Effects of Learning Accessibility as a Mediator between Learning Styles and Blended Learning in Higher Education Institutions during the Covid-19 Pandemic

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Abstract: Technology has been rapidly implemented in the learning process during the COVID-19 pandemic. It gives rise to new challenges, especially in higher learning institutions, in planning and mobilizing a sustainable learning environment. Initiatives have been taken to introduce different learning methods using the Learning Management System (LMS), that provide students with a more convenient and flexible way of learning. Thus, this study aims to determine the effects of learning accessibility as a mediator between learning styles and blended learning among students of higher education during the COVID-19 pandemic. A quantitative method using instruments from the Visual, Aural, Read and Kinaesthetic sensory (VARK) model has been selected. A total of 208 students from Universiti Putra Malaysia (UPM) have been randomly chosen as respondents who have fully utilized the LMS during the pandemic. Findings reveal that learning accessibility poses a partial mediation effect between learning styles and blended learning among students of higher education. This finding is significant and has achieved the Goodness-of-fit index (GFI). Therefore, it is proven that there are positive effects among students of higher learning institutions in Malaysia with a learning accessibility lean toward the LMS platform that increases blended learning and adaptability, prompted by the changes in the learning environment during the COVID-19 pandemic.

Keywords: Blended Learning, COVID-19, Higher Education, Learning Management System, Malaysia

1. Introduction

The utilization of technology in education has contributed to major changes in the education system nationwide. Its necessity has evidently increased during the COVID-19 pandemic, which caused a huge impact, almost immobilising students from attending lectures physically at higher learning institutions (Coman et al., 2020). There has been a paradigm shift in the education system, away from a teacher-centered learning consisting physical lectures, toward an open platform which focuses on a learner-directed learning. The LMS provides an interesting platform that ensures alignment of activities based on the course contents while providing flexibility in learning (Juárez Santiago et al., 2020; Putri & Pratiwi, 2021).

The application of LMS as a main learning platform is not a new concept; it has been in existence for a long time. Its consistent utilization among students poses a challenge, as there is a need to ensure its usage as the main learning medium with added flexibility. Despite that, the shift from a

teacher-centered learning to a learner-directed learning, has given a new dimension for students to adopt a blended learning approach, the emergence of which demonstrates LMS' credibility as a distant learning tool which can stimulate the intellectual capacities of learners, in addition to providing instructors with feedback from activities that have been conducted (Kabassi et al., 2016; Sahni, 2019).

Martin, Parker, and Deale (2012) opined that several online education characteristics are rooted in distant learning and consists of four types of interaction: learner-content, learner-instructor, learner-learn and face-to-face-learner. Additionally, Nadire and Muhammed (2014) emphasized that instructors need to be aware of the instructional method implemented in the platform, as the standard format in LMS can become either too general or too specific. This emphasizes the students' readiness to learn and assesses their ability to adapt to the learning style of this platform.

On the other hand, to ensure that the LMS platform becomes the main source of distant learning, instructors need to ensure that students can access the platform at all times. Apart from making sure that students have the gadgets required for the online learning, internet accessibility is also important to bolster effective interaction during these sessions. This is especially so during the said pandemic which demands students to interact with peers and instructors online (Mekonnen & Muluye, 2020). The key factor of LMS mediated instruction is to ease participation and promote active collaboration among students, transitioning from problem solving to knowledge creation (Kumar, 2016).

However, it is important to distinguish which type of learning process using LMS is suitable for the students. This was caused by the paradigm shift from having regular meetings in class to face-to-face online interaction necessitated by the COVID-19 pandemic. There are many learning institutions that have utilized distant learning styles and students are able to cope well and manage their assignments, but there are also cases where students face depression due to failure in managing lectures and assignments (Ajmal & Ahmad, 2019; Deng et al., 2021). Therefore, the students' learning style needs to be identified at the outset, to pave way for the distant learning process using the LMS platform.

The LMS' main objective is to centralize attention to facilitate administration together with instructional and learning management through e-learning. This system consists of a holistic distant learning process that transcends across instructor-learner, instructor-administrator, and administration interactions. In a similar fashion, the LMS system encourages the instructor and students to plan their learning process and collaborate through knowledge and information exchange (Morze et al., 2021). The main characteristics of an e-learning platform are flexibility, accessibility, learner focused, interactivity, which focuses on improving students' performance. Courses that are developed through the LMS platform have the benefit of providing quicker access to contents and have become the ultimate choice during the pandemic to ensure students continue learning without barriers (Makumane, 2021). Therefore, this study needs to be conducted to investigate whether the learning sessions can run smoothly using blended learning methods instead of physical learning.

