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DESIGNING SUSTAINABLE BARRIER-FREE LEARNING FACILITIES FOR COMMUNITY COLLEGES

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ABSTRACT

Community College is a higher education system under the Department of Polytechnic Studies and Community Colleges, Ministry of Higher Education. The institution channels training and skills needed through short courses offered to various levels of society. The concept of learning and evaluation of Community Colleges is different from most local Institutions of Higher Learning (IPT) as it places more emphasis on practical learning (skill) than theory. In this regard, community colleges need to be sustainable in providing quality, high-tech and holistic education for students from various backgrounds to pursue training and studies in technical and vocational fields, including people with disabilities. However, in recent years, many criticisms surfaced on the rights of the disabled to have equal access to higher education due to decreasing barrier-free design facilities in the higher learning institutions in which the provisions of these facilities are not well distributed and insufficient in the campus area. Hence, this study aims to identify and assess the barrier-free design facilities' current provision on four community colleges campuses in Malaysia, followed by analyzing the person with disabilities perceptions on these barrier-free facilities, using a mixed methodology approach of qualitative (direct -observation) and quantitative (survey) through the pragmatism research paradigm. Findings

relating to better space making, spatial arrangement, and accessibility to learning facilities are crucial to fulfilling the needs of the disabled students in the community colleges for learning purposes. Hence, recommending better design preferences for a sustainable learning environment is essential to policymakers, related authorities, and designers to improve the target group's demand. This is essential to increase the accessibility for the disabled students in their community colleges for sustainable learning built environment.

Keywords*: A person with disabilities; Sustainable campus design; Barrier-free learning facilities; Community college*

INTRODUCTION

A campus is a prestigious place of teaching and learning that nurtures innovation and ideas to expand and disseminate knowledge (Coulson, Roberts, & Taylor, 2017). Hence, a campus needs to have a comfortable and pleasant ambience that renders a physical environment enduring and dynamic in the realm. Apart from promoting scholarly tradition, it is also a place that should offer cutting-edge teaching and learning facilities to benefit and better campus users from various backgrounds. This is essential to ensure educational equity for accommodating and meeting individuals' specific needs, namely the disabled. In other words, to ensure that everyone's learning needs are met based on the principles of equality in allocating resources, prospects, treatment, and success for every student (Vossoughi, Hooper, & Escudé, 2016). An estimated 500 thousand disabled in the Malaysian context registered with the Social Welfare Department(Islam, 2015). Based on the past scholarly study, the total number of disabled people from 2015 to 2018 showed an increase of 23% over this three years, and it is expected that this number will rise in the coming years(Alias, Alias, Ibrahim, Attan, & Kadir, 2013).

Nonetheless, according to statistical data from the Ministry of Higher Education (MOHE), it shows that 2,139 disabled students comprising various types of disabilities have successfully qualified for the higher degree

program in Malaysia's public universities(Yusof, Chan, Hillaluddin, Ahmad Ramli, & Mat Saad, 2019). The increasing number of disabled students in public higher education was mainly due to the policies outlined and implemented by the Malaysian government like the Disabled Action Plan 2016-2022, The Malaysian Education Development Plan (2013-2025), Act 685 (Disabled Persons Act 2008) and Disabled Policy 2016. These outlined policies emphasize ensuring that the disabled have rights, opportunities and fair access under the National Laws covering 15 primary aspects such as – advocacy, accessibility, health, rehabilitation, employment, personal safety and social protection, support services, social resources, human resource development, community engagement, research and development, housing, children's rights and women and education. Nevertheless, the number of students entering higher learning institutions in Malaysia still did not reach the proposed targets as outlined by the government(Mustaffa, Rahman, Ab, Wahid, & Hudin, 2019). Based on the pilot study, many highlighted the lack of a barrier-free environment specifically for physical and cognitive disabilities. From observation, many campus environments still are not equipped with disabled-friendly physical infrastructure to help the disabled carry out their daily activities as students in a comfortable learning environment. Hence, this disinterest among the disabled demotivated them to further their tertiary level studies after obtaining primary education(Mustaffa et al., 2019).

In brief, three main issues faced by the disabled community in higher learning institutions are based on previous scholars. This include - lack of awareness among academic and support staff in handling the disabled students (Aziz, Isa, & Nordin, 2010); lack of appropriate access to information and services during study term (Bandar, Jani, & Karim, 2014) including the absence of conducive learning environment that supports their daily needs (Nasir & Efendi, 2019). However, the most critical issue is access to information and services, including the lack of a physical environment that curbs the admission of disabled students to higher learning institutions. The problem of acquiring information involves gaining access to human-based resources (lecturers, field experts, peers), printed materials, hearing materials, computer-based resources and learning capabilities through technology (Lee, 2015). Furthermore, there is also a lack of providing essential services for the convenience of the disabled in higher learning institutions. Most higher education centres have no

responsible one-stop centres (OSC) that specifically address the need for disabled students(Mustaffa et al., 2019).

