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Comparative Analysis of Physics Syllabi: Uitm Foundation Physics Vs. Cambridge International As Level Physics

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Abstract

In recent years, Malaysian universities have increased their offerings of foundation degrees. Transitioning from a foundation to an honors degree is now a popular path in higher education. This often involves moving from a further education institution to a higher one. Foundation students may struggle with the university syllabus, so it's important to provide a high-quality, international standard syllabus, especially in subjects like foundation Physics, to help them succeed. This paper reports on the syllabus comparison between UiTM Foundation Physics syllabus with the Cambridge International AS Level Physics. It highlights the differences between both syllabuses and in the aim to improvise the UiTM Foundation Physics syllabus as to strengthen the students' foundation knowledge before they pursue to the degree level. The outcome presented here suggests an explicit finding that UiTM Foundation Physics syllabus is a complete one-year studies and covers more than the Cambridge International AS Level Physics syllabus.

Keywords: Physics, Foundation Studies, Syllabus, Comparative

Introduction

Background of Study

Physics is a compulsory subject to further studies in engineering courses. Exposing the students to the related topics in physics is important as a preparation to develop further skills in engineering (Centre of Foundation Studies). A strong knowledge on the topics during the foundation studies may facilitate students to pick up the idea of complex engineering problems for their undergraduates' studies which covers cognitive, affective, and psychomotor level through learning and assessment activities. While physics is such a broad topic and students will be exposed to many engineering disciplines such as electrical and

electronics, civil and mechanical engineering, therefore, it is important to review the syllabus and benchmark the quality of syllabus with other reputable institution (Cambridge International AS Physics; Nazri et al., 2023).

Society needs education about balancing economic, environmental, and social goals, as promoted by the UN's Sustainable Development Goals (SDGs). When benchmarking a course, it is very important to recognize the component of the course that will lead to the quality of the syllabus (Tomasella et al., 2024. Three main components involve in the benchmarking are based on the topics offer in the physic syllabus, the assessments, and the teaching methodology (Craig, 2009; Fenge, 2011; Pepper et. al, 2024). The topics offered in the course should be appropriate with the teaching and learning contact hours. Based on the syllabus, it is aimed to provide students with the experimental and practical knowledge, to develop students' abilities and skills to the relevant studies, to develop students' attitudes towards accuracy and precision, to stimulate interest in environmental effects and, etc. The second component is the assessment of the course. This component is one of the components to reflect those part of the syllabus which assess students' knowledge with understanding, handling, applying and evaluation information and experimental skills and investigations. These values should be mapped accordingly to the course objectives (Nugroho & Jaqin, 2021).

Lastly, the third component to benchmark the quality of a courses is the teaching methodology and delivery. Teaching method may be varied depending on the institution and their background. However, with the emerging technologies and new era of education, blended learning has drawn an attention for a flexible delivery. Therefore, in this study, a comparison from other institution is important to improve teaching and learning delivery in order to get the students engagement (Fenge, 2011; Smith, 2015).

This study aims to benchmarking the UiTM Foundation Physics syllabus with Cambridge International AS Level Physics with a specific focus on highlighting the differences, and improvising the syllabus as to strengthen the foundation knowledge before they pursue to the degree level (Foundation Degree Forward). The reason why Cambridge International AS Level Physics is the chosen syllabus as a benchmarking, is due to annually, nearly a million Cambridge learners from 10, 000 schools in 160 countries prepare for their future with an international education from Cambridge.

