would not have access to a primary education, and for teachers, who due to understaffing are at risk of developing psychopathologies due to the unsustainable workload. New interventions are needed to support and promote education, in this regard we find a growing focus on the use of Artificial Intelligence in Education (AIED). Already Diprose and Buist [27] found that the use of AI brings enormous benefits in multiple economic and social sectors. The use of such technologies in teaching seems to be very beneficial since intelligent tutors do not experience job dissatisfaction, leave, rest, anger, fatigue, etc. Several studies have reported the positive role of robots in learning. They are in fact useful in limiting absenteeism [28], are supportive in language teaching [29], provide emotional support to students [30], and promote creativity and problem solving [31]. In response to the educational emergency reported by UNESCO Manyika and other scholars [32] thought of AI as a possible solution to enable third world countries to have access to primary education. However, the exclusive use of AI in education hides several pitfalls, as pointed out by the scholar. Machines cannot significantly affect the development of students' emotional intelligence, emotional competence and creativity. People, as social animals, need to interact with other people to learn and develop skills useful for managing interpersonal relationships. So far, it has been observed how artificial intelligence provides support for teaching, but there is much discussion about the

possibility of more frequent use of teachers guided by AI-based systems, referred to as Machine Teachers, in the near future. One futuristic project in the development of a fully AI-managed teacher was by Edwards and Cheok in 2018 [33], in which they presented a prototype of a robot capable of teaching autonomously. The scholars argued that it is imperative for effective teaching to also provide robots with capabilities in managing social interactions, proxemics in the classroom, and basic effective requirements for emotional support to students during learning. For these reasons, the project envisions a robot physically present in the classroom, capable of delivering instruction and applying pedagogical strategies appropriate for managing social interactions in the classroom. The project envisions the robot teaching STEM disciplines, preferring collaborative learning and a positivist pedagogical approach, which therefore places the learner at the center of the educational relationship. The prototype envisioned in the project should promote student engagement, motivation and interest, and effective assessment with immediate feedback. To meet these requirements in the project, a Sota, "So (cial) ta (lker)," which is a social dialogue robot capable of moving its eyes, head and body that enable it to mimic human behaviors and support interaction and conversation skills, was chosen in the project [34]. The Sota can connect to other devices to create an IoT (Internet of things) network. It is small enough to be easily carried even by a child and is designed to engage in conversations and evaluations of collected data and then share it with the class by projecting it on a connected screen. The educational system in which the robot will be called upon to operate promotes peer learning, discussion, group dialogue and metacognition in one approach. The robot can acquire the identity of students at the beginning of the lesson, this allows it to assess students at the end of classroom exercises. During in-class quizzes Sota verifies the correctness of the answers and associates them with the identity of the students. In a second stage, the robot initiates a group discussion that will be conducted independently by the students themselves in class and is able to mimic movements and facial expressions to communicate approval or disapproval for their conduct. Through movement and changing eye color it simulates emotions such as anger, sadness, joy and other emotions. This system proposed by the scholars suggests that it is increasingly fervent within the scientific community that the idea of a school in which AI is not only supportive of educational practice. The prototype described would be capable of significantly affecting the school landscape, resulting, as admitted by the scholars, in a considerable loss of teaching jobs (pp. 356) [34]. Loss that will be duly compensated for by the emergence of other professional figures within the educational context. It has been analyzed how the incredible potential of artificial intelligence has and will continue to cause remarkable changes in the world of traditional face-to-face education, it is incumbent upon us now to analyze how smart technologies also come in handy within the increasingly used and discussed online education.

2. Artificial intelligence in online education

Artificial intelligence has proven positive for improving instruction and the quality of online learning by offering accurate predictions and assessments and engaging students with virtual materials and environments [35]. Innovative applications of AI in higher education are conducive to reforming instructional design and development methods and advancing the construction of an intelligent, networked, personalized, and lifelong education system [36, 37]. The e-learning segment is undergoing a major transition with multiple offerings and pedagogical innovations [38]. The pandemic due to Covid-19 has accelerated the transition to more ICT-mediated teaching, forcing schools and universities to move to online platforms such as Moodle, Google Classroom, Edmodo, and Power School. Universities are allowing their students to earn bachelor's and master's degrees online, and the increasing number of active users in MOOCs courses shows that distance learning methodologies are appreciated by society [39]. Advances in virtual reality, augmented and artificial reality are observed. The artificial intelligence market is continuously expanding, in fact many companies are investing in the artificial intelligence sector as it is profitable. Resorting to it inevitably entails the involvement of fewer people, leading to the payment of fewer salaries and labor contributions. The conception of AI as a subordinate employee within companies makes it a major concern within the labor market [40]. Investment in education technology (Edtech) has grown 32-fold since 2010, reaching a total amount pare to $16.1 billion [41]. Educational interventions in smart technology-mediated education have