The essential services are typically provided at ad-hoc, where the authorities have no initial assessment of disabled students' needs. According to the initial assessment, there are also no services rendered, no monitoring on such service provision, no training provided to employees on the rights and needs of disabled students, and no monitoring of the impact and effectiveness of students' policies and services with disabilities. This issue is also apparent because there is a lack of studies focusing on the efficiency of barrier-free design facilities in higher learning centres, namely in community colleges, from disabled students' perception. Many of the past studies emphasize the aspects of disabling employability skills (Narayanan, 2018), self-efficacy of technical and vocational amongst the disabled (Hadi, Yusop, Mohamad, & Jaafar, 2010), and the effectiveness of lifelong learning pedagogy for the disabled (Khairuddin, Salleh, & Amin, 2020).

Hence, this study focuses on students with disabilities' perception based on the two main objectives in fulfilling this gap. First, to identify disabled facilities that lead to academic needs in higher education centres and second, to discern the perception of disabled students' perception of academic facilities provided in the case study campus. From the absence of a barrier-free learning environment and disabled-friendly academic infrastructure, three leading factors comprising space making, spatial organization, and accessibility will be referred to as the primary determinants for this study. This study's findings are significant as they will provide an overview of the condition and effectiveness of barrier-free facilities designed on the campus for the need of the disabled in having better access to education. This is essential to promote constructive personality among disabled individuals with an optimistic worldview. Findings from the selected case studies will suggest guidelines for improving and enhancing disabled learning facilities in the campus environment for future reference. This is important to create more comfortable and harmonious learning for a sustainable campus design. the quality of the users' sensory input(Démuth, 2013). This theory put forth by Gibson argues that perception is based on the information volume of sensory inputs, which we further process only via revealing and explaining the available information(Démuth, 2013). In this sense, by bottom-up processes, 'perception starts at the lowest sensory

levels, and then they gradually lead to more complicated and complex processes in higher (cortical) structures responsible for more global and abstract processes ways of thinking' (De'muth 2013: 23).

The second is the top-down theories of perception, which considers the level of participation of higher cognitive functions to interpret the viewed sensory inputs. In understanding this interpretation, the role of perception is defined based on the constructivist and computational approaches(Démuth, 2013). Unlike the bottom-up theories of perception, Gregory's theory which supports the constructivist approach emphasized that perception is the end product of the interaction between stimulus and internal hypotheses, expectations and knowledge of the observer or end-user (Ashby, 2014). Gestalt psychology's knowledge involving unconscious patterns and the influence of consciousness, experience, motivations, and emotions play an important role more than sensory image during this process. In this matter, to perceive means is to integrate feelings into a broader context to form beliefs and opinions. The computational theories, on the other hand, evolves based on Marr's model of understanding, underlines that human perception and visual stimuli are not determined by motivation or intentional consciousness but is operated by mechanical rules and evaluations as well as algorithms that can only be understood from the perspective of computational processes and analysis(Pitcher, 2015). About the above and for the benefit of this study, Gregory's theory is referred to form the model framework of the study for identifying the determinants and assessing the current provision of the barrier-free design facilities in four community colleges campuses in Malaysia, followed by analyzing the person with disabilities (PwD's) perceptions on these barrier-free facilities. This model framework is explained in the following section. The next section will explain this in detail to understand the categories and characteristics of the disabled and the available academic facilities in higher learning institutions.

Characteristics of Disable Person and Related Facilities on Campus for The Disabled Needs as Determinants

The person with disabilities cannot be excluded from the general education system, including obtaining vocational training and lifelong learning based on their incapacities. This is important to allow the disabled to be more independent and reduce dependency on the regular group. In

previous years, the disabled have also proven that they can learn where many parties have allowed them to pursue their studies. In the year 2018 statistics (Ashray, 2018), disabled categories registered with learning problems in higher learning institutions across Malaysia comprising public and private university, polytechnics, community colleges, and other related types of institution are in the estimation of three thousand people representing various categories of disabilities like visual hearing, physical, speech and multiple disabilities. This clearly shows that higher learning institutions have accepted these groups throughout Malaysia to pursue higher education.

In fulfilling the above-disabled needs, the campus design needs to consider the aspects of Universal Design. Universal Design is defined as an environmental design and product that all groups of individuals can widely use without any unique adaptation or design. The concept of accessibility to all groups has impacted the design of the building to be built. This universal design concept has also provided a new approach arising from the barrier-free or accessibility design. This design approach should be well integrated without isolating its usefulness. In this guideline, the principle of planning in providing facilities and urban environments based on the universal design must meet four principles of convenience, safety, comfort, and user-friendly.

