Teaching practices among engineering lecturers with and without professional engineer certification: The case of Universiti Teknologi Malaysia (UTM)

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Abstract

This paper describes the teaching practices among engineering lecturers with professional engineer certification at Universiti Teknologi Malaysia (UTM). Employing a case study design, this study optimised both quantitative and qualitative data. Questionnaires were distributed to 20 lecturers from various engineering faculties who agreed to be the research participants. From the 20 lecturers, five lecturers with professional qualifications (Professional Engineer, Chartered Engineer) participated in the interviews. Questionnaires were also distributed to the students of these lecturers to compare the teaching approaches of the lecturers with and without the professional engineer certification. The analysis of the quantitative data was conducted using SPSS software, while the qualitative data was analysed using NVivo software. Results were obtained from Spearman's test and t-test, as well as from the thematic analysis. From the presented results, the finding could be OBE (outcome-based education) is the most preferred NALI approach for the professional engineer (PEng) lecturer implemented in their teaching and learning processes.

Keywords: Teaching and learning practices, Engineering lecturers, NALI model, Professional certification, Accreditation.

Introduction

In recent years, higher education institutions, especially in Malaysia, have carried out many seminars and trainings for lecturers to focus on effective pedagogical approaches required in teaching and learning in the classroom. This effort is in line with the learning outcomes that are highlighted in universities nowadays (Hamdan et al., 2014). Not to mention, technology and digital transformation, especially in the 21st century era, are focusing more on physical, digital, and biological systems that disrupt lifestyles, businesses, and industries with regards to skills, talents, and jobs (Helmi et al., 2019). Thus, relevant teaching and learning approaches are important to improve students learning in order to conceptualise phenomena and ideas in order to become skilled scientists, mathematicians, historians, physicians, or other experts. 'Good teaching' has always been the focus of most universities in order to produce high-quality student learning (Biggs, 2003; Hamdan et al., 2014).

As for it is, back in 2009, Malaysia was chosen to become a full member of the Washington Accord; a universal agreement among bodies handling engineering degree programme accreditation. The Washington Accord recognises signatory bodies and makes it compulsory to meet the engineering instructional requirements before entering engineering practice in real life. The Engineering Accreditation Council (EAC) in Malaysia, a group that was delegated by the Board of Engineers Malaysia (BEM), the Institution of Engineers Malaysia (IEM), Public Services Department (JPA) and the Malaysian Qualifications Agency (MQA), among the bodies that offered professional engineer certification in engineering curriculum. It is a very challenging situation for academicians who must master 'killer

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subjects' in engineering and have many skills, not to mention critical thinking skills. At the same time, it has a good-quality curriculum that can meet the requirements (Ditcher, 2001; Puzi et al., 2017). Particularly at Universiti Teknologi Malaysia (UTM), the New Academia Learning Innovation model (NALI) has been implemented for many years (Alias & Aris, 2016).

In tandem with this development, this study examined the teaching practices in relation to the NALI model among engineering lecturers with professional engineer certification at Universiti Teknologi Malaysia (UTM). This study employed both quantitative and qualitative data that were collected among lecturers in various faculties of engineering at UTM. The analysis of the quantitative data was conducted using SPSS software, while the qualitative data was analysed using NVivo software. Findings that were obtained from the two types of analysis, the discussions based on the findings, and recommendations for future work are also explained in this paper.

Literature Review

The review of literature is confined within the scope of accreditation and its requirements for professional engineer certification, the NALI model, as well as the current teaching and learning technology.

(i) 21st Century Education

For this year and beyond, technological, and digital advancements have dramatically improved, indicating the beginning of Industry 4.0. Physical, digital, and biological industries were thoroughly utilized for their benefits and high ends in this era. Our lives, enterprises, and industries have evolved to accommodate this occurrence. This 21st-century world has a significant impact on the development of human skills and talent, as well as the employment required in the global era (Helmi et al., 2019). To adapt to this change, it is necessary to enhance education so that future generations can prepare for future requirements.