The objectives of this study are:

1) To determine the influence of learning styles, accessibility of learning and blended learning approach among higher education students.
2) To determine the learning accessibility as a mediator between learning styles and blended learning among higher education students.

2. Literature Review

2.1 E-Learning Platform in Higher Learning Institutions

The E-learning process in higher learning institutions can only be done with the corroboration of multiple online platforms. There are many methods of visualized online learning, such as computer-mediated instruction (Aguti, Walters, & Wills (2014), web-based training, e-learning system and LMS (Alier et al., 2010). However, LMS has garnered a prominent role in higher learning institutions where continuous assessments of learning activities occur (Irfan, Kusumaningrum, Yulia, & Widodo, 2020). Additionally, this system helps simplify the lecture delivery and the interaction among students and between students and their instructors. LMS is defined as web-based software that provides an

interactive learning environment which includes administrative system, organisation, delivery and learning contents, as well as reports on the students' assignments (Turnbull, Chugh & Luck, 2019).

Moreover, LMS can provide feedback to students and can be utilized as a forum for discussion. This provides a space for students to communicate whilst encouraging learner-instructor collaboration asynchronously, whereas online webinars enable audio-visual as well as written and verbal communication to take place where users can decode messages and accept responses synchronously (Klobas & McGill, 2010).

LMS consists of many different utilities to help instructors manage their lectures and courses (Ouadoud, Chkouri, & Nejjari, 2018). It was built to supervise and evaluate students continuously in the lecture session as well as monitor the students' attendance and other administrative action taken against students to ensure that the information delivered on the platform is fully utilized (Atkinson & Lim, 2013).

LMS is considered a flexible learning platform due to the user-friendly web interface (Gautreau, 2011). Through this platform, instructors can upload and provide students with information that is not accessible during face-to-face classes, and students can exchange information, share their problems and receive feedback from various sources (Dias & Diniz, 2014). Additionally, the LMS platform has various features such as forum, chat, private message, apart from module contents specification and learning activities. Higher learning institutions can adopt these as additional methods to assist the transition from traditional classroom, to exclusive online learning (Kasim & Khalid, 2016).

The LMS platform prides itself on ease of use and access. It has positive effects on students' learning performance. In a similar vein, the study conducted by Acosta and Luján (2016) highlighted that students who utilized the LMS platform throughout their education achieved higher grades than those who did not.

2.2 Role of Learning Management System during the COVID-19 Pandemic

The COVID-19 pandemic has spread worldwide without warning and has paralysed all economic sectors in the country. This includes the education sector which is the root of societal development. Due to the novel coronavirus and its widespread effect, the education sector has become a subject of interest of researchers. Investigating the effectiveness of online learning among students amidst the pandemic, Maatuk et al., (2021) has demonstrated that the easily accessible e-learning, has made a positive influence on students' learning throughout their education term.

Higher learning institutions globally were adversely affected by the COVID-19 outbreak especially in areas of research, physical conferences, international mobility programs, physical education and technical vocations. Most universities had to conduct online learning and have adopted various learning approaches to deliver the contents effectively (Ananga, 2020). This poses a challenge particularly in areas of technological access and educators' skills to deliver the courses online. Although many universities have adopted the LMS as a supplementary method during the pre- COVID-19 era, most of them were not prepared to use this platform optimally. Thus, to ensure that education is delivered continuously and effectively, it is pertinent that the LMS platform is fully utilized. This optimisation would not only need to consider student-teacher interaction, and language clarity between students and teacher (Elumalai et al., 2021), but also to ensure that the course contents and framework of each field of study, can be understood easily (Razali, 2021; Turnbull, Chugh, & Luck, 2021).

Additionally, Ożadowicz (2020) opined that learning style plays a dominant role in influencing students in adopting blended learning practices through the LMS platform, especially during the pandemic. The LMS is not merely a medium for information transfer, but one that is strategized and planned in phases with organized learning contents, projects and assignments which envelopes the blended learning approach (Siripongdee, Pimdee & Tuntiwongwanich, 2020).

Moreover, Tang et al., (2021) posited that there are important aspects to be considered to ensure that optimal online learning can be implemented in the new normal. Among these are: accessibility of learning; selecting the methods needed to promote blended learning in lectures whilst avoiding disruptions from the internet during video conference; devising suitable activities to assist learners assimilate and understand information; preparing interactive information from multiple electronic sources; using social network to reduce student individualisation during the learning process;

implementing various techniques such as debate, explorational and experiential learning; selecting features that could facilitate effective student-teacher communication (Adedoyin & Soykan, 2020).

