The Bias on Artificial Intelligence in Education (AIED): Influence of Perennialism Teaching Philosophy at Education 4.0

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ABSTRACT

The educational landscape here in the Philippines is no exception to the direct impact of emerging technologies that are readily available today thus the birth of Education 4.0 and Education 5.0. One of the most novel and controversial new emerging technologies that we have today is Artificial intelligence. Artificial Intelligence is a very powerful tool that can perform various complex and creative tasks without the presence of an actual human intervention. This new technology bears a lot of potential benefits to offer for various stakeholders- students and teachers if utilized correctly. However, there exists a challenge in the educational landscape that pertains to the coexistence of perennial teaching philosophy and the integration of new technologies. Perennialism believes in the view of education where traditional ways are the best course of action in delivering education to the students. This in fact excludes the utilization of new technologies in education. Furthermore, some educators also bear the belief of the negative impact of AI in education where it features students harnessing its capabilities into academic dishonesty. In this paper, we argued that educational stakeholders should bear an open mind with regard to new emerging technologies to ensure continuous innovation in the academic landscape. We should teach our students how to effectively integrate AI into their learning experience without compromising the authenticity of their academic progress. With the existence of a comprehensive and systematic integration of AI, we can more effectively and efficiently harness its full potential for a better teaching-learning environment.

Keywords: artificial Intelligence, perennialism, education

Introduction

It is very evident that we, citizens living in the 21st century, are prominent witnesses of the unprecedented acceleration and advancement of various technological devices and systems that have a direct and indirect impact on the various facets of different industries and sectors of our society. As elucidated by Klaus Schwab (2016), new technological advances that are readily available for the utilization of the public do not have just a mere incremental impact on different industries. Rather, these emerging technologies have caused seismic shifts in how we, the citizens, deal with the

process regarding our work, trading, daily living, communication, and education. These seismic shifts in the different facets of our lives and industries are the aftermath of the integration of the fourth industrial revolution in our society and industry. Klause Schwab (2016) defined the fourth industrial revolution as not only a mere technological revolution due to its relevance of how it revolutionized the way we live and work.

The fourth industrial revolution has redefined various facets of our industries and societies, it has synonymously exerted a profound influence and impact on the realm of our educational sectors. González-Pérez and Ramírez-Montoya (2022) stated in their paper that Education 4.0 signifies the tremendous influence and impact of new technologies in the realm of education. Education 4.0 proudly showcases the integration and adaptation of new smart technologies, work automation, and data-driven processes in administration. The dawn of Education 4.0 has ushered in transformative shifts and challenges within the realm of the teaching-learning environment, mirroring the disruptive changes synonymously experienced in other sectors influenced by the advent and emergence of the Fourth Industrial Revolution as stated by Muktiarni et al. (2019). Chaka (2022) stated that Education 4.0 exhibits the utilization of various digital technologies for the sake of the improvement of the teaching-learning environment. It features new emerging technologies such as more complex software, big data, and the emergence of Artificial intelligence (Bibi et al., 2024; Murtaza et al., 2024). The existence of new technologies that are continuously being developed stands a paramount importance in Education 4.0. These technologies ensure an effective and efficient delivery of knowledge and learning to the students and thus play a pivotal role in the education sector as elucidated by González-Pérez and Ramírez-Montoya (2022). The importance of technology in education is further observed during the recent surge of COVID-19 in the Philippines where educational institution relies upon computers and the internet to ensure the continuous flow of the semester (Cadiz et al., 2024). This proves that the absence of technologies in Education 4.0 can tremendously impede the existence of an effective educational landscape. Currently one of the most promising technology that can be integrated into education is the development of Artificial Intelligence.

The very beginning of Artificial Intelligence can be further traced back to 1950 with the paper published by Alan Turing titled "Computing Machinery and Intelligence". Now we can define Artificial intelligence as the science and engineering of crafting autonomous and intelligent machines with an emphasis on intelligent computer programs (Jeavons, 2017). It can be also linked to the synonymous task of utilizing computer models to comprehend authentic human intelligence although, Artificial Intelligence is not confined to a specific biologically observable vessel (Jeavons, 2017). In a book published by Russell and Norvig (2016), they define Artificial Intelligence as the science of intelligent agents that have the capabilities to autonomously perceive their environment and synthesize necessary actions prior to their perception with the purpose of successfully performing their desired goals with utmost precision. Due to the nature of Artificial Intelligence, it has a tremendous amount of potential to directly influence and impact different facets of our industries and society, as we already stated, one of which is the realm of education.

