Reliability and Construct Validity Assessment of the Student Competency Questionnaire among Final Year Diploma Students: A Statistical Analysis Approach

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ABSTRACT

The university strives to provide students with a curriculum that is pertinent and taught by educators with exceptional delivery methods, in a stimulating and dynamic learning setting. The goal is for students to graduate as individuals who can make positive contributions to society, start their own businesses, and take on leadership roles in their professions. This research aims to develop the Student Competency Questionnaire (SCQ) and assess its reliability and validity. Using classical test theory, the evaluation focused on reliability, construct validity, and content validity. A postal questionnaire containing 49 items was distributed in October 2022 to a sample of 59 final year diploma students from various programs. Three experts in education, statistical modeling, and decision making evaluated the content validity of the scale. The Content Validity Index (CVI) for all constructs ranged from 0.96 to 1, exceeding the threshold of 0.70, indicating that the items are 'content valid.' Cronbach's alpha values showed a high level of internal consistency, all exceeding 0.90. Additionally, all items within each construct were highly related to one another, with correlations exceeding 0.30.This research demonstrates that the Pillar 1 education 5.0 @ Universiti Teknologi MARA (UiTM) frameworks effectively capture essential skills for students' academic and professional development, enhancing their employability. The focus on Personal, Adaptive, Digital, 21st Century, and Social competencies, along with student satisfaction, ensures students are equipped with diverse skills needed to thrive in dynamic environments. Overall, UiTM's approach prepares students for success in their future careers and personal lives.

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1. Introduction

Academic accomplishment is a crucial indicator for evaluating a student's learning condition and educational advancement. It acts as a thorough measure, covering not just the gaining of knowledge but also the use of critical thinking skills, problem-solving capabilities, and a profound comprehension of the topic. These accomplishments go beyond just grades or test results; they represent the culmination of a student's commitment, hard work, and involvement in the learning process.

During the learning process, a comprehensive evaluation of a student's intellectual development involves showcasing their ability to absorb material, engage actively in class, and

overcome the obstacles encountered in their academic path. Therefore, it plays a vital role in influencing the storyline of a student's educational journey and future opportunities. Educational administration must assess students' competency to ensure their overall success.

Study by [1] have compiled many methods for measuring student accomplishment in higher education, including examinations, tests, grades, GPA, projects, assessments, class participation, portfolios, and peer assessments. Nowadays, the education system has adopted a fresh method to equip pupils to tackle the evolving environment. An intuitive approach is necessary to build and develop a fluid, dynamic, and organic curriculum to ensure students are well-prepared for the labor market.

At UiTM, the Education 5.0@UiTM initiative has developed a framework with five primary pillars that can be applied to the curriculum, learning experience, learning environment, instructors, and delivery. Students will engage with a pertinent curriculum, guided by instructors with excellent teaching methods, in a stimulating and dynamic learning environment. When students graduate from university, they will have had a fulfilling journey that has prepared them to be valuable members of society, entrepreneurs, and capable leaders who can succeed in the professional realm.

Therefore, emphasizing Pillar 1, which involves a cohesive and relevant curriculum, is essential to ensure that students are well-prepared. Five primary abilities focused on for students in the 21st century are social competence, adaptability, digital proficiency, and high levels of personal competency. This research aims to assess student skills by gathering self-evaluation data using a questionnaire.

Questionnaires are vital instruments in survey research, but researchers must recognize and understand their inherent limits. Having this insight is crucial for creating surveys that yield precise and significant outcomes. Researchers can address possible concerns by acknowledging these limits, allowing them to make educated judgements when designing and analyzing survey surveys. Integrating questionnaires with other research methodologies or validation approaches might enhance the overall strength of a study.

In this sense, this study had developed a Student Competencies Questionnaire (SCQ) based on Education 5.0@UiTMI framework (Pillar 1). The SCQ is based mainly on Likert Scale (ranging from 1(less competency) to 10 (most competent) to measure each of the theoretical constructs as presented below. Since framework still not been evaluated in any previous study, therefore the main objective in this study is to evaluate the validity and reliability of SCQ so that able to allows researchers to develop a more well-rounded and reliable investigation that leverages the strengths of diverse research methods and validation techniques. This comprehensive approach enhances confidence in the study's findings and contributes to a deeper understanding in this study. The key to research process in this study been illustrated in Figure 1.
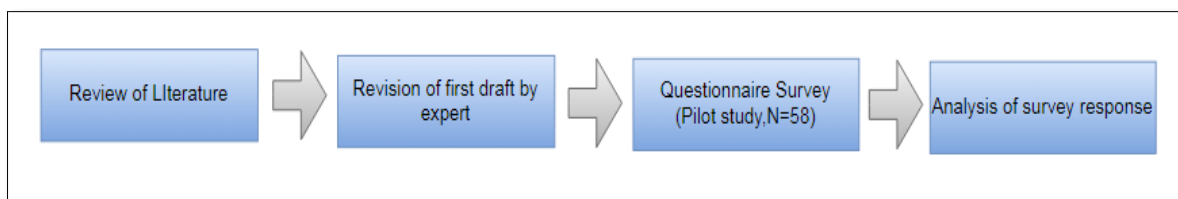

