

INTEGRATION OF ARTIFICIAL INTELLIGENCE (AI) TECHNOLOGY IN THE INFORMATION TECHNOLOGY EDUCATION (ITE) CURRICULA OF STUDIES

MARIFEL GRACE CAPILI-KUMMER, DIT

School of Information Technology & Engineering, St. Paul University Philippines
E-mail: mkummer@spup.edu.ph

Abstract - This study determined the features of Artificial Intelligence (AI) Technology which can be integrated in the Information Technology Education (ITE), and the skills needed to ensure the program relevance and responsiveness to the requirements of the workplace in the 21st century. A systematic literature review was conducted. There were 75 literatures identified and upon application of the inclusion and exclusion criteria, 20 qualified. Data extraction used was a matrix and content analysis were used to group the data. Based on the analytical review. The skills needed skills by the millennial generation in the 21st century are: complex problem solving, critical thinking, creativity, people management, collaboration, emotional intelligence, decision making, mindset in an organization, negotiation, and cognitive flexibility. The AI technology that will be integrated in the ITE curriculum with respond to the need of the millennial generation are: machine learning, neural network, deep learning, cognitive computing, computer vision and natural language processing. The study recommends for the realignment of the ITE curriculum to ensure the preparation of IT graduates who are equipped with the necessary IT and work skills that they need for survival in the 21st century. ITE needs to embrace tools and curricula that will integrate AI in order to prepare students for 21st century education and career success.

Keywords - Artificial Intelligence, Information Technology Education, Technology Integration

I. INTRODUCTION

Nowadays, the most used digital tools are Google, Facebook, YouTube, Twitter, Instagram, and Wikipedia (Karsenti, 2019). Digital technology exerts huge influence on the economic, social, and cultural advancement of societies. New forms of technology continue to permeate lives and attract the youth. In line with the 21st century visions, countries expect their teachers and students to be a responsible digital citizen (Karsenti, 2019). AI is the core of the fourth industrial revolution and provides the potential applications and processes to get smarter and provide greater benefit for society (2019). It influences every part of human lives. According to the World Economic Forum (2019), the growth of AI could create 58 million new jobs in the next few years. While Economic Modeling Specialists International (2019) predicts that 2027 jobs in Science, Technology, Engineering and Mathematics (STEM) field is expected to increase by 13%, but a gap remains. The solution for bridging this gap can be found in the K12 schools and classrooms. There's a need to educate students at an early age by not merely a consumer of AI, but also as creators (Chen, 2019). This can be done by integrating artificial AI in the curriculum, particularly those taking Information Technology and Engineering.

The rapid pace of technology innovation and the associated job displacement acknowledged widely by experts in the field implies that teaching in higher education requires a reconsideration of teachers' role and pedagogies (Popenici & Kerr 2017). Based on the

ongoing critique and inquiry in the proposed solutions is crucial to guarantee that universities be able to maintain civilization, promote, develop knowledge and wisdom. Universities needs to rethink their function and pedagogical models and their future relation with AI solutions (2017).

Moreover, institutions of higher education envision the massive register of possibilities and challenges to embrace AI in teaching and learning. These solutions present new openings in education, while promoting lifelong learning in an improved model that can maintain the integrity of core values and the purpose of higher education institutions (2017).

St. Paul University Philippines aims to provide quality and cutting-edge education to its students. But with the current curriculum provided by the Commission on Higher Education (CHED) for the Bachelor of Science in Information technology, there are lacking courses to reinforce AI technology. In consideration that St. Paul University Philippines is CHED-granted Autonomous institution and a Center of Development (COD) for Information technology Education, the department is trying to complement the needs of the current society.

Thus, with the desire of St. Paul University Philippines (SPUP) to produce graduates in line with the 21st skills and competencies, it continues to push the frontiers for further development. The university shall use current AI solutions to help teachers from classroom performance to network safety and monitoring. Students need to start learning how to

design, manipulate, and work alongside with AI machines in order to develop the skills and competencies they need as they prepare to enter the workplace. Establishing a successful AI integration in the ITE curricula of studies will take collaboration and proper planning on the part of university decision-makers (EdTech, 2019).

Related Literature

Straits Research (2019) states that Artificial Intelligence (AI) in education facilitates e-learning solutions to individuals. The integration of advanced technologies and AI algorithms into e-learning platforms is expected to boost the market growth between 2019-2026. AI-based technologies are now in demand across the globe and it is expected to drive the market growth in the years to come (Straits Research 2019). The educational institutions need to be competitive and have to look at how the 21st century ICT skills and competencies can be provided to the students. This can be done by integrating these competencies in the curriculum.

Balakrishnan & Ponnusamy, (2018) Artificial Intelligence technology application is developing through the application of big data which set the platform for a high volume and velocity of data that facilitates automation processes. AI is expected to have a strong effect on the future of technology thus making the human life simplified (Balakrishnan & Ponnusamy, 2018).

Baker and Smith (2019) “Computers which perform cognitive tasks, usually associated with human minds, particularly learning and problem-solving”. They explain that AI is an umbrella term to describe a range of technologies and methods, such as machine learning, natural language processing, data mining, neural networks or an algorithm. Considering this allows the machine to do the sophisticated task just like human (Baker and Smith 2019).