The holistic realm of the education landscape, encompassing both within and beyond the classroom, stands susceptible to profound and significant evolution catalyzed by the integration and implementation of Artificial Intelligence

(Luckin et al., 2022). The cited paper also argues for the necessity of having competent teachers who have competent knowledge about emerging technologies to ensure the utmost learning experience for 21st-century learners. In the paper published by Miranda et al. (2021), they expressed their argument that by allowing the integration of Artificial Intelligence in the various and numerous facets of the education system, a potential positive transformation could be realized and enjoyed by 21st-century learners. Some of the possible benefits of this integration of Artificial intelligence are the improvements that regard the personalized learning experience for the students, Enhanced teaching and learning processes both inside and outside the classroom, and the improvement of data-driven decision-making both for the teaching and administrative body of education (Tartuk, 2023). However, regardless of the possible potential benefit of the new emerging technologies such as Artificial Intelligence in education, some stakeholders in education are still skeptical about it, as influenced by their educational philosophy.

The individual educational philosophy that teachers bear plays a crucial part in how they function as a teachers and how they provide a quality education that suffices the needs of their students (Aquino & Natividad, 2023; Natividad, 2022; Pahlevi et al., 2020). According to Bolat and Baş (2018), pre-service teachers have a progressive philosophy in teaching which can be beneficial in adopting new emerging technologies that are readily available for utilization inside the teaching and learning environment. However, there exists a certain teaching philosophy among educators that tend to reject the integration of new technologies and innovation and thus prefer a continued utilization of traditional methods. According to Kooli et al., (2019), the perennial teaching philosophy puts a great emphasis on the involvement of educators and instructors in the learning process of the students, making it a teacher-centered teaching approach which is contrary to the student-centered approach that we apply today in our teaching-learning process (Himmetoğlu et al., 2020). Having the existence of a perennial perspective in education may cause bias against the emergence of new technologies such as artificial intelligence.

We cannot deny that the existence of artificial intelligence in education is still in its nascent stage and that there remain numerous uncharted territories for us to explore in this field. Having biases in the integration of Artificial Intelligence in education hinders us from exploring and further nourishing how the educational system benefits from its technology. In this paper, we will argue a certain educational philosophy that can create bias on the integration of artificial intelligence, along with how this bias negatively affects the students and the continued innovation of the teaching-learning process in education 4.0. As we navigate this realm, we confront a very vital and timely dilemma: Can the established belief and dependency on the perpetuity of traditional methods in the academe harmoniously coexist with the need for unbiased education in the dawn of artificial intelligence in education 4.0 for the best interests of the 21st-century learners?

The Dawn of Education 4.0 and Future of Education 5.0

Education 4.0, as defined by Tikhonova and Raitskaya (2023), represents a contemporary facet of the global education landscape. It distinguishes itself through its substantial incorporation of emerging technologies within the teaching and learning environments. While the prospect of Education 5.0, as envisioned by Ahmad et al. (2020) looms on the educational horizon, the influence of Education 4.0 remains significant, particularly within the

context of the Philippines. Education 4.0 is hallmarked by a notable paradigm shift, departing from traditional classroom setups in favor of technology-driven, learner-centric pedagogical models. Consequently, in a milieu where the integration of cutting-edge technologies is imperative for the evolution of Education 4.0, developing nations such as the Philippines confront formidable challenges, as underscored by the insights of Barrot (2021). The core concept underlying this notion pertains to the adoption and application of a novel systematic approach to education, one specifically designed to address the requirements of 21st-century learners.

The 21st Century learners stand as the center of education 4.0. In the context of Education 4.0, the focal point revolves around 21st-century learners, positioning them at the heart of educational transformation. This perspective, as articulated by Barrot (2018), underscores the critical importance of adapting the education system to meet the specific needs of this new breed of learners. These 21st-century learners represent a product of the ongoing and pervasive changes brought about by the continuous wave of innovations that have characterized the 21st century. As elucidated by Gonzales (2020), the 21st century has borne witness to remarkable technological advancements, precipitating a profound transformation in societal norms, industries, modes of communication, and, significantly, in education. Consequently, the educational system must be attuned to the requirements of contemporary learners, equipping them with the requisite knowledge and experiences to navigate and engage with the dynamic changes in our world. This adaptation is particularly relevant in light of emerging technologies, such as Artificial Intelligence, that have become integral to our evolving global landscape including in the Philippines (Rosales et al., 2020).

The utmost significance underpinning both Education 4.0 and the forthcoming Education 5.0 lies in the creation of an educational system capable of addressing the diverse needs of its students in response to the ever-evolving demands of our rapidly changing world and environment, as articulated by Barrot et al. (2021). Thus, in pursuit of this objective, the integration of new emerging technologies assumes a pivotal role, contributing significantly to the attainment of our educational goals. These emerging technologies encompass even those that may have garnered a mixed reputation among educators, such as Artificial Intelligence technologies.