(ii) Accreditation and New Academia Learning Innovation (NALI)

The International Engineering Alliance (IEA) is the primary organization for six multilateral agreements that establish and administer internationally benchmarked standards for engineering education and entry-level engineering practice among their members. Their vision is to improve the global quality, productivity, and mobility of engineers by being a respected independent authority on best practices in engineering education and professional competence standards, assessment, and monitoring. The Washington Accord (WA) was thus constituted. WA is a self-governing, autonomous agreement between national organizations (signatories) that provides external accreditation to tertiary educational programmes whose graduates are qualified for entry into professional engineering practice. Malaysia joined Japan, Singapore, Chinese Taipei, and Korea as a full member of the Washington Accord in 2009 (International Engineering Alliance, accessed December 20, 2022).

Under the Registration of Engineers Act of 1967 (revised 2015), the BEM registers graduates and professional engineers. Meanwhile, BEM represents EAC in Malaysia for engineering degree accreditation. IEM, MQA, and JPA all represent the EAC. The purpose of accreditation is to ensure that graduates of accredited engineering programmes satisfy the minimal academic requirements for registration with the BEM as a graduate engineer. In addition, the purpose of accreditation is to ensure that institutions of higher education (IHLs) practice continuous quality improvement (CQI). Accreditation may also function as a benchmarking tool for engineering programmes offered by Malaysian IHLs. 30% of the lecturers/instructors must have a professional/industrial/specialist certification or at least TWO (2) years of relevant industrial work experience. If this is not met, the institution should have a staff industrial attachment scheme in place). It is challenging for academicians to implement engineering and critical thinking skills as well as mastery of a high-quality curriculum that can satisfy the requirements (Board of Engineers Malaysia; Puzi et al., 2017, Engineering Technology Programme Accreditation Standard 2020).

In addition to meeting accreditation requirements, universities must prioritize teaching and student recruitment. Effective instruction and interactive learning are more engaging and can motivate students to achieve a high level of comprehension during the lecture. Systematic strategies in teaching and digitalizing the teaching could thereby help reduce the limitations of conventional teaching methods. The New Academia Learning Innovation (NALI) was introduced on this basis. In 2010, academic performance audit panels advised UTM to prioritize effective and high-quality instruction alongside research disciplines. This is consistent with the National Higher Education Strategic Plan Phase 2 (2011-2015), which requires lecturers to implement at least one teaching technique by 2015. Included are Harvard Business School (HBS) case research, problem-based learning, scenario-based learning, peer instruction, service learning, and job creation (pedagogy and andragogy). Ujang et al. (2013) identify the UTM Open Courseware (OCW), UTM-MIT BLOSSOMS, Student-to-Student Edutainment, Video of Exemplary Professionals, OBE analysis systems, and SCL UTM space as digital teaching resources. Nonetheless, in 2016, these techniques were refined and grouped into 15 approaches: outcome-based education (OBE), case study teaching, problem-based learning (PBL), scenario-based learning (SBL), peer

instruction, service learning, job creation, high-impact educational practices (HIEPs), and conceptualize, design, implement, and operate (CDIO) for pedagogy and andragogy. In addition, learning materials (digital resources) include UTM Open Courseware (OCW), UTM MOOC, UTM-MIT BLOSSOMS, Video of Exemplary Professionals, Student-to-Student Edutainment, and UTM e-Learning (Alias & Aris, 2016; Lazim et al., 2023).

(iii) Teaching and Learning Technology

Traditional teaching and learning techniques do not emphasize learning, critical reasoning, or interaction. The teacher itself is the only resource for reference and gathering information, beside the books in the library. Students rarely involved with learning on their own. This will result in passive learning and hinder the student's ability to engage in active study. Currently, technology is ubiquitous. The new generation is growing up in a technological environment and inhabiting it. Computers and other mobile technologies have altered how information is gathered in educational institutions. The technological skills we possess provide us with profound insights into the course material. It increases the effectiveness of the instructional lesson period in the classroom (Roy, 2019; Harnish et al., 2018).

In such a scenario, educational technology becomes increasingly prevalent. Educational technology is the process of analyzing, designing, developing, implementing, and evaluating the instructional environment and learning materials for the purpose of enhancing teaching and learning. The purpose of such works is to improve education or the learning process, and the application of technological tools in teaching and learning will help students become interested, engaged, and motivated by providing multiple resources, quick access to information, real-time teaching, and paperless tests and assignments (Kurt, 2015; Castagna, 2021; Hasa, 2020).

Research Questions

Based on the literature review, this study focused on the outcomes of implementation of NALI techniques among the engineering lecturers with professional engineer certification. Three research questions were formulated as the following:

Research Question 1: What is the relationship between lecturers with professional engineer certification and teaching and learning based on NALI model?

