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THE MODERATING EFFECT OF DIGITAL DIVIDE ON THE RELATIONSHIP BETWEEN ONLINE LEARNING MODE AND EFFECTIVE ONLINE LEARNING: LEARNERS PERSPECTIVE

Misoi, Meshack Kiplimo
University of Eastern Africa, Baraton, Kenya
Email: misoim@ueab.ac.ke

Abstract

This study sought to examine the relationship between online learning mode and effective online learning as moderated by different contexts of the digital divide in Higher Education Institutions (HEIs) in Kenya from the learners perpective. The digital divide exists due to variations in levels of access, attitude and skill in the use of digital technology amongst the population. The study adopted a descriptive correlational research design. Data was collected through a structured online questionnaire that targeted students in private and public HEIs in Kenya whereby 160 responses was obtained. Two research hypotheses were tested; first, on the relationship between mode of online learning variable and effective online learning variable and secondly, on the moderating effect of digital divide on the relationship between online learning mode and effective online learning. The study found that there exist a positive significant relationship between online learning modes and the effective online learning for both synchronous ($b=0.27$, 0.12, $p<0.05$) and asynchronous ($b=0.35$, 0.08, $p<0.01$). Further, the relationship was found to be moderated positively for synchronous online learning mode ($b = 0.19$, $SE = 0.82$, $p < 0.01$) and negatively for asynchronous online learning mode ($b = -0.27$, $SE = 0.09$, $p < 0.05$) by digital divide. The study has practical decision-making implications for HEIs managers regarding choice of mode of online learning to adopt given the varied resource endowment among the institutions as this brings in the perspective of learners who are critical in establishing the effectiveness of learning. It is imperative from the study that effective online learning online learning mode which utilize less digital resources is more preferable than online learning mode that utilizes more digital resources. The resultant empirical model is well aligns well to the novel conceptual framework developed by the researcher. This is close interpretation expected relationship between the chosen variables and affirms the relevance of the contingency theory of decision-making used in the study.

Key Words: Digital Divide; Online Learning Mode; Effective Online Learning; Moderating Effect

Introduction

SDG goal number 4 seeks to have the entire humanity access quality education. In order to achieve this goal, a flexible learning pathway that suit specific contexts need to be sought. Online learning one of the alternative learning pathways other than the traditional face-to-face. This type of learning is mediated by technology. The challenge of its adoption however is the existence of a digital divide. Digital divide is argued to exist if there is variation in access todigital devices or internet, digital skills, attitude towards technology amongst population. Digital divide is important in the

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context of online learning. This is because online learning is mediated by technology and the existence of a digital divide would imply online education would be impacted. Bridging the digital divide is desirable in order to achieve learning outcomes under online education. In addition, bridging the digital divide ensures education is inclusive and equitable. Interventions to bridge the digital divide are dependent on the nature of the digital divide. Digital divide is largely attributed to structural and policy issues within the society and sometimes education institutions may have little influence over the divide. In short term however, institutions may apply some flexible learning options to mitigate the digital divide barriers. Sengupta et al. [18] observed that to ensure effective online learning, implementing a variety of learning modalities, including offline resources and alternative assignments, can accommodate students with varying levels of technology access. Lufungulo, Jia, Mulubale and Mwila [9] also posited that innovation in teaching and learning does not need to involve the use of high-tech educational technologies but also must consider what works best for a community of learners in a particular context.

The assumption in this study therefore is that bridging the digital divide is a long-term solution to inequity in online education and require massive resources. A short-term solution that mitigates the impact of the existing digital divide context is required. The assumption is motivated by Lufungulo et.al [9] who suggest online learning innovations that provide a fit to the existing context rather than changing the context. The study follows the same thinking by Lufungula et. al and submits that an institution's choice of online learning mode is shaped by the prevailing digital divide context.