The reality is that most educators face an innovation stand-off between the naysayers who fear change, regardless of research on future employment requirements and personalized learning benefits. The LMS is a centralized, online database that records students' coursework, curriculum, and performance. In the absence of a good management system, most educators rule out student-led learning simply because it can get messy and hard to track. At the end of the day, educators are still held responsible for measuring student engagement and academic development. However, there are useful management systems like LMS which can assist the implementation of personalized learning, making it a seamless reality out of the classroom.

2.3 Blended Learning during the COVID-19 Pandemic

Blended learning is a combination of face-to-face learning using computers as mediators (Ożadowicz, 2020). To comprehend the nuances of blended learning in the field of teaching, many educators have designed suitable activities and concepts to achieve the blended learning standards of the LMS, set by the institutions (Munchen, Fazilah & Nurazidawati, 2021). However, the concept of blended learning has started to expand based on the various approaches carried out by several institutions, which has added to its complexity (Carius, 2020). Additionally, blended learning has increasingly been adopted in higher education institutions due to the spread of COVID-19, which forced the education sector to completely shut down physical learning (Marinoni, Van't Land & Jensen, 2020).Hence, blended learning is the best way to combine different approaches in teaching and learning so that the learning process may be evaluated and monitored continuously.

Considering the current pandemic situation, blended learning should be the primary choice when designing classroom curriculum. For example, face-to-face learning in lecture halls should be replaced with video conferencing through the LMS or any other suitable platform that students have access to (Ożadowicz, 2020). Online learning has also been implemented for studies that require physical attendance such as agriculture, sewing and cooking, and these had adopted the blended learning approach comprising videos, assignments, and class activities in line with the academic syllabus (Ehrlich et al., 2020). Additionally, the pandemic has called for a new dimension in learning systems in higher education institutions in Malaysia (Kamal et al., 2020; Chung, Subramaniam & Dass, 2020; Adams, Tan & Sumintono, 2020) and internationally as majority of faculties are migrating towards online teaching using the LMS platform (Turnbull, Chugh & Luck, 2021; Johnson, Veletsianos & Seaman, 2020; Rad et al., 2021). Hence, it is important for the course frameworks to adapt to the new learning styles to achieve targeted outcomes.

The implications of blended learning are not only limited to synchronous teaching, but it can also be combined with asynchronous teaching methods to promote online learning during the pandemic (Lowenthal et al., 2020). More importantly, it enables the structure of student-centered courses and course contents that foster empathy, whilst cultivating teamwork in the learning process (Agasisti & Soncin, 2021; Razali et. al., 2020). In short, regardless of whether it is pre- or post-pandemic, the blended learning approach for teaching and learning will always be applicable. Pedagogical design must be suited to students' learning styles while guaranteeing accessibility of learning to achieve targeted outcomes.

Great concern should be placed on the fact that students are facing a transition in learning styles and the capacity of the students' environment in catering to effective accessibility of learning is a dominant factor in ensuring that students have access to learning without having to be physically present at their academic institution. The pandemic has caused the majority of students to experience anxiety, brought about by the drastic changes they face with regard to the new teaching and learning approaches (Baloran, 2020). Blended learning will bring about a new dimension of learning that is easy to understand since it utilizes various methods such as webinars, simulations, assessments and virtual classrooms that promote flexibility and education without limits. Additionally, students will have more autonomy in their educational pursuits as compared to physical classes, which, in turn instills a sense of responsibility within them that helps in attaining the knowledge and skills required during the pandemic (Pham & Ho, 2020).

Blended learning also encourages greater interactivity between students and technology. Students are able to receive more information with better quality when they have wider access to resources via technology. During the pandemic, individualized learning through the blended learning approach progresses according to the capabilities and uniqueness of the individual student and through continuous student-teacher feedback (Karma, Darma & Santiana, 2021). A positive relationship has also been observed between good online learning access and the implementation of blended learning that ensures students are able to acquire knowledge from various sources (Pham & Ho, 2020). Hence, blended learning is a suitable approach for teaching and learning because it promotes creativity and encourages students to expand their skills, such as visual communication (message interpretation and production) and personal autonomy by adapting their learning style according to the situation.

Taking these parameters into consideration, this study will be looking into specific factors that affect student learning styles and accessibility of learning during the COVID-19 pandemic, as well as online learning which acts as the main education platform for most higher education institutions in Malaysia. There are three main variables investigated in this research: Learning Style, Blended Learning and Accessibility of Learning. The learning style has four constructs, such as Visual, Audio, Interpersonal and Intrapersonal which will be discussed in this study. Subsequently, the accessibility of learning as a mediator between the learning style and blended learning, will be investigated. Worth mentioning here that the constructs in the instruments were selected and formed based on the VARK model.