Objective of the Study

- To benchmark the topics in UiTM Foundation Physics syllabus with Cambridge International AS Physics.
- To identify the differences of topics taught for both syllabuses.
- To compare the assessment and teaching method done for both institutions.
- To highlight the important remarks from both institutions

Literature Review

Course Background

Established in November 2009, the Pusat Asasi, or Centre of Foundation Studies, at UiTM Dengkil campus has a clear mission: to provide students with a strong foundation for their future degree programs, whether at UiTM or other higher learning institutions, both locally and internationally. Currently, the center offers two programs: Foundation in Science (PI080) and Foundation in Engineering (PI009), both of which include Physics as a core subject. Each program spans two semesters, equivalent to one year of study, comprising a total of 50

credit hours. This structure allows students to acquire the essential knowledge, values, skills, and competencies necessary for their tertiary education journey.
To ensure its ongoing relevance, the Centre of Foundation Studies consistently updates its curriculum to align with the evolving needs of the nation. Cambridge Assessment International Education, a division of Cambridge Assessment, traces its roots back to the University of Cambridge Local Examinations Syndicate (UCLES), established in 1858. Operating as a non-profit entity, Cambridge International offers examinations and qualifications to schools worldwide, serving over 160 countries and 10,000 institutions.

Among its offerings is the Cambridge International AS Level Physics, designed to encourage students to explore their subjects deeply. Developed in collaboration with educators and universities, this syllabus aims not only to impart subject knowledge but also to foster a thorough understanding of fundamental concepts crucial to mastering the discipline. Regular evaluations and adjustments ensure that the syllabi reflect the latest insights from global experts and practitioners, while also accommodating the diverse educational contexts in which they are implemented (Foundation Degree Forward).

Findings and Discussion

Comparison of the Syllabus

The UiTM Foundation Physics curriculum covers a comprehensive range of twenty topics, including physical quantities and units, measurement techniques, kinematics, dynamics, forces, density and pressure, work, energy and power, momentum, rotational motion, deformation of solids, properties of matter, oscillations, waves, superposition, temperature and heat, electric fields, current of electricity, D.C. circuits, alternating currents, geometrical optics, physical optics, and modern physics.

In contrast, the Cambridge International AS Level Physics syllabus focuses on thirteen topics, encompassing physical quantities and units, measurement techniques, kinematics, dynamics, forces, density and pressure, work, energy and power, deformation of solids, waves, superposition, electric fields, current of electricity, direct current circuits, and particle and nuclear physics (Cambridge International AS Physics). The comparison of syllabus structures is outlined in Table 1.
When crafting the syllabus for UiTM Foundation Physics, several aims were set forth. Firstly, to provide an engaging educational experience through hands-on experimentation and practical science, fostering students' development into knowledgeable citizens with a keen interest in scientific matters. Additionally, to instill an understanding of the utility and boundaries of the scientific method, emphasizing its relevance across various disciplines and in everyday life.

Furthermore, the syllabus aims to cultivate communication skills through semester-end presentations, while also nurturing attitudes essential to scientific inquiry, such as accuracy, precision, curiosity, initiative, and creativity. Given the common perception of physics as a daunting subject, efforts are made to spark students' interest and maintain their enthusiasm throughout the course, ensuring that studying physics becomes an enjoyable and fulfilling experience (Raoufi et al., 2018).

Table 1
Structure of the syllabus

Topic	**AS Physics**	**UiTM Foundation Physics**
Physical quantities and units	√	√
Measurement techniques	√	√
Kinematics	√	√
Dynamics	√	√
Forces, density and pressure	√	√
Work, energy and power	√	√
Momentum	X	√
Rotational Motion	X	√
Deformation of solids	√	√
Properties of Matter	X	√
Oscillations	X	√
Waves	√	√
Superposition	√	√
Temperature & Heat	X	√
Electric fields	√	√
Current of electricity	√	√
Direct Current circuits	√	√
Alternating currents	X	√
Geometrical optics & Physical optics	X	√
Modern Physics	X	√
Particle and nuclear physics	√	X

This study compares the structures of two syllabi, revealing that the UiTM Foundation Physics curriculum encompasses 34% more topics than the Cambridge International AS Level Physics syllabus. This variance may be attributed to the difference in focus between the two foundation programs offered by Cambridge International Examinations: the Cambridge International AS & A Level Physics. While Cambridge International A Level typically spans two years, the Cambridge International AS Level typically lasts for one year. Some subjects can be initiated at the Cambridge International AS Level and extended to the Cambridge International A Level.