Problem Statement

COVID 19 disruptions forced many institutions of learning globally to opt for online learning to enable learners to have continued access to education. The pandemic exposed the existing digital divide, which threaten the attainment of SDG number four of inclusive and quality education for all. The digital divide is deeply embedded in the society and is caused by structural and social-economic factors that will take long to address. These factors are not unique to individual HEIs. In order for the HEIs to deliver on their mandates under the existing digital divide context, they must craft their own strategies of online learning delivery that align with their resources and context.

Unfortunately, there is limited empirical evidence that can aid decision makers to come up with optimal actions. This paper therefore seeks to examine the relationship between online learning mode and effective online learning under varied contexts of digital divide exhibited by HEIs.

Research Objectives

This study was guided by the following research objectives;

1. To assess the extent of the digital divide in HEIs in Kenya.
2. To determine the relationship between different online learning modes and effective online learning in HEIs in Kenya.
3. To establish how the digital divide moderates the relationship between online learning mode and effective online learning in HEIs in Kenya.

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Hypotheses

The research was guided by the following hypotheses, which led to empirical evidence that can inform decision making on the appropriate online learning mode to be adopted by HEIs under different digital divide contexts.

1a H_0: There is no a significant relationship between synchronous online learning mode and effective online learning.

1b H_0: There is no a significant relationship between asynchronous online learning mode and effective online learning.

2a. H_0: The digital divide does not moderate the relationship between synchronous online learning mode and effective online learning.

Conceptual Framework

The conceptual framework in Figure 1 communicates the expectations of relationship between online learning mode and effective online learning as moderated by the digital divide context. The basis of this conceptualization is the varied resilience that a specific learning mode is expected to exhibit under the existing digital divide context.

