INTERWEAVING STUDENTS' KEY SUSTAINABILITY COMPETENCIES WITH SUSTAINABILITY DEVELOPMENT KNOWLEDGE (SDK): THE INFLUENCING ROLE OF LEARNING AND TEACHING

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ABSTRACT

This study aims to determine to what extent the essential sustainability competencies of students support and enable the University to achieve the United Nation's Sustainability Development Goals (UN SDGs). The students' awareness and knowledge of SDGs are pertinent and essential to be prepared and equipped for their future working life. Design/methodology/approach - A case study using an online survey collected 320 respondents. SPSS and Smart-PLS were employed as statistical packages to analyze the collected data. Two primary competencies, specifically interpersonal and normative abilities, showed a significant direct correlation with knowledge in sustainable development. However, neither the students' academic performance appeared to act as a mediating factor, nor did educational initiatives related to learning and teaching serve as moderators influencing the connection between these key competencies and their knowledge in sustainable development. The results can be used as a guide for subject and program instructors to incorporate the necessary sustainability competencies. They may also aid policymakers in crafting policies and procedures focusing on crucial sustainable skills, considering their potential application in selecting and recruiting human resources. This study contributes to the existing literature by validating that students who possess interpersonal skills (such as collaborating sustainably with team members) and normative competencies (like introducing and implementing novel sustainability concepts and ideas) will enhance their awareness and understanding of sustainability. Therefore, it emphasizes the need for well-designed courses, programs, and curricula to prioritize these two crucial competencies.

Introduction

In fulfilling the United Nations 17 Sustainable Development Goals (SDGs), Higher Educational Institutions (HEIs) in the world are now actively participating in ensuring that they contribute to such attainment. Since then, many sustainability related studies have been conducted, over the years, after its launch in 2015. The target set so far is to realise all the 17 SDGs by 2030. Avila et al. (2019) and Sonetti et al. (2019) concurred that HEIs should play a vital role in transforming SD in society by having all the resources required to develop innovative sustainable solutions such as going beyond developing course curricula and educating a new generation of leaders.

It is widely believed that facilitating a shift towards sustainability requires the cultivation of sustainability change-makers, particularly among students, who can serve as catalysts for comprehensive implementation. This transformation is attainable through the avenue of education, which has given rise to the concept of Education for Sustainable Development (ESD). ESD aims to propel this transformation by equipping participants with the essential knowledge, competencies, and mindsets necessary to deeply engage in shaping a sustainable future and making informed and effective decisions toward that goal (Décamps et al., 2017).

UNESCO has played a significant role in promoting ESD and has provided a comprehensive set of recommendations for integrating ESD-oriented learning across all educational levels. These guidelines empower individuals to act as agents for sustainable development by instilling the requisite values, knowledge, and skills. UNESCO has identified eight critical competencies, as observed in current research on education for a sustainable society: systems thinking, anticipation, normativity, strategy, collaboration, critical thinking, self-awareness, and integrated problem-solving competency. This approach involves not only teaching these competencies but also setting an example by fostering values and attitudes that encourage thoughtful decision-making and responsible life choices. Learners are encouraged to make decisions informed by their potential impacts on society, the economy, and the environment, both in the present and the future (Findler et al., 2019).

Empowering students to reflect on their actions and behaviours in a creative and adaptable manner is crucial (Goldstein, 2005; Sanchez-Carracedo et al., 2022). Furthermore, incorporating Sustainable Development Goals (SDG)-focused assignments within an existing business curriculum can significantly enhance student learning and spark their interest in the SDGs, ultimately increasing their sense of competence in advancing these goals post-graduation, a matter of paramount significance (Collier et al., 2022). Additionally, appointing a faculty member as a dedicated advocate for the SDGs, capable of making a compelling business case for them, has proven effective in boosting student commitment to these goals.

When it comes to incorporating diverse academic disciplines into the educational process and designing assignments and assessments that create an engaging and meaningful learning

environment centered around the Sustainable Development Goals (SDGs), students in higher education possess the potential to act as change agents. They can play a pivotal role in raising awareness and positively impacting the SDGs at individual, organizational, and institutional levels (Chiara Hübscher et al., 2022). The insights gleaned from this research could offer valuable guidance for social marketers planning campaigns directed at higher education institutions.

Moreover, research conducted by Rajabifard et al. (2021) and Strachan et al. (2019) has revealed that certain academic subjects align with multiple SDGs, but not all subjects have clear and direct connections to the SDGs. This underscores the necessity of strengthening the incorporation of sustainability principles across a broader spectrum of subjects within schools. Additionally, this research emphasizes that certain business schools and faculties face challenges in establishing robust links with sustainability, especially in technical subjects. This highlights the difficulty of integrating sustainability into these particular areas.

Numerous investigations, with a particular focus on the Asia-Pacific region, have delved into the sustainability skills and knowledge of educators (Chinedu et al. 2023; Hueske et al. 2022; Claro and Esteves, 2021). The primary objective of this study was to put forth a curriculum framework intended for technical and vocational teacher training programs, with a specific emphasis on sustainability literacy. The research pinpointed and provided definitions for four crucial components within this curriculum:
- Learning outcomes designed to instill sustainability literacy.
- Teaching competencies required for effectively imparting sustainability literacy.
- Pedagogical methods aimed at fostering productive teaching and learning practices for sustainability.
- Strategies for integrating Education for Sustainable Development (ESD).

