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ORIGINAL

Prognosis of artificial intelligence in education

Pronóstico de la inteligencia artificial en la educación

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ABSTRACT

The Higher Education Institutions require emphasis on disruptive intelligent systems which includes Artificial Intelligence that challenges conventional methods with improved products and services. This study aimed to know the trend artificial intelligence in engineering education. Specifically, it aimed to know the profile of the respondents, know the level of utilization of artificial intelligence tools in engineering education, know if there is significant relationship between profile of respondents to the AI tools used in engineering education, and propose a model of artificial intelligence in engineering education. This paper used quantitative correlational methods of research. Result showed that majority of the respondents has more work experience, found that most teachers have five years or more of experience and found that in terms of educational attainment, majority of the respondents had master's degree. Artificial intelligence tools are generally "Sometimes Utilized" in engineering education and the respondents' profiles had no significant relationship on the use of the AI technologies, which are often occasionally used in engineering education. To fully utilize AI capabilities in engineering education, the model achieved offers a number of particular actions, including institutional in-house training, awareness campaigns, research conferences, and informal information exchange.

Keywords: Artificial Intelligence; AI in Education: Engineering Education.

RESUMEN

Las Instituciones de Educación Superior requieren énfasis en sistemas inteligentes disruptivos que incluyan Inteligencia Artificial que desafíe los métodos convencionales con productos y servicios mejorados. Este estudio tuvo como objetivo conocer la tendencia de la inteligencia artificial en la educación en ingeniería. En concreto, se buscó conocer el perfil de los encuestados, conocer el nivel de utilización de herramientas de inteligencia artificial en la educación en ingeniería, saber si existe relación significativa entre el perfil de los encuestados con las herramientas de IA utilizadas en la educación en ingeniería, y proponer un modelo de inteligencia artificial. La inteligencia en la enseñanza de la ingeniería. Este artículo utilizó métodos de investigación correlacionales cuantitativos. El resultado mostró que la mayoría de los encuestados tiene más experiencia laboral, encontró que la mayoría de los maestros tienen cinco años o más de experiencia y encontró que, en términos de nivel educativo, la mayoría de los encuestados tenía una maestría. Las herramientas de inteligencia artificial generalmente se "utilizan a veces" en la educación en ingeniería y los perfiles de los encuestados no tenían una relación significativa con el uso de las tecnologías de IA, que a menudo se utilizan ocasionalmente en la educación en ingeniería. Para utilizar plenamente las capacidades de la IA en la educación en ingeniería, el modelo logrado ofrece una serie de acciones particulares, que incluyen capacitación institucional interna, campañas de concientización, conferencias de investigación e intercambio informal de información.

Palabras clave: Inteligencia Artificial; IA en la Educación: Educación en Ingeniería.

INTRODUCTION

The Sustainable Development Goals, contained in the United Nations 2030 Agenda, provide a foundation for transformation of the global economies towards sustainable development. Accordingly, economic development should be in congruence with social equality and within ecological boundaries. As vital stakeholders for a global sustainable development, industrial organizations have to emphasize on sustainable value creation. Industry 4.0, or fourth industrial revolution, a concept observed since the 2010s, could positively contribute to a sustainable development in several circumstances.

The requirements on engineering education alter with a growing demand from the industry to urge the transformation of Industry 4.0. Industry 4.0 is becoming a compulsory standard in several industries, thus, there should be radical transformations in the educational system. Industry 4.0 could allow smarter connection and learning between and among machines and products, allowing intelligent, cost-effective, personalized and customized production at reasonable cost. Thus, Higher Education Institutions in many countries require emphasis on disruptive intelligent systems.

Production of conceptual architectural designs using GCN (Graph Convolutional Network) and GAN (Generative Adversarial Network) Algorithms; Automated detection of spaces in an architectural floor plan using DeepLabV3+ Algorithm; Prediction of damage index of concrete using ANN (Artificial neural network) Algorithm; Prediction of tensile strength of concrete using ANN and SVM (Support Vector Machine) Algorithms; Prediction of fatigue strength of steel using XGBoost (Extreme Gradient Boosting) Algorithm.