Artificial Intelligence

The field of Artificial Intelligence (AI) technology has experienced remarkable evolution in the 21st century, drawing substantial attention in recent years. Bundy (2016) underscores the dynamic nature of AI, highlighting its rapid development and growing significance. AI encompasses a diverse range of intricate technologies and methodologies, empowering artificial systems to emulate human intelligence, perform complex tasks, and make autonomous decisions and computations without human intervention. As elucidated by Shahar (2018), the transformative potential of Artificial Intelligence extends across multiple dimensions of contemporary life. This potential is particularly salient in critical sectors such as healthcare, transportation, financial industries, and education. The influence of AI technology on these domains promises to reshape and redefine the way society operates and benefits from technological advancements.

In the scholarly work by Jarrahi (2018), the concept of Artificial Intelligence is elucidated as a comprehensive and encompassing term, serving as a collective label for a diverse array of technologies and methodologies. This collective endeavor aims to construct intelligent systems endowed with the capacity to not only

perceive their environment but also comprehend data, discern intricate patterns, and autonomously make informed decisions. Furthermore, a more recent publication by Hopko et al. (2022) underscores the multifaceted nature of Artificial Intelligence. This sophisticated field draws upon an amalgamation of intricate processes to fulfill its multifarious functionalities. These processes span a spectrum of domains, encompassing but not limited to machine learning, natural language processing, and computer vision. Additionally, AI may integrate other subfields to cater to its diverse and versatile applications in various processes and industries.

Artificial Intelligence has become increasingly accessible with the widespread availability of internet connectivity. An illustrative example of this accessibility is the proliferation and utilization of AI chatbots, exemplified by ChatGPT, in various spheres of society. As Biswas (2023) articulates, the public health sector is actively exploring the utilization of AI chatbots, including ChatGPT, to enhance the delivery of public medical services. Furthermore, Surameery and Shakor (2023) underscore the adaptability of AI chatbots like ChatGPT, emphasizing their role in addressing programming bugs and streamlining software development processes. In a similar vein, Hill-Yardin et al. (2023) contend that ChatGPT holds the potential to exert a transformative influence on the future of scientific publishing and the landscape of academic literature. The integration of AI chatbots in these diverse sectors highlights their growing importance and applicability in enhancing efficiency and effectiveness across a wide array of domains.

Artificial Intelligence in Education

It is patently evident that the educational sector within our society is among the most predisposed domains to undergo substantial transformation through the assimilation of emerging technologies. As articulated by Escueta et al. (2020) in their scholarly work, the educational landscape and pedagogical methods employed by educators are markedly and directly influenced by the emergence of new technologies. Presently, Artificial Intelligence (AI) emerges as a technology with immense potential to significantly reshape our educational framework, as observed by Williamson et al. (2020). AI is poised to offer a wealth of direct and substantial positive contributions across multiple dimensions of the educational landscape. Notably, AI has exhibited its potential in personalized learning, as evidenced by the research conducted by van der Vorst and Jelicic (2019). Additionally, AI has demonstrated its capacity to enhance educational accessibility, as exemplified by the work of Neller (2017). Moreover, AI provides valuable support for educators, as indicated by the findings presented by Humble and Mozelius (2019). Furthermore, AI streamlines administrative tasks, optimizing efficiency, as outlined in the study by Alanoğlu et al. (2021). Lastly, AI plays a pivotal role in fostering lifelong learning, as substantiated by the research of Mhlanga (2023).

While there are existing research papers and articles that claim that the Integration of Artificial Intelligence in Education poses numerous benefits as discussed previously (Escueta et al., 2020; Humble & Mozelous, 2019; Mhalanga, 2023; Neller, 2017; van der Vorst & Jelicic, 2019; Williamson & Eynon, 2020; Ahmad et al., 2022) it is still noteworthy to discuss that Artificial Intelligence also bears negative potentials in the educational landscape. In the paper published by Göçen and Aydemir (2020), they discussed that integration of AI in education can have potential negative drawbacks for the sake of the students, teachers, and other stakeholders.

