

# A Systematic Review on The Integration of Universal Design in Architectural Outdoor Environments of Higher Educational Institutions

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Received: 21 March 2023, Accepted: 28 August 2023, Published: 1 September 2023

## ABSTRACT

Universities are a critical place for preparing humans for their future endeavours because they provide the necessary knowledge and skills for personal and professional growth. However, inadequate accessibility for students with disabilities (SWDs) has hindered them from fully participating in any university programmes that cause of lack connectivity in High Educational Institution (HEI) campuses area. With the growing numbers of SWDs, HEI should be freely access without any discrimination regarding to the physical environment. Therefore, this article will review the current literature on integration of Universal Design (UD) in HEI for the past 15 years. It is thought that the information and knowledge presented in this review can aid higher education institutions in creating a more inclusive environment to support students with disabilities (SWDs) during their campus life. A list of keywords (UD theory and principles, Students with Disabilities, Accessibility in HEI, and Outdoor environments) related to the scope of this research was identified. In the second step, the keyword for studies on Scopus and WoS were searched, and total of 20 papers were reviewed. A themed review was carried out, where 33 sub-themes were identified based on the keywords. The result suggests a new accessibility model for the integration of UD in architectural environments. This study will benefit future researchers that focus on outdoor environment with the integration of UD theory.

**Keywords:** Universal Design (UD), Student with Disabilities (SWDs), High Educational Institution (HEI), Outdoor Environment



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## 1. INTRODUCTION

Post-secondary education for students with disabilities (SWD) is an important issue that has gained attention and support at both the national and international level in providing equal opportunities. Higher education Institution (HEI) leads to an increase in individuals' capabilities and their level of self-sufficiency, which in turn increases their quality of life (Colin Barnes, 2006). Apart from that, the author aware that universities are viewed as pioneer within their communities, and lead to contribute to the social, cultural, economic, political, and technological development and they are seen as driving forces in shaping the development of a nation. University should take a leading role in society in

supporting campus life of SWD to ensure the needs that relates with the everyday life living patterns of students with disabilities are fulfilled. The shift towards viewing disability from a social perspective, rather than an individual one, and the changes in legislation that promote equal rights are essential for ensuring equitable access to higher education for students with disabilities. This transformation in the way we approach disability and its relationship to equal rights is crucial for ensuring that Higher Education Institution (HEI) can provide equal opportunities for success to students with disabilities.

In Malaysia, the Higher Education Act 1996 is the main legislation that governs the operations of higher education institutions (HEI). The act provides the framework for the establishment, administration, and development of HEI in the country. However, this law does not specifically address the rights of students with disabilities in HEI or the measures that HEI should take to ensure equitable access to higher education for students with disabilities. In addition, The National Council for Persons with Disabilities (NCPD), established under the Persons with Disabilities Act 2008 (Act 685) is responsible for promoting and protecting the rights and welfare of persons with disabilities in Malaysia. The council has been working closely with the Ministry of Higher Education that responsible for overseeing the operations of HEI in Malaysia specifically, the related regulation contained technical design specifications that applied in all public spatial environments, including university campuses. Regulations related to monitoring and controlling accessibility include a set of design standards and a checklist to determine whether a design is accessible or not. The current method of evaluating the design of the built environment for accessibility has some gaps, as it often focuses on making individual design elements accessible, rather than ensuring that the environment is inclusive for all community members, including those with disabilities. While technical design standards are important, the goal should be to adopt an integrated design approach that considers the needs and abilities of all users. Without this approach, achieving equal access in college campus environments and other public spaces remains a challenge for individuals with disabilities in Malaysia.

The accessibility of a university campus for students with disabilities depends on how well the campus's facilities, services, and activities meet the spatial needs of those students. The design of the campus should consider this relationship, whether it's a new campus being built or an existing one being renovated. To achieve this, the design should consider how accessible the campus is for all students at the earliest stages of planning. To do this, it's important to understand the real-life experiences of students with disabilities and to gather information about their specific needs. This will help ensure that the campus is accessible and inclusive for all students.