Research Question 2: What is the teaching and learning approaches applied by lecturers with professional engineer certification?

Research Question 3: Is there any difference between lecturers with and without professional engineer certification in teaching and learning approaches?

Research Methodology

Research Design and Sampling

In this study, the researchers employed a case study design to explore the implementation of NALI techniques among the lecturers from the engineering faculties at UTM. A case study design was chosen for this study as it allowed the researchers to specifically examine the teaching and learning experiences that were in line with the NALI model with a purposive sample involving UTM engineering lecturers and with extensive data collection and analysis. Thus, this became the bounded unit that was central to the study (Bassey, 1999).

Initially, the researcher distributed an online questionnaire to the lecturers with and without professional engineer certification. Professional engineer certification refers to the awards given to the lecturer both by Board of Engineers Malaysia (BEM) and Chartered Engineer (CEng), Incorporated Engineer (IEng), and Engineering Technician (EngTech) by Engineering Council, UK (Khulief, 2002). However, for our cases, we focus on graduated engineer by BEM, Chartered Engineer, and Professional Engineer by EC UK. Next, lecturers with professional engineer certification were invited to further collaborate with the researchers, and upon granting their agreement and consent, they participated in the interview session. In addition, their students were also invited as participants in the study and eventually took part in the survey study conducted at the end of the study.

Prior to the interviews, a brief introduction related to the study background and purpose was explained, and the consent forms were distributed to the lecturers with professional engineer certification. A total of 20 lecturers with professional certification answered the questionnaires. In addition, online and face-to-face interviews were conducted with five lecturers who volunteered to be the interviewees. Each session lasted from 15 to 25 minutes. The interviews were audio recorded and later transcribed. With the permission of these lecturers, a survey was conducted among their respective students. A total of 134 students who took part in the survey answered the questionnaires that were distributed to them.

The designed questionnaires were distributed to the lecturers of the Faculty of Civil Engineering (FCE), the Faculty of Electrical Engineering (FEE), the Faculty of Mechanical Engineering (FME), the Faculty of Chemical and Energy Engineering (FCEE), and the Malaysia-Japan International Institute of Technology (MJIIT), Universiti Teknologi Malaysia, Malaysia. However, the interviews were conducted among the lecturers at UTM Johor Bharu. The interview questions were developed both in Bahasa Malaysia and English in order to elicit congruent findings for lecturers. Qualitative and quantitative data collections were conducted between September and November 2022.

This study was not without limitations. Firstly, during the study, the country was in the process of recovering from COVID-19. During the pandemic, the periods of Movement Control Order (MCO) affected campus activities, which included academic activities, recreational activities, and others. Inevitably, the researchers found it challenging to reach out to the lecturers and students, which resulted in a low response rate. Secondly, this study was also affected by the semester breaks during which engineering lecturers were engaged in other activities like research fieldwork or industrial attachment. Due to these engagements, it was indeed a challenge to conduct interview sessions with the lecturers who initially agreed to be interviewed. Thus, the number of research respondents was not optimised. Thirdly, it was difficult to achieve the objectives of the study because lecturers are bound to their own tracks to be focused in their careers. For example, some lecturers have chosen a research track, and others are more interested in a teaching track. Thus, prior to the arraignments of the interviews, the researchers had to screen out the lecturers' career pathways, that is, whether they were focusing on the research track or the teaching track. In addition, it was found that most of the engineering lecturers approached were more bonded to the research track as compared to the teaching track. Therefore, in terms of teaching approaches, most lecturers were using the same teaching techniques. Thus, this limited the number of interviewees. Fourthly, the researchers also found that not many lecturers agreed to volunteer to be the interviewees. This could be due to COVID-19 safety and other unforeseen circumstances experienced by the lecturers. Such an occurrence delayed the data collection process. Despite all these challenges, the researchers successfully engaged with the chosen participants in order to obtain both quantitative and qualitative data.