Within the future production environments, engineers and skilled workers will be dependent on data collected from AI-based assistance systems while developing data-based solutions for complicated employment concerns. In this respect, integration of current developments in AI and natural language processing could be of specific significance for engineering education. (Lensing & Haertel, 2020) Moreover, artificial intelligence in engineering education should not only be about the use of innovative resources to solve certain engineering problems. It should be about applying artificial intelligence techniques and resources for advancing the teaching-learning process in higher education, in connection with scientific-technological research (Nuñez & Lantada, 2020). Findings identified several drawbacks and difficulties with the employment of AI by teachers, including its insufficient dependability, technical capability, and applicability in various contexts and to increase the capabilities of AI systems utilising multimodal data, more effort is required (Celik, Dindar, Muukkonen, & Jarvela, 2022). The artificial intelligence concept has encountered some difficulties as an emerging technology, including issues with quality, stimulating technology addiction, high delivery costs, unemployment, people who control AI have a lot of authority, reducing the capacity to multitask, etc (Kandamby, 2021). However, AI has two opposing sides, and as a result, we also examine major issues brought on by the use of AI in education, including poor algorithm design, a lack of labelled data, an excessive reliance on technology, and inaccurate security guarantees (Qin & Wang, 2022). In addition, there are challenges the teachers faced as study revealed the difficulties in evaluating AI's efficacy in education and the technological difficulties in creating AI applications (Chan & Zary, 2019).

Objective

This study aimed to know the trend artificial intelligence in engineering education.

Specifically, it aimed to:

- Know the profile of the respondents in terms of years of teaching experience, trainings and seminars attended, and educational attainment.
- Know the level of utilization of artificial intelligence tools in engineering education.
- Know if there is significant relationship between teaching experience, educational background and seminars attended of the respondents to the AI tools used in engineering education.
- Propose actions towards the utilization of artificial intelligence in engineering education.

METHOD

This paper used quantitative correlational methods of research. It focused on identifying the level of utilization of artificial intelligence tools in engineering education in higher education. This correlates the relationship between profile of respondents and level of utilization of artificial intelligence tools in engineering education. Correlational studies are designed to help determine the relationship to which different variables are related to each other. Quantitative research is the process of gathering and interpreting numerical data is known as. With a correlational research design, relationships between variables are examined without any of the variables being under the researcher's direct control or manipulation (Bhandari, 2022).

Conceptual Framework

This research is based on the idea that the level of utilization of artificial intelligence tools in engineering education are identified through identification of the knowledge of the teachers with regards to their current practices on artificial intelligence as utilized in engineering education. On this occasion, we were able to determine the level of utilization of artificial intelligence in engineering education in universities.

The respondents of this study are the engineering instructors working in higher institutions. They were asked on the level of utilization of artificial intelligence tools in engineering education.

Paradigm

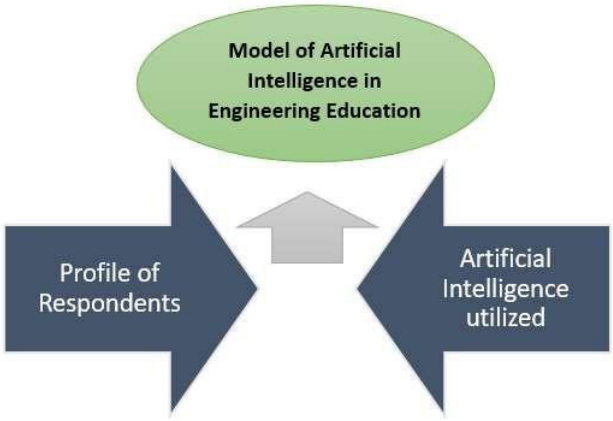

Figure 1. The diagram diagram on the relationship between the independent and dependent variables

Artificial intelligence tools utilized in engineering education

As seen in table 1 below, artificial intelligence technologies are often "Sometimes Utilised" (GRAND MEAN = 3,28) in engineering education. The results partially corroborate Zhang & Aslan's (Zhang & Aslan, 2021) findings, which indicated that artificial intelligence (AI) technology is advancing quickly and that its use in education is anticipated to increase sharply in the near future, despite not being used often or extensively.

The table 1 and figure 2 make clear that three-fourths of the AI technologies the research found are only "sometimes utilised." The remaining 25 % are classified as "Often utilised." They are all not "Rarely utilised." There are none that are "Extremely utilised." There isn't one that is "Never utilised."