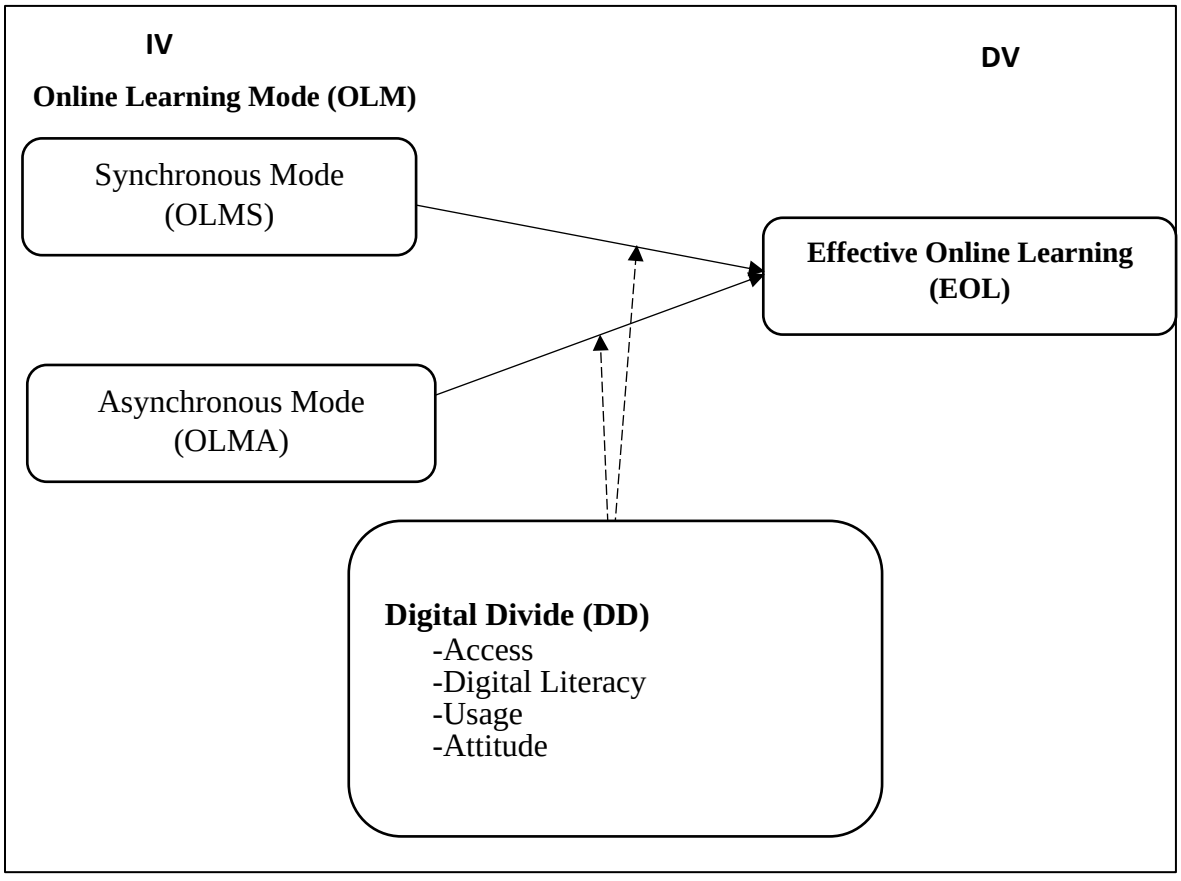

Figure 1: Conceptual Framework, Source - researcher

2a. H_0: The digital divide does not moderate the relationship between synchronous online learning mode and effective online learning.

For example, an online learning mode that is heavy on technology is expected to be less resilient under a wider digital divide gap

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scenario and vice versa. Through determination of the moderating effect of the digital divide, identification of resilient modes will be possible thus enabling the decision makers in HEIs to deploy the appropriate online mode for effective online learning.

Significance and Justification of the Study

The study is significant especially to leaders in HEIs, policy makers and scholars. HEIs leaders need to understand the digital divide contexts they operate in and the online delivery options that they must choose that lead to effective online learning. The policy makers need to know the extent of the digital divide and especially its specific components in order to develop appropriate policy interventions that bridge the divide and improve access to education. The policy interventions could range from improved ICT infrastructure and enhancing digital literacy. The empirical evidence generated from the study is important to scholars especially those in the online education realms. The scholars need to know how effectiveness of online learning is achieved using different delivery modes and how the aspect of digital divide contexts moderates this. This study is justified by the importance of ensuring access to education by all learners. The shift to online learning during and after COVID-19 brought about a threat to inclusiveness and equity of education especially to those who are affected by digital divide. Digital divide permeates the entire society and those with socio-economic challenges are greatly affected. Learners in HEIs are part of this larger society and are equally affected.

Literature Review

The theory underpinning this study is the contingency approach to decision making. Contingency approach is a decision-making theory that attributes the choices made on the existing situations or contexts. It suggests that optimal course of action depends on the internal and external situation. One of contingency theory main characteristic is that there is no one best way of doing things and that management decision making is contingent upon the existing situation. This study is about making choices on the appropriate learning strategy to attain effective online learning. Institutions of learning that have adopted online learning must make choices on the appropriate mode of online learning delivery. The choices made is dependent upon the existing digital divide gap. The dependency of choices on the existing situation is a core aspect of contingency approach to decision making thus justifying the application of this theory. COVID-19 brought a new dispensation to the global education sector. The rapid closures of institutions of learning resulted in interventions to ensure continuity of education by bringing changes in pedagogical approaches. The focus shifted from traditional face to face to remote teaching and online learning. HEIs were in the forefront in this great shift and have some have remained there post COVID19. In order to achieve effective online learning, the choice of the pedagogical approach has to be well thought out. The shift in COVID-19 was an emergency response, without the time to consider and plan online curriculum design or effective teaching and learning approaches in advance [80]. Armada and Armada [1] emphasize the importance of adapting education for quality learning in the new medium and suggest implementing flexible learning modalities to accommodate diverse challenges faced by learners. Online learning modes are broadly categorized into three; synchronous, asynchronous and blended mode. Synchronous learning involves real-time interaction through live sessions, fostering immediate feedback and dynamic engagement.