In this study, the Cambridge International AS Level serves as the benchmark due to its equivalent one-year duration. The topics covered in the UiTM Foundation Physics syllabus adequately prepare students for university by fostering deep engagement with the subject matter. This proficiency is crucial for gaining a comprehensive understanding of the subject's

intricacies and prepares students for the academic rigors they will encounter in university life.

Assessment of the Syllabus

Cambridge International AS Level Physics is the first half of Cambridge International A Level Physics. Depending on local university entrance requirements, the qualification may permit or assist progression directly to university courses in physics or some other subjects (Greenbank, 2007). Candidates for Advanced Subsidiary (AS) certification take Papers 1, 2 and 3 either Advanced Practical Skills 1 or Advanced Practical Skills 2 in a single examination series. The components in these three (3) papers are shown in the Table 2 below. The weighting for AS Level Physics is 31% for Paper 1, 46% for Paper 2 and 23% for Paper 3 with a total of 100%. This assessment is done at the end of the first year and is solely based on the final exam.

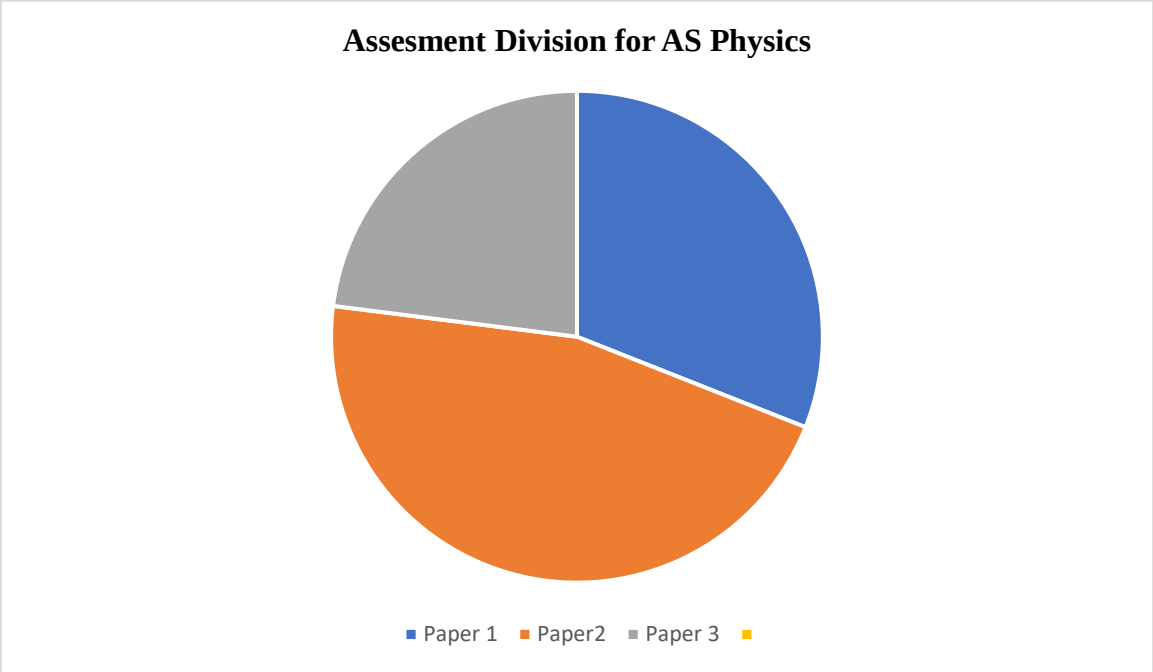

Figure 1- Assessment for AS Physics

Table 2
Description of each components for AS Physics

	Description of each Components
Paper 1	Multiple Choice 1 hour 15 minutes This paper consists of 40 multiple choice questions, all with four options. [40 marks]
Paper 2	AS Level Structured Questions 1 hour 15 minutes This paper consists of a variable number of questions of variable mark value. [60 marks]
Paper 3	Advanced Practical Skills 2 hours This paper requires candidates to carry out practical work in timed conditions. The paper will consist of two experiments drawn from different areas of physics. The experiments may be based on physics not included in the syllabus content, but candidates will be assessed on their practical skills rather than their knowledge of theory. [40 marks]

Assessment for UiTM Foundation Physics students comprises four components, each contributing to their final grade: a mid-term test (20%), two practical assessments involving laboratory observations and presentations (20%), an assignment (10%), and the final exam (50%). Details for each component are provided in Table 3 below.