provided viable and sustainable solutions to reach rural areas and struggling students. The online education market uses artificial intelligence to provide cutting-edge services and courses to students from all walks of life. The online learning market is likely to increase with a CAGR of more than 13 percent in the period between 2020 and 2026 [42]. AI as well as enabling the transition from traditional to online education makes learning more meaningful, incentivizing better retention of key concepts and better educational outcomes for students. Teachers are increasingly proficient in the management of teaching technologies; the use of video conferencing platforms improves student engagement during lessons. It is possible to assert that microcredentials and blended teaching are no longer understood as exceptions in today's educational scenario [43]. There are many online platforms that seek to promote learning and teaching using Intelligent Tutoring Systems (ITS), Dialogue-Based Tutoring Systems (DBTS) and Exploratory Learning Environments (ELE). These are widespread in Indonesia. The reason is the country's conformation, spread over more than 17,000 islands, a natural impediment that has significantly affected the spread of online learning. The five most widely used platforms in Indonesia are: Rumah Belajar, Ruangguru, Quipper, Cisco Webex, and Zenius [44]. The most widely used is Ruangguru, which won the title of best startup in Artificial Intelligence in 2020 at the "G20 Innovation League," held in Sorrento, Italy in October 2021. According to the G20 website, the company promotes quality education through innovative methods, products, and services for more than 20 million students and teachers, ensuring accessibility, affordability, personalization of instruction, and high-quality content [45]. During the Covid-19 pandemic, Ruangguru made available a free online teaching package consisting of instructional videos tailored to the grade level and subject studied. There are also various tests to check the students' level of preparedness. The educational program is part of the Learning Management Systems (LMS) or Learning Management Systems that allow courses to be delivered in e-learning mode on the commission of an educational or university institution. The application reaches 15 million students by providing them with information that can be used to plan, monitor, evaluate and enable continuous learning. It provides information about the users' solution process in real time while supporting the decision-making process of the service delivery organization, creating a harmonious flow of reliable and good quality data [46]. The use of these smart technologies can increase the productivity of university managers while decreasing the need for an intermediate administrative sector consisting of many staff. All this, without having to give up an efficient, coordinated internal organization with meaningful working relationships [47]. Another company operating in the E-learning sector is Embibe Inc. Founded in Mumbai, India, in 2012 by Aditi Avashti. Embibe provides educational services for students through online platforms. It uses personalized feedback and chatbots to develop users' educational standards. Chatbots are AI-based software designed to converse with users; their purpose is to simulate human behavior through sophisticated natural language processing systems [48]. The chatbot used on Embibe is called "Knowledge Buddy" and was created to help students reinforce and consolidate learning by asking them questions and correcting them when necessary. Thanks to Deep Learning an immediate response to questions is provided by the device, this is possible thanks to the Knowledge Graph, which is a repository of interconnected knowledge and information that is processed by Content Intelligence AI software to generate questions and answers instantly. Knowledge Buddy is built using conversational artificial intelligence and state-of-the-art linguistic and visual models. It is capable of automatically generating and asking questions based on data previously collected from the learner, answers the learner's questions as the learner engages in the study of learning content, and is also capable of automatically translating questions and answers into the language most congenial to the user [49]. The platform that powers Knowledge Buddy is the NLU Medhas. This is capable of making the knowledge and information held by the domain required to administer a specific lesson interpretable and understandable [50, 51, 52, 53]. Until now, educational platforms have been analyzed that involved interaction with systems characterized purely by ITS intelligent tutoring systems and chatbots. In addition to these, online discussion platforms for educational purposes are available on the market, where student participation is promoted through the sharing of educational content. "Packback," a specialized discussion platform that supports online learning and teaching by resorting to Gamification, and "Canvas LMS," an AI system for learning management that produces an automated and holistic approach aimed at learner growth, will be examined. Packback is designed to support teachers in monitoring and evaluating discussions while engaging learners through rapid feedback and playful learning elements. The platform does not allow the dissemination of posts that do not meet minimum sharing requirements, such as word count and