With an average weighted mean (AWM) of "4,07" "Computer Aided Software"—such as AutoCAD, MathCAD, SAP, ETABS, STAAD, GIS, Photoshop, etc.—was found to be "Often utilised." This runs counter to research by Rabiu and Ajelabi (Rabiu & Ajelabi, 2020), which found that at Nigerian TVET undergraduate tertiary institutions, CADD software is not given as much weight during technical drawing sessions. Nonetheless, this is consistent with the findings of Kösa & Karakuş (Kösa & Karakuş, 2018), who reported that the development of engineering students' spatial visualisation abilities can be facilitated by a CAD-based engineering drawing module, and that the ability to visualise spatially can be a predictor of success in a computer-aided engineering drawing module.

"Grading Automation Tools" received the second-highest AWM of "3,93" and are "Often utilised." Examples of these tools include Google Classroom, Alma Gradebook, GradeBook Pro, Teacher gradebook spreadsheet templates from Microsoft, etc. This partially corroborates the findings of Samarakou et al. (Samarakou, Fylladitakis, Prentakis, & Athineos, 2014), who found that artificial intelligence-based assessment in engineering laboratory education can incorporate qualitative evaluation because it can save instructors' time by requiring a varied and multidimensional assessment of laboratory students instead of having them grade the exercises by hand.

"Learning Management Systems" (AWM: 3,87) are "often utilised" and include CANVAS, Moodle, Blackboard Learn, and Schoology. This validates the results of the majority of students agreed or were neutral about the efficacy of the online learning management system in providing engineering education at a few private higher education institutions in Pampanga, Philippines, according to Punsalan et al. (Punsalan, Silva, Manzon, & De Lara, 2022). This corroborates the findings of Al-Hunaiyyan, et al. (Al-Hunaiyyan, Al-Sharhan, & AlHajri, 2020), who found that, in comparison to the more sophisticated interactive learning activities, instructors were generally at ease and had positive opinions about the Learning Management System (LMS) Moodle.

The fourth-highest AWM of "3,57" was awarded to "Staff Scheduling and Substitute Management," which includes tools like Connecteam, Google Sheets, Google Calendar, Homebase, upgraded online system, etc. and is "Often utilised." The results partially corroborate Silva Rocha's (Silva Rocha, 2013) findings, which indicate that using an automated scheduling model may improve the effectiveness and efficiency of the staff scheduling

process, resulting in increased production and profitability.

With an AWM of 2,59, "Learning Aids for Students with Special Needs" received the lowest rating and are only "sometimes utilised." This finding has some relevance to a study by Spingola (Spingola, 2018), which found that there is little research being done on engineering education at the graduate and college levels.

The second-lowest AWM of 2,59 went to "Virtual Reality Tools," which include 3D simulations and virtual field trips, and are only "occasionally used." One of the problems with virtual reality technology, according to Abulrub et al. (Abulrub, Attridge, & Williams, 2011), is that the accompanying expenses have proven to be too high for educational institutions. "Chatbots for Enrolment and Retention" is "Sometimes utilised" and has the third lowest AWM (2,78). This partially runs counter to the results of Mageira et al. (2022), who found that studying foreign languages and cultural material concurrently may benefit from the usage of AI chatbot technology for interactive ICT-based learning.

The following AI tools were mentioned by study participants as additional ones they use to teach engineering: teams, Google Platforms, Matlab, Virtual Reality in Inspection, MS Office Applications, Zoom Meeting Apps, Research and Innovation Laboratory, Virtual Learning Environment, Google Meet, and chain management.