UiTM Foundation Physics courses employ a blend of project works, assignments, case studies, and lecture sessions, fostering a comprehensive learning experience. This approach is deemed effective in advancing teaching, research, and innovation (Greenbank, 2007). Notably, the first four components carry equal weightage, encouraging consistent performance throughout the semester rather than relying solely on the final exam.

The final exam, lasting three hours, comprises 20 multiple-choice questions and 5 structured questions. This assessment framework, endorsed by the Ministry of Higher Education, ensures a balanced evaluation of students' understanding and proficiency in UiTM Foundation Physics.

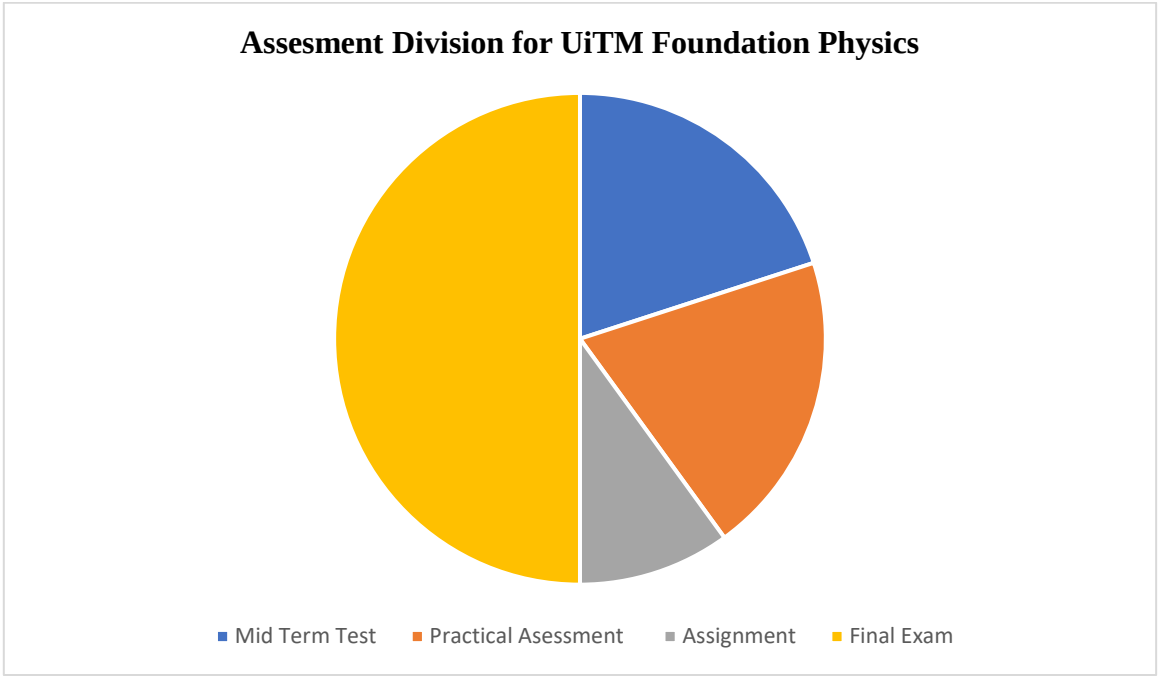

Figure 2 - Assessment for UiTM Foundation Physics

When preparing these components of assessment, there are three (3) objectives that were considering which reflect those parts of the syllabus aims that will be assessed in the examination. First, to obtain the knowledge with full understanding so that students should be able to demonstrate knowledge and understanding of this scientific and technological applications with their social, economic and environment. Next is for the students to be able to handle, apply and evaluate information, locate, select, organise and present information from a variety of reliable sources. Finally, to develop the experimental skills and investigations among students and to be able to collect, record and present observations, measurements and estimate, and finally analyses and make conclusions (Abdullah et al., 2019).