To ensure a more meaningful study, a few hypotheses were proposed, reflecting on the overall scope of the study and specific parameters that answers the study objectives. The hypotheses were as follows:

H1: Learning style is a significant factor in the development of blended learning.
H2: Accessibility of learning is a significant factor in the development of blended learning.
H3: Accessibility of learning is a significant mediator between student learning styles and the development of blended learning.
H4: There is a mediator effect (accessibility of learning) between student learning style and the development of blended learning.

These hypotheses were based on the study's framework (Figure 1) as follows:

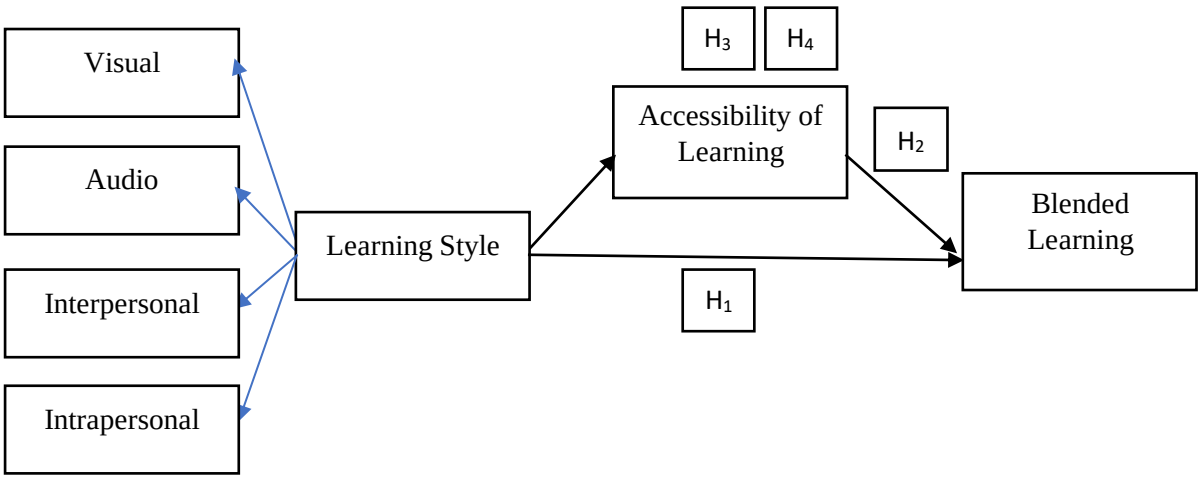

Fig. 1 Research framework based on literature review

3. Methodology

This quantitative study was designed to correlate the independent variables of student learning style and accessibility of learning together with the dependent variable of blended learning. A questionnaire was prepared for the data collection, and responses from 208 randomly selected bachelor's degree students from a university in Malaysia, were obtained. The number of responses was

in line with Kline's (2011) criteria for a large sample size, being over 200. The respondents consisted of students who actively utilized the e-learning platform and LMS, during the closure of their institution due to the COVID-19 pandemic. This mode of learning was known as PutraBLAST. It featured educator tools that ensure optimum teaching and learning in a blended learning environment. Park, Yu and Jo (2016) have reported efficacious results in blended learning through the LMS platform even for long distance learning. This study also observed the initial implementation of online learning through LMS in the Malaysian higher education institutions necessitated by the pandemic, and investigated the dominant factor that affects blended learning development in students.

Research instruments were designed to adapt to new learning norms that combined face-to-face interaction and online learning. The constructs in the instrument were selected and formed based on the VARK Model. Fleming and Mills (1992) suggested four elements in teaching and learning sessions which focused on face-to-face learning outcomes. However, this study emphasized three additional flexible elements that can be used for online and face-to-face teaching and learning sessions, such as Visual, Auditory, and Read/Write. This research is rooted in the Blended Learning Model founded by Stacker & Horn (2012). It focused on the rotation model of blended learning, which highlights the elements required during the face-to-face and online teaching sessions such as accessibility learning towards blended learning. The questionnaire developed for this study was made up of two sections: Section A collected the student's personal details while Section B determined their learning style and measured the level of learning accessibility and blended learning development. During the pilot testing, the reliability of the questionnaire was verified through validation of experts from various universities including content and measurement (scale) specialists, as well as statistical conformity and credibility.

