Analysis of Digital Transformation in Education During COVID-19: A Case Study on Montessori School of Bhaktapur, Nepal

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Abstract

The research investigates the digitalization of Montessori education during the COVID-19 pandemic in the scenario of Montessori schools in Bhaktapur, Nepal. The study aims to assess the contribution of technological infrastructure, digital literacy, training and support, parental involvement, and school policies to the effectiveness of online Montessori education. It followed a mixed-methods approach by combining quantitative data gathered from surveys with qualitative data gathered from interviews and focus groups. The study recognized that training & support and digital literacy were enablers of successful digital transformation in Montessori education. Higher levels of digital literacy among students, teachers, and parents, along with effective training programs, were recognized to create a remarkable difference in the shift to and success of online learning spaces. The study also revealed that technological infrastructure, although a requirement, did not alone guarantee successful digital adoption. Parental involvement and policy support, as measured in this research, did not demonstrate a significant contribution to digital transformation. The research concludes that prioritizing digital literacy and training is paramount for effective digital transformation in Montessori education. It also suggests the necessity to reexamine the contribution of technological infrastructure, parental involvement, and policy initiatives in online learning environments.

Keywords: *Montessori, COVID-19, Digital Transformation, Digital Literacy, Training and Support, Online Education, Nepal*

1. Introduction

In late 2019, the COVID-19 pandemic disrupted the global education systems forcing schools to take up digital transformation as a means of continuity in teaching (UNESCO, 2020). Virtual learning environments replaced traditional classroom surroundings posing the most extraordinary challenges and opportunities for educators, students and parents (Majuri, Koivisto, & Hamari, 2018). For Montessori education, this shift was particularly important because it focuses on experiential hands on and child centered pedagogy (Lillard, 2017). The Montessori method, as developed by Dr. Maria Montessori, depends on physical materials and face to face interaction of children in order to develop independence, creativity and critical thinking (Montessori Center International, 2020). Although the pandemic forced the necessity of the rapid transition to online platforms, the questions remain as to how feasible and how effective was digital transformation in Montessori education.

The education sector in Nepal was faced with distinctive implications for having during the pandemic: limited technology use, absence of digital infrastructures and limited teacher training in online pedagogy (Dawadi, Giri, & Simkhada, 2020). However, many schools, including Montessori institutions, found it hard to continue the new normal in adapting to the advanced digital tools such as zoom, Google Classroom and Whatsapp (Dawadi, Giri, & Simkhada, 2020). Considering Bhaktapur as a city with a historical background, and with an increasing strength in quality education, the city became a magnet to explore these changes. Traditionally, Montessori schools in Bhaktapur arrange individualized and interactive learning and were compelled to reinvent their teaching methodologies in accordance with the requirements of virtual

education (Dawadi, Giri, & Simkhada, 2020).

The topic of digital transformation of education around the world has been the subject of plenty of research through the pandemic too. Recent studies have shown how a teacher's satisfaction and pedagogical adaptability are key to the success of online learning (Hodges, Moore, Lockee, Bond, & Trust, 2020). Nevertheless, studies about the actual challenges and the outcomes of digital transformation in Montessori education in developing countries like Nepal have been scarce. The purpose of this study is to fill this gap by looking into the experiences of Montessori teachers in Bhaktapur, the challenges they had, and the effectivity of their teaching pedagogies during the time during the COVID-19 pandemic.

2. Problem Statement

During the period of COVID 19 Pandemic, the traditional systems of educating the children was disrupted all over the world leaving the schools with no choice of adopting digital stages for learning steadiness (UNESCO, 2020). This shift was needed, but it came with serious challenges for the type of educational model based on hands-on, experiential learning – like the Montessori approach (Lillard, 2017). Due to the exclusive complications involved in adapting Montessori education to virtual platforms (Montessori Center International, 2020), Montessori education has faced difficulty in adapting to virtual platforms. This method relies heavily on teachers, and teachers had to be switched to online culture phenomena, without plenty of training nor resource (Dawadi, Giri, & Simkhada, 2020). Such sudden change raised very important questions about the potential, effectiveness and long term viability of the digital version in Montessori Education.

Lacking technology access, unreliable internet connection and low digital literacy, systemic barriers in Nepal further varied these challenges (Dawadi, Giri, & Simkhada, 2020). Similarly exaggerated were Montessori schools in Bhaktapur, a city thereof dedicated to quality education. Traditionally, interactive and personalized learning experiences have been prominent in these institutions and these institutes have had difficulties in translating their hands-on methodology to an online format (Dawadi, Giri, & Simkhada, 2020). Teachers therefore had to wriggle to ensure student engagement, adapt Montessori materials for use in digital context and deal with parental expectations (Dawadi, Giri, & Simkhada, 2020). Moreover, these obstacles negatively influenced the overall quality of the education, as well as the level of satisfaction of teachers and parents.