According to their paper, by using AI in the different facets of the learning experience of the students it can suppress the students' intuitive knowledge. In addition to this by integration of AI in education can also be a threat to the deterioration of an authentic humanistic value in education. As stated in the paper of Suharyat (2023) educational integration of AI can potentially harm the students' social interaction skills and limit the teaching-learning environment within the boundaries of comfort. Especially these current days a humanistic approach in education is paramount in ensuring that the products of the education system will be an effective and sufficient member of the society. Integration of AI can also lead to more information-oriented learners, which is in opposition to the current goal of the education system we have today. It is well stated that the goal of the education system and educational institutions is not to produce learners who are just smart, but rather holistic learners. AI in education cannot cater to the needs of our society in producing holistic learners who possess a variety of skills and characteristics that are not just inclined to facts and knowledge. This paper also states that AI integration in education can harm the current system where certain types of human workforce are needed. It was also included in this paper that integration of AI in education can foster negative effects on students' relationships with their peers. Furthermore, according to the paper published by Tao et al. (2019), the use of AI in education poses various dangers to the learning experience of students due to the lack of sufficient emotional connections. This lack of emotions can have a negative impact on the holistic development of the students. It was also feared that there is a high possibility that AI technology can replace the job of the teachers inside the classroom, this event however, can be negative for the students since AI cannot have an in-depth comprehension of the students' academic and personal growth.

Necessity for Technology in Education and the TPACK Model

The rapid pace of technological advancement has wrought a profound transformation across diverse dimensions of our daily existence, including the educational landscape, as articulated by Chauhan (2017). Consequently, there arises an imperative for the infusion of technological knowledge and experience within the pedagogical journey of our students. The indispensable integration of technology into education assumes a paramount role in cultivating well-rounded and adept learners. In light of this momentous shift in the educational paradigm, it becomes evident that educators themselves must possess a deep understanding and mastery of various technologies that directly influence the learning experience of their students, as highlighted by Raja and Nagasubramani (2018). It follows that educators, who serve as the custodians of our society's educational future, must be equipped with a substantial array of competencies in technology advancements and their effective utilization. The absence of technology integration within the realm of education carries the potential to impede the progress of our students, rendering them less proficient in the acquisition of 21st-century skills compared to their peers who have had the privilege of gaining substantial experience and knowledge concerning these new educational technologies. This technological divide underscores the necessity of fostering a technologically adept teaching and learning environment within the education system.

To suffice the necessity relative to the capacity of educators to bear the necessary skills and knowledge on the harmonious utilization of technology in the teaching-learning environment, the Technological Pedagogical Content Knowledge (TPACK) model stands paramount in education as discussed by Mercado et al. (2019).

The TPACK model bears a lot of significance in guiding educators in the harmonious connection between the subject matter, pedagogical practices, and the utilization of various technologies (Mishra & Koehler, 2006). This ensures that the learning experience of the students is in its utmost condition. This model was first introduced in the educational landscape back in 2016. The framework is a testament to educational innovation where it presents its capability to harness emerging technologies in the learning experience of the students. This framework ensures that technological utilization in education is effective and efficient. This also ensures that technological utilization does not stand as a hindrance to the meaningful full learning of the learners. The architects of this framework contended that educators entrusted with the education of 21st-century learners must possess a comprehensive grasp of the intricate interplay between technology, assessment methods, pedagogical techniques, and content knowledge. Such multifaceted comprehension is paramount in enabling educators to orchestrate meaningful and relevant learning experiences within a world marked by the relentless advance of technology.

In the contemporary educational landscape, educators are expected to possess essential technological literacy that encompasses both existing technologies and the ever-evolving new emerging technologies. These technological tools exert a direct and profound influence on students' learning experiences and, by extension, their future competitiveness on a global scale, as articulated by Mittelman (2018). In a world that continually adjusts to the rapid pace of technological advancements, the educational sector must follow suit. This adaptation should commence with the key stakeholders in education, particularly the educators themselves, as they play a pivotal role in shaping the learning journeys of students. Recognizing that new emerging technologies, such as artificial intelligence, hold significant potential benefits for education, it becomes all the more crucial for educators to acquire the requisite technological proficiency to harness these tools effectively in the service of improved learning outcomes.

Perennialism Teaching Philosophy

Perennialism, a prominent teaching philosophy, places significant emphasis on the enduring significance of timeless ideas and universal knowledge within the curriculum. Central to perennialism is the steadfast belief in the constancy of fundamental ideas, advocating for their perpetual inclusion as the foundational framework for educational curriculum (Cabrera, 2015). Educators aligned with this philosophy notably prioritize core subjects in education and establish a teacher-centered learning environment, asserting the highest authority within the classroom lies with the educators themselves. While it is evident that the perennial teaching philosophy endeavors to uphold the preservation of crucial information and concepts in education, practitioners of this philosophy often display resistance to changes in the educational landscape, as articulated by Alanoglu et al. (2022). Furthermore, Tupas and Pendon (2016) and Pendon (2016) study highlights the prevalence of this educational philosophy within the educational sphere. Notably, this philosophy is recognized for its resistance to embracing new emerging technologies. Educators adhering to perennialism hold firm in their belief that the integration of new technologies into education may detrimentally impact students' learning experiences (Alanoglu et al., 2022).