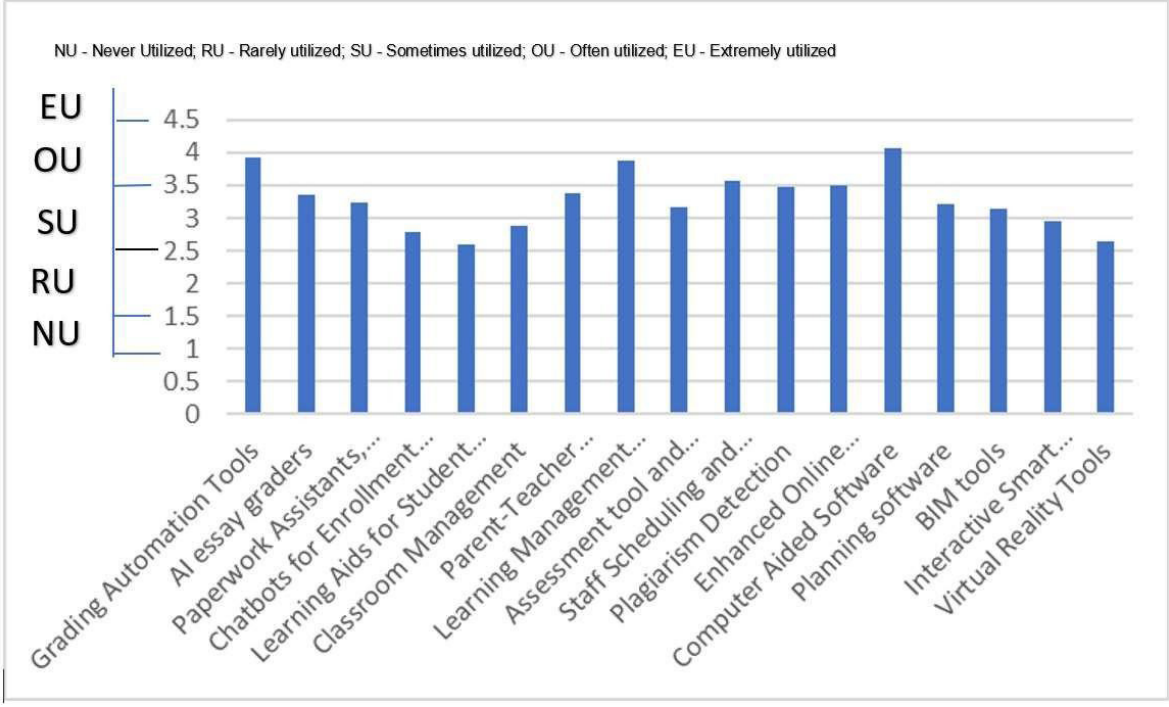

Figure 2. Utilization of AI Tools in Engineering Education

Relationship between profile of the respondents and the ai tools used in engineering education

The table 2 shows the p values between the profile of respondents in terms of years of experience, seminars attended, educational attainment, and the Artificial Intelligence Tools Utilized in Engineering Education. This implies that there is insufficient evidence to support the claim on significant relationship between the profile of respondents and the AI tools used in teaching. Although there is no significant relationship, Fourtane (2021), cited that leaders in higher education who are aware of the advantages of AI have a duty to give their organization that AI will be able to evaluate students, offer feedback, and test scientific theories just as effectively as a person (Fourtane, 2021).

In terms of years of teaching of experience, it has no significant relationship to the AI tools used in teaching. It implies that whether you are a newbie teacher or an experienced teacher doesn't relate to the use of AI tools in engineering education. Contrary to Irvine's (2019) study, which found a link between teachers' performance and years of teaching experience (Irvine, 2019). In addition, seminars attended also do not have significant relationship to the AI tools used in teaching. This goes against the findings of the Essien et.al (2016) which found a weak but favorable correlation between instructors' attendance at seminars, workshops, and in-service training sessions and their students' academic achievement (The Influence of In-Service Training, Seminars and Workshops Attendance by Social Studies Teachers on Academic Performance of Students in Junior Secondary Schools Incross River State, Nigeria, 2016). In addition, schools has to focus trainings on AI as it's time for universities to reconsider how they function, how they teach, and how they'll interact with AI solutions in the future (Popenici & Kerr, 2017).

