






**TECHNOLOGY INTEGRATION IN PHILIPPINE HIGHER EDUCATION: A  
CONTENT-BASED BIBLIOMETRIC ANALYSIS**

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**Abstract**

The penetration of technological advancements into higher education institutions is a multifaceted phenomenon influenced by diverse considerations. This paper breaks new ground by conducting a content-based bibliometric analysis of technology integration within Philippine Higher Education Institutions (HEIs). Employing a systematic five-step approach, the study meticulously navigates the bibliometric landscape, encompassing database identification, scope determination, article refinement, compilation, and analysis. A corpus of 61 articles sourced from the Google Scholar database spanning the period from 2012 to 2022 constitutes the focal point of bibliometric scrutiny. Delving into the thematic analysis, the study unveils a rich tapestry of insights encapsulated in five overarching themes: Technology, Industrial Revolution 4.0, and Education 4.0; Higher Education and Digital Technology; Educational Philosophies in the New Normal Higher Education Setting; Transformation of Technology Education in Higher Education and the Academics; and Higher Education, Technology, and the Learners. The findings underscore the imperative of aligning educational paradigms with the imperatives of Industrial Revolution 4.0, offering a blueprint for navigating the new normal in higher education. By elucidating the intricate interplay between technology and pedagogy, this research not only enriches scholarly discourse but also provides practical insights for HEIs seeking to embrace technological innovation in fostering academic excellence and resilience amidst evolving educational landscapes.

**Keywords:** Bibliometric Analysis, Higher Education, Technology Integration, Technology Education



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## INTRODUCTION

Technology integration has become a byword in Philippine Higher Education Institutions (PHEIs). In the advent of the exponentially growing pace of technology which is undeniably cutting edge in many areas if not all areas across the globe, the education system has seen its unprecedented pace of going with the changes, otherwise, it would be passive and irrelevant. Technology has expanded access to education, making learning transcends borders, and happens in real time (Matthew & Thakkar, 2012; Talib et al., 2021). Technology is a potent tool for transforming education, making it responsive to the demands of the time, especially since the Industrial Revolution 4.0 has found its way (Yang & Gu, 2021; Zervoudi, 2020). The growing necessity of its incorporation in many areas has been steadily pronounced that it is reaching far and wide (Staddon, 2023). Technological progress holds great potential to dramatically boost economic growth and social development (Balansag et al., 2018). However, as the world embraces these technological changes, resources, and workforce the academics can compromise the swift transition in terms of readiness and facility. Digitization and technological advancements have paved the way to reshaping people's lifestyles, including business operations and models, government choices and policies, as well as educational reforms and transformations (Jardinez & Natividad, 2022; Djankov et al., 2018). What may be a noble goal to target can remain unrealized. This is true even in the case of higher education and in producing quality graduates who will soon be the workforce of the globe. By and large, information takes its new form as new technology is introduced and hence the manner of integration becomes dependent on this ins and outs. It can be claimed that many existing studies pose overload of information with technology at its core. Putting them in linear consideration and considering them as corpus for a study can be a systematic way of analyzing them.

Fundamentally, what the future offers can magnet both positive and negative consequences. Philosophically, everything is uncertain because changes happen in just a snap of a finger. While the goal of any educational institution, especially at the tertiary level, is to prepare learners for jobs, technological advancement and related concerns point to the need to be ready to embrace possible breakthroughs and their downsides (Verde & Valero, 2021). There can be many considerations at play for this technological advancement to infiltrate higher education institutions. This entails removing barriers in preparing both academics and learners to navigate the incremental changes in integrating technology into the educational process (e.g. access constraints, inadequate training, and support constraints) (Johnson et al., 2016).

Preparation is crucial to leverage the benefits of technological change, realizing its potential to spur innovations. In the academe, it establishes connections between and among academics and learners in a way revolutionary, significantly leading to a paradigm shift even in the modality of the teaching-learning process. It transforms approaches and strategies to learning into collaboration and complementation avenues, to close long-standing equity and accessibility gaps, and customize learning experiences to fit learner's needs and suffice the academic requisites (Carlsen et al., 2016). Robinson (2016) expressed this apprehension stating that we are to prepare for the unknown.