There are educators who staunchly opposed the integration of technology in education, citing concerns about its detrimental impact on student learning. In one instance, a teacher prohibited the use of the Google search engine for assignments, insisting that the library should be the sole resource utilized. To ensure compliance, the teacher cross-checked the names in the library's logbook. This directive was particularly frustrating as the assignment pertained to the human digestive system, a topic abundantly available and accessible online. Such actions by educators unnecessarily burden the learning experience of students. Manual searches for topics readily available online pose an avoidable obstacle, impeding the efficiency and efficacy of the educational process. Valuable time that could have been allocated to more productive academic or personal pursuits is squandered through these restrictions, failing to yield any discernible benefits for the educational institution or its stakeholders.

This experience within the academic journey has underscored the significance of educators establishing a harmonious equilibrium between conventional teaching methodologies and the integration of emerging technologies. Such an approach is pivotal in cultivating a more efficacious teaching-learning milieu, ultimately enhancing the learning experiences of students (Jardinez & Natividad, 2024). Notably, adherence to a perennial philosophy in education, as observed, can inadvertently foster bias against emerging technologies, perpetuating resistance towards their incorporation due to conflicting perspectives on educational delivery methods. Such actions may impede the progression and innovation within the realm of education.

Conclusion

The teaching philosophies that embody an educator have a tremendous impact not just on the way he teaches, but also on the holistic development of his students. Educators who practice perennial teaching philosophy will likely create bias over the utilization of new emerging technologies in education. Actions of separating the learners with the technology that surrounds them can have a detrimental effect not just on their academic performance but also on their life after school such as, as part of the workforce or as entrepreneurs.

I once had a conversation with one of my professors, the topic was about the integration of AI technology in education. He argues that AI should not be utilized in the educational landscape because it can hurt the authentic learning of the students. He said that using AI such as AI chatbots makes the students lazy and distant in their academic tasks. After he said all those, he asked me why I think that AI should be utilized in the name of the academe. I answered by saying, "We cannot abandon our students, sir". It is indeed true that some students are already using different kinds of AI technology such as AI chatbots to aid them in doing their homework. This alone is a sufficient reason for us to integrate AI into education. The purpose of the existence of the education system is not just to teach our students about generally accepted facts and information. Our students are not robots we are just feeding ideas. We, educators, should also cater to the needs of the students in knowing the proper way of using the ideas and information they have. In the case of AI in education, we should not just prohibit the utilization of AI because it is being used for unprecedented academic misconduct, rather, we should teach our students how to properly utilize AI that can truly benefit them in their academic goals. We as educators of education 5.0 should

re-introduce AI to our students not as a tool for cheating but as a tool that effectively benefits their learning.

Educators who believe in the possible benefit of the integration of new emerging technologies in education such as Artificial Intelligence should encourage those educators who believe otherwise. We should help them achieve a reasonable comprehension of the possible impact of AI in education without any influence of philosophical and personal bias. The education landscape and the academe need teachers and educators who have a sufficient understanding of how we can enhance the learning experience of our students using AI and other emerging technologies.

There are numerous ways where we can eliminate the potential bias of perennial philosophy on the integration of Artificial Intelligence technology in education. First, Educational administrators and educational leaders should devise seminars and training programs about the capabilities of Artificial Intelligence for all of our teachers. With this we can formally introduce Artificial Intelligence technology to our teachers thus, eliminating possible fake news that subjects Artificial Intelligence technology. This will also give our educators a comprehensive understanding of the extent of AI's capacity and its limitations in education. Second, educational leaders should introduce seminars about ethical considerations and responsible use of AI not just for teachers but also for students. Actions such as this will help create a more effective and efficient use of AI in education without forsaking the authenticity and validity of our learners' learning experiences. Next, academic institutions and educational bodies should integrate AI detection tools to safeguard the integrity of the academe. The existence of this safeguard will ensure that students will not overstep the use of AI more the extent that they are allowed to. This will help educators to have mind serenity against possible academic misdemeanors using AI such as plagiarized assignments and projects. To fully suppress potential bias in the integration of Artificial Intelligence in education, academic leaders should also have open communication with teachers and other stakeholders to address possible concerns about the integration of Artificial Intelligence. Another crucial variable to ensure the beneficial integration of AI in education is a formal dialogue between technology ethics and academic leaders to pave the way in crafting formal ethics and defined limits at to which extent can AI be integrated in the teaching-learning environment.