This has been highlighted in SIRIM MS1184 (Code of Practice for Access for Disabled People to Public Buildings), SIRIM Code of Practice MS1331 (Code of Practice for Access for Disabled Persons Outside Buildings) and the SIRIM Code of Practice MS1183 (Code of Practice for Means of Escape for Disabled) which are also a continuation of the Uniform Building By-Laws Under Malaysian Standard MS1184. There are various requirements and recommendations in construction, installation, components and fittings in the built environment. It also involves accessibility from building to building, accessibility of circulation, and the ability to save oneself during an emergency.

Based on the requirements of Universal Design, the academic facilities should also meet the needs and needs of the disabled students who are studying in their respective study programmes. Thus, it must offer all students the best facilities and services regardless of the normal or the disabled. In this regard, three essential aspects for the convenience of the disabled users should be taken into account, especially in the academic block

like the lecture hall, lecture room, laboratory, workshop and the library for learning and teaching facilities(Sanmargaraja & Ta Wee, 2011).

These three essential aspects will be used as indicators to gain disabled perception. First, is the space making elements involving the size and proportion of interior space, the organization of space, ventilation and acoustics in a space, entry point, and placement and location (Sanmargaraja & Ta Wee, 2011). Second is the space's spatial arrangement involving fixtures and furniture, finishing and construction materials, nodes, and graphic symbols(Sanmargaraja & Ta Wee, 2011). The third is the preparation of barrier-free design facilities comprising accessibility elements such as ramps, pathway routes for pedestrians and sidewalks, lifts, textured passage surfaces, and staircase (Sanmargaraja & Ta Wee, 2011). Methods to collect data from these three indicators are discussed in the following sections, and the findings are analyzed in the following sections.

Table 1. Determinants for the Study

Determinants	Characteristics	Purpose
Space making	•size and proportion of interior space(Pliner & Johnson, 2004) •the organization of space (Pliner & Johnson, 2004) •ventilation and acoustics in a space (Lifchez, 1986) •entry point (Lifchez, 1986) •placement and location of the space (Silver, Bourke, & Strehorn, 1998)	•To obtain disabled students' views and perceptions on the learning space environment
Spatial arrangement	•fixtures and furniture settings and arrangements, size and proportion(Schelly, Davies, & Spooner, 2011) •finishing and construction materials (Schelly et al., 2011) •nodes (Dell, Dell, & Blackwell, 2015; Ismail & Zulkurnain, 2019) •graphic symbols (Dell et al., 2015)	•To obtain students' views and perception of the provided facilities following the Code of Practice for the Disabled (MS 1184, 1331).
Accessibility (barrier-free facilities)	•Ramps (Edyburn, 2010) •Pathway routes for pedestrian and sidewalks(Edyburn, 2010) •Lifts design(Black, Weinberg, & Brodwin, 2014) •Textured passage surfaces(Dell et al., 2015) •Staircase(Dell et al., 2015)	•To obtain the views and perceptions of the disabled whether they have easy access to the facilities and frequency of usage

Source: Author

Conceptual Model Framework on Disable Perception on Barrier-Free Facilities On Campus

About the theory of perception put forth by Gregory (Démuth, 2013), three essential determinants are established to form the conceptual model framework (refer to Figure 1). This is vital to examine the disabled user's perception of services, academic infrastructures, and barrier-free facilities on campus. These three indicators are a) direct attention, b) expectations of disabled needs c) recent experience and memory to interpret the perception of the disabled using the bottom-up theory. The first phase of the conceptual model framework analyses the user's perception based on these three perception determinants. In phase two, the established perception will then be validated with the Disabled Code of Practice (MS 1184 and MS 1331). This is essential to examine the relevancy of the established perceptions whether it met the desired requirements for a conducive learning environment for the disabled or not about three learning facilities indicators: accessibility, space-making, and spatial arrangement. This conceptual model framework is vital to analyze the selected case study from the perception of disabled students. As a result, the disabled perception of the facilities they currently experience and what they intend to acquire in the future will be outlined. The process of understanding the disabled perception will also be based upon their experience and the memory they have endured during their learning years on campus.

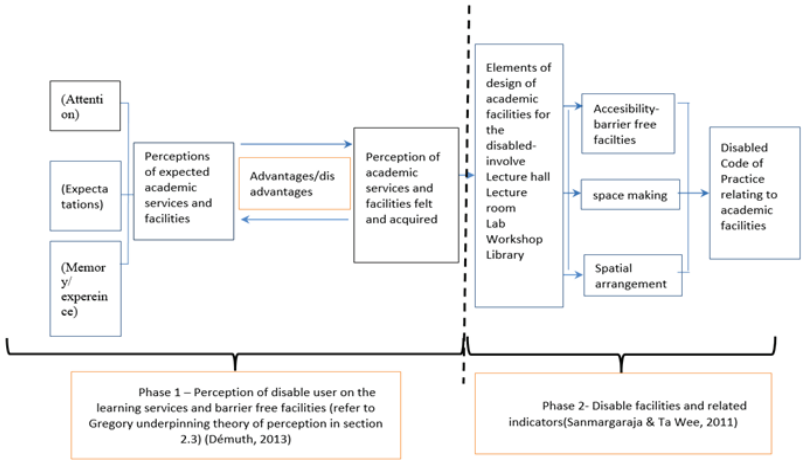

Figure 1. Model Framework

Source: Author

The indicators are essential for this study's benefit in Malaysia as it is the precursor for a better-disabled facilities scheme that determines a conducive learning environment on the campus to enhance the disabled quality of life. Before conducting a detailed case study analysis, the following section elucidates the methodology and analysis procedure using the explanatory building technique from the selected case study of the higher learning institution in the Malaysian context.

