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Usability analysis of the individual creativity assessment tool using the adjusted system usability scale

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ABSTRACT

Creativity is a critical element in the learning environment, which leads to innovation and research advancement in higher education. However, assessing creativity is challenging due to its diverse nature and the lack of standardized tools. The existing assessment tools often overlook the critical role of organizational culture in shaping individual creativity within academic settings. To address this gap, the individual creativity assessment tool (i-CAT) was developed based on the framework of organizational culture to assess its contribution to creativity among Malaysian academicians. This study aimed to i) assess the usability of i-CAT and ii) determine the significant effect of demographic factors on its usability assessment. A quantitative methodology, utilizing expert sampling and the system usability scale (SUS), was employed as the primary evaluation method. 20 experts with relevant professional and academic experience were selected for the validation. The results showed excellent usability, with 95% of experts rating the information system as functionally acceptable. A one-way analysis of variance (ANOVA) found no significant difference in usability based on profession or education levels, but a significant difference was observed for experience levels. These findings confirm that i-CAT is a functional, user-friendly, and culturally relevant tool for creativity assessment within Malaysia's higher education institutions.

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1. INTRODUCTION

Creativity is a key element in the learning environment, influencing innovation, problem-solving, and research advancement. In higher education, creativity not only enhances teaching methods but also contributes to the development of new ideas, research innovations, and interdisciplinary collaborations. Recent research has emphasized the importance of creativity in fostering critical thinking and problem-solving among students [1]. According to Beghetto and Kaufman [2], creativity is valued in educational learning environments as a component of learning, and individual creativity will allow learners to think critically as well as improve their skills in generating new ideas. However, the measurement of creativity poses a significant challenge, particularly in academic institutions where creativity depends on individual capacity and organizational environment. Earlier tests like the torrance tests of creative thinking (TTCT) developed by Dr. E. Paul Torrance and his associates in 1966 have been widely used to measure individual creativity, which focuses on cognitive dimensions such as fluency, originality, and flexibility [3]–[5]. In the studies defined creativity as problem-identification process, solution-finding, idea-changing, and communicating

the solution. However, these tools tend to overlook the influence of external factors, like organizational culture, which also plays a critical role in shaping individual creativity within academic institutions.

Cameron and Quinn [6] described those diverse organizational cultures, which comprised market, clan, hierarchy, and adhocracy, influenced how creativity is perceived and fostered within academic environments. Martins and Terblanche [7] highlighted that organizational culture, made up of shared practices, beliefs, and values, affects creativity among academic staff. Despite the importance of organizational culture, existing creativity assessment tools do not include these cultural aspects, which creates a gap in the assessment of creativity in the academic environment. In addition, it is difficult to assess creativity due to its multifaceted nature and the lack of standardized tools. Apart from that, the research on creativity assessment tools in Malaysia is limited, and there is a need to evaluate their usability and effectiveness within the Malaysian academic environment. Therefore, this study aims i) to assess the usability of individual creativity assessment tools (i-CAT) and ii) to determine the significant effect of demographic factors on usability assessment.

The i-CAT being developed for this study is based on the framework of organizational culture, focusing on the four types of culture that are market, clan, hierarchy, and adhocracy. These cultures of the organization play a significant role in shaping the employees' creativity within the organization. By understanding how these aspects of culture impact creativity, the i-CAT attempts to assess the individual contribution of the organizational culture towards creativity within the context of academic institutions in Malaysia. The i-CAT also helps to understand how different organizational cultures in Malaysian academic institutions affect their academicians' creative ability. Besides, through their understanding of creativity measures, the tool aims to help organizations predict and monitor the current level of individual creativity among the employees.

2. LITERATURE REVIEW

2.1. Individual creativity

Creativity is the most significant factor contributing to organizations' development, as it provides many crucial benefits to organizations. Employees with high satisfaction, new ideas, and strong teams are increasing innovation in organizations. According to Rodrigues *et al.* [8] it is important for employees to have a self-perceived creativity to increase the business performance in organizations. Less creative employees are usually not interested in skills such as entrepreneurship, and these traits do not match the business profile. In organizations, the innovation process initiates with individual creativity, a new idea is rooted in the individual cognitive process, and is refined and developed through the interaction among team members [9]. Individual creativity in employees is very important to the performance of organizations. According to Amabile [10], an employee with creativity will help to generate new ideas to be applied in organizations, resulting in innovation as output. Managerial mechanisms are crucial and essential in order to encourage creativity among employees in organizations.