Procedures of Data Collection

The research instrument used in this study was a set of questionnaires that were developed by Hamdan et al. (2014). On the other hand, the interview questions were developed by the researchers based on the conceptual framework of the NALI model. The questions are as below:

i. Which of the NALI techniques do you favour most implementing in your class? Why?
ii. What are the challenges and difficulties that you (the lecturer) face during the class session?
iii. Which of the challenges or difficulties do you find the most? For instance, time-consuming, energy-draining, or other reasons?
iv. How do you decide on any NALi technique that you will use in your class?
v. How do you identify ____ (based on their response) as a challenge?
vi. How do you overcome those challenges?
vii. What kind of support do you need to overcome the challenges?
viii. What kind of support do you get from your faculty in overcoming the challenges?

Findings

This section provides the findings derived from the three research questions. The results are presented based on the sequence of the research questions.

i) The relationship between lecturers with professional engineer certification and teaching and learning based on NALI model

The questionnaires were filled out by 37 engineering lecturers. 20 of the lecturers possess professional certification, while the remaining 17 do not. Five of the twenty certified lecturers consented to be interviewed by the researchers. The interview sessions took place both online and in-person. Spearman's rank correlation was utilised to determine the relationship between these two variables. The first variable in this study was the presence or absence of professional engineer certification among lecturers, while the second variable was teaching and learning based on the NALI model. Due to the fact that this study examined the relationship between two variables, the researchers were required to synchronise the number of participants for this test. Therefore, the total for each variable in this test is fixed at 17 respondents from both categories. The Spearman correlation results are tabulated in **Table 1**.

From the table, it can be seen that there was a positive correlation between two variables, $r(17) = .365$ and $.262$, $p < 0.01$, except for D vs di where, $r(17) = -.003$, $p > 0.05$ (negative correlation). This indicates that lecturers with professional engineer certification used at least one NALI teaching approach in the classroom, excluding digital mode, so it is possible that they are only using the most common and familiar platform, and not all of them. Since the implementation of NALI began in 2010, their influence on classroom teaching practices has likely been a result of their seniority within the UTM. In 2016, the approaches were expanded from twelve to fifteen projects (Ujang et al., 2013; Alias et al., 2016). Therefore, senior lecturers must have a greater understanding of NALI techniques than novice lecturers. It was also assumed that senior lecturers were less enthusiastic about educational technology than their novice colleagues. Therefore, this may explain why they did not implement digital teaching methods in their classrooms.

Table 1. Spearman's correlation for lecturers with IR vs. without IR

Correlations

			B	bi	C	ci	D	di
Spearman's rho	B	Correlation Coefficient	1.000	.365**	-.111	-.222**	.125	.077
		Sig. (2-tailed)	.	.000	.114	.001	.212	.439
		N	221	221	204	204	102	102
	bi	Correlation Coefficient	.365**	1.000	-.149*	-.066	.041	.049
		Sig. (2-tailed)	.000	.	.034	.346	.682	.621
		N	221	221	204	204	102	102
	C	Correlation Coefficient	-.111	-.149*	1.000	.262**	-.166	-.159
		Sig. (2-tailed)	.114	.034	.	.000	.096	.110
		N	204	204	204	204	102	102
	ci	Correlation Coefficient	-.222**	-.066	.262**	1.000	-.095	.114
		Sig. (2-tailed)	.001	.346	.000	.	.344	.254
		N	204	204	204	204	102	102
	D	Correlation Coefficient	.125	.041	-.166	-.095	1.000	-.003
		Sig. (2-tailed)	.212	.682	.096	.344	.	.973
		N	102	102	102	102	102	102
	di	Correlation Coefficient	.077	.049	-.159	.114	-.003	1.000
		Sig. (2-tailed)	.439	.621	.110	.254	.973	.
		N	102	102	102	102	102	102

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Legend: Larger capital alphabets- lecturers with professional engineer certification; small capital alphabets- lecturers without professional engineer certification

ii) The teaching and learning approaches applied by lecturers with professional engineer certification

Five lecturers with professional engineer certification from various faculties at Universiti Teknologi Malaysia, Johor were interviewed using a semi-structured format in order to understand more about their teaching strategies and challenges while interacting with students during class. The evaluations were conducted both in-person and via a web-based meeting platform. Three female and two male lecturers volunteered for the interviews. The duration of each interview session ranges between 15 and 25 minutes.

After identifying codes, sub-themes, and themes from the transcribed data, the results of the interview were interpreted. After the overall classification has been completed, homogeneous categories are determined based on the interview questions and their relationship to the codes. The codes are then transformed into sub-themes and themes that correspond with the research questions. The themes, sub-themes, and excerpts from the lecturer's interview are displayed in **Table 2**.