Understanding these considerations can promise a great deal in embracing Industrial Revolution 4.0. In the context of progress, this is poised to help boost the economy by facilitating social development and technological advancement in a way linear to the progressive demands of the time. "The industrial revolution 4.0 with its rapid development speed and profound impacts on all areas of the social life of each country, if left behind of this revolution, backward development is also inevitable" (Tri et al., 2021, p.1). If all the advantages are taken into account and be put into good use, new and huge opportunities are expected to unleash. The direction and paradigm of higher education will be profoundly modified from the educational environment, teacher's role and learners, and instructional deliveries and methodologies. More if all these things can be taken in a manner comprehensive and segmented at the same time. A bibliometric study in this case is called for as this rigorous approach is popular in comprehensively assessing and evaluating the relevant literatures.

Available studies identify technological tools that make integration possible; some situate and contextualize their conditions and determine appropriateness or relevance of existing technological integration practices but more have to be done on the wholistic picture of seeing them as bibliometrics so that themes can be forwarded and insights can be gleaned in a more clustered approach. This paper offers perspectives on technology integration into higher education situated in the Industrial Revolution 4.0, premised on the underpinnings and the underlying effects of this technology on the young

generation, vis-a-vis the different educational philosophies, and the transformation of this technology in the Philippine educational system. The succeeding discussions of the paper underscore considerations that have to be understood to work best in the interest of higher education institutions in the face of Industrial Revolution 4.0. These gleanings from the existing studies are thematically presented.

**METHODOLOGY**

A bibliometric approach was applied in this study to explore the integration of technology in higher education and its relevance in the Philippine context. Recently, bibliometric analysis has gained popularity as a rigorous method for reading, evaluating, and assessing the literature. This approach may effectively identify significant research, authors, journals, organizations, and nations across time, as well as offer a broad overview of voluminous academic literature (Lee et al., 2020). In contrast to other techniques of review, bibliometric analysis takes a macro-level approach and usually displays the dynamics and structure of an area of study (Öztürk, 2021). The field's dynamics and evolution, as well as the relationships between authors, publications, and word concepts inside it, may all be examined from a wider angle using bibliometric analysis.

The study is guided by an analysis following a five-step approach (Figure 1) such as (1) identifying the database, (2) determining the bibliometric scope, (3) refining article search, (4) compiling articles, and (5) analyzing articles as bibliometric. Ellegaard and Wallin (2015) explained that bibliographic analysis allows the researcher to introspect research topics in an area of interest, its trends, and its interrelationships in a wider literature scope.



Figure 1. Bibliometric Analysis Approach

As mentioned above, bibliographic analysis unravels different bibliographic networks of authors (Ha et al., 2020; Karakuş et al., 2019) leading to identifying possible research gaps and/or future researchable topics (Gao et al., 2021; Marin-Marín et al., 2019). The bibliometric analysis conducted in the study commences with identifying the database to search on. Google Scholar was chosen as the source database as this is easy to navigate, freely available to anyone with an internet connection, and provides open access to a variety of reading and resource materials (Pereira & Mugnaini, 2023).

The next step is determining the bibliographic scope. Only relevant journal articles published from 2012 - 2022 were included in the study's scope. Proceeding papers, book reviews and chapters, editorial materials, and books were excluded. The search keywords used were technology integration and higher education in the Philippine context.

With the determined study scope, the article search was refined as shown in Figure 2 by choosing relevant journal articles pertaining to the perspectives of technology integration in higher education in the Philippine context. The initial search generated a total of 17, 600 articles. This was then narrowed further yielding to a total of 1096 following journal articles with keywords technology and higher education in the title. From 1096, only 61 journal articles were found to have relevance to the Philippine higher education context.