Figure 1: The Summary of Questionnaire Development and Validation

2. Literature Review

2.1 Education 5.0@UiTM: Navigating Pillar 1 framework

Industrial Revolution 4.0 (IR4.0) provides a new catalyst for the change of the current education system in Malaysia. It is driven by technological advancements such as artificial intelligence, virtual reality, data analytics, and the Internet of Things. Based on key findings outlined by [2], [3] present graduates lacked understanding of the IR4.0 concept; they are unprepared for future careers because they relied too heavily on their academic programs to train them and universities are not adequately preparing students for jobs. Therefore, universities have to regularly review the relevancy of their current academic programs especially to prepare students with necessary skills for future IR4.0 workforce. In fact, according to [4],besides knowledge and technical skills, universities also have to equip their students with extra soft skills to enhance their critical

thinking, problem- solving, leadership skills, and lifelong learning to fulfill the changing demands of the IR4.0 job market.

Universiti Teknologi MARA (UiTM), the largest public university in Malaysia, is consistently ranked as the most famous place to study. In the past 60 years, the university has grown from an institution to a large university that manages academic matters of 27 faculties and 4 academic centres comprising 526 programmes at the main campus and 35 state, branch and satellite campuses nationwide. Since 2016, the university has actively engaged in enhancing existing academic programs, launching data analytics labs and smart classrooms in various faculties and state campuses to support the country's IR4.0 initiative.

Apart from this, UiTM has recently launched a new brand of academic ecosystem named Education 5.0@UiTM intending to humanize higher education learning in response to IR4.0 (Refer Figure 2). Education 5.0@UiTM is defined as a learning-centric ecosystem that is sustainable, balanced and principled, driven by values and concepts of Adab and Amanah, powered by intellect and afforded by new, ubiquitous technologies [5]
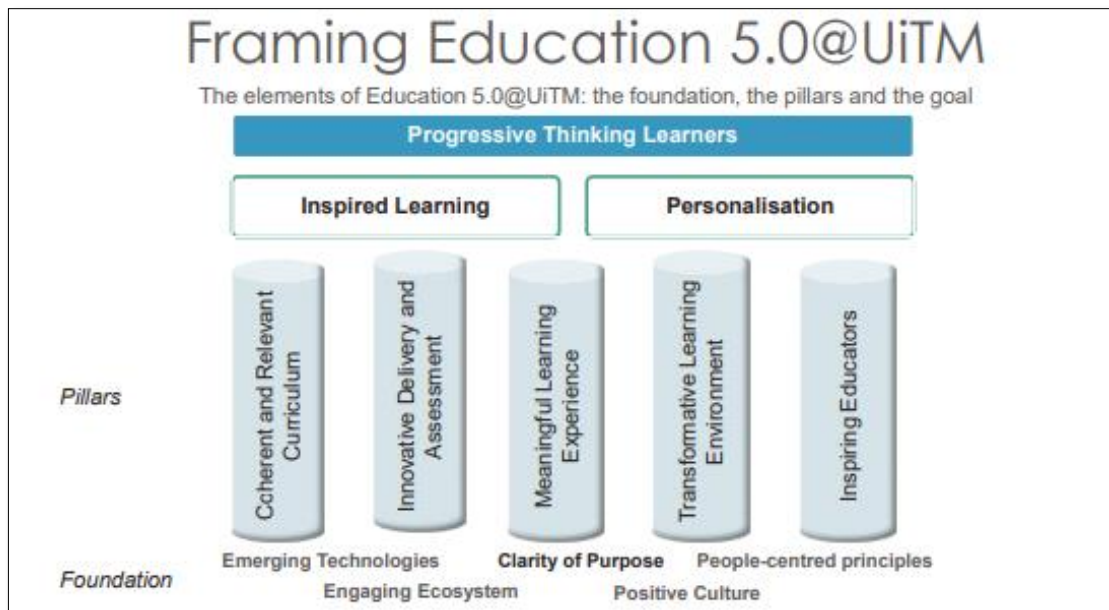

Figure 2: Framing Education 5.0 @UiTM

The Education 5.0 framework at UiTM comprises three key elements: the goal, the pillars, and the foundation. The overarching objective is to cultivate forward-thinking learners characterized by creativity, innovation, and adaptability, enabling them to become versatile professionals, job creators, and leaders in the future. This goal is achieved through the implementation of five pillars: curriculum, delivery, learning experience, learning environment, and educators.