Application of Universal Design in built environment for both existing and new building should be provided (Rahim et al., 2010) in paralleled to Malaysia's aims which to increase the participation of students with disabilities in Higher Education Institution (Yusmarhaini Yusof, 2019) through the pledge of 'leaving no one behind' is one of the initiatives by the Higher education that has been highlighted in the Sustainable Development Goals (SDGs) in which to advance inclusive development for all (Muhammad et al., 2020). In addition, according to (Wilson, 2018), the design outdoor environment can be effectively used to positively impact the social and academic lives of students.

## **2. METHODOLOGY**

In this section the method used to retrieve articles related to the integration of universal design in architectural outdoor environments of higher educational institutions. The reviewers used the method called PRISMA, which includes resources (Scopus and Web of Science) used to run the systematic review, eligibility and exclusion criteria, steps of the review process (identification, screening, eligibility) and data abstraction and analysis.

## 2.1 PRISMA

The PRISMA Statement (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guided the review, which is commonly used in the field of environmental management. As noted by (Sierra-Correa & Cantera Kintz, 2015 as cited in Shaffril et al., 2018), PRISMA provides three distinct benefits: 1) it enables the formulation of clear research questions that facilitate systematic research, 2) it identifies inclusion and exclusion criteria, and 3) it aims to comprehensively review a large database of scientific literature within a defined timeframe. The PRISMA statement allows in-depth research of terms related to universal design in architectural outdoor environments of higher educational institutions and its impact and coded information in future environmental management reviews. The methodology can be used to monitoring the integration of UD theory towards built environment in Malaysian HEI.

## 2.2 Resources

The review relied on two main journal databases – Scopus and Web of Science (WoS). WoS is a huge database consisting of >33,000 journals with coverage of over 256 disciplines including subjects related to environmental studies, interdisciplinary social sciences, social issues and development and planning. It includes over 100 years of comprehensive back file and citation data, established by Clarivate Analytics, and ranks them by three separate measures: citations, papers, and citations per-paper. Scopus is the second databases used in the review. It is one of the largest abstract and citation databases of peer-reviewed literature with >22,800 journals from 5000 publishers worldwide. Scopus consists of diverse subject areas as environmental sciences, social science, architecture and so on.

## 2.3 Eligibility and Exclusion Criteria

A few eligibilities and exclusion criterion are determined. First about literature type, only article journal with empirical data is selected which means review article, book series, book, chapter in book and conference proceeding are all excluded. Second, to avoid any confusion and difficulty in translating, the searching efforts excluded the non-English publication and focused only on articles published in English. Thirdly, regarding timeline, a period of 11 years is selected (between 2015-2022), and adequate period to see the evolution of research and related publications. As the review process focused on adaptation practices of universal design towards outdoor environment university campuses, articles indexed in social science-based indexes are selected, which means, articles published in a hard science index (Science Citation Indexed Expanded) are excluded. Lastly, in line with the objective which focused on education, all articles related to the pre-school until post-secondary education were selected.

## 2.4 Resources Systematic Review Process

Systematic review process involved in four stages. The first phase identified keywords used for the search process. Relying on previous studies, keywords similar and related to universal design, integration, university campuses, High Educational Institution (HEI) and outdoor environment were used (Table 1). This stage is carefully screening to remove any redundant articles.

Screening process apply in second stage. Out of 212 articles eligible to be reviewed, a total 108 articles were removed. The third stage is eligibility, where the full articles were accessed. After careful examination, a total 85 articles were excluded were not empirical articles and did not focus on Universal design. The last stage of review resulted in total of 20 articles that were used for the qualitative analysis.

## 2.5 Data Abstraction and Analysis

The remaining articles were assessed and analysed. Specific studies responded to the formulated research questions. The data were extracted by reading through the abstract first, then the full articles (in-depth) to identify appropriate themes and sub-themes. Qualitative analysis was performed using

content analysis to identify themes related to integration of universal design in HEI campuses. The authors then organized sub-themes around the themes established by typology.

### 3. Results

The review resulted in four main themes and 33 sub-themes related to integration practices on outdoor environment in HEI campuses. The four main themes are UD (eight sub-themes), SWDs (nine sub-themes), HEI (four sub-themes), and outdoor environment (12 sub-themes). The results provided a comprehensive analysis of the current integration of UD in outdoor environment HEI campuses.