METHODOLOGY

This study utilizes case studies as the research strategy under mixed methods, combining qualitative and quantitative approaches. Only four community colleges- the Selayang, Jelebu, Masjid Tanah and Ledang Community College, are selected from sixteen community colleges available in West Malaysia. This is because this four-case study is selected based upon two main justification criteria.

The first criteria are based on this college's educational program, which focuses on Technical and Vocational Education and Training (TVET) centred on the Education For All (EFA) approach(Lee, 1999). These four community colleges provide a unique pathway for disabled students to enrol in specific learning modules in a particular field to obtain a Certificate in Special Skills known as SKK(M). The teaching pedagogy is designed based on actual work processes, directing to specific skills using a variety of teaching approaches like Outcome Based Education (OBE), Action-Oriented Learning (AOL), Authentic Learning, student-centred Learning (SCL) and Problem Based Learning (PBL) as well as Hands-on approach(Lee, 1999). This provides an opportunity for students to do work continuously to improve their proficiency quality.

The second criterion is based on the high number of disabled student enrolments in these four community colleges, which is at an average of 20 students per year. Statistics indicate that the enrolment of OKU students in these four community colleges undertaking certificate programs of Landscape, Culinary, Food Processing and Pastry from the year 2015-2019 are in the estimation of two hundred disabled students. This clearly shows that the government is committed to realizing the Educational Development

Plan to help these disabled people to pursue higher education in community colleges. For the data collection method from the chosen case studies- direct observation and close-ended questionnaires are used to obtain data based on the disabled perception (attention, expectation and experience) on the academic services and facilities outlined in section 2.2 and Table 1, as highlighted by Sanmargaraja & Wee (2008). This is important to answer the study objectives in outlining the appropriate design approach for developing a sustainable campus design that responds to disabled students' needs. The analysis of the study findings is conducted on the two chosen methods (refer to Figure 2).

First, to analyze the data from direct observation, methods such as hermeneutics and coding are used to comprehend and read the built environment as reliable ways to analyze the disabled facilities' design internally and externally.

Second, to examine data from the close-ended questionnaire, the SPSS method is used, and findings are tabulated for discussion. The questionnaire is conducted on sixty disabled students from four community colleges as purposive sampling to focus on the characteristics of a population of interest representing each case study. The justification for the number of sample respondents was determined to refer to all categories of disabled students in each community college. The sampling size is also determined based on the Central Limit Theorem's benefits highlighting a finite population's adequate size. The respondents are also selected based on age groups from various ethnicities with different cultural backgrounds.

The disabled students are inquired referring to the indicators developed from the design framework on barrier-free disabled facilities and related indicators encompassing the space making, spatial organization and accessibility. This is important to determine whether the teaching and learning facilities fulfil the criteria of a conducive campus environment.

However, the questionnaire's focus is studied based on the disabled student response only on their perception shaped by their attention, experience, and expectations on the disabled facilities they encounter and utilize daily. The SPSS analysis technique analyses data from questionnaires to identify whether the design determinants are portrayed on the campus

or not. All collected data then is used to propose the best possible design guideline for disabled users to achieve the study's objective.