Educators who adhere staunchly to the perennial teaching philosophy may inadvertently introduce bias against the integration of new emerging technologies such as Artificial Intelligence (AI) in education. This unfortunate inclination can lead to a scenario where students are deprived of the opportunity to embrace and leverage the technological advancements of the 21st century, thus, potentially resulting in adverse effects on their learning experiences. It is imperative for educators to consistently consider and explore the most effective methodologies to cultivate the best learning environment that adeptly caters to the needs of 21st-century learners. Addressing this quandary dilemma of denying the use of new technologies to preserve old practices, necessitates proactive engagement in diverse programs and activities aimed at optimizing the educational landscape by harnessing the complete potential of AI for the benefit of both the education system, the students, and the future our country. The undeniable presence of these novel technologies underscores the futility of denying their existence. Instead, educators must strive to coexist with and adapt to these advancements. As emphasized by Socrates

millennia ago, the maxim "knowledge is a virtue, ignorance is a vice" remains profoundly relevant, emphasizing the intrinsic value of embracing knowledge, including the integration of AI, as a virtue while highlighting ignorance of these advancements as a detrimental vice.

Literature Cited

Ahmad, K., Qadir, J., Al-Fuqaha, A., Iqbal, W., Elhassan, A., Benhaddou, D., & Ayyash, M. (2020). Data-Driven Artificial Intelligence in Education: A Comprehensive Review. *IEEE Transactions on Learning Technologies*. https://doi.org/10.35542/osf.io/zvu2n

Alanoğlu, M., Aslan, S., & Karabatak, S. (2021). Do teachers' educational philosophies affect their digital literacy? The mediating effect of resistance to change. *Education and Information Technologies, 27(3),* 3447–3466. https://doi.org/10.1007/s10639-021-10753-3

Aquino, A. M. & Natividad, L.R. (2023). DM No. 30 s. 2021: A Step in the Right Direction for Recognizing Students' Academic Excellence? *Lukad: An Online Journal of Pedagogy 3(1),* 112 - 129.

Balansag, S., Natividad, L., & Evangelista, E. (2018). Social and environmental impacts of road improvements in the Philippines. Munich, GRIN Verlag, https://www.grin.com/document/496336

Balansag, S., Natividad, L., & Evangelista, E. (2018). *Environmental and Social Impacts of Road Improvement Project: Basis for Sustainable Environmental Management,* pp. 1-51. https://doi.org/10.6084/m9.figshare.8969663.v1

Barrot, J. S. (2018). English Curriculum Reform in the Philippines: Issues and Challenges from a 21st Century Learning Perspective. *Journal of Language, Identity & Education, 18(3)*, 145–160. https://doi.org/10.1080/15348458.2018.1528547

Barrot, J. S. (2021). K to 12 curriculum reform in the Philippines: towards making students future ready. *Asia Pacific Journal of Education, 43(4),* 1193–1207. https://doi.org/10.1080/02188791.2021.1973959

Barrot, J. S., Llenares, I. I., & Del Rosario, L. S. (2021). Students' online learning challenges during the pandemic and how they cope with them: The case of the Philippines. *Education and Information Technologies, 26(6),* 7321–7338. https://doi.org/10.1007/s10639-021-10589-x

Bibi, A., Yamin, S., Natividad, L. R., Rafique, T., Akhter, N., Fernandez, S. F., & Samad, A. (2024). Navigating the Ethical Landscape: AI Integration in Education. *Educational Administration: Theory and Practice, 30(6),* 1579-1585. https://doi.org/10.53555/kuey.v30i6.5546

Biswas, S. (2023). Role of Chat GPT in Public Health. *Annals of Biomedical Engineering, 51(5),* 868–869. https://doi.org/10.1007/s10439-023-03172-7

Bolat, Y., & Baş, M. (2018). The perception of the educational philosophy in the industrial Age 4.0 and the Educational Philosophy Productivity of *Teacher Candidates. World Journal of Education, 8(3),* 149. https://doi.org/10.5430/wje.v8n3p149

Bundy, A. (2016). Preparing for the future of Artificial Intelligence. *AI & Society, 32(2),* 285–287. https://doi.org/10.1007/s00146-016-0685-0

Cadiz, M.C.D., Manuel, L.A.F., Reyes, M.M., Natividad, L.R., & Ibarra, F. P. (2024). Technology Integration in Philippine Higher Education: A Content-Based Bibliometric Analysis. J*ournal Ilmiah Ilmu Terapan Universitas Jambi, 8(1),* 35-47. https://doi.org/10.22437/jiituj.v8i1.31807