Table 1. Information

AI Tools	5 Extremey utilized[1]		4 Often utilized[2]		3 Sometimes utilized[3]		2 Rarely utilized[4]		1 Never utilized[5]		Average Weighted Mean	Interpretation
	n	%	n	%	n	%	n	%	n	%		
1 AI essay graders	9	20 %	14	30 %	11	24 %	8	17 %	4	9 %	3,35	Sometimes utilized
2 Paperwork Assistants, iScanner etc	7	15 %	14	30 %	13	28 %	7	15 %	5	11 %	3,24	Sometimes utilized
3 Chatbots for Enrollment and Retention	3	7 %	13	28 %	13	28 %	5	11 %	12	26 %	2,78	Sometimes utilized
4 Learning Aids for Student with Special Needs	2	4 %	11	24 %	11	24 %	10	22 %	12	26 %	2,59	Sometimes utilized
5 Classroom Management	4	9 %	13	28 %	8	17 %	16	35 %	5	11 %	2,89	Sometimes utilized
6 Parent-Teacher Communication	9	20 %	17	37 %	8	17 %	7	15 %	5	11 %	3,39	Sometimes utilized
7 Learning Management Systems	19	41 %	13	28 %	6	13 %	5	11 %	3	7 %	3,87	Often utilized
8 Assessment tool and gamification for Enhanced Student Engagement	5	11 %	16	35 %	12	26 %	8	17 %	5	11 %	3,17	Sometimes utilized
9 Staff Scheduling And Substitute Management	16	35 %	9	20 %	9	20 %	9	20 %	3	7 %	3,57	Often utilized
10 Plagiarism Detection	14	30 %	12	26 %	8	17 %	6	13 %	6	13 %	3,48	Sometimes utilized
11 Enhanced Online Discussion Boards	11	24 %	14	30 %	10	22 %	9	20 %	2	4 %	3,50	Sometimes utilized
12 Computer Aided 21 Software		46 %	13	28 %	7	15 %	4	9 %	1	2 %	4,07	Often utilized
13 Planning Software	8	17 %	13	28 %	11	24 %	9	20 %	5	11 %	3,22	Sometimes utilized
14 BIM tools	9	20 %	11	24 %	10	22 %	9	20 %	7	15 %	3,13	Sometimes utilized
15 Interactive Smart Whiteboard	8	17 %	9	20 %	13	28 %	5	11 %	11	24 %	2,96	Sometimes utilized
16 Virtual Reality Tools	2	2 %	9	20 %	16	35 %	9	20 %	10	22 %	2,65	Sometimes utilized

Lastly. Educational attainment has no significant relationship to the AI tools used in teaching. This suggests that the educational background of the teachers—whether they have a doctorate or only a bachelor's degree—has little bearing on how effectively they employ AI tools in engineering education. This is similar to the study of, that few teachers believe that artificial intelligence has little to no bearing on the professional growth of teachers

Table 2. Pearson's Correlation Coefficient performed between profile of respondents and Artificial Intelligence Tools Utilized in Engineering Education

Profile of Respondents	Artificial Intelligence Tools Utilized In Engineering Education	Interpretation
Years of Experience	0,345	Not significant
Seminars Attended	0,183	Not significant
Educational Attainment	0,978	Not significant

Model of artificial intelligence in engineering education

the figure 3 below showed the proposed model in the utilization of artificial intelligence tools in engineering education, Engineering instructors utilized the Artificial Intelligence tools as sometimes and often. Among the tools that are sometimes utilized are the following: enhanced online discussion board, Plagiarism Detection, Paperwork assistance, Planning and BIM Software, AI essay graders, Chatbots for enrolment and retention, Classroom management and assessment tool, Learning aids for students with special needs, Parent teacher

communication, Interactive smart whiteboard and VR tools. On the other hand, among the tools that are often utilized by the instructors include Campus Aided software, Grading Automation Tools, Learning Management System, Staff Scheduling and Management Substitute. According to Nuñez and Lantada (2020), the concept "artificial intelligence-aided engineering education" describes the use of resources and techniques from artificial intelligence to enhance the teaching-learning process in higher education, particularly in relation to scientific-technological studies (Nuñez J. L., 2020).

To improve the utilization of the artificial intelligence tools used in engineering education, the following actions are to be considered. According to the study of Nebrida et.al (2022), institutional in-house training, informal sharing and discussion with colleagues, and continuing professional growth are the mechanisms used to solve the issues in addressing hybrid mode of teaching (Nebrida & Bangud, 2022).

1. **Continuing professional development.** It is a must for engineers working in the academe to pursue professional development for them to keep abreast with the new trend of artificial intelligence tools used in engineering education.
2. **Awareness campaign.** Such action is significant in disseminating information that help enhance the understanding and appreciation of engineering instructors in the utilization of artificial intelligence tools used in engineering education.
3. **Research conference involvement.** Involvement in conferences is a good opportunity to learn new tips from experts in utilizing the AI tools to improve the engineering students' learning experiences.
4. **Informal knowledge sharing.** Sharing of experiences often occurs during informal conversations which provides genuine ideas in utilizing the AI tools for educational purposes.
5. **Institutional in-house training.** The institution has the opportunity to provide a training program to address the needs of engineering instructions in utilizing the AI tools.

