

Received April 27, 2022, accepted June 5, 2022, date of publication June 14, 2022, date of current version June 21, 2022.

Digital Object Identifier 10.1109/ACCESS.2022.3183117

# Impact of Power Distance Cultural Dimension in E-Learning Interface Design Among Malaysian Generation Z Students

HAZWANI NORDIN, DALBIR SINGH<sup>ID</sup>, ZULKEFLI MANSOR, (Senior Member, IEEE),  
AND ELAHEH YADEGARIDEHKORDI<sup>ID</sup>

Center for Software Technology and Management, Faculty of Information Science and Technology, Universiti Kebangsaan Malaysia, Bangi 43600, Malaysia

Corresponding author: Elaheh Yadegaridehkordi (yellahe@gmail.com)

This work was supported in part by the Fundamental Research Grant Scheme (FRGS) by the Ministry of Higher Education, Malaysia, under Grant FRGS/1/2016/ICT01/UKM/02/2, and in part by the Universiti Kebangsaan Malaysia Internal Funding.

**ABSTRACT** Adapting the user's cultural background to Interface Design (ID) can increase student engagement in e-learning. The cultural dimensions of Hofstede's model have often been used as guidelines when adapting cultural interface design. As Malaysia's power distance cultural dimension has a perfect full score based on Hofstede's model, many interface developers tend to be guided solely based on the power distance cultural dimension. Therefore, this study aims to identify the impact of the power distance cultural dimension in e-learning interface design in Malaysia. A survey was conducted among generation Z students in public universities in Malaysia and collected 367 data. This study found that generation Z students' power distance index of e-learning interface design in Malaysia scored 63, compared to the score from Hofstede's study, which was 100. Generation Z students in Malaysia disagreed with using images of leaders and theme colour of institutions in e-learning. They prefer the image element related to students and learning. It was also found that students want the theme colours of e-learning are not the formal colours of the institution. However, they still want the official logo of the institution to be presented in the e-learning interface. Therefore, this study can help e-learning interface developers design a worthy interface for generation Z students which increases student engagement in e-learning.

**INDEX TERMS** Human-computer interface, cross-cultural projects, cultural and social implications.

## I. INTRODUCTION

Recently, education institutions have progressively emphasized e-learning opportunities to distribute learning materials to all, especially in developing countries [1]. The number of users using e-learning platforms has exponentially increased. However, the effectiveness of e-learning solutions is still the main concern of many researchers [2], [3]. E-learning interface design is an important characteristic that needs improvement to facilitate interaction between the system and users [4]. Designing an interface based on the user's cultural background is essential to ensure the success of the e-learning system. Previous researchers stated that student engagement in e-learning is still low and unsatisfactory [5], [6]. The poor look and feel of the e-learning interface design cause the students are unconcerned about e-learning [7].

The associate editor coordinating the review of this manuscript and approving it for publication was Giuseppe Desolda<sup>ID</sup>.

Various studies have shown that cultural adaptation in the interface design has positive feedback on the acceptance and usability of system applications [8]. Research by a previous study stated that cultural interface design could better understand the system without misinterpreting the meaning of interface elements [9]. Besides, a well-designed interface could increase users' satisfaction [10]. Previous researchers have agreed that culture could influence users' preferences toward e-learning interface design [9], [11]. For instance, users from different cultural backgrounds react differently toward the interface design according to their nationality, generation, state, and religion [12].

Among the elements of the interface, also known as cultural markers that affect the cultural differences, are languages, colours, symbols, icons, layout, graphics, navigation, and typography [13]–[15]. For instance, colours have symbolic or hidden meanings for different cultures in various countries. For example, green is a preferred colour in Islamic

countries and red is a preferred colour in China [16], [17]. Based on previous studies, interface design elements such as colour, graphics (including logo, symbol, and icon), typography, layout, navigation, and audio-video are frequently used in e-learning interface design [18]–[21]. Thus, these six elements of interface design are reviewed extensively in this study. Besides that, these interface design elements could ensure the look and feel of the e-learning interface are more appealing to its users, especially generation Z students.

So far, various studies have been conducted to investigate the relationship between interface design and culture, more specifically in e-learning [2]. Meanwhile, numerous cultural models are developed to understand these cultural differences mentioned in several previous studies [22]. Besides that, cultural models can also help identify and design the interface. Hofstede's cultural model is a well-known model used to explore different aspects of culture and interface design [23]. Hofstede's cultural model contains six dimensions where each cultural dimension impacts interface design and how interface elements such as images, colour, typography, icon, layout, and metaphor must be considered when designing the interface [9], [14], [24]. Many studies explored users' behaviour during e-learning using Hofstede's cultural model [25]–[27]. Hofstede's cultural dimensions have been extensively used in the user interface of mobile health applications [28], mobile [29], government websites [30], and e-commerce [31]. Meanwhile, some studies employed Hofstede's cultural dimensions in designing the user interface of e-learning. For example, Nordin *et al.* [4] adapted Hofstede's cultural dimensions when identifying the design characteristics of colour and graphics of the e-learning interface for generation Z in Malaysia. The literature review has suggested that Malaysian preferred national colours and the images of important people in the interface design. Those design characteristics implicate high power distance culture. However, further research revealed that Malaysian generation Z students preferred colors unrelated to national colors and wanted images related to students. Besides, Baharum *et al.* [20] also referred to Hofstede's cultural dimension to determine the user's expectation towards e-learning for Universiti Malaysia Sabah (UMS) and developed a new interface for e-learning based on their findings. They also evaluated the new and existing interface. The results revealed that many students preferred the new interface design because the new design is simple, easier to navigate, convenient for students, and user-friendly. Generation Z students born between 1995 and 2010 have been shaped by the advancement of technology [32]. Their daily life involves gadgets such as laptops, smartphones, and the internet, including studying and playing games [33], [34]. Thus, adequate teaching-learning approaches and design strategies should be considered to support generation Z [35]. One of the most crucial actions to attract these new generation learners is to provide new teaching and learning methods by investing more in technological resources [36]. Because of their dependency on gadgets and the internet, they want a high-quality interface

design, including e-learning [37]. However, less research has been conducted on generation Z students' preference for e-learning interface design. Nowadays, generation Z students are in universities [73], so developing e-learning interface design suitable for generation Z is crucial for students to increase student engagement in e-learning. Therefore, this study discussed the preferences of the e-learning interface design of Malaysian generation Z students in terms of the power distance dimension only. Hofstede's power distance scores have been reassessed based on generation Z students' preferences of e-learning interface design.

This paper is organised as follows: Section 2 presents the literature review. Section 3 focuses on the research method. Section 4 provides results and discussions. Section 5 provides a conclusion while section 6 presents the study's limitations and future works.

## II. LITERATURE REVIEW

### A. HOFSTEDE'S CULTURAL MODEL (HCM)

Identifying characteristics of interface design elements has become the subject of interest in cultural interface design. Dimensions of a specific cultural model must be considered to design an interface for a particular culture. The most popular culture and interface design model are Hofstede's Cultural Model (HCM). Hofstede has developed six dimensions to distinguish cultural dimensions, which are Power Distance (PDI), Masculinity (MAS), Individualism (IDV), Uncertainty Avoidance Index (UAI), Long Term Orientation (LTO), and Indulgence vs Restraint (IVR) [38]. Figure 1 shows the relationship between the e-learning interface design and the cultural dimension by Hofstede. This relationship is important to construct questionnaire items related to the culture, which will be discussed in the methodology section.