non-plagiarized document content. It is also able to assign each content shared by users a "Curiosity Score." In fact, thanks to an algorithm, it evaluates the post according to three quality criteria: relevance-depth, credibility and mode of presentation. It can reward posts on the platform by analyzing the number of characters used, sentence structure, the quality of quotations given and the formatting of the content. Inappropriate posts are flagged by the platform and subjected to human review by moderators to see if they need to be removed [54]. Within online platforms, settings pertaining to discussion structure can significantly affect user participation [55]. A significant feature of PackBack is that students, because of interaction on the platform and participation in the discussions established at the end of the lesson, are awarded points, which are reported on the "Learner Leaderboard." This feature realizes a leaderboard that makes a widely discussed post visible until the end of a semester. The Packback feed arranges discussions by employing different types of criteria. The posts that are most recent, most interesting, with the highest number of responses, or of higher quality can be filtered and easily intercepted by users. With reference to the modes of interaction, it is found that teachers can positively affect the motivation of learners by posting positive feedback publicly or by providing private coaching to them. This relationship with the teacher is a key component of the Community of Inquiry (COI) model [56] all due to the fact that frequent interaction between the parties results in behaviors typically associated with an in-presence teaching context [57]. Canvas Learning Management System (LMS), on the other hand, is an AI platform that is particularly prevalent in thousands of universities in the United States and internationally, with a growing presence in the Primary, Secondary and Academic Education markets. The platform's reach is nearly global and plans to extend further into Central and South American education markets [58]. Canvas is valued by its users; in the fall of 2018, a satisfaction survey of 4278 users of the platform found that 32.9 percent of students use Canvas from their smartphones and 45.4 percent via laptops, and that about 60 percent of these were satisfied with the LMS [59]. Canvas is able to assess students in real time allowing academic institutions to check the effectiveness of teaching and learning strategies. Canvas Instructure is being used by K-12 students, college students, and companies that set up development programs for their employees to ensure that they receive quality continuing education. According to the website, Canvas Instructure "has connected millions of instructors and students belonging to more than 4,000 primary and secondary education institutions and companies worldwide." This feat has been made possible thanks to Amazon Web Services, which has enabled Instructure to be "creative without friction" and difficulty [60]. Among the tools offered by Canvas Instructure we find: statistics on quizzes, instant assessments including from IOS and Android mobile devices, polls, notifications to email and social media accounts, exchange of audio and video between users, repository of learning objects, Learning Tool Integrations (LTI), Web conferencing, and customizable individual profiles that stimulate the sharing of students' personal data [61]. It can be inferred that these features make it easier for people to learn, but according to Madden's report, all of this exacerbates the harm done to community members who lack sufficient resources to have access to Instructure. By not having their data collected, strategies to allow them personalized instruction on par with other users are also lost [62]. Thanks to Canvas' Open Apps site, it is possible for users to install apps provided by other companies and then use them in Canvas LMS. It is allowed to use Zoom for video conferencing, Evernote for notetaking, ASPIR-EEDU for monitoring teachers' performance. All of this allows Canvas to boast a transversality, or rather a "longitudinality," that allows for a complete picture of user performance, whether students or faculty. Canvas in recent times has been embroiled within a diatribe inherent in the management of student data collected from interaction with the platform. To test the vulnerability of its software, it has turned to outside private companies. This has caused an uproar, as having access to similar data is coveted by many companies in the industry. Although there are some safeguards in reference to privacy, retrieval and management of user data, a collaboration between public education and private company generates permanent tension among the population [63]. Canvas claims that third parties have access to user data through cookies and web beacons to improve the quality of its services. However, it assured that individual user data on Instructure are anonymized [61], and that the fact that these are collected in Amazon Web Service should not cause a stir because they are not used. "They are just there" [60]. This scenario makes it clear that despite the potential of smart technologies, there is a need to intervene with data protection measures. This leaves room for deep discussion considerations in terms of ethics, transparency and fairness in the management of even users' digital identities. Similar issues, while so sensitive, will not be researched in the following study. A final educational frontier affecting the world of education is

that of Virtual Reality (VR). This is managed by AI systems and its use in the educational process enhances the educational experience by making it more stimulating [64]. Virtual reality takes the form of a computer-generated immersive three-dimensional visualization with which the user can interact [65]. Various platforms are available that can enrich the educational experience of learners within educational and university institutions such as: Oculus Rift, Samsung Gear VR, Google Cardboard. 2D environments that ensure education through different synchronous platforms can induce Zoom fatigue in learners [66]. In contrast, asynchronous platforms are affected by emotional isolation, significantly negatively affecting motivation and participation, leading to high dropout rates among students [67]. In the case of virtual reality, this is not the case thanks in part to the user's construction of a cybernetic, fictional identity through the use of an avatar [68]. Identification with one's avatar can have a profound psychological impact on behavior and learning; in fact, experiences in a virtual context have a direct influence on human behavior, affecting the physical world as well. This phenomenon is called the Proteus effect [69]. The avatar allows one to experience direct interaction with the environment, creating the psychological perception of being within a space, experiencing telepresence and the perceptual illusion of non-mediation [70]. Telepresence shared with other subjects is referred to as "co-presence." Being able to interact with other users and avatars within a virtual space in three dimensions, recognizing other people allows one to experience the power of co-presence, a key element in building virtual communities aimed at educational inquiry [71]. The integration of virtual reality and thus artificial intelligence is useful in educational settings to make the subject experience uncomfortable situations as a problematic manifestation by the learner several times, with the intent then to learn how to handle them [72]. Four stages in the virtual social relationship have been identified and described as useful for the implementation of such technologies in pedagogy. In the first phase, the teacher guides the learner through a multimodal experience by making him or her a viewer of a 360° video or YouTube VR. In the second phase, learners have elementary interactions with the virtual environment. In the third, the acquisition of greater autonomy is stimulated by letting them move freely within Google Hearth VR. In the final stage they resort to the "presence" first described [73]. In the field of virtual reality, since Mark Zuckerberg announced the official birth of the Metaverse, the idea of its use in education is gaining momentum [71]. The Metaverse is conceived as a place where users can meet, socialize and interact without any kind of limitation or restriction. Two principles dominate it: interconnection to software and the possibility for users to teleport to other worlds. Seven rules apply in it: there is only one Metaverse, it belongs to everyone, it is controlled by the community, it is open, hardware-independent, connected to the Web, and no other Metaverse or Multiverse will ever exist. The potential of this virtual place in education is very innovative and of boundless potential. It could be used for laboratory simulations, surgical skills development, and STEM education. Immersive journalism. Because of its ability to capture 360-degree photos, it could bring audiences experiences and events in remote places to life in a direct way [74]. It could be used for distance education without the problems attributable to 2D platforms. It is certainly capable of ensuring active, formally and informally rich as well as emotionally engaging learning experiences for the learner. It could see the involvement of Spatial Computing, i.e., a technology that allows the control of technological devices with gestures and words [75]. Through brain-computer interfaces, it could allow users to communicate solely through their own brain activity [76]. It could enable people who are paralyzed or limbless to use a pc. A fusion of cutting-edge technologies such as AI, educational robotics, Cloud Computing, and the Metaverse is envisioned. This digital revolution could see as its protagonist precisely this alternative universe, capable of ferrying the world of education into the era of Education 4.0 [71]. The analysis addressed so far of AI systems supporting education and training are the central focus of this research paper. So far, it has analyzed how AI platforms are widely used by students, ensuring that they receive concrete support during their study activities. Artificial intelligence is clearly an effective support tool to support, and sometimes disrupt, the paradigms of education of students of all grades and belonging to any educational institution. It is necessary to delve into how such technologies are perceived by the teacher component. There is a need to analyze their potential and critical issues, to understand what challenges teachers will face in order to provide optimal training for their learners subject to the use of AI-based technologies. This is what will be analyzed in the next section of the paper.