This research has played a significant role in shaping a novel framework for sustainable competencies. This framework takes into account students' vital sustainable competencies, as assessed through their academic performance and their level of engagement in learning and teaching initiatives.

This current study focused on students' sustainability in terms of their ability to learn and possibly to acquire sustainable development knowledge to aid their future employability. The research objectives, therefore, were:

1) To determine the students' relevant sustainability competences that would enhance the sustainable development knowledge (SDK) of a higher educational institution.
2) To assess the mediation effect of academic performance vis-à-vis the relationship between the essential sustainability competences and SDK.
3) To evaluate the moderating role of learning and teaching initiative (LTI) in influencing the relationship between the essential competences and the SDK.

These research objectives were couched to help determine whether our study would achieve students' sustainability competences as a result of the relevant pedagogical approach in each course and program. The prior study, described later in Section 2.0, enabled the production of

testable propositions within a conceptual model. The survey results were used to determine the gap to be focussed on to stay competitive in terms of teaching, learning and assessment.

1. Literature Review

1.1. The relationship between sustainability competences and SDK

The Doughnut Economics theory by Raworth (2017), presents a holistic model for sustainable development. It envisions an economic "doughnut" shape, with an inner boundary representing the minimum social standards for human well-being and an outer boundary reflecting the ecological limits of the planet. Hence, more researches focused on "sustainable development" were developed ever since. Previous studies (e.g,: Chiara Hübscher et al., 2021; Ana Marta Aleixo et al., 2020 and Albert and Uhlig 2022) showed the importance of project-based approaches and programs and courses in particular, guided by SDGs principles, in increasing or raising the awareness amongst the various groups of stakeholders. It also showed that they facilitated the process of students becoming the sustainability change agents who could help to achieve the SDGs. One of the most efficient approaches involves the utilization of active learning (AL) strategies for fostering sustainability-related skills, actively involving students in the educational process. Furthermore, research by Claro and Esteves in 2021 has demonstrated that this heightened engagement also positively impacts academic performance and hence their sustainable development knowledge. A study conducted in Indonesia university revealed that a total 76.8% of their respondents had good knowledge about the SDGs (Enie Novieastari, 2022).

Various teaching methods have been employed to equip students with sustainable competencies, such as the utilization of network science, which serves as a valuable tool in introducing students to handling complex case studies (Weber et al. 2021). Notably, this approach represents the first instance of applying network-related terminology and strategies to teach issues related to sustainability. Another innovative framework worth considering pertains to the analysis and evaluation of sustainability in higher education institutions (HEIs). This framework offers guidance to HEIs and educational leaders in supporting sustainable development, enabling them to fulfil their countries' commitments towards achieving the Sustainable Development Goals (SDGs) (Elmassah et al. 2022). Students undergo training in five essential sustainable competencies, namely systems thinking, anticipatory thinking, normative thinking, strategic thinking, and interpersonal skills, as highlighted by Wiek et al. (2011). The interdisciplinary approach adopted in addressing the SDGs has paved the way for the development of students' strategic competencies, including systems thinking and anticipatory skills. The authors argue that this approach fosters a sense of ownership and responsibility among students in their learning journey, signifying a shift in mindset and behaviour.

Essentially, the core sustainable skills, which encompass normative, anticipatory, strategic, and interpersonal competencies, are vital abilities that students require to aid their learning and assessment. Normative competence focuses on not describing the world as it is but as it should be, involving the capacity to align and reconcile sustainability values, principles, and goals with various stakeholders, without adhering to any predefined norms but rather guided by ethical considerations (Lambrechts and Van Petegem, 2016). It serves to ensure that

individuals, including managers, sustainability professionals, employees, and students, are responsible for their decisions (Wiek et al., 2011).

Interpersonal competencies play a role in motivating, facilitating collaboration, and engaging in research and participatory activities related to sustainability (Lambrechts and Van Petegem, 2016). Studies conducted by Lans et al. (2014), Wiek et al. (2011), and Hermann and Bossle (2020) underscore the significance of interpersonal competence in establishing sustainable businesses.

Strategic management and action competence refer to the ability to collectively plan, execute interventions, and implement strategies for sustainable development (Lans et al., 2014; Ashraf Fauzi et al, 2023). This domain encompasses skills such as planning (designing and implementing transformative governance interventions and sustainability strategies), organization (coordination of tasks, resources, and personnel), leadership (inspiration and motivation), and monitoring (evaluating performance, policies, action programs, and plans) (De Haan, 2006; Wiek et al., 2011).

Regarding anticipatory competence, it refers to "the skill to collaboratively assess, assess, and formulate comprehensive depictions concerning sustainability concerns and approaches to solving sustainability problems" (Wiek et al., 2011, pp. 207–209). This involves the capacity to analyze both qualitative and quantitative data, followed by the ability to assess, express, and deconstruct their components critically. Furthermore, this competence equips individuals to address unforeseen adverse effects and promote inclusivity.