A total of ten studies focused on accessibility in High Educational Institution (Delnevo et al., 2018; Dinc Uyaroglu, 2021; Eldridge et al., 2022; Lawrence, 2021; Ozdemir & Sungur, 2022; Porto et al., 2022; Prandi et al., 2021; Rafferty, 2011; Torkildsby, 2017, seven studies focus on Student with Disabilities ((Dinc Uyaroglu, 2021; Edwards & Larson, 2022; Parker et al., 2021; Porto et al., 2022; Rantanen et al., 2015; Vogt et al., 2022), eight studies discussed on Universal Design theory and new term of UD (Dinc Uyaroglu, 2021; Edwards & Larson, 2022; Nah & Lee, 2016; Ozdemir & Sungur, 2022; Prandi et al., 2021.; Torkildsby, 2017; Van Eck et al., 2022; Xu et al., 2022, and out twenty-two studies, twelve concentrated on outdoor environment Boeri et al., 2020; Bozkurt, 2021; Delnevo et al., 2018; Dinc Uyaroglu, 2021; Gasparovic & Sladovic, 2021; Nah & Lee, 2016; Parker et al., 2021, Prandi et al., 2021, Rantanen et al., 2015; Samsudin et al., 2019; van Eck et al., 2022; Ytterhus & Åmot, 2021.

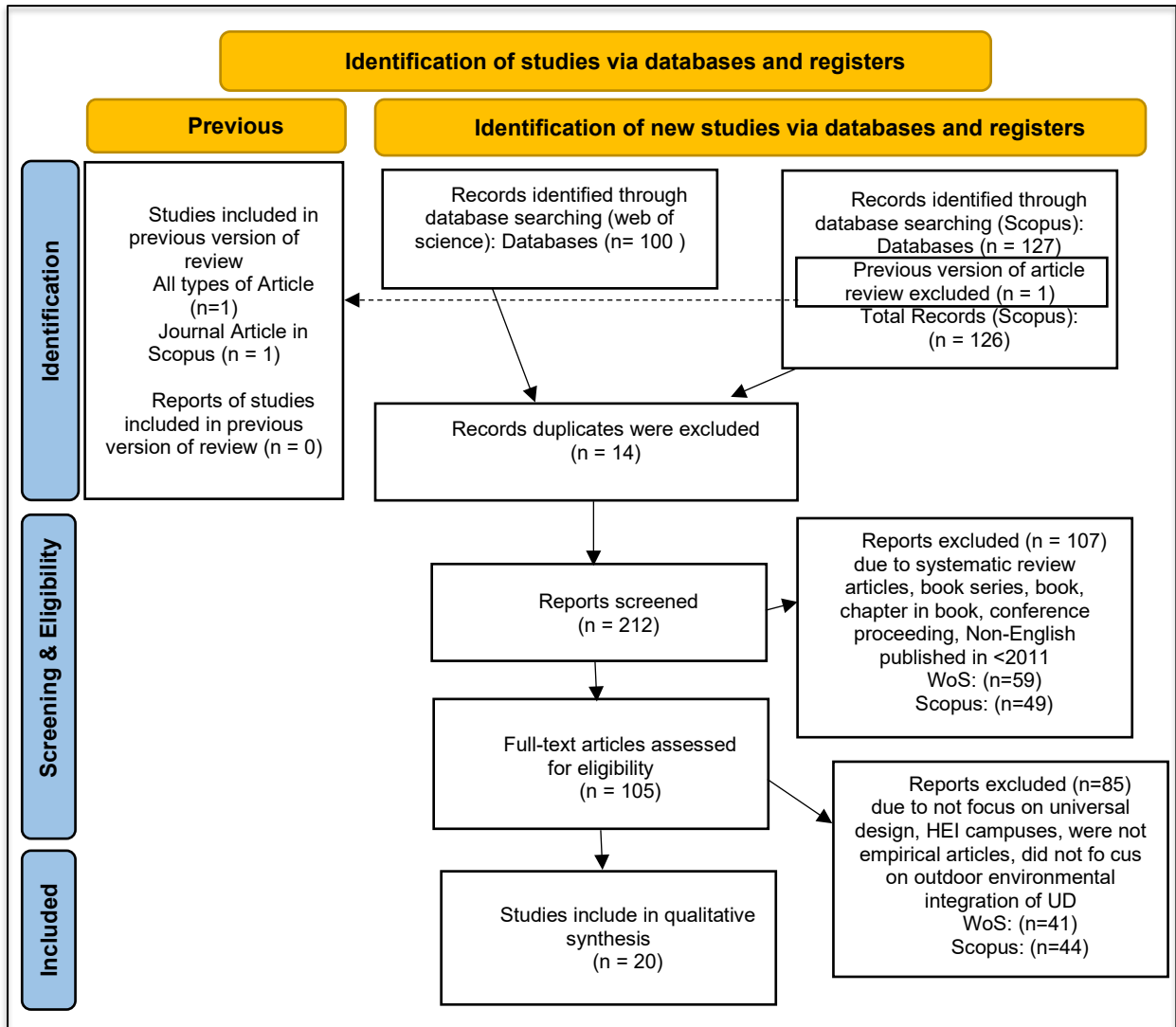
In addition, ten studies applied qualitative approach while two studies employed a mix methods (qualitative + quantitative) approach. The remaining studies (10) used quantitative analysis methods. Based on years published, six articles were published in 2022, nine articles were published in 2021, one article was published in 2020, 2019, 2018, 2017, 2016, 2015, and 2011 each. The reasons why the literature for this study starts from 2011 is basically to focus on the latest publications within 10-15 years, and to the trends towards 2022.