Figure 2. Refinement of article search

The compiling of the article search was made using Mendeley software following plain text format to ensure a counter-checking mechanism and completeness of entries. All generated articles were analyzed through thematic content analysis.

## RESULTS AND DISCUSSIONS

Homeowners may anticipate more from the smart homes as HEMS-IoT integrates big data and machine learning techniques into its service layer, especially with regard to energy management (table 1). In order to spot trends in energy use and learn more about the variables affecting these patterns, this part examines the data that HEMS-IoT gathered for the case study.

The findings of the study are presented using the themes that were generated for analysis. These are (1) Technology, Industrial Revolution 4.0, and Education 4.0; (2) Higher Education and Digital Technology; (3) Educational Philosophies in the New Normal Higher Education Setting; (4) Transformation of Technology Education in Higher Education and the Academics; and (5) Higher Education, Technology and the Learners. They are extracted from the contents of the studies that became part of the bibliometrics of this paper.

### *Technology, Industrial Revolution 4.0, and Education 4.0*

The fourth industrial revolution (IR 4.0) is currently at the forefront, altering and directing the market toward automation, digitization, and cyber-physical systems (Alcácer & Cruz-Machado, 2019). Technological development has accelerated our ability to move quickly and the industry's personnel have to keep up. The workforce's understanding of intelligent manufacturing, high-process digitalization, and organizational connectedness are prerequisites for coping with Industry 4.0 (Gorecky et al., 2014). However, the Fourth Industrial Revolution encompasses more than just intelligent, interconnected equipment and systems. It has a considerably broader range. Waves of new developments in fields like DNA sequencing, nanotechnology, renewable energy, and quantum computing are happening at the same time (Schwab, 2016). IR 4.0 is fundamentally distinct from other revolutions due to the convergence of these technologies and their interplay across the physical, digital, and biological realms.

Moreover, IR 4.0 does not just refer to intelligent and connected processes and gadgets-related, but it also entails a much broader attitude and has a significant impact on the global political, social, and economic systems (Ali et al., 2022). Due to IR 4.0's qualities, the technology industry should be quite lucrative for investors, with significant future investments perhaps strengthening the digitization and internet segments in particular. Additionally, IR 4.0 can provide a business with a significant edge since it allows for real-time data analysis (Ali et al., 2022). The population's current access to technology served as the catalyst as this is primarily built on the Internet of Things-enabled digitization, automation, personalization, customization, and integration of IT management systems and factory production systems (IoT) (Abdelmajied, 2022). As posited by Csalódi et al. (2021), the Industry 4.0 digital transformation is being driven by connectivity, automation, and optimization. The speed, dependability, and information flow amongst all systems of manufacturing are increased through the seamless integration of software, hardware, and personnel (Hussain, 2020).

The field of education in response to the needs of IR 4.0 also made advancement through the phase of Education 4.0. The educational system must accommodate a global learning environment and experiences that are automated, networked, virtualized, and adaptable in order to serve Industry 4.0 (Pangandaman, 2019). Thus, higher education institutions must integrate technology innovations into their teaching and administrative procedures to prepare future graduates for the workforce. A preferred method of teaching that fits with the impending fourth industrial revolution is known as Education 4.0. In this era, higher education institutions must educate their learners for a world where these cyber-physical systems are common across all industries if they want to keep graduating successful learners (Akour & Alenezi, 2022, Jamaludin et al., 2020). This includes incorporating lessons about technology into the curriculum, completely altering how learners study, and leveraging this technology to enhance college life (Hussin, 2018). We can stay connected at all times - thanks to technology, and as a result, professional positions are gradually becoming more flexible and adaptive.

To achieve the goals of Education 4.0, de S. Oliveira and De Souza (2022) argued that the outputs of the education sector in the Fourth Industrial Revolution must center on "citizens' proficiency in digital technologies, seen in a more interconnected and multifaceted world, where everyday improvements based on digital technologies increasingly emerge; the school must adjust to equip learners with the skills needed to create a more inclusive, cohesive and productive society; digital skills for faculty and learners to promote human, problem/project-based learning; and innovative pedagogies to encourage the learners to take an active role in promoting and exercising the skills and attitudes

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necessary for the journey towards learning” (p. 284). Digital technology should be a constant consideration in higher education institutions.