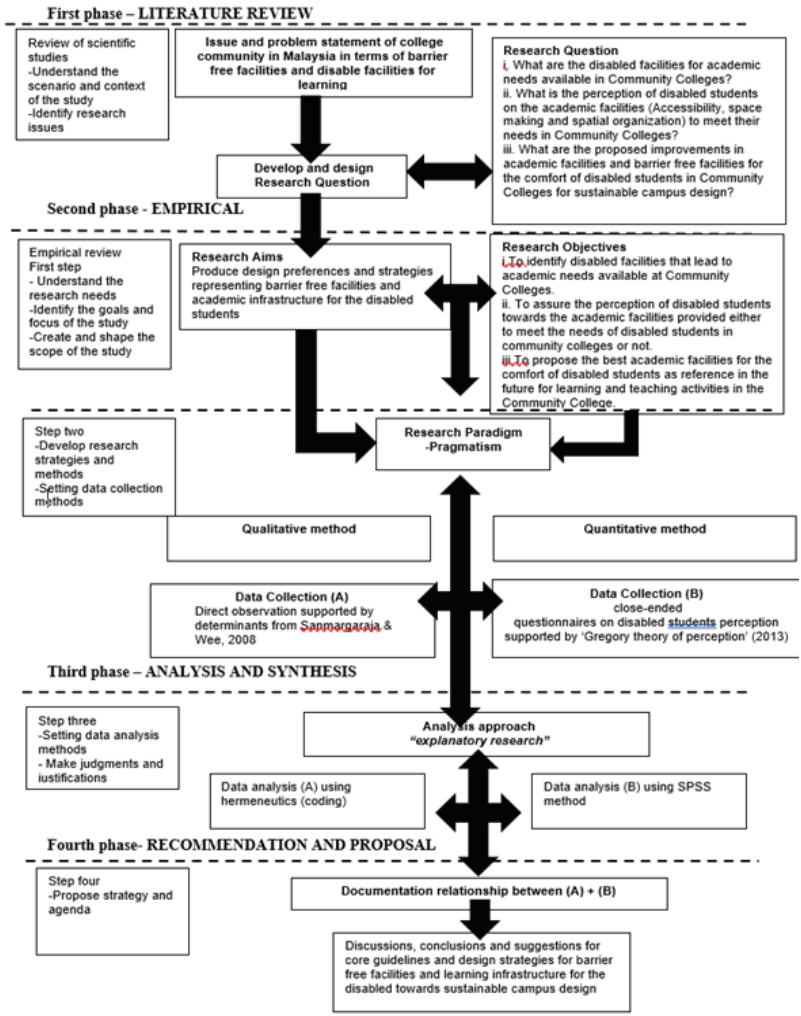

Figure 2. Methodology Framework

Source: Author

FINDINGS

This section discusses the findings gathered from direct observation and questionnaire of three case studies which are Selayang (CS1), Jelebu (CS2), Masjid Tanah (CS3) and Ledang (CS4) Community College. This case study aims to find suitable design strategies and approaches to enhance campus design quality in Malaysia for the disabled. The study on these case studies is conducted referring to the three main determinants, which are space making (SM), spatial arrangement (SA) and accessibility (AC), as put forth by Sanmargaraja & Wee (2008) (refer to Table 1). These three determinants are evaluated based on sixty respondents' perceptions of the quality of barrier-free and disabled facilities for a sustainable campus design. Table 2: Findings from the questionnaire and direct observation in response to the perception of disabled user

Table 2. Findings from the Questionnaire and Direct Observation in Response to the Perception of Disabled User

Determinants	Location (Academic Facilities)	Design characteristics	Case Study	Findings (Level of perception)%	
				% Positive respond (total PR)	% Negative respond (total NR)

Space making (SM)	Space making (SM) Classroom, Hall, The workshop, Library, Laboratory (interior and exterior)	Appropriate size and proportion of interior space within the ease of movement for the user	CS1	38	62
			CS2	52	48
			CS3	25	75
			CS4	55	45
		The space organization is universal that can be modified according to various functions and without obstruction, such as pillar structures, permanent fixtures, etc., to stimulate user activity.	CS1	35	65
			CS2	55	45
			CS3	32	68
			CS4	49	51
		Plenty of openings for air circulation and natural lighting Equipped with mechanical devices (lights, fans, air conditioning) that is sufficient to ensure the comfort of the user	CS1	43	57
			CS2	65	35
			CS3	36	64
			CS4	57	43
		Use sound absorption materials such as carpets on the floors and other absorbent materials to limit and reduce noise-echo in the interior space. Use an appropriate ceiling system to increase noise insulation. Use new technology such as an audio system to overcome the challenges associated with acoustics in the interior space	CS1	32	68
			CS2	72	28
			CS3	22	78
			CS4	69	31
		Have ease of movement to the room entrance from the foyer or main lobby, Have a circulation space easily identifiable (wayfinding) from the outside into the room space.	CS1	23	77
			CS2	85	15
			CS3	31	69
			CS4	66	34
		Have a clear entrance. The room has an axially frontal entry with a clear visual view.	CS1	21	79
			CS2	67	33
			CS3	18	82
			CS4	78	22
		Have an entrance door that is significant (with a sense of welcoming) that clearly outlines the borders between the exterior and interior and reinforces the building's character and value.	CS1	32	68
			CS2	89	11
			CS3	23	77
			CS4	79	21

		The location of the space is in the strategic path and at the focal point of the public - The location is at the ground level, close to the main lobby entrance of the building complex.	CS1	15	85
			CS2	69	31
			CS3	14	86
			CS4	72	28
		The placement of the space in a safe location that can be seen easily to the corridor path and parking space	CS1	27	73
			CS2	82	18
			CS3	32	68
			CS4	78	22
		The distance of the academic space is close to the main public facilities, office, within <10-15 meters walking distance	CS1	32	68
			CS2	75	25
			CS3	22	78
			CS4	89	11