Synchronous online learning is a dynamic mode of remote education that mirrors traditional classroom instruction by facilitating

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real-time interaction between instructors and students through digital platforms. In this mode, learners participate in scheduled sessions where they engage in live discussions, receive lectures, collaborate on projects, and interact with peers and instructors. One of the key advantages of synchronous online learning is its ability to provide immediate feedback and support. Instructors can gauge student understanding in real-time, address questions and concerns as they arise, and adapt their teaching strategies accordingly. This fosters a sense of connection and engagement among students, leading to a more immersive learning experience. Sari, Gani and Samad [17] confirm this in their study examining lecturers' satisfaction with videoconference-based virtual meeting applications in teaching-learning activities at a private college. Their finding indicated lecturers' satisfaction with virtual meeting applications, thus underscoring the need to address challenges to enhance online education's effectiveness and quality. G Paraguni and Pasha [5] established in their study entitled "Synchronous online learning versus asynchronous online learning: a comparative analysis of learning effectiveness" that the asynchronous mode of online was perceived as a mode that is not as efficient as the synchronous mode of online learning. Friska [4] concurred with G Paraguni and Pasha [5] establishing in their study that synchronous Elearning is preferred as it facilitates students have two-way communication with the lecturer and the presence of lecturer in Elearning is quite crucial. A study by Oguguo, Acheni and Adebayo [13] revealed that synchronous Elearning improved students` academic achievement more than asynchronous Elearning.

Asynchronous learning offers flexibility, allowing students to access materials and complete tasks at their own pace. Asynchronous learning is a flexible online education approach that empowers learners to engage with course materials and complete activities at their own pace, without the need for real-time interaction. In this mode, students' access pre-recorded lectures, reading materials, and assignments through digital platforms such as learning management systems (LMS). One of the primary advantages of asynchronous learning is its flexibility, allowing students to tailor their learning schedule to accommodate personal and professional commitments. Learners can access course materials at any time, from anywhere, making it accessible to a diverse range of students, including working professionals, parents, and those with busy schedules. Bilad [2] in his study established that asynchronous learning had the ability to adjust the pace of learning and conveniently access course materials. Students valued the availability of recorded lectures for reviewing difficult subject matter.

Serdyukov [19] observes in his book "Asynchronous/Synchronous Learning Chasm" that online learning is causing a conflict between asynchronous and synchronous modes of learning. Analysis of these two modes demonstrates advantages and disadvantages of both which calls for a holistic approach to online education realized through an additive interactive model in a blended learning format. Lemke [8] advocates the hybrid model that combines synchronous and asynchronous with the justification that pedagogical goal is to offer students direct access to meaningful in-class interactions, while also giving them the flexibility needed to adjust their learning in these circumstances. In their study on exploration of the effects of synchronous and asynchronous learning activities on student nurse experience during the Covid-19 pandemic, Wheatley and Turner [20] show that successful online learning environment for both the student and educator arise out of student not being reliant on a single approach to learning. Makumane et al [10] suggests that HEIs adopts blended learning to

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eliminate categorical inequalities and social divisions in education, ideally promoting equilibrated inclusion of individuals from diverse socioeconomic backgrounds in the teaching and learning process.

There are some observations though that raises the aspect of digital divide as an impediment to online learning. While going digital reduces costs for learning institutions in some ways, it reduces the opportunities for students with limited access to digital infrastructure and digital literacies [7]. Dash [3] reckons that technology allowed digital based learning to proliferate during the COVID-19 lockdown but is still far away from the majority of unprivileged people. Ohba and Malenya [12] revealed in their paper that COVID-19 pandemic exposed inequities in learning attributed to digital divide. Learners living in remote areas and urban informal settlements, girls and learners from low–socio-economic households could not access lessons. Samuel and Langat [16] suggest that universities can address digital divide issue by providing digital devices and internet connectivity to students who cannot afford them. Ochieng and Ngware [11] established that marginalized/vulnerable learner populations are still left out on EdTech supported learning. Quezada-Morales [15] suggests that the digital divide cannot be merely understood as the access to devices and the Internet but as a holistic set of factors that intervene in the use of technologies which include internet and mobile, social class, economic capital, emotions and perceptions, and public policy.