With the relevant literature reviewed, the following hypotheses were formulated:

H1: There is a positive relationship between normative competences (NC) and the SDK.
H2: There is a positive relationship between anticipatory competences (AC) and the SDK.
H3: There is a positive relationship between strategic competences (SC) and the SDK.
H4: There is a positive relationship between interpersonal competences (IC) and the SDK.

1.2. Academic performance impact on sustainability competences and SDK
Guillen et al. (2022) found that the ripple effect of emotional intelligence produced results that enabled students to be resilient, academically engaged and hence led to a positive performance outcome. Students who were resilient were proven to be successfully coping with setbacks and it strengthened the individual's biological temperament, internal characteristics, (particularly intelligence), temperament, internal locus of control or dominance; the family and the environment in which the person lived; and the number, intensity and duration of stressful or adverse circumstances the person had experienced throughout their lives. In their review of the concept, Kumpfer et al. (1993) identified seven factors of resilience in young people: optimism, empathy, insight, intellectual competence, self-esteem, direction or mission, and determination and perseverance.

A number of case studies conducted at university level (e.g.: Alm et al. 2022; Winfield and Ndlovu, 2019) linking sustainability with employability and academic assessments, revealed, in all courses, that a cross-school approach was adopted in re-designing the curriculum both at undergraduate and postgraduate levels as well as a linkage to external stakeholders. One of the common features the researchers found was that implementing sustainability courses and

programs across faculties aimed at different effective pedagogical tools and methodologies ensured students learned and enabled them to achieve academic performance.

Positing a possible relationship between the students' academic results, which enable development of necessary skills and competences, led to the following research hypotheses:

H5(a): Academic performance mediates the relationship between NC and SDK
H5(b): Academic performance mediates the relationship between AC and SDK
H5(c): Academic performance mediates the relationship between SC and SDK
H5(d): Academic performance mediates the relationship between IC and SDK

1.3. Learning and Teaching Initiatives influence on sustainability competences and SDK

The cornerstone of the majority of articles published in Theory Into Practice (TIP) over the last five decades has been research related to learning theories. This scholarship forms the foundation for discussions in all articles that explore the practical application of theories in the expansive realm of education. In fact, it's plausible to assert that any research aimed at enhancing the learning experience of students, to some extent, relies on the principles derived from learning theory (Hoy et al. 2013). Investigations on university programs and assessment that link to sustainability, are on the rise especially on how it could be integrated into future professional initiatives and efforts (Junghanns and Beery, 2020; Ghasemy et al., 2023) and considering how program outcomes in HEIs align with the actual learning processes (Redman et al., 2021). In this connection, Lozano et al. (2015) found that integrating sustainable development (SD) into the programs and curricula will also create meaningful SD learning outcomes. In HEIs, debates on the integration of the United Nations 17 SDGs and Agenda 2030 draws attention from the different groups of stakeholders and society at large. It is becoming increasingly important because it creates awareness of environmental challenges, supports knowledge about sustainability and raises awareness among students. Caniglia et al. (2018) acknowledge a pressing need for HEIs to empower future generations (students) to keep abreast of the changes and effects arising from urbanization, forest devastation, climate change and loss of biodiversity as well as its impact on the ecosystem in varied scales and different continents.

To promote the above, HEIs should endeavour to apply a variety of blended and online learning to advance sustainability development knowledge (SDK) and education for sustainable development (ESD) for formal and nonformal education (Hueske et al. 2022; Holmes et al., 2022). According to Fatima Poza-Vilches et al. (2022), SDGs are present in the majority of syllabus of the subjects analysed. Their findings show predisposition and a high interest in, and by, the teachers involved, might not be sufficient as there is still a long way to go to achieving a thorough and complete incorporation of the principles of sustainability. Holmes et al. (2022) showed approaches to SDG learning and teaching (L and T) varied in degree of alignment between theory and practice, involved some component of online L and T, questions of equity in online SDG education and highlighted that more work needed to be done to ensure that both online and offline L and T were delivering the transformational changes required for and by, the SDGs.

H6 (a)(b)(c)(d): The influence of NC, AC, SC and IC on SDK is moderated by learning and teaching Initiatives.