Chaka, C. (2022). Is education 4.0 a sufficient innovative, and disruptive educational trend to promote sustainable open education for higher education institutions? A review of Literature Trends. *Frontiers in Education, 7.* https://doi.org/10.3389/feduc.2022.824976

Chauhan, S. (2017). A meta-analysis of the impact of technology on learning effectiveness of elementary students. *Computers & Education, 105,* 14–30. https://doi.org/10.1016/j.compedu.2016.11.005

Escueta, M., Nickow, A., Oreopoulos, P., & Quan, V. (2020). Upgrading Education with Technology: Insights from Experimental Research. *Journal of Economic Literature, 58(4)*, 897–996. https://doi.org/10.1257/jel.20191507

Göçen, A., & Aydemir, F. (2020). Artificial intelligence in education and schools. *Research on Education and Media, 12(1),* 13–21.https://doi.org/10.2478/rem-2020-0003

Gonzales, N. A. (2020). 21st Century skills in Higher Education: Teaching and learning at Ifugao State University, Philippines. J*ournal Sains Sukan & Pendidikan Jasmani, 10(2),* 72–81. https://doi.org/10.37134/ajatel.vol10.2.8.2020

González-Pérez, L. I., & Ramírez-Montoya, M. S. (2022). Components of Education 4.0 in 21st Century Skills Frameworks: Systematic review. *Sustainability, 14(3)*, 1493. https://doi.org/10.3390/su14031493

Herring, M. C., Koehler, M. J., & Mishra, P. (2016). *Handbook of Technological Pedagogical Content Knowledge (TPACK) for Educators.* Routledge. Hill-Yardin, E. L., Hutchinson, M. R.,

Laycock, R., & Spencer, S. J. (2023). A Chat(GPT) about the future of scientific publishing. *Brain Behavior and Immunity, 110,* 152–154. https://doi.org/10.1016/j.bbi.2023.02.022

Himmetoğlu, B., Ayduğ, D., & Bayrak, C. (2020). Education 4.0: Defining the teacher, the student, and the school manager aspects of the revolution. *The Turkish Online Journal of Distance Education, 21*(Special Issue-IODL), 12–28. https://doi.org/10.17718/tojde.770896

Hopko, S. K., Wang, J., & Mehta, R. K. (2022). Human Factors Considerations and Metrics in Shared Space Human-Robot Collaboration: A Systematic review. *Frontiers in Robotics and AI, 9.*

Humble, N., & Mozelius, P. (2019, October). Teacher-supported AI or AI-supported teachers. In European Conference on the Impact of Artificial Intelligence and Robotics (ECIAIR 2019) (pp. 157-164).

Jardinez, M.J. & Natividad, L.R. (2024). The Advantages and Challenges of Inclusive Education: Striving for Equity in the Classroom. *Shanlax International Journal of Education, 12(2),* 57 – 65. https://doi.org/10.34293/education.v12i2.7182

Jarrahi, M. H. (2018). Artificial intelligence and the future of work: Human-AI symbiosis in organizational decision making. *Business Horizons, 61(4),* 577–586. https://doi.org/10.1016/j.bushor.2018.03.007

Jeavons, A. (2017). What is artificial intelligence? *Research World, 2017(65)*, 75. https://doi.org/10.1002/rwm3.20554

Kooli, C., Zidi, C., & Jamrah, A. (2019). The Philosophy of Education in the Sultanate of Oman: Between Perennialism and Progressivism. *American Journal of Education and Learning, 4(1),* 36–49. https://doi.org/10.20448/804.4.1.36.49

Luckin, R., Cukurova, M., Kent, C., & Du Boulay, B. (2022). Empowering educators to be AI-ready. *Computers & Education: Artificial Intelligence, 3,* 100076. https://doi.org/10.1016/j.caeai.2022.100076

Mercado, J. N. L., Panganiban, V. J. M., & Ramos, T. M. I. (2019). Technology Integration in Teaching Science using TPACK among Pre – Service Science Teachers of St. Bridget College Batangas City, Philippines. *International Multidisciplinary Research Journal, 1(1),* 63–71. https://doi.org/10.54476/iimrj411

Mhlanga, D. (2023). Open AI in Education, The responsible and ethical use of ChaTGPT towards lifelong Learning. Social Science Research Network. https://doi.org/10.2139/ssrn.4354422

Miranda, J., Navarrete, C., Noguez, J., Molina-Espinosa, J., Ramírez-Montoya, M. S., Navarro-Tuch, S. A., Bustamante-Bello, M., Rosas Fernández, J., & Molina, A. (2021). The core components of education 4.0 in higher education: Three case studies in engineering education. *Computers & Electrical Engineering, 93,* 107278. https://doi.org/10.1016/j.compeleceng.2021.107278