Research by Ouakouak and Ouedraogo [11] found that individual creativity is a vital source of organizational innovation, as is essential for modern organizations, according to most scholars and practitioners. As reported by Zhou and George [12], the starting point of innovation usually comes from creative employees. Individual creativity can be viewed as a result of personal characteristics such as cognitive abilities, personality, and upbringing, as well as environmental circumstances, such as cultural and organizational backgrounds [13]. Individual creativity can be understood as individuals in an organization working together in a complicated system to formulate worthy, fascinating new products, services, ideas, procedures, and processes [14]. When employees have a creativity is something that can help sense of ownership and control over their work and ideas, it fosters their creativity in organizations [15].

2.2. Individual creativity in Malaysia context

Creativity is something that can help others to explore more and can make the future better. The realistic ideas from the employees are generated from the research and development activities. Research by Azman *et al.* [16], on the factors that affect employee creativity among staff in a Malaysian operating in the energy industry that faced the crucial situation impact of the COVID-19 pandemic shows that there are significant relationships between personality and work environment with employee creativity. The result of this study confirmed that personality and work environment have a positive relationship with employee creativity. Ramalingam *et al.* [17] in the telecommunication industry in Malaysia found that the transformational leadership of the CEO dictates the culture of creativity and innovation in an organization, which further explains its performance and growth to ensure it remains competitive.

In culinary and gastronomy research, innovation contributes significantly to helping chefs continuously grow their creativity. Abidin *et al.* [18] introduced a new conceptual framework that explicates chefs' creativity in utilizing Malaysian local herbs (MLH) to develop modern Malaysian cuisine (MMC). The study highlights how chefs coherently organize their creativity through processes in utilizing and

modernizing the local products for the modern cuisine in expensive restaurants. It was supported by [19] as it is essential to understand the culinary innovation by uncovering the behaviors of chefs in a restaurant.

Tahir *et al.* [20] has emphasized the importance of appreciation and rewards in fostering creativity and innovation among staff. To make the staff feel appreciated, internal support and praise are important elements that should be consistently given by the employers. Organizational success is also contributed to by the external rewards, such as financial incentives and awards provided by the employer to ensure employees are motivated to sustain their creativity. As indicate by [21] in their study, positive environmental factors will encourage educators in higher education institutions (HEIs) in Malaysia to exercise more creativity in their jobs. This study was support to the needs for the research to assess educators' creativity in the context of Malaysia's higher education environment. The study of the dimensional impact of emotional intelligence (EI), creativity, and innovation on the multigenerational workforce in Malaysia by [22] found that the multigenerational workforce presents a unique setting in Malaysia's current workforce, and it shows that there is still a gap in the dimensional impact of EI within Malaysia's multigenerational workforce as the importance of EI in influencing employees' creativity and innovation. On the other hand, the influence of artificial intelligence in shaping individual creativity can no longer be ignored [23]–[26].

2.3. Accessing individual creativity

Encouraging employee creativity is vital for organizational success. The corporate social responsibility (CSR) activities that increase the happiness and creative self-efficacy of employees can consequently result in increased creativity [27]. The welfare society and an organizational climate will be improved when effective CSR is applied, and it will lead to a greater level of employee contentment and productivity. Organizations are suggested to create socialization platforms where employees can share their beliefs and assumptions with a strong sense of psychological safety. Employees who share similar work and life experiences in the workplace will result to organizational socialization, in which they will start helping each other as they have gone through the same experience at some point in time in their lives [28]. Adeel *et al.* [29] suggests that providing employees with relevant technological tools and ensuring the deployment of these technologies will increase the higher levels of employee creativity. Employers should encourage the proper utilization of technology through formal and informal training programs, as they can utilize technology to access a variety of useful information and get the support of digital technology for the generation of creative ideas. Shalley *et al.* [30] implies that, as collective creativity is valued in the organization, employees are more likely to behave collectively. In order to involve the employees in the creative process, it is important to give them autonomy, so they are able to make decisions, speak, and act independently without interference from others.

3. METHOD

This section describes the methodology used in testing the usability of the information system that was developed. This is done through expert sampling, system usability scale (SUS) usability evaluation, and utilization of an adapted SUS scoring procedure. A research tool was created through the adoption of the SUS tool of [31], [32]. The SUS tool was a good way of measuring the usability of various services and products [32]. SUS has been utilized by various research studies, as well as industrial testing [31], [33]. Besides that, SUS also enables researchers to gain users' perception measurement on product usability faster and more easily [32], [34]. The purposive sampling technique was used to offer valid confirmation of the usability of the information system, and limits the range of variation, and emphasizing similarities [35].