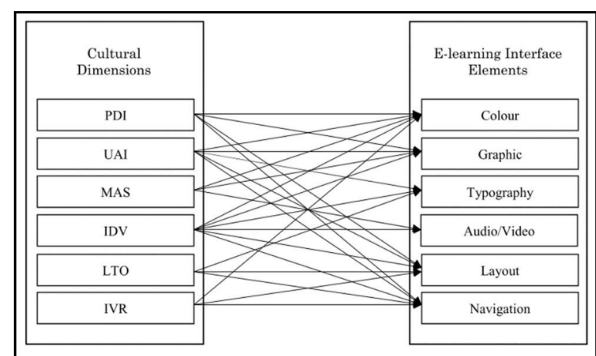


FIGURE 1. Relationship between interface design elements and cultural dimensions based on previous research.

Hofstede has conducted studies about culture's values and behaviour, covering almost every country, including Malaysia. Each country is evaluated with a score from 1 to 100 on each dimension, whereby the highest score represents the intended dimensions. Various studies have been done on how these dimensions can affect the interface design and numerous guidelines have been produced based on the result of Hofstede's studies. Interface developers have widely

used these guidelines for different countries and cultures. Hofstede's study in Malaysia has shown a perfect power distance dimension score equal to 100. Since Malaysia is a high power distance country, many interface developers tend to design the interface according to Hofstede's model's Power Distance Index (PDI) dimension [39]. In high power distance countries, authority plays an important role. So, numerous interface designs such as university websites use images of important people such as the vice-chancellor or monuments instead of images of students. Although Hofstede's study in Malaysia is almost 40 years old, various studies still rely on Hofstede's study to design the desired e-learning interface. However, the newer generation has different preferences toward e-learning interface design [4].

### B. RELATED WORK

Hofstede's work still been referred to by many researchers, although the results are more than 40 years ago [40]. Eringa *et al.* [41] conducted research to validate Hofstede's results by applying his approach to the student population from various countries. The results showed that power distance scores increased among Dutch, German and South African students but decreased among Chinese and Qatari students [41]. Alsswey and Al-Samarraie [42] explored the role of particular cultural predilections in the user interface design of Arab users. Hofstede's cultural dimensions were used and data were collected from 78 respondents. Results showed high satisfaction among Arab users when considering culture dimension in the user interface design. Alsswey, Al-Samarraie *et al.* [29] investigated the possibility of combining Hofstede's dimensions of Arabic culture for modelling mobile user interface. The findings of this research could use in mobile health application development and facilitate the preferences and needs of a group-specific culture. Zheng and Hermawati [43] identified the preference of Hong Kongese for the user interface of fitness and health apps. Results confirmed the need for designing a culturally sensitive user interface as differences were observed between Mainland China and the United States preferences. However, many researchers in various areas are still wondering whether the results from Hofstede's study are acceptable in the new era, especially for the new generation.

#### 1) HOFSTEDE'S STUDY IN MALAYSIA

Studies conducted by Hofstede have been around for a long time, leading to new dimensions in 1991 and 2011, namely long-term orientation and indulgence [38]. Hofstede's cultural model has always been referred to by previous researchers as a standard guideline when a cross-cultural study is involved in interface design. Besides that, Hofstede has conducted studies about culture in more than 60 countries, including Malaysia. Malaysia is a multiracial and multicultural country that consists of Malays, Chinese, Indians and other diverse minor ethnicities [44]. The diversity of cultures, religions, races and ethnicities is a significant characteristic

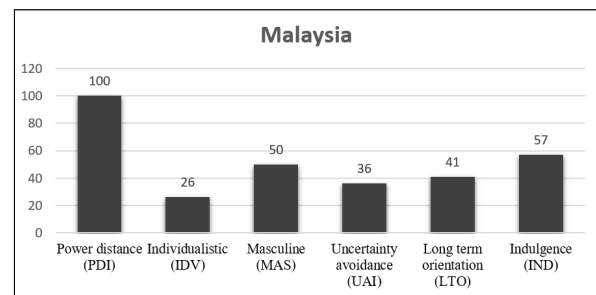


FIGURE 2. Result of Hofstede's study in Malaysia.

of Malaysia. Figure 2 shows the result of Hofstede's study in Malaysia.

Based on Figure 2, power distance value in Malaysia has scored extremely high which is 100 and is the highest among other countries [45], [46]. Besides, previous research also states that most websites in Malaysia solely focus on power distance [47]. Power distance is defined as the extent to which less powerful members of a society accept that power is distributed unequally [38]. High power distance is described as the extent to which society accepts social hierarchy and social inequalities such as power, status and wealth. Less powerful members of society should follow people with a higher position in the hierarchy [48]. Accepting inequality in a high-power distance culture is considered a norm.

Meanwhile, low power distance is described as social equality and everyone is stressed to show more power tolerance [49]–[51]. In high power distance cultures, the educational aspect is usually teacher-centred, whereby teachers must be respected inside or outside the classroom [51]. The relationship between teacher and student is formal, where students do not ask questions during class. In addition, students stay quiet if they disagree with their teacher. This is because students see the teacher as someone with power and must be respected [45], [52], [53].

Although power distance in Malaysia is the highest among other countries, limited studies are conducted on PDI in Malaysia. Different cultural dimensions are not considered as the index of these dimensions is similar to other countries where similar cultural values exist. In addition, findings from the countries which share common cultural values with Malaysia can also be adopted and further applied. Saudi Arabia and China also have high power distance value which is 80 and there are few studies regarding cultural interface design for Saudi Arabia [24], [54]. Research conducted by Alexander, Thompson and Murray [24] regarding website design preferences of Australian, Chinese and Saudi Arabian found that images of leaders were most prevalent on Saudi Arabian websites and followed by Chinese websites. In contrast, images of people in daily life were popular on Australian websites. The use of leader images in the websites shows the high power distance culture in Saudi Arabia and China. Power distance can be detected in websites where most interface design characteristics in Malaysia are adapted

to high power distance. Past researchers' interpretation of high power distance on interface design is strongly focused on authority. For example, many websites in Malaysia use images of people with authority, such as teachers, leaders or vice-chancellors, instead of images of the students [24], [47], [51]. Moreover, certain websites also use images of the monument or official buildings of the institution reflected as high power distance. It is symbolic that Malaysians have a strong sense of national pride [47], [55]. Special titles such as Professor or Dr., which have been conferred on members of the organisation, have always been seen on the websites to be effectively addressed and shown respect by others [56], [57]. Usually, an organisation chart that clearly describes and emphasizes the hierarchy level can also be found on the websites so that people can understand the basic structure of the institutional hierarchy. Logo, symbol, official stamp and certification, awards and prizes that show the greatness of organizations can be found on the website's interface [56], [57].

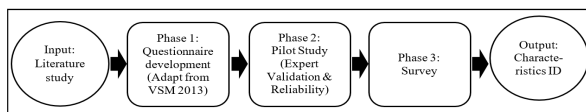
Interface design with high power distance uses black or white as the background colour. The black and white background focused on the institutional name and image used in the interface [17], [55]. Other than that, interface with high power distance uses institutional corporate colour or national flag colour as their theme colour for the website [58]. Table 1 summarises the previous studies of high-power distance toward interface design.

**TABLE 1. Summary of high-power distance and characteristics of interface design in Malaysia.**

Cultural Dimension	Interface Design Characteristics
High power distance	<ul style="list-style-type: none"> <li>Use the image of a leader (CEO, vice-chancellor or lecturers) or monument or historical buildings.</li> <li>Logo, symbol, official stamp and awards displayed.</li> <li>An organization chart with special titles (Professor or Dr.) must be displayed.</li> <li>Use black or white as the background colour.</li> <li>Use institutional corporate colour as a theme in interface design.</li> </ul>

### III. METHODOLOGY

The study aimed to identify the characteristics of interface design that are suitable for generation Z in Malaysia. In addition, it also questioned the validity of Hofstede's study in accordance with generation Z preferences towards e-learning interface design in Malaysia. The research methodology employed in this study is illustrated in Figure 3.