The review of the prior findings led to the proposed framework (Figure 1) as follows:
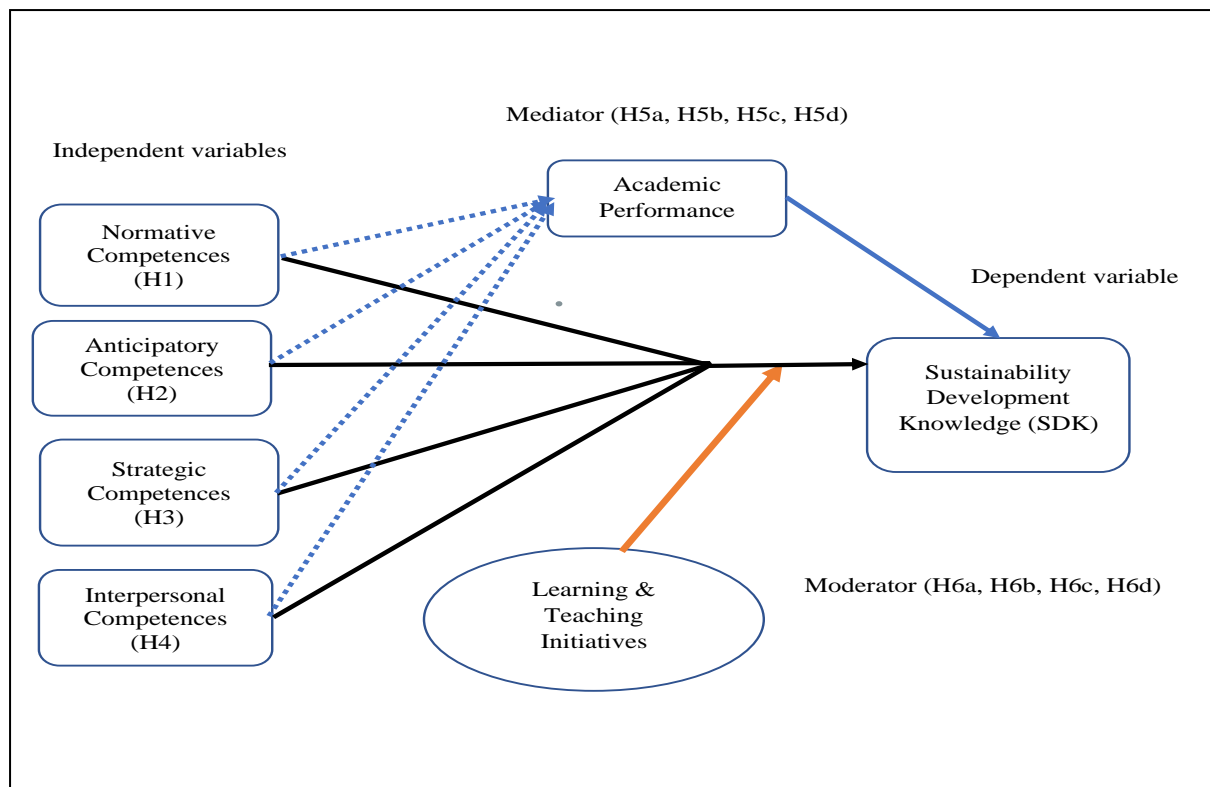
Figure 1
Proposed Model

2. Research Method

2.1. Case Study

The present study was conducted in Tunku Abdul Rahman University of Management and Technology (TAR UMT), Kuala Lumpur, Malaysia. It is one of the largest and oldest institutions of higher learning, a non-profit, private university in Malaysia, established on 1st September 1969 by the Malaysian Chinese Association (MCA). Over 50 years since its inception, TAR UMT had expanded to include 5 other branches in East and West Malaysia. The 5 branches are located in 5 different states in Malaysia, namely, Penang, Johore, Perak, Pahang and Sabah. TAR UMT currently has a total student population of 28,000 inclusive of the branches. An estimated 95% of the students originated from Chinese ancestry and some other minor ethnicities from local and foreign countries. The homogeneity of Chinese students can be viewed from the common Mandarin (language) used, ideology, philosophy and Chinese heritage although different dialects are widely used in different geographical areas. Despite that, the English language is the only medium of instruction used in all courses, programs and curricula. The institution consists of 7 faculties such as FAFB=Faculty of Accountancy, Finance and Business, FOAS=Faculty of Applied Sciences, FCIT=Faculty of Computing and Information Technology, FOBE=Faculty of Built Environment, FOET=Faculty of Engineering and Technology, FCCI=Faculty of Communication and Creative Industries, FSSH=Faculty of Social Science and Humanities.

2.2. Survey Instrument and measurement

An online survey was used to collect data for empirical testing. The constructs and its items were selected from the extensive literature review, expert opinion, and user's feedback. A

structured closed-ended questionnaire was developed using Google Form and a link was created. The draft questionnaire was pre-tested using three different experts in sustainability knowledge, sustainability competences and pedagogical/andragogical teaching staff. There was a minor amendment to some of the wording used in the instrument for the purpose of conciseness and clarity. No technical suggestion was offered by the subject expert on the definition of sustainability and its potential antecedents.

The first section of the questionnaire focused on the sociodemographic information of participants such as gender, ethnicity, age, grade point average and level of study. Sections B to section F of the questionnaire consisted of independent variables—namely normative competences (e.g., "Given the opportunity, I would introduce and implement new sustainable ideas in my future workplace".), anticipatory competence (e.g., Future sustainable developments will be driven by new technologies and innovations".), strategic competences (e.g., "Organisations and universities must work together in order to fulfil future sustainability goals".) and interpersonal competences (e.g., "During my studies I learned to work in diverse groups".) and dependent variable (i.e,: sustainability development knowledge) (e.g., "I am familiar with the sustainability development goals".). Learning and Teaching initiatives (e.g., My institution should design curricula and pedagogy to address the SDGs, my institution should orient the student experience towards the SDGs) which was adapted from Holmes (2021), was included as the last section of the survey instrument. All the constructs were measured using a 5-point Likert scale ranging from strongly agree to strongly disagree, some of which were adapted from Alm et al. (2022) with minor adjustment to be aligned with the local context.