### *Higher Education and Digital Technology*

Educators cannot simply forecast and believe the projection to be adequate and sufficient, especially in Education 4.0. Believing so would only make it become less and less adequate and sufficient because more and more knowledge will accrue, new sets of skills will eventually be necessary to develop, and new technologies will surely advance the already fast-paced life (Lee & Trimi, 2016); technology integration is inevitable (Staddon, 2023; Wangdi et al., 2023). It may seem difficult to thrive in such an unknown future, but the brighter side of it is that learners can be taught “how to learn.” The effective use of online education for teaching facilitates opportunities that enhance the education environment (Chang & Hwang, 2018; Hazaymeh, 2021 as cited in Alarabi et al., 2022).

Higher education institutions can harness learners possessing the three essential skills: complex problem-solving ability, critical thinking, and will for collaboration. Doing this, it is believed that graduates who can be produced are skilled in knowing, doing, being, and living together in peace and harmony – the four pillars of education. This puts forward the call for a shifting paradigm from being mere facilitators of learning to developing learners. Corrigan (2013) brings this to light that academics should be catalysts in developing learners and not just be merely producers of learning so that learning transcends beyond the portals of the classrooms.

As the post-COVID-19 era’s new normal is approaching, higher education must be examined considering new opportunities and challenges. The COVID-19 pandemic caused drastic changes in the education system not only in the Philippines but the entire world (Haleem et al., 2020; Tadesse & Muluye, 2020). It has closed schools and has stopped the physical delivery of the teaching-learning process. Academics, learners, parents, and other stakeholders were forced to adapt to learning at a distance (Bhamani et al., 2020). The quick shift to distance learning directly challenged the knowledge, mindsets, and skills of the workforce (Gillis & Krull, 2020).

Digital transformation became evident in society as all aspects of the business operations of any organization were reformed (Tripathy, 2019). The “nice to have” skills and knowledge on digital integration and utilization shifted and forced key players to develop these into “must - haves”. Some traditional perspective of the classroom and how it should be managed is not anymore applicable to the current milieu of the teaching and learning process. The incorporation of the “must - haves” knowledge and skills in new technologies and the digital world is expected to be a part and parcel of people’s routine. Reluctance and resistance to change can hamper growth and development at this time. Ironically, we are required to embrace these changes at a higher level of comfort even, say, on the verge of ambiguity and uncertainties. Curricular expectations and guidelines continuously evolve and shift in a manner we cannot control. Teaching styles and methodologies, then, should equally evolve and develop to stay in place. Upskilling, reskilling, learning, relearning, and unlearning have become bywords in order not to become overwhelmed, if not obsolete, and left behind. The ability to adapt to the demands has been very crucial and abrupt. Fundamentally, academics have to fit and blend in as we are left with no choice but to upgrade.

As the pandemic continues and with the previous lockdowns and restrictions, economies have been deeply devastated (El Keshky et al., 2020; Mishra et al., 2020). The course of action is to live with the threat of the pandemic. This calls for living in the new normal, even in the educational process. Schools are jeopardized to adapt and incorporate new ways of learning to ensure continuity if not maintain the quality of education that our learners deserve (Dayagbil et al., 2021, Peregrino et al., 2022). Hence, the school, the academics, the government, the learners, the parents, and other stakeholders must collectively take part in these changes. By and large, these challenges will continue to be in place with or without the threat of the pandemic. Readiness to take action and to respond and act to changes may be said as key in order to facing these squarely.