Despite the suggestions by aforementioned studies, the approaches to online learning however remain varied. The underlying factors that inform the decisions by HEIs on appropriate approach have not been clarified. In addition, the aspect of digital divide and its potential moderating effects on online learning modes has not been sufficiently explored. These variations, lack of clarity and limited explorations informed this study which sought to establish the relationship between the online learning mode and effective online learning as moderated by the exiting digital divide contexts. The ultimate purpose of the study is to offer empirical evidence that can guide the decision makers in HEIs on arriving at the appropriate online learning mode, which aligns with their existing digital divide context.

Material and Methods

The study adopted a descriptive correlational research design. The target population was all students in HEIs in Kenya both private and public universities who are estimated at 5629000 (RoK). The sample size was determined using the formula given a sampling error of *e* of 10%;

$$n = \frac{N}{(1+(N*e^2))} = \frac{5629000}{(1+(5629000*0.10^2))} = 400$$

The sample size thus was 400 students. In order to reach this sample, convenience-sampling technique was adopted whereby data was collected online. This was done using a structured questionnaire that was administered online. To ensure non-bias representation, the instrument was shared in the online platform with members of Distance, Open and Elearning Practitioners Association of Kenya (DOLPAK) whose membership is across all HEIs in Kenya for further distribution to learners. Informed consent was obtained from all individual participants included in the study through a statement on the online questionnaire. The association members were requested to use all available online platforms such as email and WhatsApp groups to maximize the distribution. 160 responses were received back making

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percentage response rate at 40%. The number of responses was considered sufficient since it met the sample size threshold for online surveys, which is pegged at 100 [6].

Results and Discussion

Demographics

Categorization by Gender

94 respondents comprising 58.8% of all respondents were male whereas 66 comprising 41.3% were from female as indicated in Table 1.

Table 1:Gender

Gender	Frequency	Percent
Male	94	58.8
Female	66	41.3
Total	160	100.0

Categorization of respondents by programme

Most of the respondents were those undertaking undergraduate programmes, making up 68.8% of the total. This was followed by those pursuing postgraduate programmes, who comprised 26.3%. This is shown in Table 2.

Table 2: Categorization of respondents by Programme

Programme	Frequency	Percent
Certificate	2	1.3
Diploma	6	3.8
Undergraduate	110	68.8
Postgraduate	42	26.3
Total	160	100.0

Type of Higher Education Institution 91 respondents comprising 56.9% of all respondents were from private university whereas 69 comprising 43.1% were from public universities as shown in Table 3.

Table 3: Type of HEI

Type of HEI	Frequency	Percent
Private	91	56.9
Public	69	43.1
Total	160	100.0

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Extent of the digital divide in HEIs in Kenya

Digital divide was captured by its components of access, digital literacy, usage and attitude as shown in Table 4. The respondents' opinions were scored on 5-point Likert scale. The opinions on the statements were Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree.

Table 4: Digital Divide Descriptive Statistics

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Digital Divide Access	160	1.63	4.88	3.2258	0.6225
Digital Divide Digital Literacy	160	1.58	5.00	3.9427	0.6144
Digital Divide Usage	160	2.40	5.00	4.0856	0.5224
Digital Divide Attitude	160	2.83	5.00	4.2974	0.4906
Valid N (listwise)	160				

Likert items were grouped as per the concepts of digital divide. Score 1 represented strongest disagreement with the statement and score 5 represented strongest agreement with the statement. The statements were such that the highest score meant absence of digital divide or a narrow digital divide whereas lowest score existence of a digital divide.