2.3. Data collection procedure

In line with the Dash and Paul (2021) and Farooq et al. (2018) s' studies, convenience data were run using PLS-SEM. Our study employed a positivist paradigm, cross-sectional approach carried out on a convenience sample of 7 faculties of the institution. Respondents were given either a Google link or a QR quote during and after classes whichever fit the lecturers' and tutors' timetables, hence 98% response rate was attained. Consent was given by the teaching staff and a prior approval from the faculty's Ethics Committee. The survey took about 10-15 minutes to complete. The instrument was pilot tested using 15 undergraduate students as our surrogates. Results of which proved to be reliable and valid (as shown in Table 1) and the subsequent roll-out of the survey were completed within two months. According to DeVellis (2012), the Cronbach's α coefficient of the scale should be above 0.7. In this study, all measurable constructs were well above the Cronbach's α coefficient of 0.8 (see Table I) indicating the scale's internal consistency reliability. There was also no negative value reported in the inter-item correlation matrix. A total sample size of 320 were collected from both the undergraduates and postgraduates.

Table 1.
Pilot Test Results

Variables	Cronbach alpha
Anticipatory competences	0.927
Interpersonal competences	0.902
Learning and teaching initiatives	0.821
Normative competences	0.810

Variables	Cronbach alpha
Strategic competences	0.959
Sustainable development knowledge	0.909

3. Result and Discussion

Sample and descriptive analyses

The analysis tools in the study were Statistical Package for Social Science (SPSS) version 29 and Partial Least Square-Structural Equation Modeling (PLS-SEM). To guarantee the accuracy of the data, SPSS via descriptive analysis, was used to find outliers and missing values (Tabachnick and Fidell, 2018). Untrustworthy data were removed leaving a total of 312 for further analysis. The sample consisted of 196 (62.8%) females and 108 males (34.6%). In terms of age, 301 respondents (96.5%) were aged between 18-23 years old whereas 11 respondents were 23 years old. About 272 (87.2%) respondents had undergraduate education level whereas 40 (12.8%) had postgraduate level. Additionally, almost 156 (50%) respondents reported they had 3.0000-3.5000 CGPA. The respondents' profile is in Table 2.

Table 2.
Respondents' Profile

Respondents' profile		Frequency	Percentage (%)
Gender.	Male.	108	34.6
	Female.	196	62.8
	Prefer not to say	8	2.6
Age.	18-23 years old.	301	96.5
	23 years old.	11	3.5
Faculty	FAFB	178	57.1
	FOAS	12	3.85
	FCIT	72	23.1
	FOBE	10	3.21
	FOET	8	2.57
	FCCI	20	6.41
	FSSH	12	3.74
Education level.	Undergraduate.	272	87.2
	Postgraduate.	40	12.8
CGPA	0.0000-2.0000	15	4.8
	2.5000-2.7500	54	17.3
	3.0000-3.5000	156	50
	3.7500-4.0000	87	27.9

Note: FAFB=Faculty of Accountancy, Finance and Business, FOAS=Faculty of Applied Sciences, FCIT=Faculty of Computing and Information Technology, FOBE=Faculty of Built Environment, FOET=Faculty of Engineering and Technology, FCCI=Faculty of Communication and Creative Industries, FSSH=Faculty of Social Science and Humanities.

Measurement Model Analyses

The research model had a good fit because the Standardized Root Mean Square Residual (SRMR) value was 0.096, lower than the threshold of 0.10 as recommended by Henseler, Dijkstra, Sarstedt, Ringle, Diamantopoulos, Straub, Ketchen, Hair, Hult and Calantone (2014).

Loadings of individual items, Composite Reliability (CR) and Average Variance Extracted (AVE) were examined (Hair et al., 2021). The results confirmed individual items were reliable (see Table 3) because all loadings were greater than 0.60 excluding NC1, SDK4, SDK5, SDK6 and SDK7. These items were removed and did not alter the meaning of the variables because they were interrelated with each other (Tay et al. 2021; Tay et al. 2022).

Similarly, the CR scores in Table 3 exceeded 0.70 respectively. Further, AVE scores beyond the threshold of 0.50, in accordance with Hair et al., 2017. As such, all the constructs in this research achieved the requirements for convergent validity at the first-order stage. (Tay et al., 2017; Tay et al., 2018; Yeo et al. 2022), thus achieving convergent validity for all variables. Finally, all the variables met discriminant validity, with the AVE square root of each variable exceeding the other in the rows and columns (see Table 4) (Hair et al., 2021).