3. The support of artificial intelligence to educational offerings

Artificial intelligence emerges as a useful tool not only for the full education of students. Its functionality can also be found in the administrative and teaching sectors in all levels of education, including higher education. Artificial intelligence applications (AIAs) provide help to teachers in the form of Learning Analytics (LA), Virtual Reality (VR), Grading/Assessments (G/A) and Admissions, minimizing the tasks of the administrative technical sector and teachers. AIA reduces the workload of faculty, including during the assessment phase, consequently ensuring a significant improvement in educational delivery towards learners [77]. AI is assisting education organizations on two different levels: administrative and academic. In the former, it is used in admissions, counseling, and to provide library services; in the academic sector, on the other hand, it helps to provide immediate and stimulating feedback and evaluations, ensuring constant mentoring about the entire student community. AI is a topic that increasingly can be found in every sector and social sphere, especially in education [78]. There are different types of algorithms for managing administration and teaching. In the administrative sector, in order to fulfill all duties, teaching staff are often used. Artificial intelligence is used for this, as it can bring great benefits in carrying out such tasks as: personalized instruction, learning analytics and admissions management. It is the right of every student to see himself or herself meticulously monitored throughout his or her education; however, it remains difficult to ensure personalized intervention without the help of state-of-the-art technologies and educational tools. Artificial intelligence, especially in educational settings with limited budgets, succeeds in providing individualized tutoring to students, especially those who are struggling. AI allows each student to learn according to his or her own mental abilities, intelligence type, and learning style [79]. Practices typically attributed to teachers, such as assessing learners' performance, interacting with learners' parents, are now supported by AI. All this allows faculty to focus more on relevant tasks, such as devoting more attention to motivated and participatory learners, supervising projects, and participating in academic discussions [80]. AI is used for the analysis of job applications. Such systems automatically identify criteria to be applied in the selection of applicants by arranging guidelines to be followed in interviews [81]. AI devices do not replace administrative and teaching staff; they are simply supportive of the work activity. They are very supportive during the admission phase of trainees from any department by being able to manage the procedure in a very short period [82]. The function of AI systems is managerial in nature unlike information and communication technologies that are used for purely technical matters. An increasingly widespread application of such systems is at the time of student assessment. They can apply student-centered performance measurement models, providing them with immediate and unbiased judgment. This application has come in very handy in the pandemic period. Teaching because of Covid has shifted to e-learning platforms such as Learning Management Systems, Massive Open Online Courses (MOOCs), MOODEL, and it has been difficult for teachers to assess each and every student's assignment online [83], for which purpose automated systems from clustering algorithms and deep learning have been used [84]. The usefulness of AI is not bound only to assessment and tutoring during teaching and learning. Systems first described as chatbots are used to assist students during the application and admission phase of college by greatly speeding up the process. Since these are capable of simulating human conversations they manage to guide people during the enrollment phase of degree and training courses, consequently decreasing the workload of technical and administrative staff. The chatbot ensures a complete and comprehensive 24/7 service [85] and consequently avoids the accumulation and procrastination of many purely bureaucratic procedures. AI also can be applied in the context of analyzing student learning. This process in research is understood as a model to be applied for predicting student learning as a result of data collected from the interaction between the two domains [86]. All this makes clear the great impact that Artificial Intelligence has had and is having in the world of education and the organization of school and academic administrations, as well as with regard to the teachers themselves, no longer obliged to deal with every single aspect of teaching but rather seeing them involved, thanks to AI, only within those that are most formative and stimulating for themselves and their students. So many are the challenges to which AI has subjected teachers and so many are the improvements it has brought to the world of teaching by preventing school dropout [87], monitoring student progress, and assessing student work in a reliable and automated manner [88]. Unfortunately, the use of AI in education is less applied than in other fields. As argued by Celik to other scholars [89],

one solution to this issue would be the involvement of teachers in the design, testing, and development phase of educational smart technologies, so that they can consolidate skills in the management of such devices that would contribute daily to the improvement of educational delivery and practice. Allowing those who teach and those who administer to employ AI technologies of such boundless potential during training and specialization courses inevitably results in immediate educational progress for the school and academic system. The synergistic relationship between intelligences, whether human or artificial, will ferry society toward new educational, communicative and social scenarios. Perspectives then translated into more efficient, evolved and performing realities, attentive to the training and psychophysical health of people. Intent, thanks to research and technology, to ensure the achievement of greater well-being for the entire community.