Universities should aim not only to educate young minds and contribute to make dynamic citizens, but also to generate new ideas and encourage innovation (Simm. et. al, 2011). The semester system is said to keep students on their toes with their progress being regularly and closely monitored like the UiTM Foundation Physics approached. Compared to the annual system such as Cambridge International AS Level Physics, it helps to keep students busy all year round with an even level of burden instead of allowing them to pile up work towards the end of the year (Winter & Dismore, 2010; Baker & Heron, 2023). A semester system permits greater freedom and scope for designing and delivering a variety of courses that the students can pick flexibly from in order to enhance the quality of their learning (Shah & Kumar, 2020).

Teaching Method

In modern society, there's a growing demand for efficient learning methods that prioritize the scientific method, emphasizing the constructive development of new knowledge through empiricism and research. This approach focuses not only on teaching scientific findings but also on fostering exact reasoning skills essential for solving the complex problems of contemporary life (Nagl et al., 2012; Firman et al., 2018; Nur'ariyani et al., 2023).

At the Centre of Foundation Studies, each cohort undergoes two semesters of study. In the Foundation Physics course, which carries 5 credit units, students engage in a total of 200 hours of Student Learning Time (SLT), comprising 75 face-to-face hours and 125 non-face-to-face hours. This comprehensive course covers fundamental topics outlined in Table I, exploring their applications across various domains.

Through a combination of in-depth guidance techniques, in-class exercises, group projects, and laboratory work, the course aims to equip students with a solid understanding of physics concepts, analytical prowess, and problem-solving skills. Furthermore, students gain exposure to scientific analytical analysis, fostering long-term retention of principles and practices crucial for their future studies.

Upon completing the course, students should be capable of applying their physics knowledge to diverse fields such as engineering, medicine, and sectors including environment, agriculture, and health.
Teaching methods vary across institutions (Ferreira et al., 2024). In UiTM Foundation Physics, instruction is delivered through three modes: lecture, tutorial, and laboratory practical. Weekly contact hours are allocated as follows: 3 hours for lectures, 1 hour for tutorials, and 2 hours for laboratory practicals.

Various teaching methodologies are employed, including interactive lectures, collaborative learning, peer practice, and group discussions. The recommended textbook for the course is "College Physics" by Raymond A. Serway, 11th edition (2018), supplemented by additional references such as:

1. "Physics" by J.S. Walker, 5th edition, Pearson Education Inc., 2015
2. "Physics for Scientists and Engineers with Modern Physics" by D.C. Giancoli, 7th edition, Pearson Prentice Hall, 2013
3. "Physics" by J.D. Cutnell and K.W. Johnson, 10th edition, John Wiley & Sons, 2014
4. "Physics in Context for Cambridge International AS & A Level" by J. Breithaupt, 2nd edition, Oxford and Cambridge, 2015
5. "College Physics" by D.H. Young, P.W. Adams, and R.J. Chastain, 10th edition, Pearson Prentice Hall, 2014

While students are encouraged to utilize any reference materials, they must adhere to the lesson plans provided.
In the modern era, UiTM has implemented an online self-study platform called UiTM UFuture, allowing lecturers and students to communicate, submit, and assess quizzes and tests online. All data are securely stored in cloud storage (Sharafuddin & Allani, 2024).Table 4 Teaching Method for UiTM Foundation Physics and Cambridge International AS Physics

AS Physics (per week)	**UiTM Foundation Physics (per week)**
Lecture - 2 hours	Lecture - 3 hours
Tutorial – 1 hour	Tutorial - 1 hour
Laboratory practical - 2 hours	Laboratory practical - 2 hours