Table 3.
Item Loadings, CR and AVE

Variables.	Items	Loadings	CR	AVE
Anticipatory competences (AC).	AC1	0.853.	0.924.	0.752.
	AC2	0.859.		
	AC3	0.888.		
	AC4	0.881.		
Interpersonal competences (IC).	IC1	0.613	0.886.	0.567.
	IC2	0.759.		
	IC3	0.781.		
	IC4	0.820.		
	IC5	0.740.		
	IC6	0.789.		
Learning and teaching initiatives (ITI).	ITI1	0.832.	0.925.	0.711.
	ITI2	0.858.		
	ITI3	0.868.		
	ITI4	0.819.		
	ITI5	0.838.		
Normative competences (NC).	NC1	†	0.893.	0.676.
	NC2	0.852		
	NC3	0.875		
	NC4	0.773		
	NC5	0.782.		
Strategic competences (SC).	SC1	0.785.	0.933.	0.666.
	SC2	0.724.		
	SC3	0.877.		
	SC4	0.806.		
	SC5	0.868.		
	SC6	0.794.		
	SC7	0.846.		
Sustainable development knowledge (SDK).	SDK1	0.744.	0.851.	0.534.
	SDK2	0.746.		
	SDK3	0.762.		
	SDK4	†		
	SDK5	†		
	SDK6	†		
	SDK7	†		
	SDK8	0. 735.		
	SDK9	0.663.		

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Notes: †=items removed as the items below loading values 0.40.

Table 4.
Fornell and Larcker (1981) Criterion

	AC	IC	LTI	NC	SC	SDK
AC	0.867.					
IC	0.447.	0.753.				
LTI	0.607.	0.560.	0.843.			
NC	0.705.	0.553.	0.629.	0.822.		
SC	0.816.	0.549.	0.634.	0.724.	0.816.	
SDK	0.441.	0.496.	0.515.	0.556.	0.470.	0.731.

Note: Anticipatory competences (AC), Interpersonal competences (IC), Learning & teaching initiative (LTI), Normative competences (NC), Strategic competences (SC), Sustainability development knowledge (SDK)

Structural Model Analyses

Collinearity was examined using Variance Inflaction Factor (VIF) (Hair et al., 2021). The results indicated that all VIF values were less than the threshold of 5, showing the collinearity was not an issue. The coefficient of determination (R^2) value was 0.367, which was acceptable. Such R^2 value indicated that 36.7% variance of sustainable development knowledge was described by academic performance. Whereas, anticipatory competences, interpersonal competences, normative competences, strategic competences described 3.1% variance of academic performance.

In addition, Table 5 showed that anticipatory competences, interpersonal competences, learning and teaching initiatives, normative competences and strategic competences had a small effect on sustainable development knowledge, following Cohen (1988) guidelines. In a similar vein, anticipatory competences, interpersonal competences, learning and teaching initiatives, normative competences and strategic competences had a small effect on academic performance (see Table 5) referring to Cohen (1988) practices. Additionally, predictive relevance (Q^2) was performed using a blindfold process (Hair et al., 2021). The results revealed sustainable development knowledge had predictive relevance since the Q^2 value was larger than 0 (sustainable development knowledge =0.156) (Hair et al., 2021).

Further, the results in Table 5 revealed two hypotheses were supported while the rest were not supported (see Figure 2). In other words, the results showed the significant influence of interpersonal competences and normative competences on sustainable development knowledge. In contrast, the results also reported the insignificant influence of anticipatory competences and strategic competences on sustainable development knowledge. Besides, academic performance did not mediate between anticipatory competences, interpersonal competences, normative competences, strategic competences and sustainable development knowledge. Further, learning and teaching initiatives did not moderate anticipatory competences, interpersonal competences, normative competences, strategic competences and sustainable development knowledge.