**FIGURE 3. Phases of methodology.**

It consisted of two main phases after the literature study. During the literature study phase, various relevant questionnaires from previous studies regarding the dimensions of

**TABLE 2. Proposed questionnaire items that represent the power distance dimension before expert validation.**

Code No. VSM2013	VSM2013	Proposed Questionnaire Items	Element of ID
02	Have a boss (direct superior) can you respect.	I am comfortable with the theme colour of e-learning which doesn't represent the institution.	Colour
		I like the image of students in e-learning compared to that of high-ranking people in the institutions. The University's official logo must be placed on the main page of e-learning.	Graphic
07	Be consulted by your boss in a decision involving your work.	I like the unstructured layout compared to the structural layout.	Layout
20	Are subordinates afraid to contradict their boss (or students their teachers?)	I am still using e-learning although I am disturbed with the theme colour of e-learning.	Colour
		I am still using e-learning even though the graphic is not clear and does not have meaning.	Graphic
23	An organization structure in which certain subordinates have two bosses should be avoided at all costs.	I like to see different colours on different page in e-learning.	Colour
		I can tolerate different graphics on different pages in e-learning. I like many choices in e-learning.	Graphic Navigation

Hofstede's cultural model and interface design have been studied and referred to develop a set of questionnaire items for the proposed survey employed in this study. Each phase is explained in detail in the following section.

#### A. PHASE 1: DEVELOPMENT OF THE QUESTIONNAIRE

After studying every questionnaire item from the previous studies, a set of questionnaire items was developed to achieve the survey's proposed objectives. This study developed the questionnaire by adopting items from the Value Survey Module 2013 (VSM2013). VSM2013 is an updated module that includes new dimensions of Hofstede's cultural model. VSM2013 is an advancement from the older module VSM82 (4 dimensions) and VSM94 (5 dimensions) [59]. VSM2013 was designed by Geert Hofstede and used by previous studies to develop questionnaire items related to cultural-based research. VSM2013 consists of 24 items pertaining to six dimensions of Hofstede's cultural model. Four items of VSM2013 represent each dimension. In this study, 9 of the 48 proposed questions mapped the interface design element related to power distance dimension. Table 2 shows the proposed questionnaire items representing the dimension of power distance adapted from VSM2013 before being validated by experts.



TABLE 3. Correction proposed by experts.

Elements of ID	Proposed Questionnaire Items	Proposed VSM2013 (Dimension)	Corrected by Experts (Dimension)
Layout	I can tolerate with a consistent and familiar layout.	Do other people or circumstances ever prevent you from doing what you want to? (IVR)	Have a boss (direct superior) can you respect. (PDI) [02]

TABLE 4. Sample size of pilot study.

Questionnaire	Pilot study
Sample size	
• Distributed	50
• Returned	35
• Returned (Online)	-
• Valid	32
Cronbach's Alpha (reliability)	0.932

**B. PHASE 2: PILOT STUDY (EXPERT VALIDATION AND RELIABILITY TEST)**

After constructing questionnaire items by adapting VSM2013, the questionnaire was reviewed and validated by two experts in culture and interface design before using it in the proposed survey. Expert validation is a crucial step in the pilot study. The chosen experts are academicians, and they have experience of more than 10 years in culture and interface design. In this study, the experts validated 48 proposed questions adapted with VSM2013 and agreed with all 9 items under the power distance dimension. However, they changed an item proposed under the indulgence vs restraint (IVR) dimension to the power distance dimension, as shown in Table 3.

Overall, ten questionnaire items are related to the PDI dimension. After expert validation, a pilot study for a reliability test was conducted. A reliability test was conducted to identify weaknesses in the instrument and research procedure before the actual survey. Besides that, a reliability test was conducted to make sure all questionnaire items were free from errors [60]. For the pilot study, 50 questionnaires were distributed and only 35 were returned. Purposive sampling was used to select the respondents for the pilot study. Besides that, these respondents are generation Z students and have experience using the e-learning platform. This pilot study also focused on each respondent's duration to answer the survey and revised all items and instructions so that students could understand the questions or statements in this survey. Table 4 shows the reliability test results collected during the pilot study.

Based on Table 4, only 32 feedbacks were valid to be used for the reliability test. The past research recommended 10 to 50 respondents in pilot study for the questionnaire instrument [17], [61]. The respondents were asked to rate each questionnaire item on a 5-point Likert scale which indicates 1 (strongly disagree), 2 (disagree), 3 (somewhat agree), 4 (agree) and 5 (strongly agree). The overall Cronbach's

alpha value for questionnaire items was 0.932, indicating the questionnaire's reliability was at an acceptable level. The value of Cronbach's alpha between 0.70 and 0.95 is considered reliable. In contrast, the lower value suggests a low number of questions or poor correlations between items and the higher value indicates that some items are redundant [62].

In addition, a Pearson correlation was conducted to confirm the validity of the questionnaire. Pearson correlation is a standard method for assessing the validity of the questionnaire instrument [63]. The simple way to confirm the validity of each item was by comparing the obtained value from the research with the critical value from the Pearson correlation table. If the obtained value is higher than the critical value, so the question is significant and valid. Below is the simple formula to calculate the Pearson correlation for each questionnaire item.

$$N = \text{sample size}$$

$$\text{Degree of freedom (df)} = N - 2$$

Based on Table 4, only 32 feedbacks were valid, so the sample size (N) to calculate Pearson correlation was 32 and the degree of freedom was 30. The correlation significant for this study is 0.01. Figure 4 shows the results of the Pearson correlation test for power distance questionnaire items.

		W1	W2	W3	G1	G2	G3	G4	L1	L4	N1
W2	Pearson		.351*								
	Correlation Sig. (2-tailed)		.049								
W3	Pearson	.164	.426*								
	Correlation Sig. (2-tailed)	.370	.015								
G1	Pearson	.380*	.489**	.385*							
	Correlation Sig. (2-tailed)	.032	.005	.030							
G2	Pearson	.282	.292	.340	.508**						
	Correlation Sig. (2-tailed)	.118	.105	.057	.003						
G3	Pearson	.096	.004	.101	.082	-.149					
	Correlation Sig. (2-tailed)	.602	.982	.584	.655	.417					
G4	Pearson	.290	.299	.098	.324	.284	-.364*				
	Correlation Sig. (2-tailed)	.107	.096	.593	.071	.115	.041				
L1	Pearson	.161	.274	.043	.428*	.101	.029	.167			
	Correlation Sig. (2-tailed)	.379	.129	.815	.015	.582	.873	.360			
L4	Pearson	.126	.155	.142	.576**	.355*	-.092	.577**	.302		
	Correlation Sig. (2-tailed)	.493	.396	.439	.001	.046	.617	.001	.093		
N1	Pearson	.304	.368*	.152	.688**	.348	.036	.481**	.436*	.655**	
	Correlation Sig. (2-tailed)	.090	.038	.406	.000	.051	.845	.005	.013	.000	
Total	Pearson	.522**	.643**	.519**	.843**	.518**	.205	.493**	.571**	.624**	.760**
	Correlation Sig. (2-tailed)	.002	.000	.002	.000	.002	.261	.004	.001	.000	.000

FIGURE 4. Pearson correlation of pilot study for power distance dimension.

From Figure 4, only the total value is needed to compare with the critical value. For example, obtained value for questionnaire item W1 is .522. and Figure 5 shows the critical value of the Pearson correlation table.

df \ α	0.2	0.1	0.05	0.02	0.01	0.001
1	0.951057	0.987688	0.996917	0.999507	0.999877	0.999999
2	0.800000	0.900000	0.950000	0.980000	0.990000	0.999000
3	0.687049	0.805384	0.878339	0.934333	0.958735	0.991139
28	0.240749	0.306057	0.361007	0.422572	0.462892	0.570317
29	0.236612	0.300898	0.355046	0.415792	0.455631	0.562047
30	0.232681	0.295991	0.349370	0.409327	0.448699	0.554119

FIGURE 5. Pearson correlation table.