Spatial arrangement (SA)	Classroom, Hall, The workshop, Library, Laboratory (interior and exterior	Interior space is equipped with fixtures and furniture that respond to the users' needs for ease of movement. Types of Furniture are designed according to the user's scale and anthropometrics for the comfort of learning.	CS1	52	48
			CS2	70	30
			CS3	35	65
			CS4	89	11
		Interior space adopts finishing and construction materials suitable for disabled users on floors, walls, and ceiling. Eg, not slippery floor finishes. Floor finishing accentuates the variety of texture, colour and patterns tiling to stimulate the user's activities like safety and wayfinding.	CS1	35	65
			CS2	73	27
			CS3	33	67
			CS4	76	24
		Have a wide corridor pathway size that is spacious, flat with no raised floor, well-lit and not narrow – well connected from the main lobby to the academic facilities	CS1	42	58
			CS2	87	13
			CS3	46	54
			CS4	89	11
		Have nodes that indicate the path of movement from the lobby to the academic facilities to provide a chance for the user to rest and orient themselves	CS1	44	56
			CS2	88	12
			CS3	41	59
			CS4	72	28
		Have many nodes that are conceived have variation in terms of scale, size, function, and form, such as rest benches, garden landscapes, etc, along the pathway to the academic facilities for wayfinding and orientation	CS1	34	66
			CS2	86	14
			CS3	32	68
			CS4	85	15
		Have graphic symbols that are appropriate and correct as guidance and direction marks for the disabled.	CS1	37	63
			CS2	89	11
			CS3	38	62
			CS4	84	78
		Have graphic symbols to indicate the location and direction to the facility based on disability type.	CS1	28	72
			CS2	87	13
			CS3	36	64
			CS4	79	21
		Have graphic symbols provided for disabled mobility to indicate the location: i. Parking/ garage ii. Access to elevator buildings, toilets, stairs etc.	CS1	34	66
			CS2	91	9
			CS3	33	67
			CS4	89	11

		Have a light reflectance value (LRV) scale that is suitable for disabled facilities. Differences in colour on doors, floor levels or buildings follow the LRV scale. Moreover, avoid combinations of red and green colours.	CS1	32	68
			CS2	76	24
			CS3	24	76
			CS4	89	11
		Have clear, bright and easy signage to understand either by the person who is sitting, standing or walking. The signage is installed at the height of 1200mm and 1600 mm from the floor level.	CS1	23	77
			CS2	79	21
			CS3	43	57
			CS4	88	12
Accessibility (AC)	Barrier-free facilities	Ramp- Have a ramp at all levels which has a height difference. Have stairs provided next to the ramp when the level difference exceeds 300 milimeters. Ramp- The ramp's surface is stable, made from non-slippery finishes to accommodate dry and wet conditions.	CS1	32	68
			CS2	90	10
			CS3	33	67
			CS4	92	8
		Pathway- Have wheelchair barrier-free path size access to the building from the outdoor surroundings or parking area for accessibility in and out of the building.	CS1	30	70
			CS2	87	13
			CS3	31	69
			CS4	88	12
		Lift- Have safety features and specified to disable needs. Barrier-free wheelchair access to lift	CS1	21	79
			CS2	32	68
			CS3	22	78
			CS4	41	59
		Staircase -Have safety features specified to disable needs like railing, wide landing area and has visible, tactile features	CS1	43	57
			CS2	89	11
			CS3	42	58
			CS4	75	25

Source: Author

DISCUSSION

About the above findings, the perception of disabled students on the availability of the barrier-free facilities as well as infrastructure for the disabled in the campus is still at a very moderate to the low level, which requires much attention to elevate the quality of the amenities towards better emotional fulfilment and physical benefit for a sustainable learning

environment in the campus. This is much evident in the Selayang (CS1) and Masjid Tanah (CS3) Community College. The results showed that the level of compliance of disabled facilities to MS1184 is moderate, and this is evidenced by an analysis of the study, which found that the percentage rate of all community colleges studied was less than 60%. There are two community colleges categorized at a medium level: Selayang Community College and Masjid Tanah Community College.

This finding is also supported by feedback from respondents with a moderate mean range. Based on the perception responses from these disabled students in terms of emotional findings (attention), sensory (memory) and hope (expectation) (refer to Figure 1), supported by literature study based on case studies of successful community colleges abroad as a benchmark, a more resilient and appropriate design for disabled is developed as in Table 3.