Table 5.
Hypothesis Testing

|	AC	IC	LTI	NC	SC	SDK
H₁	AC->SDK	0.112	1.209 1.987	[-0.060, 0.299]	No	0.004
H₂	IC->SDK	0.157		[0.005, 0.402]	Yes	0.014
H₃	NC->SDK	0.228	2.899	[0.118, 0.316]	Yes	0.032
H₄	SC->SDK.	-0.031	0.305	[-0.230, 0.164]	No	0.000
H_{5a}	AC->AP->SDK	-0.004	0.272	[-0.033, 0.024]	No	0.025
H_{5b}	IC->AP->SDK	0.000	0.061	[-0.010, 0.008]	No	0.000
H_{5c}	NC->AC->SDK	0.002	0.237	[-0.011, 0.016]	No	0.006
H_{5d}	SC->AC->SDK	0.001	0.166	[-0.012, 0.016]	No	0.002
H_{6a}	AC*LTI->SDK	0.037	0.336	[-0.162, 0.279]	No	0.000
H_{6b}	IC*LTI->SDK	0.035	0.428	[-0.137, 0.177]	No	0.000
H_{6c}	NC*LTI->SDK	-0.016	0.156	[-0.221, 0.177]	No	0.000
H_{6d}	SC*LTI->SDK	-0.033	0.307	[-0.260, 0.168]	No	0.000
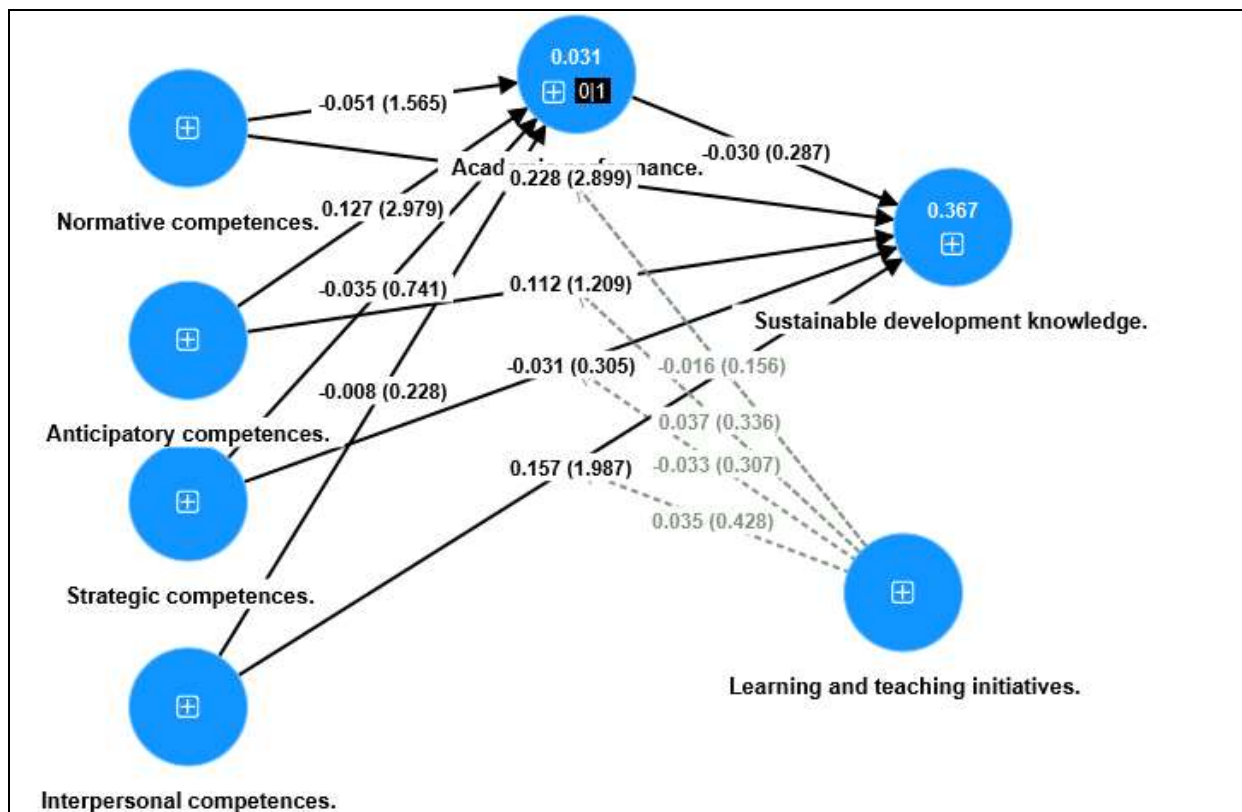
4. Conclusion

Discussion

Anticipatory competences were found to have insignificant relationship with sustainable development knowledge, despite the fact that prior studies (De Haan, 2006; Grunwald, 2007) found that anticipatory competences enhanced sustainable development knowledge. A possible explanation could be that the TAR UMT students were of a younger age group i.e., 96.5% were 18-23 years old (see Table 1), albeit they had undergone 4 months of internship, the majority of them did not have sufficient real-world working experience to hone the skill and ability to anticipate environmental happenings, in particular, the use of state-of-art technologies and other newest related sustainability developments. Hence, the students in TAR UMT have not been successful in developing their anticipatory competences required to recognise sustainability problems, create assumptions, gain experience inexplicitly via stories and response patterns to handle an untold sustainability future. As such, students will find it more difficult to acquire SDK.

On the other hand, interpersonal competences had a significant relationship with sustainable development knowledge. Such a significant relationship confirmed a prior study of Lambrechts et al. (2019) which clearly showed that interpersonal competences can encourage and facilitate joint research and problem solving. Interpersonal competences consist of advanced communication, negotiation, leadership, trans-cultural and empathy skills which are crucial for effective partnership collaboration for sustainable development knowledge. The positive result also confirmed that TAR UMT students have the ability to interact with others and with the community and society at large. It also reaffirmed the ability of TAR UMT students to build and maintain healthy relationships that are mutually beneficial, and have the capacity for interdependence and collaboration.

In a similar vein, normative competences had a significant relationship with sustainable development knowledge. This finding aligns with a prior study of Lambrechts et al. (2016) which claims that normative competences can determine, relate, accommodate and negotiate sustainability values, principles, goals, and targets. It enables the examination of the current and future role of sustainability systems and improves sustainable development knowledge. More importantly, it also shows how the understanding of the normative competence concept varies across and within cultures, and how integrating these concepts contributes to solving sustainability problems. In line with Wiek et al. (2011) exhortation, using methods such as visioning, multi-criteria assessment, and risk assessment, should enable graduates to collaborate with stakeholders to apply sustainability values and hence, enable graduates to assess the (un-) sustainability of current and future states of social-ecological systems, and to create and craft sustainability visions for these systems.