From Figure 5, the critical value at 30 df and correlation significant at 0.01 is 0.448. Questionnaire item W1's obtained

value is higher than the critical value, so the validity of the questionnaire was supported.

**C. PHASE 3: SURVEY**

There were two methods in this study that were used to distribute the questionnaire. The first method was employed by posting the online link of Google Form via e-mail, Whatsapp and Facebook. The second method was using a questionnaire form. 500 questionnaire forms were distributed among generation Z students at Higher Educational Institutions in Malaysia and only 298 feedbacks of questionnaire form and 88 online responses were received. Overall, 386 respondents participated in this survey. Based on Krejcie & Morgan [64], a sample size of 384 is recommended for a population size of more than 100,000. So, 386 feedbacks are acceptable for this study. The next section describes the discussion on the results, particularly focusing on the power distance dimension.

**IV. RESULTS AND DISCUSSION**

The survey data were analysed to obtain interface design features for generation Z students in Malaysia. Besides that, data from the survey were used to verify if the generation Z student’s choice of interface design features is still consistent with Hofstede’s study. Thus, this study will also compare the PDI dimension from the survey with Hofstede’s study in Malaysia.

**A. DEMOGRAPHIC DATA OF RESPONDENTS**

The respondents for this research are generation Z students at higher learning institutions, including universities and colleges. Table 5 shows the demographic data of respondents.

**TABLE 5. Demographic of respondents.**

	Demographic	Frequency	Percentage (%)
Race	Malaysian-Malay	342	93.2
	Malaysian-Chinese	6	1.6
	Malaysian-Indian	6	1.6
	Malaysian-Others	13	3.5
Gender	Male	145	39.5
	Female	222	60.5
Higher Education Providers	University	207	56.4
	College	160	43.6
Year of birth	1995	66	18.0
	1996	106	28.9
	1997	26	7.1
	1998	32	8.7
	1999	137	37.3

From table 5, this survey involved 367 respondents, of which 145 (39.5%) are male and 222 (60.5%) are female and the majority of the respondents are Malay (93.2%). All respondents are generation Z students born from 1995 to 1999 and pursuing tertiary education in Malaysia.

**B. DESCRIPTIVE ANALYSIS OF POWER DISTANCE DIMENSION IN E-LEARNING INTERFACE DESIGN**

This section aims to analyze the features of e-learning interface design based on the preference of generation Z students in Malaysia for the power distance dimension. Past studies have mentioned that people from the same culture or country share particular features, including interface design preference [48]. Thus, such analysis would identify the features of interface design elements for generation Z students in Malaysia and specifically for the power distance dimension. Table 6 shows the Mean (*m*) and Std. Deviation (*sd*) values of generation Z students’ preferences in e-learning interface design features for the power distance dimension.

**TABLE 6. The result from the survey for power distance dimension.**

Elements	Questionnaire Items (Power Distance Dimension)	Mean ( <i>m</i> )	Std. Deviation ( <i>sd</i> )
Colour	[02] I am comfortable with the theme color of e-learning which does not represent the institution. [W1]	3.21	0.940
	[20] I am still using e-learning although I am disturbed with the theme color of e-learning. [W2]	3.11	0.916
	[23] I like to see different colors on a different page in e-learning. [W3]	3.68	0.974
Graphic	[02] I like the image of students in e-learning compared to the image of a high ranking person in the institutions. [G1]	3.66	0.935
	[23] I can tolerate different graphics on different pages in e-learning. [G2]	3.60	0.765
	[20] I am still using e-learning even though the graphic is not clear and does not have meaning. [G3]	2.75	0.999
	[02] University official logo must be placed on the main page of e-learning. [G4]	3.75	0.922
Layout	[07] I like unstructured layout compared to the structural layout. [L1]	3.08	1.064
	[02] I can tolerate the consistent and familiar layout. [L4]	3.75	0.860
Navigation	[23] I like many choices in e-learning. [N1]	3.77	0.871

Table 6 shows that most respondents somewhat agreed with using a theme colour that does not represent the institutions (*m* = 3.21, *sd* = 0.940). Most learning institutions in Malaysia use national colours as formal colours, including e-learning [65]. However, generation Z students are comfortable with the e-learning that does not use the formal institution colour. These changes show that low power distance culture among generation Z students is more independent and detached from the country’s cultural thinking. Besides, most respondents somewhat agreed with using e-learning, although they feel disturbed with the theme colour in the e-learning interface (*m* = 3.11, *sd* = 0.916). This indicates a high power distance culture among generation Z students for

being willing to use e-learning despite being less comfortable with the theme colours [66]. However, the majority of the respondents agreed with seeing different colours on different pages in e-learning ( $m = 3.68$ ,  $sd = 0.974$ ). Using different colors for different pages is against the conventional design principle, namely consistency. However, past studies have stated that using different colours in e-learning can improve memorization, including remembering information location and layout of the interface design [67], [68]. These changes reveal that generation Z students feel more independent and do not fully bond with the thought of a unified national culture.

Graphic is always in the spotlight while designing an e-learning interface design. Most respondents agreed that images related to students and learning should be used in the e-learning interface design ( $m = 3.66$ ,  $sd = 0.935$ ). Past studies have stated that the interface design in Malaysia tends to use an image of a leader or high ranking person because it shows the high power distance culture [47], [51]. However, these results show that generation Z students prefer their images, indicating low power distance culture. Most respondents agreed that the official logo on the main page of e-learning must be shown on the main page ( $m = 3.75$ ,  $sd = 0.922$ ), indicating the high power distance culture. The respondents agreed to maintain the official logo on the main e-learning page because it represents the institution's identity [50]. The majority of the respondents also agreed to see different graphics on different pages on the e-learning interface ( $m = 3.60$ ,  $sd = 0.765$ ). Many of the respondents agreed that different graphics are used on each page of e-learning because graphics can be translated into various forms such as symbols, logos and images. Previous research stated that high power distance countries are more focused on the quality of information and limited graphic use [66]. However, these results showed that generation Z students wanted different graphics on different pages of e-learning and it is contrary to the high power distance culture. In addition, generation Z students disagreed with tolerating e-learning if the graphic is unclear and meaningless ( $m = 2.75$ ,  $sd = 0.999$ ). This outcome contrasts the previous research that stated that Malaysians could tolerate ambiguity and uncertainty [48]. Generation Z students are reluctant to accept meaningless and blurry graphics because it can be tiring for students to think about the function of the graphic. Graphics should be designed not to tire the user, such as using simple and clear graphics [69].

The layout is one of the important elements in e-learning interface design because users always pay attention to a certain layout design while using e-learning. Layout involves the position of interface elements such as graphics, logo, audio, and video. Based on Table 6, the majority of respondents somewhat agreed with an unstructured layout compared to a structured layout ( $m = 3.08$ ,  $sd = 1.064$ ). The unstructured layout refers to the content arrangement in the e-learning interface design that is disorganised and freer, indicating low power distance [14], [66]. These results contradict the previous research because structured layouts are preferred in

high power distance cultures with only minimum information at the first level and a deeper information hierarchy [14].

However, generation Z agreed with the consistent and familiar layout ( $m = 3.75$ ,  $sd = 0.860$ ). Consistency and familiarity are interface design principles continuously being applied in the e-learning system. Generation Z students prefer many navigation choices in e-learning interface design ( $m = 3.77$ ,  $sd = 0.871$ ). Previous studies have shown that Malaysia is a high power distance country where interface design with limited options and navigations is common among Malaysians [70]. However, this result indicates a low power distance culture where students can access all the options offered in e-learning without any restrictions, which contradicts the past research. Generation Z students want many choices in navigation as it gives them more freedom when exploring e-learning. Many options in e-learning can offer more benefits and functions to the students.