20 experts were chosen based on their professional experience, work experience, and academic qualifications. The system usability was assessed using a revised SUS, which consists of 10 items, each rated on a 5-point Likert scale ranging from strongly disagree (1) to strongly agree (5). All SUS items in this study were revised to maintain positive polarity to facilitate scoring and analysis, as suggested in [31], [36]. A modified SUS scoring algorithm was developed to convert individual answers into a composite usability score out of 100. Individual item responses were subtracted by 1, resulting in a 0-4 scale. Normalized scores per 10 items were added to the highest score, which is 40. The total score was multiplied by 2.5 as altered to generate an adjusted SUS score ranging between 0 and 100. This eased system usability level categorization, giving better insight into total user classification and potential areas of improvement.

4. FINDINGS

Following the completion of the information system usability validation process, this subsection will explain the findings of the study from several perspectives. First, we elaborate on the demographic details of the expert validators. Second, the nature of the descriptive evaluation of the SUS scale was described and discussed by following the works of [31], [32], [36]. Third, we added elements of inferential analysis using analysis of variance (ANOVA) and an independent sample *t*-test. Fourth, SUS scoring was used to assess the information system usability status.

4.1. Demographic analysis

Table 1 shows the demographic assessment of the respondents. A total of 20 experts were selected for the validation of the information system usability assessment. Most of the respondents are from academia (N=12 or 60%), followed by industry (N=4 or 20%) and specific IT professionals (N=4 or 20%). Interestingly, the expertise of the respondents is proven in relation to experience of more than 10 years (N=15 or 75%) and possesses a doctoral qualification (N=9 or 45%).

4.2. Descriptive analysis

Table 2 shows the descriptive analysis of the adjusted SUS scale of the study. The results show that all experts have a positive attitude towards the acceptance of information system usability, indicated by the lowest mean value of 3.30 and the highest mean value of 4.45, as well as an overall mean value of 4.23. The SUS score also indicates that most experts can handle the application on their own without the need for assistance from IT experts or technical assistance.

Table 1. Demographic analysis of expert

Item	Sub-item	Frequency	%
Profession	Academics	12	60.0
	Industry	4	20.0
	IT Professionals	4	20.0
Experience	<5 years	4	20.0
	5 years to <10 years	1	5.0
	>10 years	15	75.0
Education	Diploma	1	5.0
	Degree	6	30.0
	Master	4	20.0
	Ph.D.	9	45.0

Table 2. Descriptive analysis of adjusted SUS scale item

Item	Item	Mean	Std. Dev.	Mod
US1	I think that I would like to use this system frequently	3.95	0.887	4
US2	I found the system is not very complex	4.35	0.587	4
US3	I thought the system was easy to use	4.45	0.605	5
US4	I think that I do not need the support of a technical person to be able to use this system	4.45	0.759	5
US5	I found the various functions in this system were well-integrated	4.35	0.671	4
US6	I thought there was little inconsistency in this system	3.30	1.261	4
US7	I would imagine that most people would learn to use this system very quickly	4.35	0.671	4
US8	I found the system very easy to use	4.30	0.571	4
US9	I felt very confident using the system	4.25	0.639	4
US10	I do not need to learn a lot of things before I can get going with this system	4.40	0.821	5

4.3. ANOVA

Subsequently, one-way ANOVA analysis was conducted between demographic factors (profession, experience, and education) and usability assessment, as illustrated in Table 3. The results indicated as follows. First, there is no significant different between three level of profession [F(2, 17)=0.079, p=0.924]. Second, there is a significant different between three level of experience [F(2, 17)=3.524, p=0.050]. Third, there is no significant different between four level of education [F(3, 16)=1.543, p=0.242].

Table 3. One-way ANOVA results for the effect of demographic factors on usability

Independent	Dependent	Sum of squares	df	Mean square	F	Sig.
Profession	Usability	0.041	2	0.021	0.079	0.924
		4.424	17	0.260		
Experience		1.309	2	0.654	3.524	0.050
		3.157	17	0.186		
Education		1.002	3	0.334	1.543	0.242
		3.463	16	0.216		

4.4. Adjusted SUS scoring

To determine the information system SUS scoring, this study developed an algorithm based on [1], [3]. Accordingly, all the items were converted into a positive value, eliminating the use of positive and negative poles as suggested by [1]. Next, the scale position will be minus 1 and added to get the final score. The final score will then be multiplied by 2.5 to obtain the total adjusted usability score, as suggested by [3]. Next, to evaluate the SUS score, the criterion illustrated in Table 4 is used.