These pillars are guided by a clear sense of purpose, a positive culture, the incorporation of relevant emerging technologies, an engaging ecosystem, and principles centered on people. By aligning these elements, the framework aims to inspire learning and personalization, ultimately nurturing individuals who are well-equipped for the challenges of the future. Thus, to make sure the students embarking into a workforce world with preparedness, this framework of Pillar 1: Coherent and Relevant Curriculum as illustrated in Figure 3.
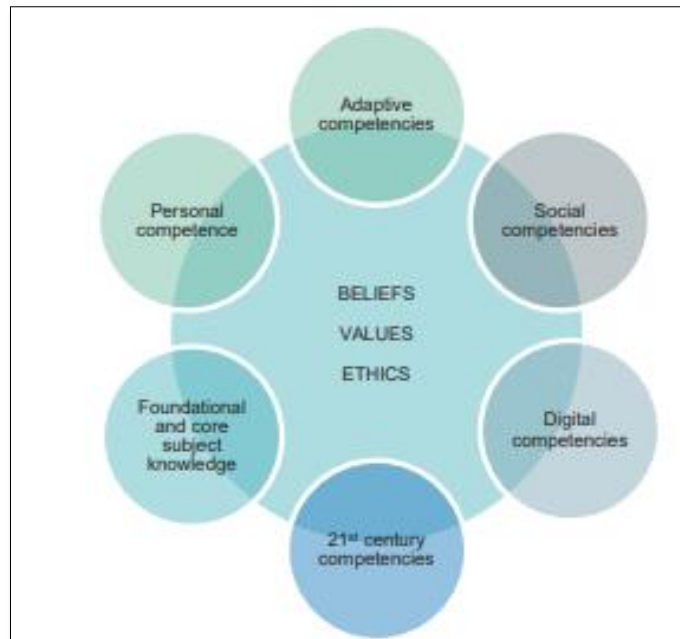
Figure 3: Pillar 1-Coherent and Relevant Curriculum

Students must be holistically prepared to face the world. Holistic preparation means that students should achieve a well-rounded excellence, not just focusing solely on academic curriculum. Therefore, an intuitive approach is necessary for designing and developing a coherent and relevant curriculum. Each program offered should encompass the overall excellence of students, addressing both academic and competency enhancements in every area. Emphasis on these six competencies has been incorporated into Education 5.0@UiTM to ensure that student excellence is achieved comprehensively.

2.2 The connection between six main competencies in Pillar 1 with academic Achievement Efficiency

Competencies are referring to ability to generally understand and perform anything at a basic level. Competence also refers to your ability to comprehend actions or knowledge throughout different parts of life. This means competence occurs at various stages of life as you grow older, learn new things, meet new people and experience new environments. In education field, student competencies are pivotal as they extend beyond mere academic knowledge, encompassing a spectrum of skills, attitudes, and behaviors crucial for overall personal and academic triumph.

The significance of student competencies lies in their capacity to prepare students for success across diverse life domains, transcending academic achievements. In the contemporary workforce, skills like critical thinking, creativity, communication, collaboration, and adaptability are increasingly esteemed. The essence of student competencies in education lies in furnishing a framework that embraces a comprehensive and forward-looking approach to learning. By concentrating on competencies, education not only equips students for academic success but also for a prosperous and gratifying life in the face of rapid societal changes.

Past research has brought attention to the significance of directing focus towards a range of student competencies. These encompass digital competencies as explored by [6] which are essential for navigating the digital landscape. Additionally, the emphasis on 21st-century competencies, as investigated by [7] underscores the importance of skills like critical thinking, creativity, and collaboration in the modern era. Social competency been explored by [8] highlighted the interpersonal skills crucial for effective communication and collaboration. [9] have delved into personal competency, shedding light on the importance of individual attributes and self-awareness.