### C. ANALYSIS OF POWER DISTANCE DIMENSIONS FOR GENERATION Z IN MALAYSIA

Hofstede has conducted his study in more than 60 countries, including Malaysia. Based on Hofstede's study, Malaysia is a high-power distance country with a perfect score of 100. Besides that, past studies have stated that the power distance dimension directed the interface design of websites or systems in Malaysia solely. This is because power distance is usable in explaining cultural differences without involving other cultural dimensions and power distance is an accessible dimension to see and differentiate [71]. Because Hofstede's study in Malaysia was long ago and culture changes from time to time, then the power distance index needs to be calculated again to know whether the power distance value by Hofstede is suitable or not for the newest generation.

The cultural index is calculated based on the formula developed by Hofstede. Every dimension has a different formula. Below is the procedure to calculate the power distance index.

$$PDI = 35(m07 - m02) + 25(m20 - m23) + C(pd)$$

where,

$$m02 = \text{mean score for question number 02.}$$

$$m07 = \text{mean score for question number 07.}$$

$$m20 = \text{mean score for question number 20.}$$

$$m23 = \text{mean score for question number 23.}$$

$C(PD)$  = constant no. (can be chosen to shift PDI score to a value between 0 and 100).

Question numbers from the formula were derived from VSM2013 and the result from each number of questions from the survey has been discussed in Table 6. Besides that, the constant number that has been chosen for this study was 100. The PDI dimension among generation Z students in Malaysia toward e-learning interface design is:

$$\begin{aligned} PDI &= 35(m07 - m02) + 25(m20 - m23) + C(pd) \\ &= 35(3.08 - ((3.21 + 3.66 + 3.75 + 3.75)/4)) + 25 \\ &\quad \times (((3.11 + 2.75)/2 - (3.68 + 3.60 \\ &\quad + 3.77)/3) + 100 \\ &= 63.4 \end{aligned}$$

The power distance index of e-learning interface design by generation Z students in Malaysia only scored at 63, compared to the score from Hofstede's study, which was 100. The power distance score has decreased from 100 to 63 after more than 40 years of Hofstede's analysis. A few types of research were conducted that replicate Hofstede's research to know whether Hofstede's score is still relevant. The study conducted by [41] on international students from Netherlands, Germany, China, South Africa and Qatar found many differences with Hofstede's original score. The differences are expected based on the new surrounding of the research, context and time [41]. This study's power distance score is low compared to Hofstede's original score due to generational or time effects [40]. Therefore, to use Hofstede's scores to develop the interface design, especially for generation Z, is irrelevant. This is because Hofstede's original score is obsolete to these new generations either in Malaysia or other countries.

## V. CONCLUSION

User interface design has gained much attention in all fields [74]–[76], including e-learning. This study aimed to reveal whether power distance of Hofstede's score in Malaysia is relevant among generation Z students to developing the e-learning interface design. A survey was conducted among generation Z students to investigate their preferences towards e-learning interface design. The finding obtained from this research highlight that the power distance score is lower among generation Z in Malaysia compared to Hofstede's study. The newly discovered score needs to be referred when developing an e-learning interface design for generation Z due to the changes in preferences. Past research stated that image of the leaders and color representing the countries or institutions are preferred in high power distance countries [24], [47]. However, generation Z students in Malaysia disagreed to use images of leaders and theme colour of institution in e-learning. They prefer the image element should be related to students and learning. They also want the theme colours of e-learning are not the formal colours of institution. However, they still want the official logo of institution to be presented in the e-learning interface. Prioritising the user's preference for the interface design could increase student engagement towards e-learning and a positive learning experience. This study also involves improving knowledge on interface design based on user cultural background, which involves the details of generation Z preferences towards e-learning interface design. As generation Z is a technology generation [77], these details could help e-learning developers to develop more accurate interface designs based on generation Z preferences. This study also contributes to improving the existing model where previous research focused on one dimension only without taking into account the cultural background of target users. In addition, other researchers can also utilise this study as a reference in conducting further studies related to the culture or preferences of target users towards interface design either for e-learning or any other systems.

## VI. LIMITATION AND FUTURE STUDY

This study discovers the latest power distance score and the interface design preferences among generation Z in Malaysia. Some limitations occur during this study. Firstly, previous research has often highlighted the perfect score of power distance culture in Malaysia and how interfaces should be designed in high power distance culture, causing this research only to focus on the power distance dimension. This study solely concentrated on the power distance dimension and neglected the other dimensions. Thus, all cultural dimensions should be reviewed equally and examine which dimension impacts generation Z students most.

Secondly, only four interface design elements covered power distance dimensions, namely colour, graphic, layout, and navigation. Moreover, the characteristics of each element were only briefly described. Therefore, more interface design elements for the power distance dimension should be reviewed in the future. Besides, the characteristics of each element corresponding to the cultural dimensions need to be investigated in more depth to ensure the design quality of the e-learning interface.

Finally, the study only focused on generation Z in public universities in Malaysia, which may not be illustrative of the overall population of generation Z. It is worth to note that the application of e-learning platforms in public and private universities is different whereby e-learning is more successful in private universities [34]. Thus, future studies are proposed to focus on private educational institutions and review the results obtained from this study to strengthen the interface design for generation Z students in Malaysia.

## ACKNOWLEDGMENT

The authors thank the generation Z students who participated in this research.

## REFERENCES

- [1] F. Kanwal and M. Rehman, "Factors affecting e-learning adoption in developing countries—empirical evidence from Pakistan's higher education sector," *IEEE Access*, vol. 5, pp. 10968–10978, 2017, doi: [10.1109/ACCESS.2017.2714379](https://doi.org/10.1109/ACCESS.2017.2714379).
- [2] S. Ali, S. R. Gulliver, M. A. Uppal, and M. Basir, "Research investigating individual device preference and e-learning quality perception: Can a one-solution-fits-all e-learning solution work?" *Heliyon*, vol. 7, no. 6, Jun. 2021, Art. no. e07343, doi: [10.1016/j.heliyon.2021.e07343](https://doi.org/10.1016/j.heliyon.2021.e07343).
- [3] S. Ali, M. A. Uppal, and S. R. Gulliver, "A conceptual framework highlighting e-learning implementation barriers," *Inf. Technol. People*, vol. 31, no. 1, pp. 156–180, Feb. 2018, doi: [10.1108/ITP-10-2016-0246](https://doi.org/10.1108/ITP-10-2016-0246).
- [4] H. Nordin, D. Singh, and Z. Mansor, "Interface design for e-learning: Investigating design characteristics of colour and graphic elements for generation Z," *KSH Trans. Internet Inf. Syst.*, vol. 15, no. 9, pp. 3169–3185, Sep. 2021, doi: [10.3837/tiis.2021.09.005](https://doi.org/10.3837/tiis.2021.09.005).
- [5] A. K. Alhazmi and A. A. Rahman, "Why LMS failed to support student learning in higher education institutions," in *Proc. IEEE Symp. E-Learn., E-Manage. E-Services*, Oct. 2012, pp. 1–5, doi: [10.1109/IS3e.2012.6414943](https://doi.org/10.1109/IS3e.2012.6414943).
- [6] M. Hu and H. Li, "Student engagement in online learning: A review," in *Proc. Int. Symp. Educ. Technol. (ISET)*, Jun. 2017, pp. 39–43, doi: [10.1109/ISET.2017.17](https://doi.org/10.1109/ISET.2017.17).
- [7] R. Thienmongkol and S. Sangchat, "A study of user interface design problem in electronic learning as a Thai context," *J. Adv. Social Sci. Humanities*, vol. 2, no. 6, pp. 62–66, 2016, doi: [10.15520/jassh20785](https://doi.org/10.15520/jassh20785).