For primary data collection, the questionnaire was distributed randomly online through Google Form. Social media was the primary medium of contact in reaching out to students from five faculties (Education, Human Development, Mathematics, Science and Agriculture) in UPM. The statistical tools such as SPSS and SEM-AMOS software were used for analyzing the data collected. Data validation and analysis of respondents were determined through Cronbach's Alpha to ensure internal consistency between observable variables and credibility of latent constructs defined in the study. The Confirmatory Factor Analysis (CFA) was conducted through the AMOS software (version 24) to ensure a clear definition of latent constructs through measured variables. Influence testing was conducted for each variable in relation to the study objectives to analyze the impact of learning style and online learning accessibility against blended learning development among higher education students during the COVID-19 pandemic.

4. Findings

The students' demographic profile, online learning accessibility, learning styles, and blended learning approaches through the e-learning platform were analyzed as follows:

Table 1. The Confirmatory Factor Analysis (CFA) summary for all constructs

Construct	Component	Item	Factor Loading	Cronbach Alpha (> 0.7)	CR (≥ 0.6)	AVE (≥ 0.5)
Learning Style (LS)	Visual	LSV1	.72	.88	.89	.66
		LSV2	.79			
		LSV3				
		LSV4				
		LSV5	.86			
		LSV6	.87			
		LSV7				
		LSV8	.63			
	Audio	LSA1	.67	.87	.86	.50
		LSA2	.78			
		LSA3				

		LSA4			
		LSA5	.77		
		LSA6			
		LSA7			
		LSA8	.79		
		LSA9	.72		
	Interpersonal	LSB1			
		LSB2	.62		
		LSB3	.71	.89	.89	.57
		LSB4	.66		
		LSB5	.79		
		LSB6	.85		
		LSB7	.85		
	Intrapersonal	LSC1			
		LSC2	.81		
		LSC3	.79	.89	.89	.62
		LSC4	.86		
		LSC5	.72		
		LSC6	.75		
		ALC 2	.79		
		ALC 3	.70		
		ALC 4			
		ALC 5	.70		
		ALC 6	.75		
		ALC 7			
		ALC 8			
		ALC 9			
		ALC10			
Accessibility of Learning (AOL)		AOL1			
		AOL 2			
		AOL 3			
		AOL 4	.86		
		AOL 5	.88	.95	.95	.73
		AOL 6	.79		
		AOL 7	.84		
		AOL 8	.85		
		AOL 9	.89		
		AOL10	.87		
Blended Learning (BL)		BL1	.77		
		BL2			
		BL3	.84		
		BL4	.86		
		BL5			
		BL6	.87	.95	.95	.71
		BL7	.86		
		BL8			
		BL9			
		BL10	.91		
		BL11	.78		
		BL12	.83		

*Highlighted boxes represent items deleted due to low factor loading.

Table 1 summarizes the CFA of each instrumental item developed for this study. Several instruments were developed to investigate different aspects of the study and were denoted by their respective construct items. The Learning Style construct consisted of four sub-constructs, namely Audio, Visual, Intrapersonal, and Interpersonal, represented by 34 items. The Learning Accessibility construct was represented by 10 items while the Blended Learning construct was represented by 12 items. As shown in Table 1, several items were removed due to their low factor loading. Data analysis of each construct resulted in Cronbach's Alpha value of more than 0.80 without exceeding 0.95, proving high credibility for each item tested (Hulin, Netemeyer & Cudeck, 2001). Subsequently, these items were analyzed to determine the validity and reliability of the overall measurement model for each construct.

4.1 Validity and Reliability of the Measurement Model

Unidimensionality

Unidimensionality was achieved through the item-deletion process for low factor loading items in the measurement model. Thereafter, a new model was tested, and the item-deletion process was repeated until the fitness indices achieved the required level.

4.1.1 Validity

Validity was achieved through the following processes: i) Convergent validity: AVE ≥ 0.50, refer to Table 1. Average Variance Extracted, AVE = ΣK2 / n where K = factor loading of every item and n = number of items in a model. ii) Construct validity: All fitness indices for the model met the required level. iii) Discriminant validity: There were no redundant items for any of the constructs involved, and the correlation between all constructs was lower than 0.85 (Table 2).

4.1.2 Reliability

Reliability was achieved through the following processes: i) Internal reliability: Cronbach's Alpha ≥ 0.70, refer to Table 1. ii) Composite reliability (C.R): C.R ≥ 0.6, refer to Table 1, CR = (ΣK)2 / [(ΣK)2 + (Σ1 - K2)] where K = factor loading of every item and n = number of items in a model.