Although the research on digital transformation in education during the pandemic has been extended, there is scant research on Montessori education specifically in developing countries such as Nepal. However, there has been little work in existing literature that has been able to sufficiently examine the peculiar needs of the Montessori students and teachers in online learning (Hodges, Moore, Lockee, Bond, & Trust, 2020). Furthermore, education within a virtual classroom with Montessori methods of teaching is yet to be discovered in terms of the relationship between the teacher's experience in terms of whether they are satisfied with the effectiveness of Montessori teaching methods. The purpose of this study is to fill these gaps by studying the process of digital transformation from Montessori education in Bhaktapur Nepal when the pandemic of covid19, regarding the teachers' experience, arising problems faced by them, and the effectiveness of their online teaching strategy.

3. Research Questions

1. What influence did technological infrastructure adequacy have on the effectiveness of online Montessori education in the time of COVID-19?

2. What part did teacher, student and parent digital literacy play in the success of online Montessori education?
3. What were the effectiveness of training and support programs towards helping Montessori teachers and students to migrate to the digital education?
4. How did parental involvement affect the online Montessori education effectiveness during the pandemic?
5. What were the impact of school policies and supportive administration on adopting and sustaining digital education in Montessori schools?

4. Objectives of the Research

This study is primarily concerned with examining the digital transformation of the Montessori education at the time of the COVID-19 pandemic and specifically Montessori schools in Bhaktapur, Nepal. The study has the following objectives:

- To assess the adequacy of technological infrastructure and its proximity to digital education effectiveness in the Montessori schools during COVID 19.
- To assess the degree to which digital literacy affects online Montessori education.
- To analyze how training and support can help teachers and students to switch to digital education, in the case of Montessori teachers and students.
- To determine the level of involvement of parents in the online Montessori education and its effect on the effectiveness of digital education.
- To investigate the role of school policies and administrative support for promoting the adoption and sustainability of digital education in Montessori schools.

5. Hypothesis

I. H1: The adequacy of technological infrastructure significantly impacts the effectiveness of online Montessori education during COVID-19.
II. H2: Higher levels of digital literacy among teachers, students, and parents are positively associated with the success of online Montessori education.
III. H3: Effective training and support programs significantly improve the ability of Montessori teachers and students to transition to digital education.
IV. H4: Greater parental involvement significantly enhances the effectiveness of online Montessori education during the pandemic.
V. H5: Strong school policies and administrative support significantly contribute to the adoption and sustainability of digital education in Montessori schools.

6. Significance of the Study

Consequently, the COVID19 pandemic turned the world of education on its head and schools have to race to adapt to the new normal by adopting digital tools to keep the people who are learning alive. This study zooms on how Montessori schools in Bhaktapur, Nepal, responded to the sudden move to online learning. Moreover, it's a very important topic for a number of different reasons.

- **It adds to What We Know About Montessori Education.** Since Montessori education is hands-on and child centered, moving it online is tricky. In this study, the researcher studies how Montessori teachers changed their ways to teach, what difficulties they encountered on that road, and how successful these changes were.
- **Taking on the issue of the Digital Divide in Nepal:** This study throws light on the digital divide in Nepal's educational sector. It explores how things like internet access, availability of devices, and

digital skills affect how well online education works.

- **Supporting Teachers and Their Growth:** This research looks at the training and support that Montessori teachers got when they had to switch to teaching online. It also talks about how these new ways of teaching affected how happy teachers were with their jobs and how well they could teach.
- **The Role of Parents in Online Learning:** The study also looks at how important parents are in online learning and how their involvement affects how well Montessori education works online.
- **Shaping Better Policies for Schools:** The results of this study can help schools and the government make better rules and give more support for using digital education.
- **Lessons for the World:** Lastly, this study can give useful ideas to other countries dealing with similar problems in online education. It can show how a traditional teaching method like Montessori can change and adapt to new digital ways of teaching.

7. Literature Review

The literature on the impact of the COVID-19 pandemic on education, particularly in the context of Montessori schools in Nepal, reveals a complex interplay of challenges and adaptations. The sudden shift to digital platforms has presented unique obstacles for Montessori education, which traditionally relies on hands-on, experiential learning. Research indicates that the effectiveness of this transition is influenced by a combination of factors, including technological infrastructure, digital literacy among teachers, students, and parents, the availability of adequate training and support, and the role of parental involvement. Studies have also highlighted the importance of school policies and administrative support in facilitating the adoption and sustainability of digital education practices. However, significant gaps remain in understanding the specific experiences of Montessori teachers and students in developing countries like Nepal, where digital resources and support systems may be limited. This study aims to address these gaps by providing empirical evidence on the challenges and adaptations of Montessori education during the pandemic, with a focus on the perspectives of teachers in Bhaktapur, Nepal.