The result from Table 4 indicates an excellent output of usability assessment scoring, of which 95% of the experts agreed that the information system is functionally acceptable, and the rest as marginally acceptable. No expert argues with the proposed information system, thus confirming its usability. Table 5 illustrates the analysis of the expert distribution of the SUS scoring.

Table 4. SUS acceptance ranges

Scale	Range (%)	Frequency	Score assessment (%)
Acceptable	70-100	19	95%
Marginal acceptance	50-69	1	5%
Not acceptable	0-49	0	0%

Table 5. Adjusted SUS score distribution

#	Adjusted SUS score	Percentage (%)	Indicator
1	40	80	Acceptable
2	40	80	Acceptable
3	39	78	Acceptable
4	36	72	Acceptable
5	46	92	Acceptable
6	45	90	Acceptable
7	39	78	Acceptable
8	49	98	Acceptable
9	39	78	Acceptable
10	42	84	Acceptable
11	40	80	Acceptable
12	30	60	Marginally acceptable
13	39	78	Acceptable
14	48	96	Acceptable
15	36	72	Acceptable
16	43	86	Acceptable
17	42	84	Acceptable
18	47	94	Acceptable
19	47	94	Acceptable
20	36	72	Acceptable

5. DISCUSSION

The findings of this study provide strong support for the usability and acceptance of the i-CAT as a digital assessment tool among Malaysian academicians. The results from the SUS scale indicate that the i-CAT is perceived as usable and acceptable. The inferential analysis reveals that the i-CAT is both functional and relevant for assessing individual creativity within higher education settings in Malaysia.

5.1. Usability of i-CAT and academic expert validation

The descriptive results indicate that experts are showing a positive attitude towards i-CAT, with an overall mean score of 4.23 and a high usability score in the SUS analysis. This exhibits the importance of providing employees with effective technological tools. The experts' ability to navigate and utilize i-CAT without technical assistance suggests that the system design successfully met usability criteria such as learnability, efficiency, and satisfaction. The excellent SUS scoring also proves that i-CAT supports the principles of user-centered design, becoming evident in the usability dimensions emphasized in previous studies on creativity-support systems. Therefore, the positive usability assessment of i-CAT implies its potential to be a reliable tool for fostering creativity assessment within academic environments. It also served as a good indicator for usability assessment for potential future references.

5.2. i-CAT and the assessment of individual creativity

The high usability results reflect that i-CAT can capture individual perspectives based on personal characteristics and factors. In the Malaysian context, this supports [16], who highlighted that personality and work environment significantly affect employee creativity. I-CAT's design, which highlights individual responses and intuitive navigation, potentially enhances users' reflective engagement in assessing their own creative traits. Moreover, the findings affirm the relevance of developing localized creativity assessment tools tailored to Malaysia's educational and cultural context, as i-CAT's usability not only facilitates assessment but also contributes indirectly to encouraging a culture of creativity and self-awareness among academicians.

5.3. Implications for Malaysian academia and organizational innovation

The successful usability validation of i-CAT has several implications for higher education institutions in Malaysia. Firstly, it offers a standardized, user-friendly instrument for measuring creativity among

academicians, which can be integrated into professional development and performance enhancement programs. Secondly, by enabling educators to self-assess creativity levels, the tool aligns with Malaysia's higher education transformation agenda that emphasizes holistic and innovative academic talent. i-CAT's usability extends beyond assessment since it signifies an enabler for fostering innovation-driven academic environments.

6. CONCLUSION

The i-CAT is designed to evaluate how organizational culture affects creativity among Malaysian academicians and to assist institutions in fostering creative potential within their staff. This study aimed to evaluate the usability of i-CAT and to examine whether demographic factors influence usability perceptions. To achieve these objectives, the researchers used expert sampling and the SUS as the main evaluation method. 20 experts with relevant professional and academic experience were selected to ensure a reliable assessment. Its successful validation highlights its potential as an effective digital platform for fostering creativity, self-awareness, and innovation within Malaysia's higher education institutions. However, several limitations of the study should be acknowledged. First, due to SUS's limited sample size requirement, it is not possible to produce reliability assessments. Second, the goal of the paper is to assess the usability of the application; other descriptive and inferential analyses will not be conducted. Third, the instrument was adopted from a previous study and has been tested multiple times, thus proving the reliability of the instrument. Fourth, we suggest that future studies look at other usability assessment techniques, as the emergence of artificial intelligence has become more significant over the years.

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AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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Nur Ainatul Mardiah Mat Nawi	✓			✓		✓	✓	✓	✓	✓			✓	✓
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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

The authors state there is no conflict of interest.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author, [MRMR], upon reasonable request.

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