The abundance of online services addressing the whole range of human activity from wake to sleep makes one dependable. Transitioning and embracing the digital world becomes a necessity for everyone from all walks of life. These technological advances make our life’s work and living easier and more comfortably. Barriers like distance and time are no longer a big concern as technology is able to interfere with them in real-time. In fact, even with the threat of the pandemic, we are all able to surpass and survive through the help of technology.



Digitalization greatly prospered along with the COVID-19 pandemic (De' et al., 2020; Murtaza et al., 2024; Zancajo et al., 2020). All the aspects of human life are affected and transitioned to digital versions. Enterprises transformed their workspaces online allowing employees to work in the comforts of their homes. This scheme leverages digital technology moving business operations virtually online and providing public internet access to businesses' internal private networks. This gives both employees and employers alike, eliminate their struggles with the daily commute, however, confronted with the need to compete for bandwidth with their children and other relatives at home who are also engaged in other activities online. In addition, workers are able to cook their own lunches or have them delivered instead of the usual takeout or leisurely lunch breaks in nearby restaurants or malls thereby creating a big hit to food delivery services like Grab. Commerce industries were forced to remodel their operations. From their physical retail store, companies shifted or remodeled online. They boosted their websites, social media accounts, and chat apps both for promoting their brands and catering to orders and payments made by their clients. This then corresponds to an increase in online banking transactions as well as e-mobile wallets such as Gcash, PayMaya, and the like. Those companies that were not able to cope with the demand suffered and lost a lot.

The education sector is not exempted. It is but one sector greatly affected by digitalization. Amid the threats of the outbreak and surge of the pandemic, governments all over the world were forced to shift from face-to-face classes to online learning modality. This modality allowed for the continuance of education despite the pandemic. The internet became the superhighway of the process of delivering teaching and learning across borders. The new normal setting in education sets the requisites that would suffice the adjusted modalities, thereby making higher education institutions responsive to the changing milieu. On this note, educational philosophies have to be reevaluated and reinvented in the context of the new normal setting.

### *Educational Philosophies in the New Normal Higher Education Setting*

Natividad (2022) opined that our education system is guided by different philosophies that have been tested, developed, and evolved through time. The four famous and being considered as primary philosophical schools are idealism, realism, pragmatics, and existentialism. Idealist perspective focuses on the ideas and concepts, supporting logic, however, this is in contrast with applying science and perception (Guyer & Hortsmann, 2022). The concepts of idealism are considered to be the most confident as they endure and surpass both time and space. For idealist believers, teaching timeless concepts and great works will benefit learners as they will be able to learn cultural norms better. Further, debates and limitations in an idealist classroom are natural.

Meanwhile, realists firmly support learning by the senses and empirical research. They put a lot of stress on the physical world in their argument that truth, knowledge, and worth exist irrespective of the intellect (Stutchbury, 2022). This cosmos is made of matter. Realists believe that education should improve human reason via experimentation and observation. It is highly anticipated that the instructor will be knowledgeable and experienced. The usefulness of experimenting in the classroom is recognized by realist educators. In this respect, the most effective approach for learners to learn is by doing.

Notably, a key theme for pragmatism is the idea of change. People must understand what it means to be knowledgeable in light of this continuing development. Pragmatics claims that learning is an interaction between the environment and the learner (Rai & Lama, 2020). They also believe that truth and values evolve throughout time because they change along with the people who hold them. Pragmatists believe that how to question what we know and how to reconstruct what we know to fit the changing environment is the most important lesson that should be taught in schools. A greater focus is placed on deliberately solving difficulties rather than digesting enormous volumes of information.

Considerably, existentialism values individual judgment and knowledge reflection (Mozaffari & Jahanian, 2016). The existentialist in the classroom places a strong emphasis on building a free and self-actualizing individual. This calls for allowing kids to discuss their unique experiences and choices. As one of the most significant schools of philosophy, existentialism emerged as a response to post-World War II criticism of the methodologies of conventional Western philosophy. This philosophy contains ideas that are at odds with conventional philosophical thinking. Existentialism holds that man's uniqueness is paramount, larger, and more significant than the existence of man, nation, and the world. This philosophy rejects the ideas of intellect and nature and affirms the reality of individuality. It is quite close to a man's unique existence (Malik & Akhter, 2013).