Table 2 showed a strong and positive correlation between constructs in the measurement model through SEM's AMOS analysis with an approximate value of 0.80 where <.85 (Collier, 2020), which supported the use of this measurement model for this study.

Table 2. Correlation between constructs in the measurement model (AMOS output)

Construct			Estimate
LS	<-->	LA	.80

4.2 Hypotheses Testing

Further analysis was carried out to test the hypotheses of this research. Three hypotheses were assessed. For the first hypothesis:

H_1: Learning style is a significant factor in the development of blended learning among higher education students.

Table 3. Analysis of learning styles towards blended learning

Construct	Estimate	S.E.	C.R.	P	Result

LS → BL	.208	.077	2.699	.007	Significant

Table 3 displayed that learning styles directly affect blended learning development with significant values at β=.208 and p=.007.

For the second hypothesis:
H_2: Accessibility of learning is a significant factor in the development of blended learning among higher education students.

Table 4. Analysis of accessibility of learning towards blended learning

Construct	Estimate	S.E.	C.R.	P	Result
AOL → BL	.806	.117	6.863	.001	Significant

Table 4 proved that the second hypothesis was acceptable where accessibility of learning and blended learning development has significant direct influencer values (β=.806, p=.001). Mediators may have existed in this model due to significant direct influencers between the independent and dependent variables. The analysis also justified the crucial role of accessibility in learning as well as learning styles in adapting towards changes in learning approaches to ensure effective learning, especially when considering the blended learning approach using the LMS platform. Even though the LMS platform can be conducted through either synchronous or asynchronous learning, students favored the approach of guaranteed access during delivery and receiving information as outlined in the academic schedule for higher education institutions.

For the third hypothesis:

H_3: Accessibility of learning is a significant mediator between students' learning styles and the development of blended learning among higher education students.

In respect of the third hypothesis, the analysis had determined that a mediator must be implemented in the study to examine the effect of accessibility of learning as a mediator between students' learning styles using LMS as the main platform and the blended learning development among students in higher education institutions during the COVID-19 pandemic.

Table 5. Analysis of a mediator (accessibility of learning) between learning styles and blended learning

Construct	Estimate	S.E.	C.R.	P	Result
LS → BL	.183	.072	2.680	.007	Significant
LS → AOL	.820	.097	9.458	.001	Significant
AOL → BL	.811	.079	9.731	.001	Significant

Table 5 demonstrated the mediator analysis results that determine whether it is acceptable to use LMS as a learning platform to assess the effectiveness of accessibility of learning as the mediator between students' learning styles and blended learning. Thus, the accessibility of learning is a mediator that causes significant influence between students' learning styles and blended learning development. The type of mediator that existed as a result of this analysis was measured at the value of $p<0.05$, indicating Partial Mediation.

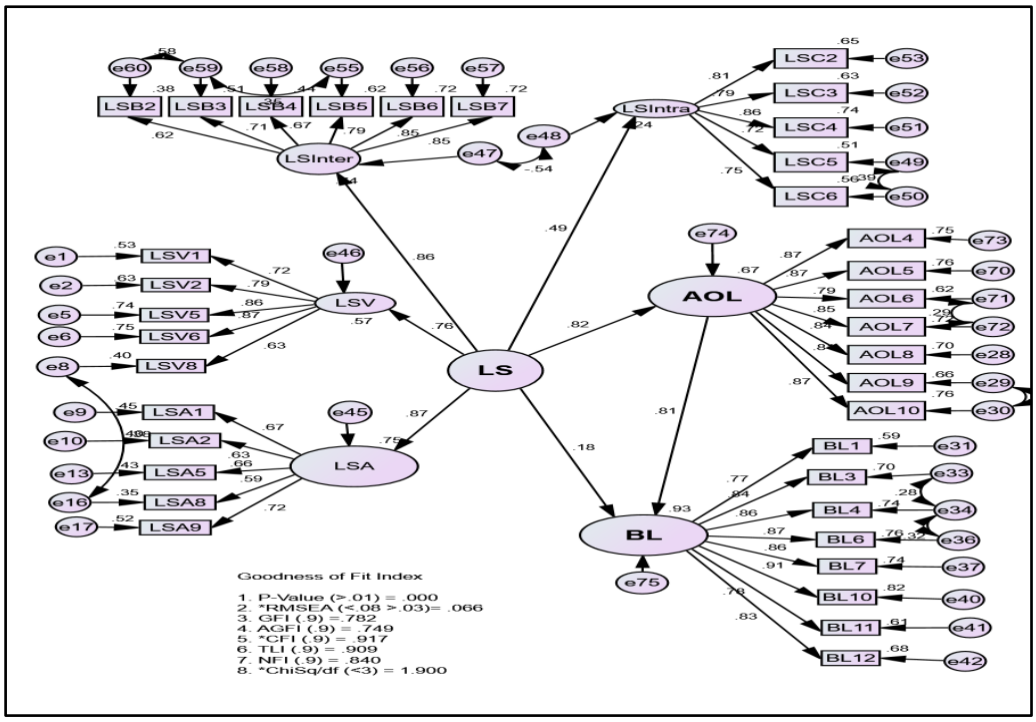

Fig. 2 Relationship between learning styles and blended learning using accessibility of learning as a mediator