For Cambridge International AS Physics, there are two (2) examinations, one in June and another in November each year. Cambridge International AS Level is typically a one year programme. The first option is Cambridge International AS Level (the stand alone AS). Students can take the Cambridge International AS Level only. The syllabus content for Cambridge International AS Level is half of a Cambridge International A Level programme. The teaching method applies for Cambridge International AS Physics are in 3 modes; lecture, tutorial and laboratory practical. The contact hours per week for lecture is 2 hours, whereas for tutorial is 1 hour and laboratory practical is 2 hours, respectively. Compared to UiTM Foundation Physics with more topics to cover, the contact hours are relevance for both courses. Table 4 shows the different teaching method for UiTM Foundation Physics and Cambridge International AS. In these modern technologies, there is an online self-study courses that are available as to help lecturers and students to prepare, deliver, submit and mark the coursework as to reach the Cambridge standards.

Annually, thousands of students with Cambridge International AS gain places at leading universities worldwide. Cambridge International AS Level is accepted and valued by top universities around the world including those in the UK, US (including Ivy League universities), European nations, Australia, Canada and New Zealand. In some countries universities accept Cambridge International AS Levels as qualifications counting towards entry to courses in the same or other related subjects.

Conclusion

Comparative analysis of physics syllabus between UiTM (Universiti Teknologi MARA) and Cambridge International AS Level Physics can provide valuable insights into the educational approaches, content coverage, and pedagogical methodologies employed by different educational systems.

This study explores the difference in Physics foundation syllabus of UiTM with Cambridge International AS Level Physics. The nature of these studies' mode is different. Firstly, UiTM Foundation Physics students has more topics to cover compared to Cambridge International AS Level Physics students although the study duration is the same that is one year. Next, the assessment throughout this one-year studies are also different. For UiTM Foundation Physics assessment, there is a carry marks of 50 % meaning that the assessment is continuous whereas for Cambridge International AS Level Physics, the assessment is annually at the end of one-year studies. For both courses, students should have previously completed Sijil Pelajaran Malaysia (SPM) or Cambridge O Level or Cambridge IGCSE® course,

or the equivalent, in Physics or Co-ordinated Science as to be able to pursue their studies in foundation level.

By comparing the syllabus of UiTM Foundation Physics and Cambridge International AS Level Physics, educators can identify the strengths and weaknesses of each curriculum. This analysis can help in refining existing curricula to better meet the needs of students and align with educational goals. Besides, different educational systems often have distinct philosophies and approaches to teaching and learning. Comparative analysis can shed light on the underlying educational philosophies of UiTM and Cambridge International, allowing educators to understand the theoretical frameworks that inform the design of their physics curricula. Analysing the content coverage of physics syllabus can reveal the depth and breadth of topics addressed in each curriculum. Educators can assess whether essential physics concepts are adequately covered and whether there are any gaps or redundancies in the content. Comparative analysis can also examine the assessment methods and standards employed in each curriculum. This includes the types of assessments used (e.g., exams, coursework, practical) and the criteria used to evaluate student performance. Understanding differences in assessment practices can inform discussions on standardization and quality assurance.

Ultimately, the theoretical and contextual contributions of comparative analysis lie in its potential to improve students learning outcomes. By identifying effective teaching strategies, relevant content, and appropriate assessment methods, educators can enhance the quality of physics education and better prepare students for further studies or careers in the related field. Comparing physics syllabus from different institutions and educational systems provides a global perspective on physics education. It allows educators to see how physics is taught and learned in different cultural and institutional contexts, fostering cross-cultural understanding and collaboration in education.

Overall, the theoretical and contextual contributions of comparative analysis of physics syllabi between UiTM Foundation Physics and Cambridge International AS Level Physics lie in its ability to inform curriculum development, improve teaching practices, and enhance student learning outcomes within a broader global educational context.

References

Abdullah, N., Anuar, N., Zolkipli, N. F., Shaharudin, R. H., & Hod, S. N. S. (2019, November). Assessing Pre-University Students' Attitude Towards Mathematics. In 2019 IEEE 11th International Conference on Engineering Education (ICEED) (pp. 251-254). IEEE.