Table 3. Design Preferences and Characteristics for a Better Learning Environment

Item	Determinants (WHAT)	Disable Learning Infrastructure and Barrier-Free Facilities Design characteristics (HOW)

1	Space -making	**•Size and Space for Approach Use** The learning space provided should be ergonomically suitable for physically disabled people. It is suggested to have squared room units for mobility movement and viewing proximity within visible distance. Having this visual clarity will encourage awareness and, thus, participation. The difference in size requirement is critical for wheelchair and stretcher users. Corridors should be big enough for the wheelchair to operate. A wide tapering corridor encourages the visibility of rooms even at corridor ends & buffers direct lighting from the façade into room space. **•Sensory reach** Visibility & diffused lighting is essential in which openings should be designed accordingly to the disabled needs and height limitation in all learning spaces. All rooms should be visible to and from corridors for wayfinding & evacuation safety (visible alarm from the corridor) **•Low Physical Effort** The learning space design should allow the user to minimize their energy while operating in the building. Facilities should be accessible near distance to avoid fatigue while moving with wheelchairs or stretchers. The use of vertical circulation, such as elevators, is justifiable due to the effectiveness and time-saving. While in the case of fire, an exit ramp can be provided for the user to exit the building faster and safely. **•Flexibility in Use** Flexibility provides an option for disabled people to operate in the academic building. Facilities should be able to be operated by the right-handed or left-handed person. The design should adapt to the user's pace while moving in the building. For example, the water closet handlebar should be situated on both sides for the left or right-handed user. By creating a pausing space, physically disabled people may rest if fatigued without interfering with the circulation area.

2	Spatial arrangement	**•Perceptible Information** The academic building design should deliver information regardless of the user's sensory abilities. It can be done through passive and active design implemented in the building. Colour-coded strips on the floor can give directions to different spaces or tactile feedback tiles, namely for blindness. **•Bright coloured paints** Bright coloured should be painted in all learning spaces where this helps visually impaired students and the deaf notify the obstacles and location quickly. **•Simple and Intuitive Use** Floor plans design should be functional and straightforward for the disabled to access quickly and understand the space entirely. It should provide a direct way to operate while entering, building, or exiting the building. Circulation can be centralized for the user to move freely and accordingly.
3	Accessibility	**•Equitable Use** The design should ensure that physically disabled people and other people with different disabilities operate in the building. Other aspects of privacy, security and safety are all equal to every user. **•Have Textured Pathway** The textured pathway should come with two lanes (to come and go), where it has a similar design of tactile pavement points indicating the direction of flow, it also comes with different textured points (indicating reach of a space, nearby seating area, reaching an intersection point, or reaching a nearby braille handrail, etc.).Blind people may follow the tactile pattern on the floor and emergency lights for alerting the deaf people event the building is designed for physically disabled people in the first place. **•Have wayfinding landmark** The establishment of significant façade element with bold fair-faced bricks for recognition of building and navigation will provide unmistakable wayfinding landmark The corridor's widths should be within 3600milimeters for occupants to walk side-by-side for conversations to carry on during transitions. **•Tolerance for Error** The design should minimize the hazardous situation that can cause accidents and unintended situations. It should provide a warning for any dangerous situation for the user. For example, the change of level that includes steps should be avoided and replaced with a ramp. If still needed, a warning signal should be available.

Source: Author

CONCLUSION

To conclude, the four community colleges portray the similarity of findings in terms of lack of representation of barrier-free facilities and disabled amenities in which the campus environment did not showcase a conducive and sustainable learning environment. This non-compliance is interpreted in specification, measurement, and provision of facilities that the designer should have given much priority. In the analysis of the findings, the most not adhered to were the ramp and walkway facility elements, accessible toilets, fire warning system, and signage. These facilities are not adequately built and have become an obstacle to the disabled students in their respective community colleges in carrying out their daily activities. These limitations have restricted accessibility and mobilization within the campus and thus restricted their academic needs. Many disabled students urge improvement to be made to improve the design facilities to be embedded with the architectural design of the building form and space-making. From this, it is recommended that campus design portray much consideration for the disabled in the future, referring to the outlined strategies suggested above (refer to Table 2 and 3), emphasizing better space making, spatial arrangement, and accessibility. Upgrading and creating accessible facilities can increase the diversity of functions for using the academic and open spaces. This will also improve the mobility of disabled students around the outdoor and internal spaces of the campus. This is crucial to ensure equity in education so that personal and social circumstances will not become obstacles to achieving educational potential. Education is necessary for economic mobility, as it may create wealth for the populace and is crucial for nation-state development. Therefore, the government and related authorities should consider elevating the educational facilities for the disabled in higher learning institutions to the optimal level.

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CONFLICT OF INTEREST

The authors declare no conflict of interest about this article being submitted for publication.

REFERENCES

Alias, R., Alias, N., Ibrahim, A., Attan, H., & Kadir, A. (2013). What do the disabled students need? A study on the needs of the special educational needs (SEN) learners in Malaysian public universities. *The European Journal of Social & Behavioural Sciences*, 603-623.

Ashby, F. G. (2014). *Multidimensional models of perception and cognition*: Psychology Press.

Ashray, F. S. B. M. (2018). Social Welfare Services in Malaysia: The Role Of Government. Paper presented at the 2018 *Annual Conference of Asian Association for Public Administration*:" Reinventing Public Administration in a Globalized World: A Non-Western Perspective"(AAPA 2018).

Aziz, M. A., Isa, W. A. R. W. M., & Nordin, N. (2010). Assessing the accessibility and usability of Malaysia higher education website. Paper presented at the 2010 *International Conference on User Science and Engineering* (i-USEr).