Mediator analysis (Table 5) was to gauge the accessibility of learning as a mediator between students' learning styles and development of blended learning among higher education students, using LMS as a learning platform during the COVID-19 pandemic. The mediator analysis utilized bootstrapping, which revealed accessibility of learning as a partial mediator that affected students' learning styles and blended learning development ($p<0.05$), and this proved that the third hypothesis was acceptable.

Preacher and Hayes (2004) discovered that bootstrapping was a more valid and powerful method for testing intervening variable effects. Furthermore, bootstrapping was already embedded in SEM software such as AMOS. One of the advantages of bootstrapping is that the inference is based on an estimate of the indirect effect itself. Additionally, bootstrapping was frequently utilized, and it was discovered that no standard error was needed to make the inference, resulting in a moot point about how best to estimate the standard error of the indirect effect. In addition, it was a very general approach, in that it can be used for making inferences about indirect effects in the intervening variables model, regardless of the complexity and numerous paths between the dependent and independent variables.

Mediator testing was also conducted on the modification model as shown in Figure 2 with estimated beta coefficient value of .193 (Table 5). The analysis yielded significant p-value between students' learning styles and blended learning development during the COVID-19 pandemic. Mediator values (indirect value of influence) for LS → AOL (β=.920, p=.001), and AOL→ BL (β=.770, p=.001) were also significant.

4.3 Determining Mediator (Accessibility of Learning) Effect Size in the Model towards Blended Learning Development through the LMS Platform

Mediator effect size was determined through the summation of variances in the model that justified intermediary contribution for a single path analysis (Yılmaz & Yılmaz, 2016; Collier, 2020). Hence, determination of the mediator effect was conducted to identify the relative contribution of each single projection in the mediator model towards blended learning development among higher education students.

An additional analysis was also carried out to answer the fourth hypothesis:
H_4: There is a mediator effect (accessibility of learning) between students' learning styles and development of blended learning among higher education students during the COVID-19 pandemic.

Table 6. Coefficient of Determination (R^2) for the intermediate effect

Construct	Standardized Estimate	R^2
LS→AOL	.248	
AOL→BL	.855	.925
LS→BL	.191	

Table 6 had analyzed the mediator effect size for accessibility of learning. Variance at R^2=.925 demonstrated considerable implication for learning styles as a mediator towards blended learning development among higher education students. According to Kline (2011), its general effect from R^2 can be clearly observed in Table 7. Hence, the mediator effect size for a single projection analysis yielded considerable implication towards blended learning development among higher education students who utilized the LMS as their primary learning platform.

Table 7. Effect size in research

R^2	Effect size
<.01	Small
.10 - .29	Medium
>.30	Big

A summary of results between the direct and indirect relationships hypothesized are presented in Table 8.

Table 8. Summary of hypothesis testing

Hypothesis	Result
H_1: Learning style is a significant factor in the development of blended learning among higher education students.	Accepted
H_2: Accessibility of learning is a significant factor in the development of blended learning among higher education students.	Accepted
H_3: Accessibility of learning is a significant mediator between students' learning styles and the development of blended learning among higher education students.	Accepted
H_4: There is a mediator effect (accessibility of learning) between students' learning styles and the development of blended learning among higher education students.	Accepted

Analyses of hypotheses testing had accepted hypotheses H_1, H_2, H_3, and H_4 in testing the variable of students' learning styles when using LMS as a new learning platform during the COVID-19 pandemic, which consequently proved its significance in blended learning development among higher education students in Malaysia.

5. Discussion

The findings of this study had discovered that the mediator determination and hypothesis testing had satisfied the objectives of this study in relation to direct effects, mediator presence, as well as the effect of the mediator towards blended learning development, which utilized the LMS platform during the COVID-19 pandemic. Accessibility of learning as a mediator was in line with the findings of ltınay (2017), who reported that access to technology was the primary mediator affecting long-distance learning environments, and improvement of teaching quality in higher education institutions. Ben and Offir (2019) also opined that synchronous accessibility of learning was more significant as a mediator between learning style influences and effective learning development in long-distance learning environments. Hence, accessibility of learning as a mediator, had been proven as an effective tool in ensuring blended learning development for long-distance education, especially during the COVID-19 pandemic.