Baker, L., & Heron, M. (2023). Advocating for oracy: supporting student success in foundation year study. Journal of further and higher education, 47(10), 1289-1303.

Centre of Foundation Studies, UiTM Dengkil, https://asasi.uitm.edu.my/ Accessed 12 July 2022. Cambridge International AS Physics website, available at: https://www.cambridgeinternational.org/ Accessed 13 July 2022.

Craig, J. (2009). New ways of being public: the experience of foundation degrees. Journal of Further and Higher Education, 33(1), 23-31.

Foundation Degree Forward 2008 website, available at: www.fdf.ac.uk Accessed 13 July 2022.

Fenge, L. A. (2011). 'A second chance at learning but it's not quite higher education': experience of a foundation degree. Journal of further and higher education, 35(3), 375-390.

Firman, F., Baedhowi, B., & Murtini, W. (2018). The effectiveness of the scientific approach to improve student learning outcomes. International Journal of Active Learning, 3(2), 86-91.

Ferreira, M., Marques, A., & Santos, S. (2024). Foundations of teaching and learning–a study with teachers on conceptions and pedagogical practices. International Journal of Instruction, 17(2), 67-84.

Greenbank, P. (2007). From foundation to honours degree: the student experience. Education+ Training, 49(2), 91-102.

Nagl, M. G., Obadovic, D. Z., & Segedinac, M. (2012). Effective teaching of physics and scientific method. Tem Journal, 1(2), 85-89.

Nazri, N. A., Muhammad, F. H., Sheikh, S. N. Y., Suhaimi, H. N. H., Saidin, N., Ngah, S., & Rahmat, N. H. (2023). What is The Relationship between Burnout and Motivation to Learn?. Journal of Academic Research in Business and Social Sciences, 13(8), 1596-1614.

Nugroho, B. H., & Jaqin, C. (2021). Implementation of Benchmarking Method for Higher Education Institution: A Literature Review. IJIEM (Indonesian Journal of Industrial Engineering & Management), 2(2).

Nur'ariyani, S., Jumyati, J., Yuliyanti, Y., Nulhakim, L., & Leksono, S. M. (2023). Scientific approach to learning science in elementary schools. Jurnal Penelitian Pendidikan IPA, 9(8), 6659-6666.

Pepper, I., Cox, C., Fee, R., Horgan, S., Jarman, R., Jones, M., & Tattum, C. (2024). The first national subject benchmark statement for UK higher education in policing: the importance of effective partnership and collaboration. *Higher Education, Skills and Work-Based Learning*.

Raoufi, K., Raman, A. S., Haapala, K. R., & Paul, B. K. (2018). Benchmarking undergraduate manufacturing engineering curricula in the United States. *Procedia Manufacturing*, *26*, 1378-1387.

Shah Ph, D., & Kumar, R. (2020). Relevance of Foundation of Education Curriculum from Indigenous Knowledge Perspectives: Post-Graduation Teachers' and Students Opinions. International Journal of Creative Research Thoughts (IJCRT), 8(11), 3606-3621.

Sharafuddin, H., & Allani, C. (2024). Making TMAs Meaningful: An Evaluation of the Online Assessment within a Blended Learning System. American J Sci Edu Re: AJSER-157.

Simm, D., Marvell, A., Winlow, H., & Schaaf, R. (2011). Student experiences of foundation degrees in further and higher education. Planet, 24(1), 2-9.

Smith, P. H. (2015). An exploration of teaching assistants' engagement with Foundation degree study (Doctoral dissertation, University of York).

Tomasella, B., Akbar, B., Lawson, A., Howarth, R., & Bedford, R. (2024). Embedding the Sustainable Development Goals Into Higher Education Institutions' Marketing Curriculum. Journal of Marketing Education, 02734753241231182.

Winter, J., & Dismore, H. (2010). Investigating the experiences of foundation degree students progressing to an honours degree: an integrated approach. Journal of further and higher education, 34(2), 253-270.