4. Conclusions

Sustainable Development Goals (SDGs) were identified in the 2015 United Nations Development Program (UNDP). The Oxford Initiative on AIxSDGs seeks to determine how artificial intelligence has been and can be used in the future to promote the sustainable development goals first mentioned [90]. The intent at Oxford is to pursue ethically sound design aimed at addressing and solving societal issues of global significance through the potential of AI. The projects promoted by the organization all cover areas of undeniable relevance to humanity, which has been bedeviled in recent times, as never before, by suffering battles that undermine the integrity of the individual and society. Among goals such as: the defeat of poverty, the defeat of hunger, health and well-being, gender equality, clean and affordable energy, decent work and economic growth, we find the one that most interests this study, namely, quality education. Artificial intelligence, since its official birth in 1956 at Dartmouth College in Hanover, has revolutionized by improving people's lives over time. Consider how in the Philippines and India millions of students thanks to intelligent educational platforms are assured the right to education, enshrined as inviolable, inalienable and fundamental to man and citizen. This shows that similar technologies, used in a consonant manner, are very powerful tools that are useful in achieving greater social justice. An intelligent machine can collect data during the interaction with the learner, and then simultaneously identify and prepare the most useful educational strategy for the learner's education, all of which is sealed by the most transparent, impartial and timely assessment to the learner's work. The world of education integrates technologies into teaching processes, according to increasingly complex schemes [91], because their use contributes to the mental and physical well-being of students [92, 93]. Such devices allow teachers to invest their time and energy more effectively, without being absorbed by bureaucratic and administrative commitments that could, at times, cause teaching to fall by the wayside. AI is the tool and potential vehicle useful in making concrete and possible a quality education, accessible to all, that effectively supports the growth of educands and educators. Scenarios are posed before us that are futuristic, as in the case of Zuckerberg's Metaverse, which has the right potential to provide a very strong impetus to distance education, making it experienced by all as in presence and in a more meaningful way, especially in reference to educational intervention aimed at the training of students who have disabilities, physical dysfunctions and therefore with special educational needs. We are analog beings, projected into the Infosphere where we regularly share our experiences with intelligent agents [94], seeking greater well-being and a better quality of life. The evaluation of a technologically intelligent device, regarding its use in pedagogy and education, besides being accurate and unbiased, would certainly be positive. This is because the digital increases the possibilities of interaction between humans and at the same time allows them to find a link between the phenomena that characterize modernity. This increasingly solid relationship between society and technology breaks down distances because it creates communicative bridges between people. It elevates the potential of users by guiding them to a modernity free of limiting boundaries. It projects the world of education toward new scenarios, such as that of best educating the totality of students. By virtue of a future that increasingly conceives technologies as tools aimed at the dissemination of knowledge and useful for society to freely form itself.

5. References

[1] A. Buffardi, Futuri possibili: Formazione, innovazione, culture digitali. EGEA spa, 2022.

[2] R. Fragnito, La Rete della didattica, Pensa multimedia, Lecce, pp. 87-88, 2022.

[3] D. De Kerckhove, Brainframes: Technology, mind and business, utrecht (ola), bosch & Keuning, 1991; tr. it. Brainframes. Mente, tecnologia, mercato, 1993.

[4] N. Martini, & V.M. Mastronardi, Il mondo della comunicazione: comunicazione non verbale (CNV), programmazione neuro-linguistica (PNL) e strategie di persuasione, 2020.

[5] P. Watzlawick, J. H. Beavin, D. D. Jackson, LA COMUNICAZIONE UMANA, 1976.

[6] D. Doni, Comunicazione digitale e nuovi media: una sfida per l'educazione, 2015.

[7] P. C. Rivoltella, La comunicazione nell'era digitale. Prospettive di intervento formativo. In Identità e missione di una Facoltà di Comunicazione di una Università Cattolica, Pontificia Università Lateranense, 2008.

[8] G. Casalino, L. Grilli, P. Limone, D. Santoro, D. Schicchi, Deep learning for knowledge tracing in learning analytics: an overview, teleXbe, 2021.

[9] Intelligenza artificiale, Treccani.it – Vocabolario Treccani on line, Istituto dell'Enciclopedia Italiana, URL: https://www.treccani.it/enciclopedia/intelligenza-artificiale_%28Enciclopedia-della-Scienza-e-della-Tecnica%29/ , consulted on 19/03/2022.

[10] C. Janiesch, P. Zschech, K. Heinrich, Machine learning and deep learning. Electronic Markets, 31(3), 2021, pp. 685-695.

[11] G. Barone, Machine Learning e Intelligenza Artificiale-Metodologie per lo sviluppo di sistemi automatici, Dario Flaccovio Editore, 2021.

[12] I. Goodfellow, Y. Bengio, A. Courville, Deep learning, The MIT Press, 2016.

[13] Y. LeCun, Y. Bengio, G. Hinton, Deep learning. Nature, 521(7553), 2015, pp. 436–444. https://doi.org/10.1038/nature14539.

[14] F. Agrusti, G. Bonavolontà, Artificial Intelligence and Education: the perceptions of the students of the Department of Educational Sciences at Roma Tre University on the concept of Artificial Intelligence, 2021.

[15] B. Shneiderman, Human-centered artificial intelligence: Reliable, safe & trustworthy, International Journal of Human–Computer Interaction, 36(6), 2020, pp. 495-504.

[16] Stanford institute for human-centered artificial intelligence, https://hai.stanford.edu/ , consulted on 22/03/2022.

[17] S. J. H. Yang, Precision education: New challenges for AI in education, In Proceedings of the 27th International Conference on Computers in Education (ICCE)(pp. XXVII-XXVIII). Kenting, Taiwan: Asia-Pacific Society for Computers in Education (APSCE), 2019.