Subsequently, to test the hypothesized relationships proposed in the model, SEM which adopts the maximum likelihood estimation method was performed using AMOS software. Before testing the direct effects, the SEM was first examined for its goodness of fit. With the overall fit indices being within the acceptable thresholds, the standardized estimates for all direct paths were examined. The results showed five significant and positive relationships, which supported the four hypotheses, namely H_1, H_2, H_3, and H_4. Next, H_4 on the mediating effect was tested using the bootstrapping method in AMOS. The results revealed a significant path, which involves the partial mediating effect of accessibility of learning as a mediator between students' learning styles using LMS and for blended learning development among students in higher education institutions during the COVID-19 pandemic. Therefore, H_4 was supported. In conclusion, all four hypothesized relationships were supported in this study. The summary of hypothesis testing results was displayed in Table 8above.

MacKinnon (2007) defined mediators as a third variable that exists between exogenous and endogenous variables. Mediators call for the understanding of causal relationships, or the effect of influencers. This research discussed the primary role of accessibility of learning as a mediator between learning styles and blended learning development among higher education students, using LMS as a main platform of learning during the COVID-19 pandemic. Mediators may also be present in the models due to the direct influences of significant independent and dependent variables (Aguinis, Edwards & Bradley, 2017). Hence, the hypothesis was accepted since the students' learning styles influenced blended learning through LMS among higher education students in UPM, Malaysia. According to Arianne, Raymond and Arno (2004), a hypothesis can be accepted if its p-value is lower than 0.049 with factors demonstrating positive influence on the study's variables. The findings of this study also provided valuable feedback regarding the general preparedness of higher education students towards innovative education styles during the COVID-19 pandemic as well as the success of the Ministry of Higher Education's initiative in developing sustainable online learning for these students.

The effect of indirect influencers (i.e., mediators) was tested to determine the existence of mediators, and to assess their potential effects on the models mentioned in the mediator determination analysis. H_3 was tested using mediator determination analysis to identify whether accessibility of learning as a mediator between learning styles and blended learning development existed among higher education students. This was possible since learning styles was a significant direct influence on blended learning development when using the LMS platform during the pandemic. This was in line with the results obtained by Aguinis et al. (2017), who stated that direct influencers must be significant between the independent and dependent variables, prior to identifying possible mediators within a model. Hence, the mediator determination analysis and effects of the mediators in the single projection analysis during H_3 testing, had verified that accessibility of learning was a partial mediator ($p<0.05$), with a considerable mediation effect towards blended learning development of higher education students through the LMS platform.

6. Conclusion

Blended learning is a combination of online study and traditional face-to-face teaching. It has been on the rise for several years, but the Covid-19 pandemic has changed the way humankind interacts with each other. From the education perspective, the blended learning approach provides students and

teachers with the opportunity to utilize digital tools to significantly improve the learning experience. Therefore, this research will provide a huge implication for the education sector. Primarily, this study emphasizes the initiative for a global education system, including Malaysia, to ensure that students enjoy learning with more flexibility. Learning styles and accessibility of learning are dominant factors in ensuring the development of blended learning among students and have indirectly proven their necessity for long distance learning. Hence, the needs of students must be given thorough consideration to ensure effective learning, and to provide a more flexible infrastructure for long-distance learning among higher education students. This is in line with the aspirations of the Ministry of Higher Education to instill technology-based learning in conjunction with the Education 4.0 plan. The study also proves that there is no limitation for students of higher learning when using LMS as the main learning platform, even though the situation may be challenging, since students are unable to physically attend lectures.

7. Suggestion for Future Research

It is suggested the future research works should determine other mediator factors that relate to blended learning. This is because such analyses will open the eyes of various stakeholders such as students, educators, and the Ministry of Higher Education among others, to the opportunities to develop effective learning sessions even in a pandemic scenario. Along with the advancement of technology, the blended learning approaches need to be highlighted to ensure that diversity in learning can be formulated.

8. Co-Author Contribution

The authors affirmed that there is no conflict of interest in this article. Author1 carried out the fieldwork, prepared and wrote the literature review. While Author2 had written the research methodology and did the data entry. Author3 carried out the statistical analysis and interpretation of the results. Lastly, Author4 was responsible to ensure the structure of the article is the incorrect format and overlook the whole write-up of the article.

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