Six themes were derived from the thematic analysis, as explained below:

a) Knowledge: It needs to be highlighted in the research. Since 2010 (Ujang et al., 2013), the knowledge of NALI techniques has been implemented in the teaching and learning process at UTM. In addition, it is essential to consider the factors that may influence the implementation of various techniques at different engineering schools.

b) Awareness: Before deciding on the techniques, lecturers must have a greater understanding of how to implement the technique in the classroom and why they must do so in order to make the class interactive and students appreciate learning.

c) Challenges: During implementation, there were many challenges for lecturers in the classroom. This includes both internal and external challenges, as well as tangible and intangible obstacles. All these challenges may affect the effectiveness of NALI implementation in the classroom.

d) Assessments: How do you evaluate the efficacy of your classroom instruction? What criteria will be considered in order to enhance your classroom instructional strategies? Students must adhere to certain criteria, which will determine the ability to attract them to the lecturers' classes.

e) Suggestions: Certain lecturers may be able to obtain excellent student feedback. Others may not even be able to attract student attention in class. Therefore, it is essential to emphasise the suggestions that other lecturers must follow or refer to in order to create a healthy classroom environment.

f) Expectations: It is noted that for the NALI technique to be successfully implemented in the classroom, it must originate from both parties. It is more effective if both parties assist one another on the voyage. It can be the initiative of a university, faculty, or department to ensure that students have exceptional class knowledge and master the skills necessary for lifelong application.

Regarding the first sub-theme, knowledge of NALI techniques, the interviewees mentioned approximately 12 active-learning strategies. It is shown in **Table 2**. Outcome-based education (OBE) is the second subtheme. In the interview, outcomes-based education was mentioned approximately 17 times. The following sub-theme is cooperative methods. This strategy was mentioned seven times during the interview. Blended learning, scenario-based learning, and problem-based learning comprise the fourth subtheme. This sub-theme was mentioned approximately thirteen times during the interview. The final sub-theme for the theme of knowledge is collaborative technique. This sub-theme was mentioned approximately three times during the interview.

Table 2. The information on themes, sub-themes and excerpts of interview from lecturer

Themes	Sub-themes	Excerpts of interview
Knowledge	NALI technique • Active learning • Outcome based education • Cooperative learning • Blended learning/scenario-based learning/problem-based learning • Collaborative technique Factors • Syllabus • Subject given • Familiar with scenario/problem • Student participation/activeness/confident	Respondent 1: *'Yup..it is **active learning**…'* *'It is like mixed-based..we want to achieve **active learning**..'* *'We used **active learning**…'* *'It is to decide whether or not we want to use **active learning** or passive learning, it is?..'* *'So, there is a chapter that must use **active learning**..most of the time we use **active learning**. 3 to 4 chapters used **active learning**…'* *'If **active learning**…Is it **active learning**? Are you referring to **active learning**?...'* Respondent 4: *'It is like **active learning**…'* *'So, I used blended **active learning**…'* The second sub-theme: Respondent 1: *'We want to achieve **outcome-based education**…'* *'**Outcome-based**…?'* *'It is **outcomes-based education**…'* Respondent 2: *'It is more on **outcome-based education**…'* *'If before this is based on **OBE**, so our subject must follow an **OBE**..erm which is why I think most of my subject that was given to me is must use **OBE**, **outcome-based education**..correct or not? Other subjects that I did not teach also use **outcome based learning**, scenario based learning, problem based learning so forth..so for my situation, I was given the subject that required to use **OBE**...'* *'We must follow **OBE** approach because it has been approved…'* *'If the subject is based on **OBE**, I must follow **OBE**..To be honest, all the subjects that given to me are based on **outcome based education**…'* *'This is not based on **OBE** only right?...'* Respondent 3" *'So, basically one of NALI technique that everyone in UTM even myself, we use **outcome-based learning education**…'* *'Yup..so for **outcome-based** is pretty much the requirement for the whole UTM..**outcome-based education**…'* The third sub-theme is cooperative technique: Respondent 3: *'so at the meantime because for the last 2 years it all online acquittance than to do so **cooperative learning**…'* *'so what I did is to do informal **cooperative learning**…'* *'when it comes to informal **cooperative learning**…'* *'for example **cooperative learning**…'* *'so interest to informal **cooperative learning**…'* *'because errr you should the paper for example of **cooperative learning**…'* *'but then there are elements in the **cooperative learning**…'* The fourth sub-themes: Respondent 1: *'Outcome, case study based learning, **problem based learning**?is it?...'* Respondent 2: *'outcome based learning, **scenario based learning, problem based learning** so forth…'* Respondent 3: *'so instead of using **problem-based** because **problem-based** are complicated…'* Respondent 4: *'NALI technique means the one with **blended-learning**?...'* *'so, I did **blended learning**…'* *'**blended learning** means they have lecture-based as well…'*