[18] S. J. Yang, H. Ogata, T. Matsui, N. S. Chen, Human-centered artificial intelligence in education: Seeing the invisible through the visible. Computers and Education: Artificial Intelligence, 2, 100008, 2021.

[19] D. Tempelaar, B. Rienties, Q. Nguyen, The contribution of dispositional learning analytics to precision education, Educational Technology & Society, 24(1), 2021, pp. 109-122.

[20] R. Freedman, S.S. Ali, S. McRoy, Links: what is an intelligent tutoring system?, intelligence, 11(3), 2000, pp. 15-16.

[21] R. Nkambou, R. Azevedo, J. Vassileva, Intelligent Tutoring Systems: 14th International Conference, ITS 2018, Montreal, QC, Canada, Proceedings (Vol. 1085), 2018.

[22] A.K. Goel, D.A. Joyner, Using AI to teach AI: Lessons from an online AI class. AI Magazine, 38(2), 2017, pp. 48–59.

[23] UNESCO, "The Challenge of Teacher Shortage and Quality: Have We Succeeded in Getting Enough Quality Teachers into Classrooms?" In 12th Session of the Joint ILO/UNESCO ARTIFICIAL INTELLIGENCE 359 Committee of Experts on the Application of the Recommendations Concerning Teaching Personnel (CEART), Paris, (2015), 1–9. Paris: GMR and UNESCO

[24] S. Aragon, Teacher Shortages: What We Know. Teacher Shortage Series, Education Commission of the States, 2016.

[25] K. Mussman, Previous Lake-Savage Area Schools: U.S. Department of Education Green Ribbon Schools, " Previous Lake-Savage Area: U.S. Department of Education, 2016.

[26] S. Provasnik, A. KewalRamani, M. M. Coleman, L. Gilbertson, W. Herring, Q. Xie, Status of education in rural America, US Department of Education, National Center for Education Statistics, Institute of Education Sciences, 2007.

[27] W. Diprose, N. Buist, Artificial intelligence in medicine: humans need not apply?, N Z Med J, 2016;129(1434):73-6. PMID: 27349266.

[28] M. A. Mac Iver, D. J. Mac Iver," STEMming" the Swell of Absenteeism in Urban Middle Grade Schools: Impacts of a Summer Robotics Program, Society for Research on Educational Effectiveness, 2014.

[29] S. Tegos, S. Demetriadis, T. Tsiatsos, A configurable conversational agent to trigger students' productive dialogue: A pilot study in the CALL domain. International Journal of Artificial Intelligence in Education 24 (1), pp. 62–91, 2014, doi:10.1007/s40593-013-0007-3.

[30] M. Dennis, J. Masthoff, C. Mellish, Adapting progress feedback and emotional support to learner personality, International Journal of Artificial Intelligence in Education 26 (3), pp. 877–931, 2016, doi:10.1007/s40593-015-0059-7.

[31] E, Liu, Z. Feng, C. H. Lin, P. Y. Liou, H. C. Feng, and H. T. Hou, An analysis of teacher-student interaction patterns in a robotics course for kindergarten children: A pilot study. Turkish Online Journal of Educational Technology 12 (1), 2013, pp. 9–18.

[32] J. Manyika, M. Chui, M. Miremadi, J. Bughin, K. George, P. Willmott, M. Dewhurst, A future that works: Automation, employment, and productivity, New York:McKinsey Global Institute, no. January, 2017, pp. 1–28.

[33] B. I. Edwards, A. D. Cheok, Why not robot teachers: artificial intelligence for addressing teacher shortage, Applied Artificial Intelligence, 32(4), 2018, pp. 345-360.

[34] Osaka University, Development of social dialogue robots 'commu' and 'sota', Research at Osaka University, 2015, http://resou.osaka-u.ac.jp/en/research/2015/20150120_2.

[35] C. Yang, S. Huan, Y. Yang, A practical teaching mode for colleges supported by artificial intelligence, International Journal of Emerging Technologies in Learning (IJET), 15(17), 2020, pp. 195-206.

[36] F. Ouyang, P. Jiao, Artificial intelligence in education: The three paradigms, Computers and Education: Artificial Intelligence, 2, 100020, 2021.

[37] B. Arsovic, N. Stefanovic, E-learning based on the adaptive learning model: case study in Serbia, Sādhanā, 45(1), 2020, pp. 1-13.

[38] R. Sharma, M. Mohan, Artificial Intelligence and E-Learning: Best Practices Across the Globe, In Adoption and Implementation of AI in Customer Relationship Management , IGI Global, 2022, pp. 1-25.

[39] L. R. Octaberlina, A. I. Muslimin, EFL Students Perspective towards Online Learning Barriers and Alternatives Using Moodle/Google Classroom during COVID-19 Pandemic, International Journal of Higher Education, Springer, 9(6), pp. 1-9, 2020.

[40] P. Bisconti, D. Orsitto, L'intelligenza artificiale e il mercato dell'ozio, 2021.

[41] B. Williamson, Meta-edtech. Learning, Media and Technology, 46(1), pp. 1-5, 2021.

[42] Global E-learning Market-Research and Markets. - Outlook and Forecast 2021-2026, 2021. Retrieved on July 10, 2021, from: https://www.researchandmarkets.com/reports/5327504/global-e-learningmarket-outlook-and-forecast

[43] M. I. Qureshi, N. Khan, H. Raza, A. Imran, F. Ismail, Digital Technologies in Education 4.0, Does it Enhance the Effectiveness of Learning? A Systematic Literature Review, International Journal of Interactive Mobile Technologies, 15(4), 2021.