Even as the global pandemic continues to progress and develop new variants, lockdowns, and restrictions are no welcome scenarios as economies have already been deeply devastated. The only course of action is to live with the threat of the pandemic. This calls for living in the new normal, including the education process. Higher education institutions are enjoined to go back to in-person setup in order not to jeopardize the learning of the next key players of the land - the higher education learners (Dayagbil et al., 2021). Presumably, life will never go back to what it used to be. We have to be prepared and ready to incorporate new ways of learning to ensure continuity if not maintain the quality of education that our learners deserve. Hence, the school, the academics, the government, the learners, the parents, and other stakeholders must collectively take part in these changes and challenges.

Admittedly though, these challenges will continue to be in place with or without the threat of the pandemic. On the upper hand, readiness to take action to respond and act to changes with the help of different educational philosophies can be very pivotal in order to face these challenges. As far back as the time of Charles Darwin, this was noted, "It is not the strongest of species that survives, nor the most intelligent, it is the one most adaptable to change". Premised on this, technology education at the core of the education system has to transform itself. The academics at the forefront have to be multi-faceted, bearing the humongous task of facilitating knowledge production that befits the social milieu.

### *Transformation of Technology Education in Higher Education and the Academics*

Education and its different branches and counterparts employ a variety of dynamics to aid its transformation. Education operates in a wide perspective including in-school curricula, international perspectives, and even the spiritual realm. Hence, the transformation should happen in a holistic manner to cover all important dimensions of the educational process.

The United Nations 17 Sustainable Development Goals (SDGs) includes SDG 4 - Quality Education, which establishes the groundwork for inclusive education by proposing that all learners, regardless of gender or socioeconomic background, should have equal access to education (Palestina et al., 2020). This inclusion should cover all tenets of the educational process, including the utilization and access to technology. One of the important dimensions that should be given focus is the implementation and use of technology in education. With technological advancement, everything and anything in the world we operate in is uncertain, and unpredictable in a way uncontrolled. Aptly put, change becomes the only consistent entity that forces each of us to progress and adjust to the needs of the time. The abundance of numerous online services addressing the whole range of human activity from wake to sleep makes one dependable on it. Transitioning and embracing the digital world becomes a necessity for everyone from all walks of life.

In this light, it can be noted that higher education has always experimented with technological advancements ranging from the use of personal computers to the use of traditional chalkboards some years back. Technology has become an indelible component not only in the delivery but more so in the appreciation of higher education systems. Being very powerful, technology is able to shift the way people acquire knowledge and skills. Lifelong learning is promoted and time and location concerns and constraints no longer become barriers.

The amalgamation of technology and curriculum gives a social, authentic, innovative, and beneficial pedagogy not only to the learners but also to the academic' technique. This concept is the premise of the SAMR (Substitution-Augmentation-Modification-Remodification) Model in which the strategies in the teaching of academics are reinvented with the use of technological tools (Falloon, 2020); teachers, and academics at that, play an important role in integrating technology into the classroom (Alsarayreh, 2023). However, this reinvention will not be achieved if the technological or digital skills of the academics are lacking. UNESCO through their "ICT Competence Framework for Teachers" enumerated some of the basic technological skills needed by the teacher which include word processor knowledge, graphics software skills, presentation software, and other digital resources skills, search engine knowledge, and utilization, educational software, and online resources integration, communication and collaboration technology skills, and internet safety issue management (Almenara et al., 2020). These skills are vital as academics must be capable of using different technology tools to "solve problems, make informed decisions, and generate new knowledge" (Raob et al., 2012, p. 14). Moreover, the technological competencies of academics (Wangdi et al., 2023) will help their learners to become decisive, committed, innovative, creative, and collaborative citizens (Almenara et al., 2020). Technological competencies of academics are highlighted in the COVID-19 pandemic when face-to-face classes are prohibited. During this pandemic, the technological skills of academics are put to the

test to provide an educational environment where learners can still learn and gain knowledge through remote teaching (Portillo et al., 2020).