Themes	Sub-themes	Excerpts of interview
		*'so what I did is **blended learning**..**blended active learning**…'* *'If **problem-based learning**..**problem-based learning** is normally I will use for certain topic that involve with real life application…'* *'so I apply the concept **problem-based** I want to relate with real life application...'* *'I give **scenario** so that they will familiar with the problem..'* The fifth sub-theme: Respondent 5: *'we use **collaborative technique**…'* *'I did **collaborative technique**..**collaborative technique** is required them to be in group of 10 for example…'* The sixth subtheme is the reason why lecturers choose aforementioned NALI techniques in the class: Respondent 1: *'I looked at the **syllabus**…'* *'like traffic engineering subject has 4 chapters…'* *'mostly for chapters….'* Respondent 2: *'but lecturers in our faculties we have the **subject that was given** to us to teach by default…'* *'So **it is given**..when the **subject is given**…'* Respondent 4: *'based on **subject itself**…'* *'I give scenario so that **they familiar with the problem**..'* *'students will response to that forum…'* Respondent 5: *'so..they are **active to participate**…'*
Awareness	•Course •Situation •Subject curriculum •Faculty or university approaches •Initiatives and experience •Subject •Lifelong learning	Respondent 1: *'in **subject** traffic engineering itself…'* Respondent 2: *'due to my **situation**…'* Respondent 3: *'so that one is **faculty or university approaches**…'* *'another one the **course**…'* Respondent 4: *'this is from my **initiative and through experience**…'* Respondent 5: *'because I think **engineering electrical** is a bit difficult…'* *'you will have **life-long learning** skill…'*
Challenges	•Student engagement •Industrial awareness practice •Lecturers awareness •Students' knowledge •Class size •Student involvement •Student late •Ad hoc group	Respondent 1: *'Challenges are to get **engagement with students**…'* *'to retain **engagement with students**…'* *'during pandemic, students just turn on the computer but **lack of engagement** with others in the online class…'* *'**Time consuming**…'* Respondent 2: *'so we want to **relate to industry** is very challenging…'* *'the content of the subject itself **not much to industry**…'* *'so that student can imagine or **link with industry** or real world application…'* *'Ok..aa I think the **environment**..the classroom..the chair the table..the **environment**..in general the **environment**..means what I refer to the **environment** is that class room equipment..even equipment like projector or frontier projector, the chair or many others are actually influence teaching and learning (T & L) session..that is for physical class..for online class, it is worsen as no **class environment** at all.. **environment element** is not there..so for me the most challenging is*
Challenges	•Time consuming •Class environment •People factor •Time constrains •Student answers	