Mishra, P., & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: a framework for teacher knowledge. *Teachers College Record, 108(6),* 1017–1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

Mittelmann, A. (2018). Competence development for Work 4.0. In Progress in IS. https://doi.org/10.1007/978-3-319-73546-7_16

Muktiarni, M., Widiaty, I., Abdullah, A. G., Ana, A., & Yulia, C. (2019). Digitalisation trend in education during industry 4.0. J*ournal of Physics, 1402(7),* 077070. https://doi.org/10.1088/1742-6596/1402/7/077070

Murtaza, A., Fadare, S. A., Mocsir, O. M., Odilbek uglu, S. V., Fadare, M. C., Natividad, L. R., Rafique, T., Akhtar, N., Shaheen, J., Mohsin, M., & Taj, R. (2024). From Theory to Practice: Harnessing AI for Enhanced Teaching-Learning Dynamics. *Educational Administration: Theory and Practice, 30(4),* 6331-6338.

Natividad, L.R. (2022). Understanding Alternative Conceptions: Constructivism and Nature of Science Approach. *Lukad: An Online Journal of Pedagogy 2(1),* 21-30.

Neller, T. W. (2017). AI education. *AI Matters, 3(1),* 12–13. https://doi.org/10.1145/3054837.3054841

Pahlevi, M. R., Kusrin, K., & Kamil, A. B. (2020). Teacher's Belief on Teaching Philosophy as Teachers Professionalism platform. *Ahmad Dahlan Journal of English Studies, 7(1),* 18. https://doi.org/10.26555/adjes.v7i1.14196

Raja, R., & Nagasubramani, P. C. (2018). Impact of modern technology in education. *Journal of Applied and Advanced Research*, S33–S35. https://doi.org/10.21839/jaar.2018.v3is1.165

Rosales, M. A., Magsumbol, J. V., Palconit, M. G. B., Culaba, A. B., & Dadios, E. P. (2020). Artificial Intelligence: The Technology Adoption and Impact in the Philippines. 2020 *IEEE 12th International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment, and Management* (HNICEM). https://doi.org/10.1109/hnicem51456.2020.9400025

Russell, S., & Norvig, P. (2016). *Artificial intelligence: A Modern Approach, Global Edition.*

Schwab, K. (2021). Fourth Industrial Revolution. *In Encyclopedia of the UN sustainable development goals* (p. 475). https://doi.org/10.1007/978-3-319-95963-4_300069

Shahar, A. (2018). Exploring artificial intelligence futures. *Journal of AI Humanities. 2,* 169–194. https://doi.org/10.46397/jaih.2.7

Suharyat, Y. (2023, October). Artificial Intelligent: Positive And Negative Role in Education Management. In International Conference on Education (pp. 349-357).

Surameery, N. M. S., & Shakor, M. Y. (2023). Use Chat GPT to solve programming bugs. International *Journal of Information Technology and Computer Engineering, 31,* 17–22.

Tao, B.; Díaz, V.; Guerra, Y. Artificial intelligence and education, challenges and disadvantages for the teacher. Arct. J.2019,72, 30–50.

Tartuk, M. (2023). Metaphorical perceptions of middle school students regarding the concept of artificial intelligence. *International Journal of Education and Literacy Studies, 11(2),* 108–116. https://doi.org/10.7575/aiac.ijels.v.11n.2p.108

Tikhonova, E., & Raitskaya, L. (2023). Education 4.0: the concept, skills, and research. *Journal of Language and Education, 9(1),* 5–11. https://doi.org/10.17323/jle.2023.17001

Tupas, J. B., & Pendon, G. P. (2016a). College Teachers' Educational Philosophy: A Step towards Improving Teaching Performance. IRA *International Journal of Education and Multidisciplinary Studies, 3(3).* https://doi.org/10.21013/jems.v3.n3.p12

Tupas, J. B., & Pendon, G. P. (2016b). College Teachers' Educational Philosophy: A Step towards Improving Teaching Performance. IRA *International Journal of Education and Multidisciplinary Studies, 3(3).* https://doi.org/10.21013/jems.v3.n3.p12

Williamson, B., Eynon, R., & Potter, J. (2020). Pandemic politics, pedagogies and practices: digital technologies and distance education during the coronavirus emergency. *Learning, Media and Technology, 45(2)*, 107–114.

van der Vorst, Tommy; Jelicic, Nick (2019) : Artificial Intelligence in Education: Can AI bring the full potential of personalized learning to education?, 30th European Conference of the International Telecommunications Society (ITS): "Towards a Connected and Automated Society", Helsinki, Finland, 16th-19th June, 2019, International Telecommunications Society (ITS), Calgary