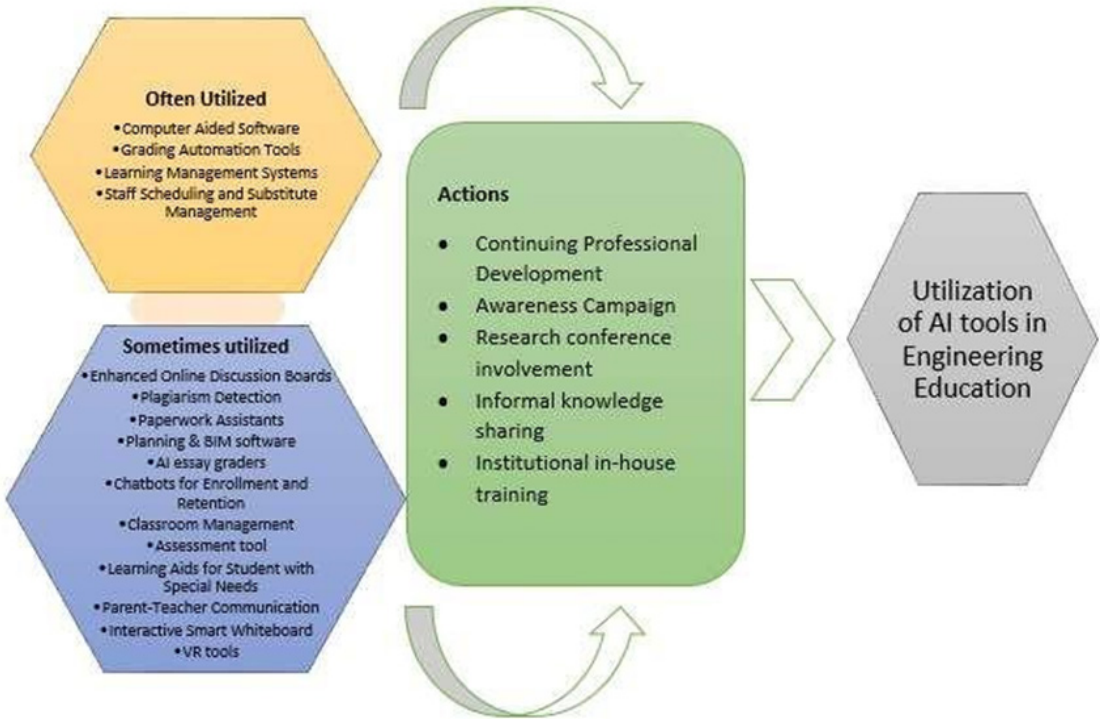

Figure 3. Proposed Actions in the Utilization of Artificial Intelligence Tools in Engineering Education

CONCLUSIONS

The purpose of this study determined the trend of artificial intelligence in engineering education. Result showed that majority of the respondents has more work experience, found that most teachers have five years or more of experience and found that in terms of educational attainment, majority of the respondents had master's degree. This implied that majority of respondents are well experienced teachers with relevant educational attainment.

The respondents' profiles had no significant relationship on the use of the AI technologies, which are often occasionally used in engineering education. Contrary to the study of that the learning of AI-assisted courses is strongly dependent on course role cognition, and the construction of role cognition is related to the understanding of course content, teaching methods, and activity methods To fully utilize AI capabilities in engineering education, the model achieved offers a number of particular actions, including institutional in-house training, awareness campaigns, research conferences, and informal information exchange. According to

both teachers and students who participated in the study strongly advocate for the optimistic use of AI in the classroom.

RECOMMENDATIONS

The following suggestions are being put forth following a thorough analysis of the study's findings:

1. It is advised to conduct further study on the relationships between respondents' profile and artificial intelligence' trend in general education not only engineering and in just one institution using mixed design method of research.
2. Awareness campaigns on AI tools can be conducted among Higher Education Institutions offering engineering programs. The campaigns can focus on the importance of AI in engineering education, level of utilization of AI tools in engineering education and the types of AI tools. These can also include workshops on the use of AI tools, with emphasis on those which are "Sometimes utilized". Attendees of the awareness campaigns and workshops can share their knowledge and skills to their colleagues.
3. It is also recommended that the model be adopted by the engineering educators to improve the level of utilization of the artificial intelligence tools used in higher education institutions.
4. Lastly, the researchers recommend that the continuing professional development, dissemination of information, knowledge sharing, and trainings be provided by the institution to the faculty members in the field of engineering.

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FINANCING

None.

CONFLICT OF INTEREST

None.

AUTHORSHIP CONTRIBUTION

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