Technological challenges, which may also be advantages, brought education to its height, producing both positive and negative effects for all of its stakeholders. For one, a prominent positive effect of technology-enhanced teaching and learning is that learning becomes limitless and without barriers. Both the academics and learners are able to explore a wide array of knowledge, skill sets, and information that makes learning easier, fun, and interesting (Ghavifekr, 2015). However, the question of the “valuability of academics” and “academics being obsolete” because of the available technologies becomes one great drawback in the continuous flourishing of technology. The idea of computers (i.e. Artificial Intelligence (AI)) replacing academics became a hit and alarmed all concerns. This has called for the upskilling and reskilling of academics to keep abreast with the demands of the current milieu of education.

Interestingly, rapid technological progress is constantly reshaping the educational system. The transformation of teaching practices, including access to digital connections, technological advancements, and online platform adaptation, is a challenge to academicians to uphold the duty of developing learners with efficient and innovative minds who can make a noteworthy contribution to enhancing the nation's potential, particularly in higher education level (OECD, 2016). Higher education institutions' dedication to updating their digital pedagogies has great promise to help them thrive in the 21st century, keep the key players creative and active, and guarantee that all learners get equal opportunities to get a high-quality education.

Academics and learners are both expected to use technology as a communication and information access tool with the arrival of the 21st century. Thus, technology education is wanting. The educational system is projected to benefit from the technical expertise of academics delivering quality instruction and technically competent learners who can navigate the technology spaces in order to grasp the necessary 21st-century skills. Teaching learners the values and skills that are relevant to the 21st century requires instructors to be technologically proficient (Kim et al., 2019). Completing the cycle of technology sharing and knowledge transfer necessitates that technology-adept learners are at the receiving end. Integrating technology in a responsive curriculum will likely result in a social, genuine, useful, and innovative pedagogy that benefits both learners and academics (Yu et al., 2020).

This idea brings forth the foundation of technology education which uses technology resources to re-engineer and tailor-fit educational practices to the demands of the time. If academics lack the necessary digital or technological abilities, this reinvention is seeing its futility. Additionally, technological proficiency can likely support the goal of producing learners who are themselves relevant and responsive, inventive, creative, and key players in the changing milieu (Dhawan, 2020). Who and what they are at the core of teaching and learning can leverage the process; after all, these learners are the by-products of the transformation in education and they have to keep up with the globally arresting standards of higher education institutions.

### *Higher Education, Technology and the Learners*

The exponential pace of technological advancement in our world today brings us the realization that everything is relative, changes happen in just a snap of a finger. Things become dependent on circumstances that surround the given phenomena if that is the consideration. At the comfort of one's fingertips, which is at the same time borderless, things get managed and done. They get to be accomplished. On this note, it becomes advantageous to those who are adept in technology, those who can navigate cyberspace and manipulate the gadgets to suit their need - these Gen Z. It is not surprising then that an eight-year-old takes the lead, and those who are in the middle - not too young therefore not too brave, not too old therefore not too alien in this orientation - shy away and make themselves remote.

Joshi and colleagues (2019) stated that “today's youth are using technology in a variety of ways, from texting and tweeting to chatting, online gaming, and posting through a variety of Internet portals” (p. 101). A survey revealed that almost 99% of Americans aged 18 and more use the internet while 77% have a smartphone and 95% have a cellphone (Pew Research Center, 2018). This number reflects how technology already infiltrated today's youth and online services.