[44] D. Indriyani, K. D. Solihati, An Overview of Indonesian's Challenging Future. In 2nd International Conference on Administration Science 2020 (ICAS 2020), pp. 279-284, Atlantis Press, 2021.

[45] G20 Innovation League (2021), Online, https://www.g20innovationleague.com/azienda/ruangguru   visited on 08/05/2022.

[46] B. Badrudin, M. Khusnuridlo, M. Z. El Wahyu, The influence of learning management information system and service quality on the customer satisfaction of Ruangguru application. Cypriot Journal of Educational Sciences, 17(1), 2022, pp. 148-158.

[47] I. S. Lisetskaya, A. Y. Kovalishin, Implementation of Distance Training in Quarantine At the Department of Paediatric Dentistry of Ivano Frankivsk National Medical University. Actual Problems of the Modern Medicine: Bulletin of Ukrainian Medical Stomatological Academy, 20(3), 2020, pp. 241–244, https://doi.org/10.31718/2077-1096.20.3.241

[48] M. L. Mauldin, Chatterbots, tinymuds, and the turing test: Entering the loebner prize competition. In AAAI, Vol. 94, 1994, pp. 16-21.

[49] Embibe Inc., Knowledge Buddy, Web, 2022, URL: https://www.embibe.com/ai-in-education/articles/track?id=4 , visited on 04/04/2022.

[50] K. Faldu, A. Sheth, P. Kikani, H. Akbari, KI-BERT: Infusing knowledge context for better language and domain understanding. arXiv preprint arXiv:2104.08145, 2021.

[51] M. Gaur, A. Desai, K. Faldu, A. Sheth, Explainable AI Using Knowledge Graphs, In ACM CoDS-COMAD Conference, 2020.

[52] M. Gaur, K. Faldu, A. Sheth, Semantics of the black-box: Can knowledge graphs help make deep learning systems more interpretable and explainable?, IEEE Internet Computing, 25(1), 2021, pp. 51-59.

[53] A. Sheth, M. Gaur, K. Roy, K. Faldu, Knowledge-intensive language understanding for explainable ai, IEEE Internet Computing, 25(5), 2021, pp. 19-24.

[54] C. Hudson, A. Archibald, T. Heap, Integrating an AI-driven discussion platform: The impact of platform on engagement and quality. In EDEN Conference Proceedings, 1, 2020 pp. 117-126.

[55] J. Hewitt, How Habitual Online Practices Affect the Development of Asynchronous Discussion Threads, 2003.

[56] J. M. Zydney, A. deNoyelles, K. K. J. Seo, Creating a community of inquiry in online environments: An exploratory study on the effect of a protocol on interactions within asynchronous discussions. Computers & Education, 58(1), 2012, pp. 77-87.

[57] D. L. Schallert, A. J. Sanders, K.M. Williams, E. Seo, L.T. Yu, J. S. Vogler, M.C. Knox, Does it matter if the teacher is there?: A teacher's contribution to emerging patterns of interactions in online classroom discussions, Computers & Education, 82, 2015, pp. 315-328.

[58] Hill, Phil, "Movement of Canvas LMS to Global Markets, 2017, eLiterate. https://mfeldstein.com/movement-canvas-lms-global-markets/.

[59] R. Marachi, L. Quill, The case of Canvas: Longitudinal datafication through learning management systems. Teaching in Higher Education, 25(4), 2020, pp. 418-434.

[60] Amazon Web Services [YouTube Channel]. August 4, 2015. "Infrastructure delivers online learning. Using AWS globally. " Video clip at 2:49.https://aws.amazon.com/solutions/case-studies/instructure/.

[61] Infrastructure.2019."Canvas,features".https://www.instructure.com/canvas/features/higheristruzi one? newhome = canvas

[62] M. Madden, M. Gilman, K. Levy, A. Marwick, Privacy, poverty, and big data: A matrix of vulnerabilities for poor Americans. Wash. UL Rev.,2017, pp. 95- 53.

[63] J.R. Reidenberg, F. Schaub, Achieving big data privacy in education. Theory and Research in Education, 16(3), 2018, pp. 263-279.

[64] L. O. Gbenga, O. T. Oluwafunto, A.H. Oluwatobi, An Improved Rapid Response Model for University Admission Enquiry System Using Chatbot. Int. J. Comput, 38(1), 2020, pp. 123-131.

[65] G. Bell, A. Parisi, M. Pesce, The virtual reality modeling language. vol. Version, 1, 1995.

[66] N. Yee, J. Bailenson, The proteus effect: The effect of transformed self-representation on behavior. Hum. Commun. Res. 33, 2007, pp. 271–290.

[67] R. M. Anderson, H. Heesterbeek, D. Klinkenberg, T. D. Hollingsworth, How will country-based mitigation measures influence the course of the COVID-19 epidemic? The Lancet, 395(10228), pp. 931–934, 2020, https://doi.org/10.1016/S0140-6736(20)30567-5

[68] B. Dalgarno, M. J. W. Lee, What are the learning affordances of 3-D virtual environments? Br. J. Educ. Technol, 41, 2010, pp 10–32.

[69] N. Yee, J. Bailenson, The proteus effect: The effect of transformed self-representation on behavior. Hum. Commun. Res. 33, 2007, pp. 271–290.