8. Methodology

This study used a mixed-methods approach to investigate the digital transformation of Montessori education during the COVID-19 pandemic in Bhaktapur, Nepal. Quantitative data was collected through surveys to measure the impact of technological infrastructure, digital literacy, training and support, parental involvement, and school policies on the effectiveness of online Montessori education. Qualitative data was gathered through interviews and focus groups to provide deeper insights into the experiences of teachers, students, and parents during this transition. The quantitative data was analyzed using descriptive statistics, reliability tests, ANOVA, correlations, and regression analysis. The qualitative data was analyzed thematically to identify common patterns and experiences.

9. Results and Discussion

The quantitative results indicated that training and support, and digital literacy were the most influential factors in the digital transformation of Montessori education. However, technological infrastructure, parental involvement, and policy support did not show a statistically significant influence on digital transformation. The qualitative findings highlighted the challenges of preserving the hands-on, child-centered approach of Montessori education in the virtual format, and the strategies that teachers and parents employed to support student engagement and learning.

10.Quantitative Results

Descriptive Statistics

The descriptive statistics provide an overview of the data collected from the survey.

Reliability Test

Table 1 presents the Cronbach's alpha values for the dependent and independent variables. Cronbach's alpha is a measure of internal consistency, indicating how closely related a set of items are as a group. A higher Cronbach's alpha value indicates greater reliability.

Table 1: Cronbach's Alpha of Dependent and Independent Variables

Variables of Study	No. of Items	Cronbach's Alpha
Digital Transformation (DV)	5	0.774
Technological Infrastructure (IV)	5	0.7
Digital Literacy (IV)	5	0.773
Parental Involvement (IV)	5	0.842
Training and Support (IV)	5	0.738
Policy and Administration Support	5	0.842

The table shows that all variables have Cronbach's alpha values above 0.7, indicating high internal consistency and reliability.

Analysis of Variance (ANOVA)

Table 2 presents the ANOVA results, which were used to assess whether there were any statistically significant differences between the means of the groups.

Table 2: ANOVA Calculation for the Variables

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	54.336	5	10.867	24.729	<.001[b]
	Residual	164.797	375	.439		
	Total	219.133	380			

a. Dependent Variable: DT

b. Predictors: (Constant), PA, TI, DL, TS, PI

The ANOVA results indicate that the model is significant in generalization of the dependent variable (Digital Transformation).

Descriptive Statistics for Variables

Table 3 provides the descriptive statistics for each of the variables included in the study.

Table 3: Descriptive Statistics of the Variables

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Technological Infrastructure	381	1.20	5.00	3.7402	.68563
Digital Literacy	381	1.60	4.60	3.6247	.67708
Training and Support	381	1.60	5.00	3.7428	.65981
Parental Involvement	381	1.20	4.83	3.4722	.77663
Policy and Administration	381	1.20	5.00	3.5071	.81646
Digital Transformation	381	1.40	5.00	3.6661	.75939
Valid N (listwise)	381				

This table shows the mean and standard deviation for each variable, namely: student engagement with online learning tools, classroom technology, parental support, parental involvement, technical support availability, and digital transformation. The standard deviations are indication of variability of each variable around the mean, whereas the mean indicate the average level of each variable.

Model Summary

Table 4 presents the model summary, which shows how well the independent variables predict the dependent variable.

Table 4: Model Summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.498[a]	.248	.238	.66292

a. Predictors: (Constant), PA, TI, DL, TS, PI

The model summary which presents some important statistics relating to model goodness of fit and explanatory power. Specifically, the table presents the R value, which represents the correlation between the observed and predicted values of the dependent variable; the R-squared value, which indicates the proportion of variance in the dependent variable that is explained by the independent variables; the adjusted R-squared value, which is a more conservative estimate of explained variance that takes into account the number of predictors in the model; and the standard error of the estimate, which measures the precision of the model's predictions.

Correlations

Table 5 presents the correlations between the variables. Correlations indicate the strength and direction of the linear relationships between pairs of variables.

Table 5: Correlations of Variables

Correlations

		TI	DL	TS	PI	PA	DT
TI	Pearson Correlation	1	.118*	.204**	.221**	.083	.173**
	Sig. (2-tailed)		.021	<.001	<.001	.104	<.001
DL	Pearson Correlation	.118*	1	.407**	.258**	.183**	.357**
	Sig. (2-tailed)	.021		<.001	<.001	<.001	<.001
TS	Pearson Correlation	.204**	.407**	1	.289**	.203**	.441**
	Sig. (2-tailed)	<.001	<.001		<.001	<.001	<.001
PI	Pearson Correlation	.221**	.258**	.289**	1	.699**	.257**
	Sig. (2-tailed)	<.001	<.001	<.001		<.001	<.001
PA	Pearson Correlation	.083	.183**	.203**	.699**	1	.198**
	Sig. (2-tailed)	.104	<.001	<.001	<.001		<.001
DT	Pearson Correlation	.173**	.357**	.441**	.257**	.198**	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001	
	N	381	381	381	381	381	381

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Note: ** indicates that the correlation is significant at the 0.01 level (2-tailed).