The abundance of numerous online services addressing the whole range of human activity from wake to sleep makes one dependable on it. Transitioning and embracing the digital world becomes a necessity for everyone from all walks of life but only the brave and aggressive ones stay. In this case, the young ones do rule; our learners, indeed rule. This time and age are really for them. Gone are the



days when people solely relied on each other in order to survive. When they become too dependent on the complementation that is very necessary to exist in order to make things happen. Sort of saying that the absence of either makes a lot of difference. It has reversed in a manner that is unprecedented. The call of the times has made it so. Technology is one but sufficient company to last a person for a day, week or so. It has become a constant that supplies the hollow, that completes the cycle - and lo and behold that gets the process in a full circle.

These technological advances make our life's work and living easier and more comfortably. In the same respect, Reyes (2019) set this early on that "the complex nature of humanity and its equivalent simplicity are oftentimes understated. With the available choices and possibilities, we create and choose." Society operates in a speed and manner that creates positive spaces for growth and development even in the absence and presence of some traditional requisites like consolidated human labor and the like (Joynes et al., 2019). Distance and time are no longer limitations to communicating and interacting with people all over the world. In fact, to date, communication and interaction happen in real-time, perhaps on the top of the list of why the internet is like a magnet that hypnotizes people. Even with the threat of the pandemic, we are able to surpass. Technology is one big reason. It keeps us occupied while we stay in one place. It gives us reason to strive because we see the world rolling before our eyes in the comfort of our zones. Our world today has never been this connected and interrelated as before, thanks to the advancement of technology.

With this, our young generation of learners tends to be of great advantage compared to the older generation. Digitalization in almost all aspects is clearly seen based on the usage and engagement of the different generations with technology (Verhoef et al., 2021). This dictates who gets to stay and who gets left behind or aptly put, who gets moving up and who gets lagging down. Our older generation of learners - being digital immigrants, adapt to technology; however, tend to do it slower and most of the time encounter difficulty. In contrast, our younger generation of learners are classified as digital natives. Being native to the digital age, they eat and breathe technology. They are able to grasp and understand easily and flawlessly how technology works. Nowadays, when you give a one-year-old kid a smartphone, navigation is not a major problem, you may expect that the gadget can be used without supervision in a short time. Given the skill set of a one-year-old kid explains why the youngsters are tagged as "masters", and an eight-year-old a "ruler", hence we can expect this one-year-old to be "king" in the near future.

## CONCLUSION

The fusion or merging of technology and education has affected our society in a manner we become adaptive in our way of life. We have become cognizant of the demands and needs of IR 4.0 and Education 4.0 that we have to confront in the midst and beyond the pandemic. In the case of PHEIs, academics, learners, and other stakeholders compounded their collective efforts to face significant challenges brought about first and foremost by the much-needed and abrupt paradigm shift in pedagogy. The changes come along with challenges. The delivery of education has forcibly pushed for some evolution in teaching styles and strategies. Creativity, innovation, problem-solving skills, and critical thinking to go with the finest refinement of grit for survival have been tested, causing them to unleash. The pandemic has tested everybody's endurance - all key players have been put to the test. This same consideration for technology adaptation has put all concerned in alarm. In its course, it is either we pass or fail. To pass is to survive and to fail is to demise - literally and figuratively as is the case. On the brighter side, this enables key players to make the greatest possible contribution to humanity - to be resilient, responsive, and adaptive in order to be relevant to the time. To achieve this goal in the context of higher education, effective education techniques, and practices must be incorporated into the curriculum vis-a-vis the recognition of the technological revolution and the changes that are inevitable. The integration of technology to higher education institutions spells the need to align our perspective in education at the niche of Industrial Revolution 4.0 for better thriving at the new normal.

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## AUTHOR CONTRIBUTIONS

Conceptualization, MCD Cadiz and LAF Manuel; Methodology, LRNatividad and LAF Manuel; Software, MCD Cadiz and LRNatividad; Validation, MM Reyes, MCD Cadiz, and LAF Manuel; Formal

Analysis, MCD Cadiz and MM Reyes.; Investigation, LR Natividad and MM Reyes; Writing – Original Draft Preparation, MCD Cadiz and LAF Manuel; Writing – Review & Editing, MM Reyes; Supervision, LR Natividad

## CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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