- [8] N. Saidin, D. Singh, Z. A. M. Drus, and R. Hidayat, "Cultural marker identification for web application design targeted for Malaysian multicultural users," *Int. J. Adv. Sci., Eng. Inf. Technol.*, vol. 6, no. 6, pp. 959–965, 2016, doi: [10.18517/ijaseit.6.6.1210](https://doi.org/10.18517/ijaseit.6.6.1210).
- [9] F. Lachner, M.-A. Nguyen, and A. Butz, "Culturally sensitive user interface design: A case study with German and Vietnamese users," in *Proc. 2nd Afr. Conf. Hum. Comput. Interact., Thriving Communities*, Dec. 2018, pp. 1–12, doi: [10.1145/3283458.3283459](https://doi.org/10.1145/3283458.3283459).
- [10] F. Fernandus, "The effect of website design, website security, information quality, and perceived ease of use on customer," *Int. J. Adv. Trends Comput. Sci. Eng.*, vol. 9, no. 2, pp. 1696–1703, Apr. 2020, doi: [10.30534/ijatcse/2020/121922020](https://doi.org/10.30534/ijatcse/2020/121922020).
- [11] A. G. Persada, "Indonesian cultural preference in designing user interface," in *Proc. MATEC Web Conf.*, vol. 215, Oct. 2018, p. 02012, doi: [10.1051/mateconf/201821502012](https://doi.org/10.1051/mateconf/201821502012).
- [12] Z. Ishak and A. Jaafar, "Cultural dimensions of Malaysian teenagers and their relationship with interface design," *J. Theor. Appl. Inf. Technol.*, vol. 90, no. 2, pp. 220–227, 2016.
- [13] N. Alomar, V. Wanick, and G. Wills, "The design of a hybrid cultural model for Arabic gamified systems," *Comput. Hum. Behav.*, vol. 64, pp. 472–485, Nov. 2016, doi: [10.1016/j.chb.2016.07.045](https://doi.org/10.1016/j.chb.2016.07.045).
- [14] R. Cermak and Z. Smutny, "A framework for cultural localization of websites and for improving their commercial utilization," in *Global Observations of the Influence of Culture on Consumer Buying Behavior*. Hershey, PA, USA: IGI Global, 2018, pp. 206–232, doi: [10.4018/978-1-5225-2727-5.ch013](https://doi.org/10.4018/978-1-5225-2727-5.ch013).
- [15] N. Singh, H. Zhao, and X. Hu, "Analyzing the cultural content of web sites: A cross-national comparison of China, India, Japan, and U.S.," *Int. Marketing Rev.*, vol. 22, no. 2, pp. 129–146, Apr. 2005, doi: [10.1108/02651330510593241](https://doi.org/10.1108/02651330510593241).
- [16] G. I. I. Kondratova, "Color your website: Use of colors on the web," in *Proc. Int. Conf. Usability Internationalization*, in Lecture Notes in Computer Science: Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics, vol. 4560, 2007, pp. 123–132, doi: [10.1007/978-3-540-73289-1](https://doi.org/10.1007/978-3-540-73289-1).
- [17] H. U. Khan and A. Alhusseni, "Optimized web design in the Saudi culture," in *Proc. Sci. Inf. Conf. (SAI)*, London, U.K., Jul. 2015, pp. 906–915.
- [18] J. Amantha, B. Muniandy, and W. A. J. W. Yahaya, "Exploring the effects of visual aesthetics in e-learning for engineering," *Knowl. Manage. E-Learn.*, vol. 10, no. 3, pp. 250–264, 2018.
- [19] A. S. Adnan, M. Ali, and R. Ahmad, "The utilisation of visual elements on interface design of e-learning," in *Proc. Int. Conf. Inf. Technol. Soc.*, Kuala Lumpur, Malaysia, Jun. 2015, pp. 273–279.
- [20] A. Baharum, N. F. Fabeil, N. S. Ab Fatah, S. H. Tanalol, N. H. M. Zain, and R. Hanapi, "Evaluating the localization for e-learning website: Case study in Universiti Malaysia Sabah," *IEEE Comput. Soc.*, vol. 50, no. 1, pp. 40–47, 2017, doi: [10.1109/MC.2017.6](https://doi.org/10.1109/MC.2017.6).
- [21] I. Kim and J. Kuljis, "Applying content analysis to web-based content," *J. Comput. Inf. Technol.*, vol. 18, no. 4, pp. 369–375, 2010, doi: [10.2498/cit.1001924](https://doi.org/10.2498/cit.1001924).
- [22] N. Guseva, "Website quality improvement through its localization," *Tech. Rep.*, Jan. 2022, pp. 1–8. [Online]. Available: <http://www.kv.ef.vu.lt/wp-content/uploads/2010/10/N.G.-J.R.-iaccm-conference.pdf>
- [23] N. Tavakoli, "Cultural heritage and user interface design," M.S. thesis, Tehran Univ., Tehran, Iran, 2020.
- [24] R. Alexander, N. Thompson, and D. Murray, "Towards cultural translation of websites: A large-scale study of Australian, Chinese, and Saudi Arabian design preferences," *Behav. Inf. Technol.*, vol. 36, no. 4, pp. 351–363, Apr. 2017, doi: [10.1080/0144929X.2016.1234646](https://doi.org/10.1080/0144929X.2016.1234646).
- [25] P. Barrett, Y. Zhang, J. Moffat, and K. Kobbacy, "A holistic, multi-level analysis identifying the impact of classroom design on pupils' learning," *Building Environ.*, vol. 59, pp. 678–689, Jan. 2013, doi: [10.1016/j.buildenv.2012.09.016](https://doi.org/10.1016/j.buildenv.2012.09.016).
- [26] P. Omidvar, M. Y. Chan, N. T. Yap, and J. Bolong, "Learning culture of Iranian and Chinese-Malaysian undergraduate students," *Pertanika J. Social Sci. Humanities*, vol. 20, no. 3, pp. 865–880, 2012.
- [27] R. Luppici and E. Walabe, "Exploring the socio-cultural aspects of e-learning delivery in Saudi Arabia," *J. Inf. Commun. Ethics Soc.*, vol. 19, no. 4, pp. 560–579, Dec. 2021, doi: [10.1108/JICES-03-2021-0034](https://doi.org/10.1108/JICES-03-2021-0034).
- [28] A. H. Alsswey, H. Al-Samarraie, F. A. El-Qiream, A. I. Alzahrani, and O. Alfarrag, "Culture in the design of mHealth UI: An effort to increase acceptance among culturally specific groups," *Electron. Library*, vol. 38, no. 2, pp. 257–272, May 2020, doi: [10.1108/EL-04-2019-0097](https://doi.org/10.1108/EL-04-2019-0097).
- [29] A. Alsswey, H. Al-Samarraie, and R. Yousef, "Hofstede's dimensions of culture and gender differences in UI satisfaction," *J. Reliable Intell. Environ.*, vol. 8, no. 2, pp. 183–191, Jun. 2022, doi: [10.1007/s40860-021-00143-4](https://doi.org/10.1007/s40860-021-00143-4).
- [30] H. C. L. Hsieh and S. D. Hong, "Localization of web design: An investigation of culturally preferred web attributes in Taiwan and the U.K.," in *Proc. Int. Conf. Cross-Cultural Design*, in Lecture Notes in Computer Science: Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics, vol. 8024, 2013, pp. 404–413, doi: [10.1007/978-3-642-39137-8\\_45](https://doi.org/10.1007/978-3-642-39137-8_45).
- [31] P. Broeder and A. Gkogka, "The cultural impact of navigation design in global e-commerce," *J. Tourism, Heritage Services Marketing*, vol. 6, no. 3, pp. 46–53, 2020, doi: [10.5281/zenodo.4064008](https://doi.org/10.5281/zenodo.4064008).
- [32] C. Seemiller and M. Grace, "Generation Z: Educating and engaging the next generation of students," *About Campus, Enriching Student Learn. Exper.*, vol. 22, no. 3, pp. 21–26, Jul. 2017, doi: [10.1002/abc.21293](https://doi.org/10.1002/abc.21293).
- [33] F. Tjiptono, G. Khan, E. S. Yeong, and V. Kunchambo, "Generation Z in Malaysia: The four 'E' generation," in *The New Generation Z in Asia: Dynamics, Differences, Digitalization*. Bingley, U.K.: Emerald Publishing Ltd., 2020, pp. 149–163, doi: [10.1108/978-1-80043-220-820201015](https://doi.org/10.1108/978-1-80043-220-820201015).
- [34] D. Hampton, D. Welsh, and A. T. Wiggins, "Learning preferences and engagement level of generation Z nursing students," *Nurse Educator*, vol. 45, no. 3, pp. 160–164, May 2020, doi: [10.1097/NNE.0000000000000710](https://doi.org/10.1097/NNE.0000000000000710).
- [35] J. Chicca and T. Shellenbarger, "Connecting with generation Z: Approaches in nursing education," *Teaching Learn. Nursing*, vol. 13, no. 3, pp. 180–184, Jul. 2018, doi: [10.1016/j.teln.2018.03.008](https://doi.org/10.1016/j.teln.2018.03.008).
- [36] M. Hernandez-de-Menendez, C. A. Escobar Díaz, and R. Morales-Menendez, "Educational experiences with generation Z," *Int. J. Interact. Des. Manuf.*, vol. 14, no. 3, pp. 847–859, Sep. 2020, doi: [10.1007/s12008-020-00674-9](https://doi.org/10.1007/s12008-020-00674-9).
- [37] K. McKeon, "3 Ways to optimize your UX for gen Z users—Visual contenting," *Tech. Rep.*, Feb. 2019. [Online]. Available: <https://visualcontenting.com/2019/02/01/3-ways-to-optimize-your-ux-for-gen-z-users/>
- [38] G. Hofstede, "Dimensionalizing cultures: The Hofstede model in context," *Online Readings Psychol. Culture*, vol. 2, no. 1, pp. 1–26, Dec. 2011, doi: [10.9707/2307-0919.1014](https://doi.org/10.9707/2307-0919.1014).
- [39] M. A. Nasrul, K. M. Nor, M. Masrom, and A. Syarif, "Website user interface characteristics for multiracial settings in Malaysia," in *Proc. Int. Conf. Innov. Manage. Technol. Res. (ICIMTR)*, May 2012, pp. 252–257, doi: [10.1109/ICIMTR.2012.6236398](https://doi.org/10.1109/ICIMTR.2012.6236398).
- [40] S. Beugelsdijk and C. Welzel, "Dimensions and dynamics of national culture: Synthesizing Hofstede with Inglehart," *J. Cross-Cultural Psychol.*, vol. 49, no. 10, pp. 1469–1505, Nov. 2018, doi: [10.1177/0022022118798505](https://doi.org/10.1177/0022022118798505).
- [41] K. Eringa, L. N. Caudron, K. Rieck, F. Xie, and T. Gerhardt, "How relevant are Hofstede's dimensions for inter-cultural studies? A replication of Hofstede's research among current international business students," *Res. Hospitality Manage.*, vol. 5, no. 2, pp. 187–198, Jan. 2015, doi: [10.1080/22243534.2015.11828344](https://doi.org/10.1080/22243534.2015.11828344).
- [42] A. Alsswey and H. Al-Samarraie, "The role of Hofstede's cultural dimensions in the design of user interface: The case of Arabic," *Artif. Intell. Eng. Des., Anal. Manuf.*, vol. 35, no. 1, pp. 116–127, Feb. 2021, doi: [10.1017/S0890060421000019](https://doi.org/10.1017/S0890060421000019).
- [43] F. Zheng and S. Hermawati, "Cultural aspects for the user interface design of health and fitness apps," in *Proc. Conf. Ergonom. Human Factors*, Apr. 2021. [Online]. Available: <https://nottingham-repository.worktribe.com/output/5363463>
- [44] M. Kaboudarahangi, O. M. Tahir, and M. Kamal, "Malaysia's three major ethnic group preferences in creating a Malaysian garden identity," *Austral. Geographer*, vol. 44, no. 2, pp. 197–213, Jun. 2013, doi: [10.1080/00049182.2013.789588](https://doi.org/10.1080/00049182.2013.789588).
- [45] C. Y. Raymond, "Understanding Asian students learning styles, cultural influence and learning strategies," *J. Educ. Social Policy*, vol. 7, no. 1, pp. 194–210, 2017.
- [46] G. Hofstede, G. J. Hofstede, and M. Minkov, *Cultures and Organizations: Software of the Mind: Intercultural Cooperation and Its Importance for Survival*, 3rd ed. New York, NY, USA: McGraw-Hill, 2010.
- [47] F. Mahmood, W. A. W. Adnan, N. L. M. Noor, F. M. Saman, and Z. A. Nasruddin, "User perception towards cultural-based E-government portal design," in *Proc. Asia Pacific Inf. Technol. Conf. (APIT)*, Jan. 2019, pp. 65–69, doi: [10.1145/3314527.3314539](https://doi.org/10.1145/3314527.3314539).
- [48] D. Tan, A. Basit, and Z. Hassan, "Does cross-cultural differences influence personality and intention to leave? A study on HEL in Malaysia," *Int. J. Educ., Learn. Training*, vol. 2, no. 1, pp. 28–41, 2017, doi: [10.24924/ijelt/2017.04/v2.iss1/28.41](https://doi.org/10.24924/ijelt/2017.04/v2.iss1/28.41).