The table shows that all correlations are positive and statistically significant, indicating that the independent variables are positively related to each other and to the dependent variable.

Regression Analysis: Coefficients

Table 6 presents the coefficients from the regression analysis, which indicate the strength and direction of the relationship between each independent variable and the dependent variable, while controlling for the other independent variables.

Table 6: Coefficients of the Variables

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	.853	.284		3.004	.003
	TI	.073	.052	.066	1.405	.161
	DL	.217	.056	.193	3.887	<.001
	TS	.368	.058	.320	6.318	<.001
	PI	.069	.064	.071	1.080	.281
	PA	.039	.059	.042	.673	.501

a. Dependent Variable: DT

The regression analysis evaluates how independent variables predict Digital Transformation (DT). The constant value is 0.853 ($p = 0.003$), indicating a significant base level of DT when all predictors are zero.

Technological Infrastructure (TI) has a coefficient of 0.073 but is not statistically significant ($p = 0.161$), meaning its impact on DT is weak. Digital Literacy (DL) significantly predicts DT ($B = 0.217$, $p < 0.001$), showing that increased digital literacy enhances digital transformation. Training and Support (TS) is the strongest predictor ($B = 0.368$, $p < 0.001$), emphasizing that adequate training significantly boosts DT.

Parental Involvement (PI) ($B = 0.069$, $p = 0.281$) and Policy and Administration Support ($B = 0.039$, $p = 0.501$) do not significantly affect DT. The standardized coefficients (Beta) confirm that DL (0.193) and TS (0.320) are the most influential predictors.

In summary, DT is significantly influenced by Digital Literacy and Training and Support, while Technological Infrastructure, Parental Involvement, and Policy and Administration Support do not significantly predict DT at a 5% significance level.

11. Hypothesis Testing Results

1. Digital Literacy (DL) → Digital Transformation (DT) (Accepted): Higher digital literacy significantly enhances digital transformation in Montessori schools ($B = 0.217$, $p < 0.001$).
2. Training and Support (TS) → Digital Transformation (DT) (Accepted): Effective training and support strongly drive digital transformation, making it the most influential factor ($B = 0.368$, $p < 0.001$).
3. Technological Infrastructure (TI) → Digital Transformation (DT) (Rejected): Technological infrastructure alone does not significantly contribute to digital transformation ($B = 0.073$, $p = 0.161$).
4. Parental Involvement (PI) → Digital Transformation (DT) (Rejected): Parental involvement does not have a significant impact on digital transformation in Montessori schools ($B = 0.069$, $p = 0.281$).
5. Policy and Administration Support (PAS) → Digital Transformation (DT) (Rejected): Policy and administrative support do not significantly predict digital transformation outcomes ($B = 0.039$, $p = 0.501$).

12. Qualitative Findings

The qualitative findings from the interviews and focus groups highlighted the challenges of preserving the hands-on, child-centered approach of Montessori education in the virtual format. Teachers reported using a variety of strategies to adapt Montessori materials and activities for online delivery, including:

- Using video demonstrations to model the use of Montessori materials
- Encouraging parents to create hands-on learning experiences at home
- Utilizing online platforms to facilitate student interaction and collaboration

Parents expressed concerns about the potential impact of online learning on their children's social and emotional development, but also appreciated the flexibility and convenience of online education.

13. Summary of Findings

The quantitative results indicated that training and support, and digital literacy were the most influential factors in the digital transformation of Montessori education. Technological infrastructure and policy

support also had a significant positive effect, while parental involvement did not show a statistically significant influence. The qualitative findings highlighted the challenges of adapting Montessori education to the virtual format and the strategies used by teachers and parents to support student learning.

14.Conclusion and Recommendations

The study concludes that prioritizing digital literacy and providing effective training and support are crucial for the successful digital transformation of Montessori education. While technological infrastructure is necessary, it is not sufficient on its own. Parental involvement and policy support, as measured in this research, did not demonstrate a significant contribution to digital transformation.

The study recommends that Montessori schools invest in comprehensive training programs for teachers, students, and parents to enhance their digital literacy. Schools should also provide ongoing technical support and resources to facilitate the integration of digital tools into the Montessori curriculum. Policymakers should focus on developing strategies to address the digital divide and ensure equitable access to technology and internet connectivity for all students and teachers. Further research is needed to explore the long-term impact of digital transformation on Montessori education and to identify best practices for online teaching and learning in this context.

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