[70] M. Lombard, T. Ditton. At the heart of it all: The concept of presence. Journal of computer-mediated communication, 3(2), JCMC321, 1997.

[71] S. Mystakidis, Motivation enhancement methods for community building in extended reality. In Augmented and Mixed Reality for Communities, CRC Press, 2021 pp. 265-282.

[72] K. Kim, L. Boelling, S. Haesler, J. Bailenson, G. Bruder, G. F. Welch, Does a digital assistant need a body? The influence of visual embodiment and social behavior on the perception of intelligent virtual agents in AR, In 2018 IEEE International Symposium on Mixed and Augmented Reality (ISMAR), 2018, pp. 105-114.

[73] S. Bambury, The depths of the VR v2.0 model. Available online: https://www.virtualiteach.com/post/the-depths-of-vr-model-v2-0, accessed on 11/05/2022.

[74] N. De la Peña, P. Weil, J. Llobera, B. Spanlang, D. Friedman, M.V. Sanchez-Vives, M. Slater, Immersive journalism: immersive virtual reality for the first-person experience of news. Presence, 19(4), 2010, pp. 291-301.

[75] J. Delmerico, R. Poranne, F. Bogo, H. Oleynikova, E. Vollenweider, E., S. Coros, M. Pollefeys, Spatial Computing and Intuitive Interaction: Bringing Mixed Reality and Robotics Together. arXiv preprint arXiv:2202.01493, 2022.

[76] S. Kim, S. Lee, H. Kang, S. Kim, M. Ahn, P300 Brain–Computer Interface-Based Drone Control in Virtual and Augmented Reality. Sensors, 21(17), 5765, 2021.

[77] S. F. Ahmad, M. M. Alam, M. Rahmat, M.S. Mubarik, S. I. Hyder, Academic and Administrative Role of Artificial Intelligence in Education. Sustainability, 14(3), 1101, 2022.

[78] J. M. Reid, Learning styles in the ESL/EFL classroom. Heinle & Heinle Publishers, International Thomson Publishing Book Distribution Center, 7625 Empire Drive, Florence, KY 41042, 1995.

[79] R. J. Mislevy, D. Yan, J. Gobert, M. Sao Pedro, Automated scoring in intelligent tutoring systems. In Handbook of automated scoring (pp. 403-422). Chapman and Hall/CRC, 2020.

[80] A. Larrabee Sønderlund, E. Hughes, J. Smith, The efficacy of learning analytics interventions in higher education: A systematic review. British Journal of Educational Technology, 50(5), 2019, pp. 2594-2618.

[81] J. D. Gobert, M. A. Sao Pedro, T.S. Baker, E. Toto, O. Montalvo, Leveraging educational data mining for real-time performance assessment of scientific inquiry skills within microworlds. Journal of Educational Data Mining, 4(1), 2012, pp. 104-143.

[82] N. Goksel, A. Bozkurt, Artificial intelligence in education: Current insights and future perspectives. In Handbook of Research on Learning in the Age of Transhumanism (pp. 224-236). IGI Global, 2019.

[83] B. Lorica, Semi-automatic method for grading a million homework assignments,2013, Online at http://radar. oreilly. com/2013/10/semi-automatic-method-for-grading-a-million-homeworkassignments. html. Accessed 11/05/2022,

[84] S. Combéfis, Automated Code Assessment for Education: Review, Classification and Perspectives on Techniques and Tools. Software, 1(1), 2022, pp. 3-30.

[85] L. Cui, S. Huang, F. Wei,C. Tan, C. Duan, M. Zhou, Superagent: A customer service chatbot for e-commerce websites. In Proceedings of ACL 2017, system demonstrations , 2017, pp. 97-102.

[86] G. J. Hwang, H. Xie, B. W. Wah, D. Gašević, Vision, challenges, roles and research issues of Artificial Intelligence in Education. Computers and Education: Artificial Intelligence, 1, 100001, 2020.

[87] S. A. Popenici, S. Kerr, Exploring the impact of artificial intelligence on teaching and learning in higher education. Research and Practice in Technology Enhanced Learning, 12(1), 2017, pp. 1-13.

[88] A. Okada, D. Whitelock, W. Holmes, C. Edwards, e-Authentication for online assessment: A mixed-method study. British Journal of Educational Technology, 50(2), 2019, pp. 861–875.

[89] I. Celik, M. Dindar, H. Muukkonen, S. Järvelä, The Promises and Challenges of Artificial Intelligence for Teachers: a Systematic Review of Research. TechTrends, 2022, pp. 1-15.

[90] Aiforsdgs, Said Business School 2022, Oxford, accessed 13/04/2022, URL: https://www.aiforsdgs.org/

[91] G. A. Toto, P. Limone, New Perspectives for Using the Model of the Use and Acceptance of Technology in Smart Teaching, In International Workshop on Higher Education Learning Methodologies and Technologies Online, Springer, Cham, 2020, pp. 115-125.

[92] L. Pierpaolo, G. A. Toto, The psychological constructs and dimensions applied to sports performance: a change of theoretical paradigms. Journal of Physical Education and Sport, 18, 2034, 2018.

[93] G. A. Toto, P. Limone, Self-directed learning: An innovative strategy for sport and physical education. Journal of Human Sport and Exercise, 2019, 14(Proc4), S568-S577. doi:10.14198/jhse.2019.14. Proc4.14

[94] L. Floridi, Digital ethics online and off. American Scientist, 4(109), 2021.