- [49] D. W. Baack and N. Singh, "Culture and web communications," *J. Bus. Res.*, vol. 60, no. 3, pp. 181–188, Mar. 2007, doi: [10.1016/j.jbusres.2006.11.002](https://doi.org/10.1016/j.jbusres.2006.11.002).
- [50] A. Calabrese, G. Capece, M. Corbò, N. L. Ghiron, and M. M. Marucchi, "Cross-cultural strategies for web design," *World Acad. Sci., Eng. Technol. Int. J. Humanitwis Social Sci.*, vol. 6, no. 11, pp. 78–83, 2012.
- [51] M. A. Hamid, "Analysis of visual presentation of cultural dimensions: Culture demonstrated by pictures on homepages of universities in Pakistan," *J. Marketing Commun.*, vol. 23, no. 6, pp. 592–613, Nov. 2017, doi: [10.1080/13527266.2016.1147486](https://doi.org/10.1080/13527266.2016.1147486).
- [52] D. Renner, S. Laumer, and T. Weitzel, "Blended learning success: Cultural and learning style impacts," in *Proc. 12th Int. Conf. Wirtschaftsinformatik*, Osnobruck, Germany, 2015, pp. 1375–1390.
- [53] M. Speece, "Learning style, culture, and delivery mode in online distance education," *U.S.-China Educ. Rev. A*, vol. 1, no. 1a, pp. 1–12, 2012.
- [54] H. Almakky, R. Sahandi, and J. Taylor, "The effect of culture on user interface design of social media—A case study on preferences of Saudi Arabians on the Arabic user interface of Facebook," *Int. J. Social, Educ., Econ., Bus. Ind. Eng.*, vol. 9, no. 1, pp. 107–111, 2015, doi: [0.5281/zenodo.1337790](https://doi.org/0.5281/zenodo.1337790).
- [55] E. W. Gould, N. Zakaria, and S. A. M. Yusof, "Applying culture to website design: A comparison of Malaysian and U.S. Websites," in *Proc. 18th Annu. Conf. Comput. Document.*, 2000, pp. 161–171, doi: [10.5555/504800.504826](https://doi.org/10.5555/504800.504826).
- [56] M. A. Nasrul, K. M. Nor, M. Masrom, and A. Syarif, "Website fit: An overview," *Proc.-Social Behav. Sci.*, vol. 40, pp. 315–325, Jan. 2012, doi: [10.1016/j.sbspro.2012.03.194](https://doi.org/10.1016/j.sbspro.2012.03.194).
- [57] G. Vitols and Y. Vitols-Hirata, "Impact of culture dimensions model on cross-cultural website development," in *Proc. 20th Int. Conf. Enterprise Inf. Syst. (ICEIS)*, 2018, pp. 540–546, doi: [10.5220/0006781005400546](https://doi.org/10.5220/0006781005400546).
- [58] E. Callahan, "Cultural similarities and differences in the design of university web sites," *J. Comput.-Mediated Commun.*, vol. 11, no. 1, pp. 239–273, 2005, doi: [10.1111/j.1083-6101.2006.tb00312.x](https://doi.org/10.1111/j.1083-6101.2006.tb00312.x).
- [59] M. Minkov and G. Hofstede, "Values survey module 2013 manual," Tech. Rep., May 2013, p. 17.
- [60] F. F. Susilo, J.-H. Lee, J.-H. Park, and J.-M. Park, "Cross-cultural touch-based SNS interface design for the elderly," in *Proc. Int. Conf. Ubiquitous Inf. Technol. Appl.*, in Lecture Notes in Electrical Engineering, vol. 474, Dec. 2018, pp. 1153–1161, doi: [10.1007/978-981-10-7605-3\\_184](https://doi.org/10.1007/978-981-10-7605-3_184).
- [61] M. Aparicio, F. Bacao, and T. Oliveira, "Cultural impacts on e-learning systems' success," *Internet Higher Educ.*, vol. 31, pp. 58–70, Oct. 2016, doi: [10.1016/j.iheduc.2016.06.003](https://doi.org/10.1016/j.iheduc.2016.06.003).
- [62] M. Tavakol and R. Dennick, "Making sense of Cronbach's alpha," *Int. J. Med. Educ.*, vol. 2, pp. 53–55, Jun. 2011, doi: [10.5116/ijme.4dfb.8dfd](https://doi.org/10.5116/ijme.4dfb.8dfd).
- [63] R. Oktavia, Irwandi, Rajibussalim, M. Mentari, and I. S. Mulia, "Assessing the validity and reliability of questionnaires on the implementation of Indonesian curriculum K-13 in STEM education," *J. Phys., Conf. Ser.*, vol. 1088, Sep. 2018, Art. no. 012014, doi: [10.1088/1742-6596/1088/1/012014](https://doi.org/10.1088/1742-6596/1088/1/012014).
- [64] R. V. Krejcie and D. W. Morgan, "Determining sample size for research activities," *Educ. Psychol. Meas.*, vol. 30, no. 3, pp. 607–610, Sep. 1970, doi: [10.1177/001316447003000308](https://doi.org/10.1177/001316447003000308).
- [65] S. Wartna and C. Risse. (2019). *Designing for Culture, Dynamic Design Magazine*. [Online]. Available: <https://medium.com/@cynthiarisse/designing-for-culture-be0d8be92422>
- [66] C. Zhu, "Re-examining cross-cultural user interface design indicators: An empirical study," M.S. thesis, Twente Univ., Enschede, The Netherlands, 2015.
- [67] O. Olurinola and O. Tayo, "Colour in learning: It's effect on the retention rate of graduate students," *J. Educ. Pract.*, vol. 6, no. 14, pp. 1–5, 2015, doi: [10.1515/bot-2012-0216](https://doi.org/10.1515/bot-2012-0216).
- [68] N. Bonnardel, A. Piolat, and L. Le Bigot, "The impact of colour on website appeal and users' cognitive processes," *Displays*, vol. 32, no. 2, pp. 69–80, Apr. 2011, doi: [10.1016/j.displa.2010.12.002](https://doi.org/10.1016/j.displa.2010.12.002).
- [69] F. Kurtcu, "An analyze of high school web interface designs in terms of graphic design," *Proc.-Social Behav. Sci.*, vol. 46, pp. 5661–5665, Jan. 2012, doi: [10.1016/j.sbspro.2012.06.492](https://doi.org/10.1016/j.sbspro.2012.06.492).
- [70] I. Khaddam and J. Vanderdonck, "Towards a culture-adaptable user-interface architecture," *Romanian J. Hum.-Comput. Interact.*, vol. 7, no. 2, pp. 161–194, 2014.
- [71] A. Ly, "A critical discussion of Hofstede's concept of power distance," *SYNAPS-J. Prof. Commun.*, vol. 28, pp. 51–66, Jan. 2013.
- [72] D. M. Lashayo, M. H. Alkawaz, and G. M. Johar, "Model for measuring multiple factors in e-learning systems' adoption in Malaysia's universities: An experience from management and science university (MSU)," *J. Theor. Appl. Inf. Technol.*, vol. 96, no. 18, pp. 6180–6190, 2018.
- [73] A. G. Kyrousi, E. Tzoumaka, and S. Leivadi, "Business employability for late millennials: Exploring the perceptions of generation Z students and generation X faculty," *Manage. Res. Rev.*, vol. 45, no. 5, pp. 664–683, May 2022, doi: [10.1108/MRR-04-2021-0328](https://doi.org/10.1108/MRR-04-2021-0328).
- [74] M. Sobri, M. T. Ijab, and N. M. Nayan, "Design and evaluation of user interface design of mobile heart monitoring application," *Turkish J. Comput. Math. Educ.*, vol. 12, no. 3, pp. 2211–2216, Apr. 2021.
- [75] N. Rajesh Mavani, C. Y. Lim, H. Hashim, N. Abd. Rahman, and J. Mohd Ali, "Fuzzy Mamdani based user-friendly interface for food preservatives determination," *Food Bioproducts Process.*, vol. 126, pp. 282–292, Mar. 2021.
- [76] N. Jailani, M. Al-Aaidroos, M. Mukhtar, M. A. Bakar, and A. Ismail, "Mapping e-auction sharia compliant requirements to user interface design," *Int. J. Adv. Sci. Eng. Inf. Technol.*, vol. 10, pp. 1058–1065, Jun. 2020.
- [77] A. Abdullah, M. M. Ismail, and A. Albani, "At-risk generation Z: Values, talents and challenges," *Int. J. Asian Social Sci.*, vol. 8, no. 7, pp. 373–378, 2018.