**Table 1** The inclusion and exclusion criteria

Criteria	Eligibility	Exclusion
Literature type	Journal (research articles)	Journals (systematic review), book series, book, chapter in book, conference proceeding
Language	English	Non-English
Timeline	Between 2011-2022	<2011
Indexes	Web of Science	Science Citation Indexed Expanded (Web of Science)
Countries and territories	All over the world	-

**Table 2** The search string used for the systematic review process.

Search strings	Keywords	Results
SCOPUS	TITLE-ABS-KEY(("Universal design" OR "Inclusive design" OR "inclusi*") AND ("Outdoor*" OR "exterior" OR "outdoor environment*") AND ("universit*" OR "campus" OR "institution*" OR "facult*"))	127
Web of Sciences	TS=("Universal design" OR "Inclusive design" OR "inclusi*") AND ("Outdoor*" OR "exterior" OR "outdoor environment*") AND ("universit*" OR "campus" OR "institution*" OR "facult*"))	100



**Figure 1** PRISMA 2020 flow diagram for new systematic reviews which included searches of databases and registers only.

**Table 3 Authors (W.o.S) and Countries according to themes**

Authors/Countries	Main research design	UD theory & principles										Students with disabilities							Accessibility				Outdoor Environment													
		E A	E U	F U	S I	P I	T E	L E	S S	I N	A D	V I	B I	D F	L D	M D	P D	P Y	S D	T R	L S	P S	S S	M E	P P	P C	C R	S W	T M	P O	D O	R M	M O	W F	O E	
1. Prandi et al. (2021) - Italy	QN					√													√					√			√								√	
2. Dinc Uyaroglu. (2021) - Turkiye	QL	√							√			√				√					√		√	√	√	√					√					
3. Torkildsby. (2017) - Norway	QL		√																	√																
4. Lawrence. (2021) - U.S	QL																				√															
5. Delnevo et al. (2018) - U.S.A	QN																		√		√			√	√	√	√	√								
6. Xu et al. (2022) - China	QN										√													√	√	√	√	√								
7. Van Eck et al. (2022) - Netherland	QL									√																								√		
8. Porto et al. (2022) – Argentina & Chile	QL																	√				√														
9. Edwards & Larson. (2022) - Canada	QN		√														√																			
10. Vogt et al. (2022) - U.S.A	QL															√																				
11. Ytterhus & Amot. (2021) - Norway	MM																												√							
12. Bozkurt. (2021) - Turkiye	QL																										√									
13. Gasparovic & Sladovic. (2021) - Croatia	MM																						√	√					√				√			
14. Rantanen et al. (2015) - Finland	QL											√					√																	√		