The greatest contributor of digital divide was perceived to be access to digital technology with a mean score of 3.2258. The least contributor of digital divide was attitude towards use of digital technology, which had a mean score of 4.2974. Generally, literacy, usage and attitude indicated least contribution of digital divide. In overall, the results on digital divide indicated an existence of a narrow digital divide in HEIs in Kenya. Generally, there was homogeneity among the respondents on the various components of digital divide as exhibited by the low standard deviations that ranged from 0.5224 to 0.6225.

The first objective in this study therefore sought to establish the extend of digital divide in HEIs in Kenya. From the foregoing, the study established that there was a narrow gap in the digital divide. The respondents indicated that other than digital literacy, access, use and attitude were not of great concern. This was contrary to the findings by Owidi et al [14] who established that technological challenges such as inadequate digital gadgets, unreliable internet, inadequate technological background and difficulty of use affected online learning. The findings however was limited to one institution and could not provide a good comparison.

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Relationship between different online learning modes and effective online learning in HEIs in Kenya.

A correlation analysis was conducted to ascertain the relationship between online learning modes and effective online learning. The results indicated by pearson correlation product moment indicate a significant correlation. The synchronous online mode had a significant and positive correlation ($r=0.596$, $p<0.05$) whereas asynchronous mode also had significant and positive relationship with effective online learning ($r=0.563$, $p<0.05$). The correlation matrix is indicated in Table 5.

Table 5: Correlation between online Learning Mode and Effective Online Learning

Correlations

		Online Learning Mode Synchronous	Online Learning Mode Asynchronous	Effective Online Learning
Online Learning Mode Synchronous	Pearson Correlation	1	.655**	.726**
	Sig. (2-tailed)		.000	.000
	N	67	67	67
Online Learning Mode Asynchronous	Pearson Correlation	.655**	1	.669**
	Sig. (2-tailed)	.000		.000

**. Correlation is significant at the 0.001 level (2-tailed).

The results on the second objective therefore indicated a positive relationship between online learning mode and effective learning indicated with a preference for asynchronous online learning as depicted by higher beta values. This contradicted findings by G Paraguni and Pasha [5] and Oguguo, Acheni and Adebayo [13], which had established a preference for synchronous learning. This result may be attributed to difficulties in digital access, which make asynchronous learning the faire option.

The Moderating Effect of Digital Divide on the Relationship between Online Learning Mode and Effective Online Learning in HEIs in Kenya

The objective of the study was to establish the moderating role of digital divide on relationship between online learning mode and effective online learning in HEIs in Kenya. Online learning modes chosen for the purpose of this study were synchronous mode and the asynchronous mode. Fig. 2 shows R-squared of 0.495 meaning the online learning mode and the digital divide explain 49.5% of the variation in effective online learning. The digital divide however moderates the relationship between the two variables of online learning mode and effective online learning.

Moderating effect of digital divide on relationship between synchronous learning mode and effective online learning.

The results in Table 6 show a significant relationship between synchronous online learning mode (OLMS) and effective online learning ($b = 0.27$, $SE = 0.12$, $p < 0.05$),

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indicating that higher synchronous online learning mode was associated with higher effective online learning. However, this relationship is moderated by a significant positive interaction between synchronous online learning mode and digital divide (b = 0.19, SE = 0.08, p < 0.05). This means that under a wider digital dive, the relationship of synchronous online learning mode and effective online learning is weaker than under a narrower digital divide. The model in Figure 2 demonstrates the effect.

Moderating effect of digital divide on relationship between asynchronous learning mode and effective online learning.