Ortola (2019) to be competitive in today’s 21st century, the university need to be fast adopters of best-in-class technology, like Artificial Intelligence. In addition, they need to start building their own unique digital capabilities. It refers to this combination of factors as the “tech intensity” of the university. However, in order to fully embrace tech intensity, the university need to invest in their human capital. The rise of Artificial Intelligence in education means that workers need to reskill and upskill in order to remain relevant and competent in the workforce of tomorrow (Ortola, 2019).

Kubickova (2019) IT Education in the Philippines: Educational Technology (EdTech) merges innovative learning techniques with digital technology. It symbolizes a new era of education. The Filipino

government understands the significance of teaching students how to utilize a digital economy. The vision is to elevate a generation that’s ready to compete in the global market. (Kubickova, 2019). Smith (2019) Artificial intelligence is now changing the society and empowering people in new ways by enabling innovation in areas like healthcare, agriculture, education and transportation. This technology will continue to flourish, before deploying AI around the world ensure that it will be ethically, inclusively, and with transparency works for everyone (Smith, 2019).

Conceptual Framework

The conceptual framework presents the integration of AI Technology in the ITE curricula of studies.

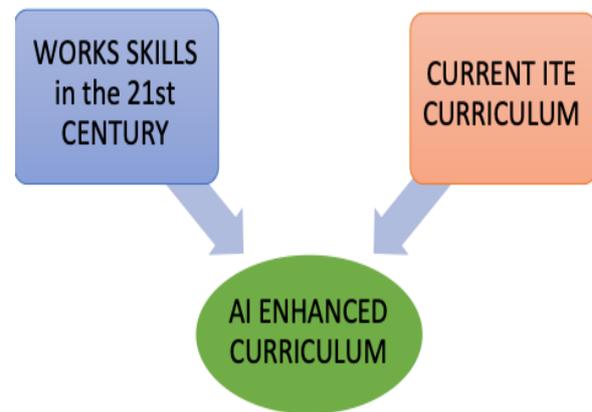


Figure 1: Integration of AI Technology in the ITE Curricula of Studies

The feature of AI Technology, skills in the 21st century and the ITE curriculum are the inputs for the AI enhanced ITE curriculum.

The first component is ITE works skills in the 21st century. The capabilities and strategies for higher order thinking skills were used to develop the capacities and expertise required of today’s technology student in order to prepare them for the 21st century. Students can interact with others around the world (Association of Computing Machinery 2017).

The second component is the current ITE curriculum. The ITE curriculum needs to enhance and realign the courses offered so that there would be a continuity in the professional subjects to address the need for the 21st century.

The School of Information Technology & Engineering needs to embrace the tools, technology and improve the curricula to teach the full complement of AI in order to truly prepare students for 21st century college and career success. Considering the literature reviewed the current status

of the ITE curriculum of the University shows lacking courses to reinforce AI technology.

Purpose and Statement of the Problem

The purpose of this study was to determine the skills needed to be develop for the millennial generation in the 21st century which can be integrated in current ITE curriculum to ensure the program relevance and responsiveness to the requirements of the workplace in the 21st century. Specifically, the study sought to answer the following specific questions:

1. What ITE skills should millennial generation need to develop?
2. How does the AI technology in the ITE curriculum respond to the need of the millennial generation?

II. METHODOLOGY

The study utilized the systematic review of literature. The objective of a systematic review is to satisfy specific questions, based on an evident, organized and replicable search strategy, with inclusion and exclusion criteria identifying studies to be included or excluded (Gough, Oliver & Thomas, 2017). This study therefore determined skills needed by the millennial generation in the 21st century which can be integrated in the Information Technology Education (ITE) Curricula of Studies to ensure its relevance and responsiveness to the requirements of the workplace in the 21st century. Seventy-five (75) articles were identified from the databases. Data was separated from included studies, in order to synthesize discoveries and to shed light on their application in IT workforce, as well as differences. This study mapped 20 articles finally chosen on the topic of artificial intelligence in higher education.

Search Strategy

The primary search string (Figure 2) and criteria (Figure 3) for this systematic review included peer-reviewed articles in English, reporting on artificial intelligence within education at any level, and indexed in five international databases; EBSCO Education Source, Web of Science, Academia, Google Scholar, and Scopus (covering titles, abstracts, and keywords). While there are apprehensions about peer-review processes within the scientific community (Smith, 2006). Articles in this review were limited to those published in peer-reviewed journals, due to their general trustworthiness in academia and the rigorous review processes undertaken (Nicholas et al., 2015). Likewise, search terms used were Artificial intelligence, education level and learning setting. The search was undertaken in October 2019, with initial 75 records identified.