The insignificant direct relationship between strategic competence and SDK contradicts previous studies (Lambrechts et al., 2016; Lans et al., 2014). One possible explanation is that the TAR UMT students in the study view themselves as not having any experience and skills in actual situations and relationships, hence their familiarity in designing, overcoming obstacles, experimenting, implementing, evaluating, adapting programs and actions are

unknown. As suggested by Wiek et al. (2011), to equip an individual with strategic competence, individuals must expose themselves to real-world scenarios, connections, challenging positions, relevant language that the real world is comfortable with and deadlines that governments or communities are comfortable with. Generally, without this familiarity, students are unable to develop their SDK.

Academic performance had no mediation effect on essential sustainability competences and SDK. The result aligns with Al-Naqbi and Alshannag (2018) who reported an insignificant relationship between academic level to achieve education for sustainable development. This could be possibly due to the fact that TAR UMT students' academic performance is not extensively used in all faculties and/or measured with sustainability development goals. This limited adoption seems inadequate to improve essential sustainability competences and SDK. As Giannetti et al. (2021) showed, the finding is appropriate considering restricted exposure to academic performance aimed at fostering essential competences and the SDK.

Additionally, learning and teaching initiatives had no moderation effect on essential competences and the SDK. One possible reason could be due to the variation and emphasis of each assessment used across different courses and programs. Moreover, learning and teaching systems focus more on students' final exams, coursework, employment prospects and job skill (Bennett et al., 2022; Grauer et al., 2022), hence giving higher weight to main subjects such as mathematics, engineering and information technology. In other words, the guarantee of the people's welfare, planet and environment are less focused on the learning and teaching initiatives, thus developing rather incrementally the essential competences to attain the SDK.

Implications, Conclusion and Future Research
This study contributes to the literature in several ways. Firstly, it enriches SDK literature by identifying that students' who have interpersonal and normative competence are more likely to build the SDK.

Secondly, it did not confirm the contribution of academic performance to enhance essential competences and the SDK. This suggests that additional research is necessary as it remains to be seen for academic performance may be associated with essential competences and the SDK.

Thirdly, it did not find empirical evidence for the moderating role of learning and teaching initiatives in the relationship between the essential competences and the SDK. Students' SDK relies on other moderators such as environmental values (Qazi et al., 2021), student engagement (Cogut et al., 2019), institutional support (Lukman et al., 2020). Interest in learning sustainability competencies tended to differ among different programs, majors and fields which were found by (Hyytinen et al. 2023) in their studies. This clearly testifies that LTI play little role in guiding the acquisition of SDK. Hence, future research could investigate further whether the proposed relationship is moderated by other potential moderators.

According to the results, two essential competences (i.e., interpersonal and normative competence) are relevant to improve SDK. This study can be the reference or guideline for HEIs that wish to improve SDK in their university programmes using interpersonal and normative competences. It is suggested that HEIs may adopt problem and project-based learning-sustainable development goal educational models via peer-to-peer teaching, students' discussion in group work and students organising and observing their learning process. Such an educational model fosters students' interpersonal and normative competence to address not

only recent problems but also real world social and environmental issues. These abilities equip students with national and global vision, the ability to scrutinise scientific concepts and aids critical thinking, all being relevant competencies for their future working life. As indicated earlier, the integration of interpersonal and normative competencies in all University curriculae, across science, health and social science subjects, may pose a challenge. However, whatever the disciplines, interpersonal skills are de rigueur and the ability to think 'outside the box' (or the 'norm') is a paradigm for progress, especially in the context of 'sustainability'.

Besides, the findings demonstrate that anticipatory, strategic competences, academic performance, learning and teaching initiatives were not found to influence SDK. The results remind HEIs not to eliminate the significance of anticipatory, strategic competences, academic performance, learning and teaching initiatives to achieve SDK. However, it identifies HEIs should not consider anticipatory, strategic competences, academic performance, learning and teaching initiatives to prepare students encountering various obstacles in pursuit of sustainable development and for increasing their SDK.

This study suggests that organisations can shift their attention to understand the importance of students' interpersonal and normative competence and the SDK. It can be realistically used by the organisations for improving the SDK among the fresh graduate workers such as conducting joint work on real-work and recent issues. Given the insignificant contribution of anticipatory, strategic competences, academic performance, learning and teaching initiatives on the SDK, organisations, with limited resources to develop the SDK, may keep this in mind when prioritizing amongst these factors.

In terms of the future gaps to be filled, we acknowledged that based on the self-report data, students may tend to choose the acceptable answer of researchers instead of expressing their views genuinely. On this note, the authors themselves are currently conducting another study using in-depth interviews in gathering more insightful information among all the middle (Dean and Associate Deans) and upper management (President and Vice Presidents) teams. Our cross-sectional study design tends not to examine the relationship changes of anticipatory competences, interpersonal competences, learning and teaching initiatives, normative competences, strategic competences, academic performance on sustainable development knowledge over time. Thus, conducting longitudinal studies could be considered as they describe how the interruption of anticipatory competences, interpersonal competences, learning and teaching initiatives, normative competences, strategic competences and academic performance could progressively enhance sustainable development knowledge. Since the data was entirely obtained from the TAR UMT which may not be generalisable to other universities and countries. Hence, future research could focus on inter-universities or perhaps across countries comparison. In addition, more information and feedback could be sought from different groups of stakeholders (e.g., alumni, student council, community) to ensure a more parsimonious and well-rounded study.

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