Themes	Sub-themes	Excerpts of interview
		*always **environment**... it is difficult to have everything in 1 short however, I must attract the student not because of **environment** but the subject itself…'* Respondent 3: *'so, first thing for NALI approaches I think the way **they (refer to lecturer) understand** it…'* *'**we need to understand**..so, we need to fulfil the requirement…'* *'challenge number 2 is that **students might not understand** the implementation…'* *'so the idea of getting NALI is to be understood **not only us educator and also the students**…'* *'I think very **difficult to get the student** to get the idea…'* *'**People factor**..it is **people factor**…'* Respondent 4: *'each forum if the student is **so many in the class**…'* *'so, when the **students is too much**, there will be 1 group in passive learning…'* *'so the **class size is small**, may be we can notice from early, otherwise, it is difficult to decide the approach…'* *'**time constrain**…'* Respondent 5: *'if we **get pro-active student**, that is not a problem…'* *'if the student just coming to the class in **the sake of attendance** not for learning, then it is the problem…'* *'sometimes the class is too early in the morning, students are **coming late** because of the bus…'* *'if we have to form the group, they have to **find their own group** because of student availability in the morning…'* *'challenges is when student gives **wrong equation in the test**…'*
Assessments	•Students response •Student evaluation (ePPP) •Student participation •Exam grade	Respondent 2: *'lack of **response**…'* *'we can see from their **response**…'* *'difficult to get their **response**…'* Respondent 3: *'student **response** is definitely…'* *'**feedback** from our ePPP…'* *'we get our **feedback** from the students…'* Respondent 4: *'from exam, from test, from **grade**, only then we know the students…'* Respondent 5: *'from their **response**…'*
Suggestions	•Form small group discussion •Request good facility •Educators awareness •Provide 2 lecturers - class size •Share template question	Respondent 1: *'to overcome it I sometimes do **break up room**..we form **small group**..that **small group** they can choose their own who will be…'* Respondent 2: *'I want to **request good facility**…'* Respondent 3: *'so as part of residency, we are encourage **to share idea and get lecturers to join** activities all…'* Respondent 4: *'if the class size is bigger, perhaps we can have **2 lecturers** in the class at same time…'* Respondent 5: *'sometimes I give them **template question**…'*
Expectations	•Workshop •Industrial engagement •Initiative to introduce to the students •Free teaching •Familiar with the approaches/capstone for final year	Respondent 1: *'I think **workshop**..**workshop** on how to get engage with the student in the class..perhaps, the approach 10 years back is not relevant to current generation (digital generation)…'* *'Support from faculty, **workshop announcement** from time to time…'* Respondent 2: *'to provide this student with industrial application. Suggested good industry..we need to **engage with this industry**…'*
Expectations	•Workshop announcement	

Themes	Sub-themes	Excerpts of interview
	• Implementing industrial consultation • Introduce education approaches • Workshop • Structured curriculum	*'get **involve with the industry**…'* *'involve through research and **consultation with industry**…'* *'for example, if the **industry can comment on certain subject** to improve that for me if they provide several talk or speech to the student..that will be good…'* *'thats how we try **to engage this student with industry**…'* *'certain subject probably we got **direct involvement with industry**…'* *'if students see the **involvement with industry in teaching**, they might probably more interest to dig more knowledge in the class..'* Respondent 3: *'the first few weeks to inform the things to students..**introduce our education** methods…'* *'the faculty the university need to **introduce education approaches**…'* Respondent 4: *'Support like I said before, **free teaching**..a few teaching..perhaps other lecturers can help…'* *'I think more or less from time to time, we have a **workshop**, or **meeting for review**..so, through this **workshop** lecturer can polish teaching style…'* Respondent 5: *'but they **capstone**..**capstone** for 4th year..working under pressure is something must in life learning especially engineering…'* *'I mean **structured curriculum**…'* *'A **structured curriculum**..**structured curriculum** means course information is fully organized…'*

The following sub-theme explains why instructors choose the aforementioned NALI techniques in class. There are four explanations why these teaching and learning (T&L) techniques were utilised. This includes the syllabus (1 occurrence), the topic (4 occurrences), familiarity with a scenario or problem (1 occurrence), and student participation, activity, or confidence (2 occurrences).

The theme of awareness has seven sub-themes. All these subthemes were mentioned multiple times during the interview. For instance, lecturers choose to implement NALI techniques based on the course (2 times), situation (1 time), subject curriculum (3 times), faculty or university approaches (1 time), initiatives and experience (1 time), subject instruction (1 time), and lifelong learning (1 time). This is evident from **Table 2**'s interview responses.

In spite of all NALI implementations during class time, lecturers still encountered some challenges in the classroom. This can be confirmed through interviews with professors. Their sub-themes relate to student participation (3 times), industrial awareness practise (3 times), lecturers' awareness (2 times), students' knowledge (3 times), class size (3 times), student participation (2 times), student tardiness (1 time) and ad hoc group formation (1 time). However, the most difficult circumstances are when time is consumed (1 instance), the classroom environment (8 instances), the people factor (2 instances), the time constraint (1 instance), and student responses (1 instance).

The next topic is assessment. How do instructors determine the efficacy of their classroom instruction? Four sub-themes are present in the interview. There are five instances of student responses, one of student evaluations, one of student participation, and one of exam grades. It is from the interview listed below:

Typically, instructors surmount their difficulties by implementing some suggestions. It is whether to form small group discussions (mentioned three times), request excellent facilities (mentioned once), raise educators' awareness (mentioned once), provide more instructors (mentioned once), and provide template questions (mentioned once).