The results in Table 6 show a significant relationship between asynchronous online learning mode (OLMA) and effective online learning (b = 0.34, SE = 0.0.08, p < 0.05), indicating that higher asynchronous online learning mode was associated with higher effective online learning. However, this relationship was moderated by a significant negative interaction between asynchronous online learning mode and digital divide (b = -0.27, SE = 0.09, p < 0.05). This means that under a wider digital divide, relationship of asynchronous online learning mode and effective online learning is stronger than under a narrow digital divide.

Table 6: Path Coefficients

	Beta	Standard Deviation (STDEV)	T statistics	P values
OLMA -> EOL	0.347	0.078	4.421	0.000
OLMS -> EOL	0.272	0.117	2.319	0.020
DD x OLMS -> EOL	0.187	0.082	2.289	0.022
DD x OLMA -> EOL	-0.274	0.094	2.915	0.004

Hypotheses testing

1a H_0: There is no a significant relationship between synchronous online learning mode and effective online learning.

The p value for the coefficient of relationship between synchronous online learning mode and effective online learning was 0.02, this is less than critical p of 0.05 hence the null hypotheses is rejected and it can be concluded that there is a significant relationship between synchronous online learning mode and effective online learning.

1b H_0: There is no a significant relationship between asynchronous online learning mode and effective online learning.

The p value obtained for the coefficient of relationship between asynchronous online learning mode and effective online learning was 0.00, this is less than critical p of 0.05 hence the null hypotheses is rejected and a conclusion is drawn that there is a significant relationship between asynchronous online learning mode and effective online learning.

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2a. H_0: The digital divide does not moderate the relationship between synchronous online learning mode and effective online learning.

The p value obtained for the coefficient of interaction between digital divide and relationship between synchronous online learning mode and effective online learning was 0.02; this is less than critical p of 0.05. The null hypotheses is thus rejected and it can be concluded there is a positive moderating effect of digital divide on the relationship between synchronous online learning mode and effective online learning.

2b. H_0: The digital divide does not moderate the relationship between asynchronous online learning mode and effective online learning.

The p value obtained for the coefficient of interaction between digital divide and relationship between synchronous online learning mode and effective online learning was 0.00. This value is less than the critical p of 0.05 hence the null hypothesis is rejected and a conclusion is made that there is a negative moderating effect of digital divide on the relationship between synchronous online learning mode and effective online learning.

Empirical Model

The empirical model that summarizes hypotheses testing is illustrated in Figure 2. This model is in harmony with the conceptual framework of the study.