Furthermore, the research conducted by [10] has contributed insights into adaptive competency, emphasizing the ability to navigate and thrive in dynamic and changing environments. Collectively, these studies underscore the multidimensional nature of student competencies crucial for their comprehensive development. The belief is that with these competencies, students are well-equipped to succeed comprehensively.

In this study, a framework has been developed to examine the interconnection between student competencies, academic achievement, and the satisfaction derived from pursuing a diploma.. However, the focus of this study is specifically limited to evaluating satisfaction with university services as a key element influencing overall student achievement as depicted in Figure 4.
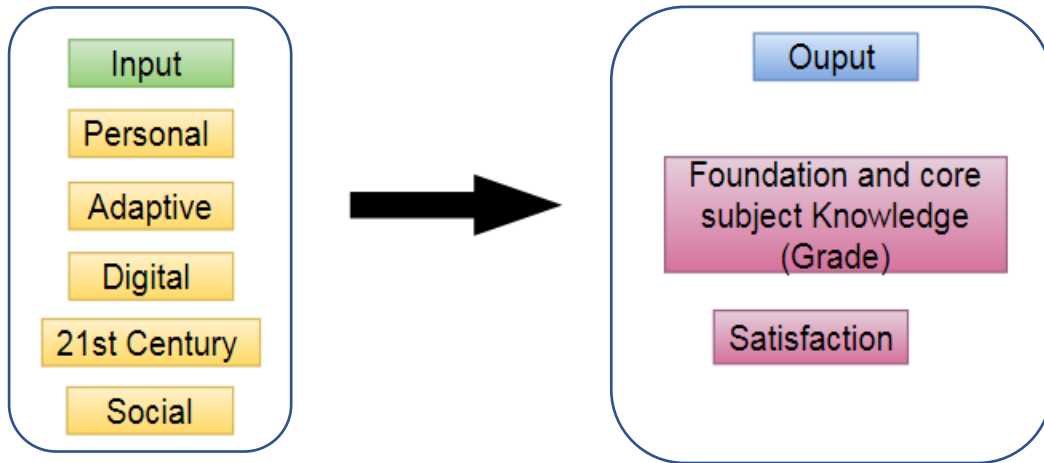

Figure 4: Conceptual model for determining Student academic achievement efficiency

3. Methodology

3.1 The Development of Student Competency Questionnaire (SCQ)

In this paper, Student's Competency Questionnaire been developed consisting of four parts. Part A focuses on the demographics of students where seven items been asked. Part B on Academic Background involving the history of student achievement during school day on selected four selected subjects. Meanwhile for Part C focused on Student Competencies factors as stated in Pillar 1 education 5.0@uitm.Part D on Student Satisfaction. Table 1 shows the description of the questionnaire for this study.

The construction of the questionnaire is based on the adaptation from previous studies. Whenever possible, items for Part C have been built as 10 Likert scales ranging from Not Competence at all to Very competent. This study prefers to use 10 Likert scale compares to 7 Likert scale like commonly social study used to provide more granularity by allowing for a finer differentiation of response. In fact a study by [11] revealed that 10 points of Likert scale is more efficient than 5 points of Likert scale in operating of measurement model.

3.2 Testing SCQ through Pilot Study

A pilot study provides an excellent opportunity to uncover such problems ahead of time, minimizing the need to adapt procedures or to develop contingency plans on short notice when the larger study is being conducted. Thus, this study was conducted to assess the feasibility and effectiveness of the research design and data collection methods planned in this study. This small-scale investigation aimed to identify potential challenges, refine the research instruments, and ensure the smooth implementation of the larger study. The pilot study employed a quantitative approach, utilizing a cross-sectional design. The key variables under investigation included five competencies factor and one satisfaction. Before the process of collection data started, an application to conduct the study will be made to Research Ethic Committee, Program Coordinator and Student Affair officer in order inform and get permission regarding this study. Participants were selected using a convenience sampling method, with inclusion criteria (final year diploma students). A total of 59 final year diploma students were recruited for the pilot study considering with 95% confidence and 5% probability the practical constraints of time and resources.