Topic	Search terms
Artificial intelligence	“artificial intelligence” OR “machine intelligence” OR “intelligent support” OR “intelligent virtual reality” OR “machine learning” OR “automated tutor” OR “intelligent agent” OR “expert system” OR “natural language processing” OR “ITE Curriculum” OR “AI Application Tool” OR “ITE Education”
AND	
Education level	“higher education” OR “college” OR “undergrad” OR “graduate” OR “postgrad” OR “corporate training” OR “professional training”
AND	
Learning setting	“Learn” OR “Student”

Figure 2: Primary Search String

After duplicates were removed, the inclusion and exclusion criteria were utilized. The researcher decided to limit articles to those published during or after 2013. Among the inclusion criteria were those published in English, discussing applications of artificial intelligence in higher education. After considering all the inclusion and exclusion criteria, there were 20 literatures left for data extraction.

Inclusion Criteria	Exclusion Criteria
Published 2013 – Nov 2019	Published before 2013
English	Not in English
Higher education	Not higher education
Empirical, primary research	Not primary research (e.g., review)
Indexed in Web of Science, Scopus or EBSCO Education Source, Academia	Not a journal article
	No artificial intelligence
Artificial intelligence use in education	No learning setting

Figure 3: Final Inclusion and Exclusion Criteria

Data Extraction

In order to extract the data, the researcher made use of a matrix. Each of the references is listed along with the identified like skills needed by the millennial generation in the 21st century and those that can be integrated into the ITE curriculum. Content analysis was used to group the data before it was analysed.

III. RESULTS AND DISCUSSION

From the initial 75 literatures identified, 20 literatures were finally reviewed for the skills needed by the millennial generation in the 21st century, that can be integrated into the ITE Curriculum.

1. ITE skills should millennial generation need to develop

The skills needed to thrive in the 21st century are: Complex Problem Solving, Critical Thinking, Creativity, People Management, Coordinating with Others, Emotional Intelligence, Evaluation and Decision Making, Service Orientation, Negotiation, and Cognitive Flexibility (Jensen, 2019).

Complex Problem Solving: Skills are needed to craft creative IT solutions to problems in the IT industry to keep up with AI machines.

Critical Thinking: Is the ability to think logically, clearly and rationally in order to understand the logical connection of ideas.

Creativity: Is the act of turning new and imaginative ideas into reality.

People Management: We know that Robots can't replace human beings therefore there's a need of human beings intervention in terms of leadership and managerial roles that require human skills.

Coordinating with Others: Communication and team collaboration skills is very much needed among job candidates who intend to apply in the IT industry.

Emotional Intelligence: Empathy and curiosity is the qualities related to emotional intelligence are the factors needed in hiring future managers.

Evaluation and Decision Making: Is the skills needed in the information age in order to compress huge amounts of data, into a intuitive interpretations and to measure decisions.

Service Orientation: Is someone who knows how to value clients in the form of services and assistance. This is an important factor to be considered in order to provide solutions to the problems of society.

Negotiation: The skill needed in order to survive in an affected industry is someone who knows how to negotiate to businesses and individuals to come up with a win-win situation. y.

Cognitive Flexibility: Is someone who can easily adopt and shift between different persons personality

in order to accommodate the challenges among industries.

2. AI technology in the ITE curriculum respond to the need of the millennial generation

The focus now is to integrate AI technology in the ITE curriculum. AI works by merging huge amounts of data, iterative processing and intelligent algorithms, by allowing the software to learn automatically from patterns or features of the data. AI is a comprehensive field of study that includes many theories, methods and technologies. The following courses are proposed to be embedded in the ITE curriculum:

Machine Learning - Uses techniques from neural networks, statistics, operations research and physics to discover hidden insights in data without explicitly being manipulated from where to view or what to conclude.

Neural Network - A machine learning that is made up of interconnected units (like neurons) that processes information by responding to external inputs, relaying information between each unit.

Deep Learning - Uses huge neural networks with many layers of processing units, taking advantage of advances in computing power and improved training techniques to learn complex patterns in large amounts of data.

Cognitive Computing - A subfield of AI that strives for a natural, human-like interaction with machines.

Computer Vision- Relies on pattern recognition and deep learning to recognize what's in a picture or video.

Natural Language Processing (NLP) - The ability of computers to analyze, understand and generate human language, including speech. The next stage of NLP is natural language interaction, which allows humans to communicate with computers using normal, everyday language to perform tasks.

Moreover, the need to modernize resources used to enhance the capability of the teachers and the learners. There's a need for the university to expose the teachers for further studies and trainings on the technologies that support AI in order to implement the enhance curriculum.

SAS Institute insights (2019), the following technologies were identified and to be imbedded in the ITE curriculum like;

Graphical processing units - Are key to AI that provides the heavy computer power that is required for iterative processing.

The Internet of Things - It generates massive amounts of data from connected devices.

Advanced Algorithms - Are being developed and combined to analyze more data faster and at multiple levels. This intelligent processing is the key to identify and predict rare events, understand complex systems and optimize unique scenarios.

APIs, or application programming interfaces. Are movable packages of code that make it possible to add AI functionality to existing products and software packages. AI will provide human-like interactions with software and offer decision support for specific tasks, but it's not an alternative for humans (SAS Institute insights, 2019).

IV. CONCLUSION

Integration of AI in the ITE Curriculum entails understanding of its features, awareness of skills of the 21st century and realignment of the courses offered to the needs of the IT workplace.

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