Bandar, N. F. A., Jani, R., & Karim, M. A. (2014). Psychometric properties of the WHOQOL-BREF questionnaire among disabled students in Malaysian higher learning institutions. *Applied Research in Quality of Life, 9*(3), 469-478.

Black, R. D., Weinberg, L. A., & Brodwin, M. G. (2014). Universal design for instruction and learning: A pilot study of faculty instructional methods and attitudes related to students with disabilities in higher education. *Exceptionality Education International, 24*(1), 48-64.

Coulson, J., Roberts, P., & Taylor, I. (2017). *University trends: Contemporary campus design*: Routledge.

Dell, C. A., Dell, T. F., & Blackwell, T. L. (2015). Applying universal design for learning in online courses: Pedagogical and practical considerations. *Journal of Educators Online, 12*(2), 166-192.

Démuth, A. (2013). Perception theories. Kraków: Trnavská univerzita.

Edyburn, D. L. (2010). Would you recognize universal design for learning if you saw it? Ten propositions for new directions for the second decade of UDL. *Learning Disability Quarterly, 33*(1), 33-41.

Hadi, A., Yusop, M., Mohamad, B., & Jaafar, M. (2010). Study of information and communication technology (ICT) usage in technical and vocational special education programme. *Global Journal of Human Social Science Research, 10(*1), 35-43.

Haron, S., Abdul Talib, Y., Mohamed, A., Abdul Ghani, A., Hamid, M., & Md Ajis, A. (2016). Usability Evaluation Via Accessibility Design. *Malaysian Journal Of Sustainable Environment, 1*(1), 1-11.

Islam, M. R. (2015). Rights of the people with disabilities and social exclusion in Malaysia. *International Journal of Social Science and Humanity, 5*(2), 171.

Ismail, A. S., & Zulkurnain, N. S. Z. (2019). The Role of Environment As Third Teacher Towards The Development Of Educational Space For Dyslexic Children. *International Journal of Built Environment and Sustainability, 6*(2), 51-62.

Khairuddin, K. F., Salleh, S. D., & Amin, A. S. (2020). Supporting Students with Autism in Tertiary Education: Malaysian Lecturers' Views and Experiences. *Universal Journal of Educational Research, 8*(11A), 1-8.

Lee, M. N. (1999). Education in Malaysia: towards vision 2020. *School effectiveness and school improvement, 10*(1), 86-98.

Lee, M. N. (2015). *Higher education in Malaysia: national strategies and innovative practices.* In Mass higher education development in East Asia (pp. 105-118): Springer.

Lifchez, R. (1986). *Rethinking architecture: Design students and physically disabled people*: Univ of California Press.

Mustaffa, W. S. W., Rahman, R. A., Ab, H., Wahid, S. M. R., & Hudin, N. S. (2019). *Exploring Disabled Students' Service Quality Dimensions: A Case of Malaysian Higher Education Institutions* (HEIs).

Mohd Shobri, N., Zakaria, I., & Mat Salleh, N. (2018). Accessibility Of Disabled Facilities At Fi-Sabilillah Mosque, Cyberjaya. *Malaysian Journal Of Sustainable Environment, 4*(1), 137-164.

Narayanan, S. (2018). A study on challenges faced by disabled people at workplace in Malaysia. Paper presented at the Proceeding—*5th Putrajaya international conference on children, women, elderly and people with disabilities*.

Nasir, M. N. A., & Efendi, A. (2019). Thematic analysis on the rights of disabled people to higher education. *Journal of Education and Social Sciences, 12*(1), 8-17.

Pitcher, G. (2015). Theory of perception: Princeton University Press.

Pliner, S. M., & Johnson, J. R. (2004). Historical, theoretical, and foundational principles of universal instructional design in higher education. *Équity & excellence in education, 37*(2), 105-113.

Sanmargaraja, S., & Ta Wee, S. (2011). Kajian penyediaan fasiliti orang kurang upaya (OKU) di institusi kerajaan di Nusajaya, Johor Bahru.

Schelly, C. L., Davies, P. L., & Spooner, C. L. (2011). Student perceptions of faculty implementation of Universal Design for Learning. *Journal of postsecondary education and disability, 24*(1), 17-30.

Silver, P., Bourke, A., & Strehorn, K. (1998). Universal Instructional Design in higher education: An approach for inclusion. *Equity & Excellence, 31*(2), 47-51.

Vossoughi, S., Hooper, P. K., & Escudé, M. (2016). Making through the lens of culture and power: Toward transformative visions for educational equity. *Harvard Educational Review, 86*(2), 206-232.

Yusof, Y., Chan, C. C., Hillaluddin, A. H., Ahmad Ramli, F. Z., & Mat Saad, Z. (2019). Improving inclusion of students with disabilities in Malaysian higher education. *Disability & Society,* 1-26.