**HAZWANI NORDIN** received the Ph.D. degree in information science from the Universiti Kebangsaan Malaysia, in 2021. Her research interest includes human–computer interaction focusing on interface design.



**DALBIR SINGH** received the degree in computer science from the Universiti Sains Malaysia, in 2002, and the Ph.D. degree in computer science from the University of Malaya, in 2009. He is currently an Associate Professor and a member of the Strategic Informatics Research Group, Universiti Kebangsaan Malaysia. He has led several funded research projects and published numerous academic publications. Besides that, he also has a keen interest in quality assurance for academic programs. His current research interests include human–computer interaction, e-learning technology, quality models, and impact study and strategic planning for information systems.



**ZULKEFLI MANSOR** (Senior Member, IEEE) received the degree in business information system from the University of East London, U.K., the master's degree in software engineering from the Universiti Malaya, Malaysia, and the Ph.D. degree in software engineering from the Universiti Teknologi MARA, Malaysia. He is currently an Associate Professor of software engineering at the Research Center for Software Technology and Management, Faculty of Information Science and Technology, Universiti Kebangsaan Malaysia, Malaysia. He taught undergraduate and postgraduate students for software management courses. He also has supervised undergraduate and postgraduate students and published articles in journal and proceeding in software engineering domains. He also received a Professional Certificate in Certified Tester (Foundation Level) from the International Qualification Software Testing Board in 2010.



**ELAHEH YADEGARIDEHKORDI** is currently a Senior Lecturer with the Faculty of Information Science and Technology (FTSM), Universiti Kebangsaan Malaysia (UKM), Selangor, Malaysia. Her research interests include big data analytics, educational technology, tourism management, cloud computing, mobile learning, and recommendation systems. Her contributions have been published in prestigious journals and international conferences.