**Table 4 Authors (Scopus) and Countries according to themes**

Authors/Countries	Main research design	UD theory & principles										Students with disabilities							Accessibility				Outdoor Environment													
		E A	E U	F U	S I	P I	T E	L E	S S	I N	A D	V I	B I	D F	L D	M D	P D	P Y	S D	T R	L S	P S	S S	M E	P P	P C	C R	S W	T M	P O	D O	R M	M O	W F	O E	
15. Ozdemir & Sungur. (2022) - Turkiye	QL									√												√	√													
16. Eldridge et al. (2022) - England	QL																						√													
17. Boeri et al. (2020) - Italy	QN											√																								
18. Samsudin et al. (2019) - Malaysia	QN																																			√
19. Nah & Lee. (2016) - South Korea	QN									√																										√
20. Rafferty. (2011) - Australia	QL																					√														
<b>UD theory &amp; principles</b>		<b>Students with disabilities</b>										<b>Accessibility</b>							<b>Outdoor Environment</b>																	
EU: Equitable Use FU: Flexibility in Use SI: Simple and Intuitive use PI: Perceptible Information TE: Tolerance for Error LE: Low Physical Effort SS: Size and Space for Approach IN: Inclusive		AD: Attention Deficit VI: Blindness/ Low vision BI: Brain Injuries DF: Deaf/ Hard of Hearing LD: Learning Disabilities MD: Medical Disabilities PD: Physical Disabilities PY: Psychiatric Disabilities SD: Speech and Language Disabilities										TR: Technology Resources LS: Learning Style PS: Physical Spaces SS: Student Services (Onsite & online)							ME: Main Entrance PP: Pedestrian Path PC: Pedestrian Crossing CR: Curb on Ramp SW: Sidewalk TM: Tactile/Material PO: Parking OKU DO: Drop-off RM: Ramp MO: Mobility WF: Way Finding OE: Outdoor Education																	
<b>Main research design</b>												QN: Quantitative QL: Qualitative MM: Mixed Method																								

### 3.1 Universal Design (UD) Theory and Principles

A total of 8 out of 21 studies focused on Universal Design theory and principles could integrate to the physical environment in high educational institution. The most common integrations of UD are manipulating and absorption the thinking process on design phase. Meanwhile, urban environments, university campuses, and public and private buildings often present architectural barriers that prevent people with disabilities and special needs to move freely and independently (Prandi, Barricelli, et al., 2021). Education and right to access are among central issues of a democratic public life as well as higher education (Dinc Uyaroglu, 2021). However, changes in the living environment may negatively affect the mental health of the people (Xu et al., 2022). Research built environment has focused on the diverse ways in which public spaces where diversity and social inclusion coexist with conflict and reproduction of inequalities (van Eck et al., 2022). In the UK, a clear national mandate exists for designing more accessible outdoor spaces, but despite a growing understanding of the access barriers experienced by underrepresented groups, the institutional factors contributing to these barriers remain underexplored (Edwards & Larson, 2022). However, As a modern design approach, the inclusive design philosophy; To create quality spaces by increasing the liveability and quality of university campuses as a public space, and to spread this philosophy to the whole society in their professional lives by ensuring that this design concept is placed on university students, who are the main campus users, who will provide the development of the society (Ozdemir & Sungur, 2022). An inclusive context and sustainable implementation of students' participation are recommended for the purpose of realizing student's rights and transforming education and practices (Nah & Lee, 2016). Besides that, throwing light upon the design process from a critical perspective and highlighting considerations that might otherwise be overlooked (Torkildsby, 2017).

### 3.2 Student with Disabilities (SWDs)

Students with disabilities often in the studies on type of disabilities. A total of 5 articles reported and discussed about the strategy to overcome the disabilities in HEI campuses. Student with disabilities with wheelchairs and severe visual impairments participated in this study (Dinc Uyaroglu, 2021). It ranged from entering the campus to accessing to spaces or buildings. Theoretically, the study is grounded in a conceptualisation of social justice language education beyond redistribution, with a focus on recognition, inclusive language ideologies and practices, and transformative learning (Porto et al., 2022). Protected areas deliver a wide variety of benefits to visitors including mental and physical health, environmental knowledge, and a sense of community (Edwards & Larson, 2022).

During the global COVID-19 pandemic, access to outdoor recreation is desperately needed for youth; however, students with physical disabilities who regularly experience barriers and constraints to engagement in outdoor physical activity may experience additional challenges (Vogt et al., 2022).