Table 1: The description of Student's Competency Questionnaire

Component	Reference
Part A:Demographic Profile	
Gender Semester Hometown Family Income Education Aids Mother's Level of Education Father's Level of Education	-
Part B:Academic Background	
SPM Result: Mathematic Additional Mathematic Science English Student Grade(CGPA) Student Grade (GPA)	- - - - - - -
Part C:Competency Factors	
Personal Competencies	Adapted from [12]
Adaptive Competencies	Adapted from [13]
Digital Competencies	Adapted from [14]
21st Century Competencies	Adapted from [7]
Social Competencies	Adapted from [15]
Part D: Other Factors	
Student Satisfaction	Adapted from [16], [17]

3.3 The Validation Process of Student Competency Questionnaire (SCQ)

According to [18] content validity is the degree to which a measurement reveals the specific intended domain of content. Content validity, also identified as logical or rational validity, is the assessment of how much the item measure or represents the construct of the research. Earlier, [19] states that content validity are the determination of the content representativeness or content relevance of the elements or items of an instrument by the application of two-stage process: the development and judgment. The CVI is derived from the content relevance of the items based on the four-point scale rating given by the experts. The actual CVI is the proportion of items that obtained a rating of 3 or 4 by the experts divide with the total items in the construct [20].Established on [21] suggestion, the content validity index (CVI) must be at least 0.70 to show higher content validity.

To obtain expert reviews have become a widespread practice in questionnaire development [22] .Researchers have often requested subject matter experts, methodology experts, and language experts to appraise the draft questionnaires and provide a critique on the items as a technique of recognizing questionnaire problems, potential measurement errors or a breakdown in the question answering process. To determine the number of expert reviewers for content validity of the questionnaire, These suggest that the number of expert reviewers for content validity should between five to 20 [23], [24].However, [19] argues that a minimum of three experts should be employed but not to exceed ten experts.

Thus, this study decided to appoint three expert reviews (PT, DN and DF) where each of these experts is an academician and PhD holder that have expertise in their field. Expert 1 namely as PT expertise in Educational Technology, Expert 2 namely as DN expertise in Statistical Modeling while Expert 3 namely as DF expertise in on Decision Making area. Content validity was attended to ensure that the items in the questionnaire had been adopted and customized adequately. The review of the items is carried out by five experts; three experts in the content of the subject, one expert in the field of methodology, and one language expert. The experts were requested to value each item on the relevance of the construct according to Table 2 below:

Table 2: The ranking of each constructs/items in SCQ

Statement	Score
Not Relevant (Requires Major amendment)-NA	1
Somewhat relevant (Requires minor amendment-BE	2
Relevant (No amendment but need minor revision)-IA	3
Highly relevant (No amendment)- EE	4

The content validity approach can be conducted through the face to face approach or non-face to face approach. This study decided to use non face to face approach (online) for Expert 1 due to long distance reason while Expert 2 and Expert 3 were conducted through face to face approach. After the discussions with all the content experts, the researcher builds a summary of all responses and comments. From there, the researcher calculates the 'content validity index (CVI)', the most widely used quantification of content validity.

3.4 Items Internal Consistency

Internal consistency is a critical measure for assessing whether scale items effectively capture the intended construct. Commonly used indices for this purpose include Cronbach's alpha, corrected item-total correlation, and average inter-item correlation [25]–[27] .Cronbach's alpha is widely utilized to gauge the extent to which items in a multi-item scale measure the same underlying concept, while corrected item-total correlation assesses an item's consistency with the overall test score. Researchers in [28] suggested reliability thresholds, as presented in Table 3.

Table 3. Interpretation of Cronbach alpha-score

Cronbach alpha score	Interpretation
<0.5	Items need to be dropped
<0.6	Items need to be dropped
0.6-0.7	Acceptable
0.7-0.8	Good and acceptable
0.8-1.0	Very good and effective level of consistency

Inter-item correlations reveal how items within a scale are interrelated, aiding in identifying item redundancy and relatedness. Researchers in [25], [29] recommended that both the average inter-item correlation and the average inter-item correlation for each item should fall within the range of 0.15–0.50, with a corrected item-total correlation ideally exceeding 0.30 [30] Items failing to meet these criteria were excluded from the scale.

4. Results and Discussion

4.1 Content Validity

The CVI for all the constructs of this study ranged from 0.96 to 1 (Table 4) found to be above the threshold of 0.70 to demonstrate that the items in each of the constructs are approximately 'content valid'.