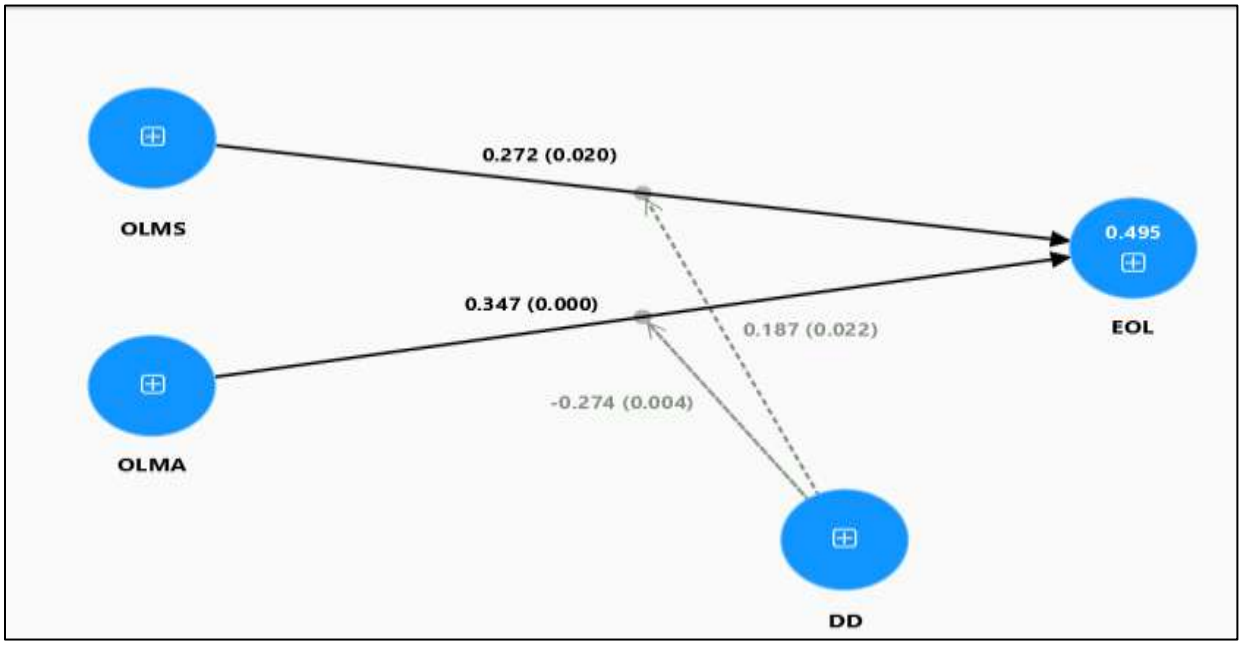

Figure 2: Empirical Model on Moderating Effect of Digital Divide on Relationship between Online Learning Modes and Effective Online Learning

Conclusion

The study sought to establish the moderating effect of digital divide on the relationship between online learning mode and effective online learning in HEIs in Kenya. The targeted population was learners in both public and private HEIs. A sample of 160 was accessed out

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of a target sample of 400 using online survey. Though the study met the sample size criteria for online surveys which is pegged at 100 responses, the response rate of 40% appear low and may limit the study's generalizations.

The digital divide components were identified as digital access, skills, usage and attitude on digital technology. It was established from the descriptive statistics, that the extend of digital divide was minimal except for digital access. Online learning mode focused on two online learning delivery methods namely synchronous and asynchronous modes.

Correlation analysis between online learning modes and effective online learning depicted a strong positive significant correlation with asynchronous learning modes having a stronger correlation compared to synchronous learning mode. A further analysis using smart PLS 4 to generate a model capturing relationship between online learning modes and effective online learning established that 49.5% of variation on effective online learning was explained by the online learning mode. The path coefficients had p values of less than 0.05 meaning that the predictive effect of two online learning modes on effective online learning were significant. Asynchronous online learning mode had a better predictive effect compare to synchronous online learning.

The moderating effect of digital divide on the relationship between the online learning modes and effective online learning was found to be significant but with different effects. The path coefficients showing positive interactions of digital divide on relationship between synchronous learning mode and effective learning mode and a negative interaction of digital divide on relationship between asynchronous learning mode and effective online mode. It can therefore be concluded from the interactions that under a narrow or minimal digital divide contexts, relationship between synchronous online learning mode and effective online learning is enhanced. On the other hand, under narrow digital divide context, the relationship between asynchronous online learning and effective online learning was dampened. This therefore means that asynchronous online learning thrives more under wider digital context than in narrow digital divide context in HEIs in Kenya. The findings are logical in that the digital resources in digital divide contexts are few hence online learning modes that can utilize less digital resources would be more preferable than online learning mode that utilizes more digital resources if effective online learning is to occur. The findings were therefore in harmony with conceptual framework, the theoretical expectation and the researcher's hypothesis.

This study makes the following recommendations.

1. The current study focuses on learners. Since teachers and leaders of ODeL in HEIs are also very critical actors in online learning, the focus of future research should seek to get their perspective too.
2. The specific digital divide components moderating effects should be considered to identify which and how the digital divide components such as access, usage, literacy or attitude effect online learning. This will enable proper interventions to be made in bridging the digital divide in HEIs.
3. Future research should be conducted on the hybrid online learning model referred to as blended learning which incorporates face-to-face traditional learning to establish how the model can mitigate the digital divide effects of the pure online learning modes.

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