### 3.3 Accessibility

A total of 10 studies reported accessibility in outdoor environment as one of the strategies for integrations of universal design in high educational institution. Under this theme, a total of four sub-themes divided, namely, Technology Resources, Learning Style, Physical Spaces, and Students Services (Onsite and Online). Three studies focused on accessibility in technology resources, one study focused on accessibility in learning style, five studies focus on accessibility in physical spaces, and three studies investigated accessibility in student services either onsite or online (Table 3).

Technology resources may affect the accessibility in HEI. Devices, and software applications aimed at fostering accessible wayfinding and navigation in indoor and outdoor environments (Prandi, Barricelli, et al., 2021). Providing support by means of smart phones to location technologies can be a useful means of integration and inclusion, with the effect of also facilitating students (Delnevo et al., 2018).

Moreover, there is growing number of literatures in relationship between the learning style and student with disabilities in Secondary School, but one and only study in Norway that investigated accessibility in university learning style. Bringing this way of thinking about design into higher education could encourage teachers and students to broaden their knowledge in this field, better equipping students to create in an inclusive manner and ensuring that future products, buildings, and exterior spaces are accessible to all to the greatest extent possible (Torkildsby, 2017).

Accessibility in HEI environment often in the studies on physical spaces strategies. In United States of America, the experiences university students have during outdoor recreation opportunities have holistic benefits, yet there is a sizeable discrepancy in the representation of marginalized students in outdoor campus recreation (Lawrence, 2021). Apart from that, according to Delnevo (2018) moving across a university campus (outdoor, among the buildings, and indoor, among classrooms and offices) could represent a barrier for students with disabilities, affecting their independence while they conduct their daily activities. Exploring design parameters for inclusive university campus outdoor spaces together with the shared spatial experiences addressing needs, desires, and preferences of SWDs in an equal way (Dinc Uyaroglu, 2021). As a modern design approach, the inclusive design philosophy; To create quality spaces by increasing the liveability and quality of university campuses space (Ozdemir & Sungur, 2022). According to (Rafferty, 2011), the value of outdoor environments as legitimate and critical spaces for learning within higher education.

### **3.4 Outdoor Environment**

A total of 12 studies reported that outdoor environments consist of few lists which are main entrance, pedestrian path, pedestrian crossing, curb or ramp, sidewalk, tactile or material, parking OKU, drop-off, way finding and outdoor education. Detecting obstacles in outdoor environments is an important problem for blind people who desire to move autonomously (Prandi, Delnevo, et al., 2021). According to (Dinc Uyaroglu, 2021), case-based situation does not lead them to participate in diverse educational activities. Spontaneous and infrequent meetings in different department buildings may also force participants with visual impairments to use unidentified parts of the outdoor environment. Besides, according to (Delnevo et al., 2018), moving across a University campus (outdoor, among the buildings, and indoor, among classrooms and offices) could represent a barrier for students with disabilities, affecting their independence while they conduct their daily activities. A growing number of academics has started to consider the importance of outdoor retail markets, not only in economic terms but also in relation to their social and cultural value (Van Eck et al., 2022). According to the (Ytterhus & Amot, 2021) through a cross sectional multi-method study design, based on qualitative methods, we, in collaboration with students with and without disabilities identified which places indoors and outdoors these students defined to be comfortable and inclusive spaces, and what characterise them. This basic qualitative research by (Bozkurt, 2021) aims to reveal the meaning of outdoor learning activities experienced by social studies teacher candidates. However, the planning scale at the wider area of city district, and the second level is the urban design project of one of selected new public outdoor spaces (Gasparovic & Sladovic, 2021). We examined the effects of an individualized out-of-home activity intervention delivered by volunteers on QoL among community-living disabled people, who have difficulty accessing the outdoors independently (Rantanen et al., 2015). According to the (Samsudin et al., 2019) the perception can be changed by providing evidence which proves that outdoor education is important for students in fostering resilience when facing an extreme condition. In fact, the educator also changed her perspectives and attitudes toward student's rights and capacities as well as toward outdoor play and learning and maintained these changes in her pedagogy and management of the classroom (Nah & Lee, 2016).

## **4. DISCUSSION**

This study attempts to systematically analyse the existing literature on integration of universal design on outdoor environment in high educational institutions. Accessibility is a global challenge and integration of universal design must be practised to minimize the obstacles that face by the students



with disabilities. A precise review sourced from two database have resulted in 20 articles related to the integration of universal design on outdoor environments. The result indicates that half of the research is precisely discussed on high educational institution setting. Other than that, discussed on first and secondary school.