The final theme of the class's implementation of NALI techniques is expectation. There are approximately ten sub-themes within the interview. It is supported by the university and its faculty and staff. They were workshops (5 times), industrial engagement (3 times), introducing an initiative to the students (1 time), free teaching (1 time), familiarity with the approaches/capstone for the final year (2 times), workshop announcement (1 time), implementing industrial consultation (3 times), introducing education approaches (1 time), university workshops (3 times), and structured curriculum (3 times).

This demonstrates that lecturers favour outcome-based education (OBE) in their teaching practises over other approaches. Blended learning is followed by scenario-based learning, problem-based learning, and active learning. Due to the fact that a particular topic necessitates the use of such a technique. Additionally, the subject curriculum prevents them from employing the technique. The majority of lecturers face challenges when attempting to engage students effectively, due to limited industrial awareness practise during class sessions, students' knowledge of NALI requirements, and class sizes that are too large for a single lecturer. Other obstacles include the classroom environment,

which impacts the teaching situation. It is evident from the class responses of the students. During the past two years of a pandemic, they have been required to conduct their classes via an online platform, which exacerbates the situation. They are expected to initiate small-group discussions regarding the lecturer's issue in the classroom. During teaching and learning sessions, it is essential for senior and novice lecturers to have a productive discussion about potential solutions. In addition, it is anticipated that there will be seminars for lecturers to familiarise themselves with NALI techniques prior to teaching.

iii) The difference between lecturers with and without professional engineer certification in teaching and learning approaches

A total of 134 questionnaires from students from various faculties were obtained. The results of the t-test for students in this study are displayed in **Table 3**. It is an analysis comparing the teaching practice of lecturers with and without professional certification, based on the perception of their students.

The table indicates that there is a statistically significant difference between lecturers with and without professional engineer certificate ($p < 0.01$). A smaller p value (0.01) represents a more significant impact (Zhu, 2016). It demonstrates that the teaching practices of lecturers with professional certification are different from those of lecturers without professional certification. As teaching experience is one of the prerequisites for joining the engineering faculties, lecturers with professional certification typically have a solid background in the field. It is stipulated in the Engineering Accreditation Council (EAC) agreement in Malaysia (Puzi et al., 2017). Therefore, lecturers with professional certification are required to familiarise themselves with and implement the suggested approaches for teaching.

Conclusion

This study provides a data analysis and thematic evaluation of the implementation of New Academia Learning Innovation (NALI) techniques in engineering faculties at Universiti Teknologi Malaysia (UTM) among lecturers with and without professional engineer certification. In accordance with the objective of this study, 171 studies covering four faculties namely the Faculty of Civil Engineering (FCE), the Faculty of Electrical Engineering (FEE), the Faculty of Mechanical Engineering (FME), and the Faculty of Chemical and Energy Engineering (FCEE)) were included in the data analysis and approximately five studies in the thematic analysis. Spearman's test of correlation reveals a positive correlation between professional engineer certification and NALI practise. A quarter of the twenty lecturers with professional certification participated in the interview. Five themes and fifty-seven subthemes were derived from the interview. This indicates that lecturers with professional engineer certification utilised at least one NALI technique in the classroom. This is confirmed by the t-test, which indicates that there is a substantial difference in teaching practice between lecturers with and without engineer certification.

Limitation: study carried out during the pandemic, where the experiences are based on the online teaching that may rise the difficulties in engineering teaching implementation. New study to observed the physical teaching must be carried out.

Table 3. T-test analysis among students in two groups

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
B	Equal variances assumed	4.326	.038	-5.437	1740	.000	-.305	.056	-.415	-.195
	Equal variances not assumed			-5.399	752.744	.000	-.305	.057	-.416	-.194
C	Equal variances assumed	25.702	.000	-7.679	1606	.000	-.283	.037	-.355	-.210
	Equal variances not assumed			-8.367	829.526	.000	-.283	.034	-.349	-.216
D	Equal variances assumed	8.677	.003	-3.200	802	.001	-.243	.076	-.391	-.094
	Equal variances not assumed			-3.436	401.186	.001	-.243	.071	-.381	-.104

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