Table 4: The Result of Content Validity

SCQ content meaningful items	Expert 1	Expert 2	Expert 3
Items rated 'not relevant' and 'somewhat relevant'	2	0	0
Items rated 'relevant' and 'highly relevant'	47	49	49
Total Initial Items	49	49	49
Content Validity Index	0.96	1	1

4.2 Reliability (Internal Consistency)

The results in Tables 5 display the corrected item-total correlations and Cronbach's alpha coefficients for all items across six main constructs: Personal Competency, Adaptive Competency, Digital Competency, 21st Century Competency, Social Competency, and Student Satisfaction. The Cronbach's alpha values indicate a very good level of internal consistency, all exceeding 0.90. Additionally, Pearson Product Moment of correlation was employed to assess the corrected item-total correlations within each construct. The result revealed that for the Personal Competency domain, all item-total correlations were above 0.591 (range: 0.591 to 0.800), for Adaptive Competency, above 0.540 (range: 0.540 to 0.829 for Digital Competency, above 0.629 (range: 0.629 to 0.835), for 21st Century Competency, above 0.717 (range: 0.717 to 0.834), for Social Competency, above 0.723 (range: 0.723 to 0.884), and for Satisfaction, above 0.884. These results indicate that each item within a scale correlates well with the other items in the scale, contributing to the overall score. Overall, all items within each construct are highly related to one another within their respective domains, with correlations exceeding 0.30.

Table 5: Internal Consistency of Personal Competency domain items (N=58)

Domain	Code	Item	Corrected item-total correlation	Cronbach's Alpha
Personal	P1	Self-Control	0.591	0.911
	P2	Trustworthiness	0.735	
	P3	Conscientiousness	0.746	
	P4	Adaptability	0.692	
	P5	Innovativeness	0.633	
	P6	Achievement drive	0.669	
	P7	Commitment	0.701	
	P8	Initiative	0.800	
	P9	Optimism	0.722	
Adaptive	A1	Recognizing skills	0.740	0.924
	A2	Respecting	0.540	
	A3	Capable of making one's own decision	0.808	
	A4	Assuming responsibility	0.744	
	A5	Exercising leadership	0.792	
	A6	Showing interest in the topic	0.783	
	A7	Showing the interest in learning process	0.829	
	A8	Having a flexible attitude	0.729	
Digital	D1	Information Literacy	0.776	0.910
	D2	Computer Literacy	0.795	
	D3	Media Literacy	0.835	
	D4	Communication Literacy	0.776	
	D5	Visual Literacy	0.629	
	D6	Technological Literacy	0.683	
21st Century Competency	21ST 1	Critical Thinking	0.720	0.914
	21ST 2	Collaboration	0.752	
	21ST 3	Communication	0.803	
	21ST 4	Creativity	0.770	
Social	S1	Empathy	0.770	0.924
	S2	Leveraging diversity	0.717	

	S3	Political Awareness	0.797	
	S4	Communication	0.811	
	S5	Conflict management	0.775	
	S6	Team Capabilities	0.834	
Satisfaction	SAT1	the University	0.853	0.971
	SAT2	the Administrative and Student Services	0.884	
	SAT3	the Cafeteria	0.781	
	SAT4	the Facility Condition provided	0.831	
	SAT5	the Library	0.723	
	SAT6	the Class Placements	0.823	
	SAT7	the Lecturers	0.828	
	SAT8	the University Buildings	0.853	
	SAT9	the Relevance of Teaching to Practice	0.834	
	SAT10	the Support from Lecturers	0.824	
	SAT11	the Presentation of Information	0.779	
	SAT12	the Atmosphere among Students	0.844	
	SAT13	the Courses	0.835	
	SAT14	the Reputation of the University	0.873	
	SAT15	the Additional Courses Offered	0.842	
	SAT16	the University Life Outside the Courses	0.752	

5. Conclusion

The present study aimed to validate the competency properties based on the Pillar 1 education 5.0 @ UiTM frameworks, which comprises five main competency domains and student satisfaction for final year diploma students at UiTM. The selected scales for Personal, Adaptive, Digital, 21st Century, and Social competencies were deemed content valid (greater than 0.70) through expert review. Cronbach's alpha values for all domains exceeded 0.90, confirming the adequacy of internal consistencies. Consequently, these findings support the conclusion that the competencies outlined in the Pillar 1 education 5.0 @ UiTM framework are well-represented and reliably measured among final year diploma students at UiTM.

The validation of competencies among final year diploma students at UiTM has significant implications. The confirmed content validity and high internal consistency of the competency domains indicate that the Pillar 1 education 5.0 @ UiTM framework effectively captures essential skills for students' academic and professional development, enhancing their employability. The focus on Personal, Adaptive, Digital, 21st Century, and Social competencies, along with student satisfaction, ensures students are equipped with diverse skills needed to thrive in dynamic environments. These findings suggest that UiTM is preparing students holistically, fostering their success in both future careers and personal lives.

Conflict of Interest
The authors declare no conflict of interest in the subject matter or materials discussed in this manuscript.

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