Universal design is an approach that aims to create products, environments, and systems that are accessible and usable by everyone, including people with disabilities. By designing for accessibility from the outdoor environment, universal design can help to remove barriers and provide equal access to all individuals, regardless of their abilities. Those articles discussed about move freely and independently, right to access, and changes in the living environment for social inclusion. However, coexist with conflict and reproduction of inequalities still there. In the UK, a clear national mandate exists for designing more accessible outdoor spaces, inclusive design philosophy, inclusive context and highlighting considerations to the needs of students with disabilities.

Students with disabilities are often excluded or marginalized in educational settings due to inaccessible environments or curriculum. However, when students with disabilities are included in universal design discussions, their unique needs and perspectives can help to identify barriers and suggest solutions that benefit all students. The issue of accessibility for students with wheelchairs and severe visual impairments has become a widely discussed on those articles in efforts to ensure that inclusive education can be accessed by all students without unnecessary barriers and have equal opportunities to access education and succeed in it.

During the global COVID-19 pandemic, mental health has become a serious topic that has been widely discussed in several articles. inadequate outdoor environments may limit opportunities for social interaction and community building among students. Outdoor spaces can provide opportunities for socializing, group activities, and community events, which can help students feel connected and supported in their academic and personal lives.

Ensuring accessibility in Technology Resources, Learning Style, Physical Spaces, and Students Services (Onsite and Online) are important for promoting equity and inclusion in higher education and providing equal access to learning opportunities for all students. Proposing devices, and software applications aimed at fostering accessible wayfinding and navigation, physical spaces strategies. In United States of America, the experiences university students have during outdoor recreation opportunities have holistic benefits, quality of university campuses space.

## **5. FUTURE DIRECTION**

Collaborative design planning between stakeholders, designers, students, faculty, staff, and disability services professionals can help in framing a model of accessibility to ensure that the design of outdoor spaces meets the diverse needs of all students. Engaging with students with disabilities and incorporating their feedback into the design process can help to create spaces that are truly inclusive and welcoming. Use of technology: Technology can play a significant role in enhancing accessibility and inclusivity in outdoor spaces. For example, digital maps and wayfinding tools can help students with disabilities to navigate the campus more easily, while smart lighting and sound systems can improve safety and accessibility in outdoor areas.

Overall, the future direction of integrating universal design in the outdoor environment of higher educational institutions is likely to involve a holistic and collaborative approach that prioritizes SWDs by integrating UD theory and principles in accordance with the urgent current situation to resolve core needs and issues.

## 6. CONCLUSION

This systematic review has highlighted the importance of the integration of universal design on outdoor environment high educational institution. While the topic of disability in higher education outdoor environment is not novel, there is a growing need for thorough research to provide a more accurate understanding of policies and practices specifically on connectivity of outdoor environment. This is particularly urgent given the increasing number of students with disabilities enrolling in universities.

## ACKNOWLEDGMENT

I would like to dedicate this research to my late mother, Bedah Binti Rethuan, whose strength and perseverance in the face of chronic kidney failure inspired me to embark on the topic of universal design. Despite the many challenges she faced, my mother remained steadfast in her commitment to living a full and independent life. Her determination to overcome the barriers created by her physical limitations motivated me to explore ways in which design could be made more inclusive and accessible to all. I am deeply grateful for her unwavering love and support, and I know that her memory will continue to guide me as I pursue my research in this field. This work is dedicated to her, as a tribute to her resilience and as a commitment to making the world a more equitable and inclusive place for all.

## FUNDING

There is no financial aid was received.

## AUTHOR CONTRIBUTIONS

I would like to acknowledge my supervisor's committee for the significant contributions to aligning the keywords used in this paper. Their careful attention to detail and thoughtful suggestions have helped me to identify the most relevant and appropriate terms to describe the key concepts and findings of my research. Their guidance has also enabled me to articulate my ideas with greater clarity and precision, which has been essential to the success of this project. We state the roles of each of the authors in this publication, including data collection, analysis, writing etc.

## CONFLICT OF INTEREST

There is no conflict of interests.

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