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ORIGINAL ARTICLE

Role of ICT in Educational Development during COVID-19 Pandemic in Bagmati, Gandaki and Lumbini Zone of Nepal

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ABSTRACT

This paper investigates the role of Information and Communication Technology (ICT) in educational development during the COVID-19 pandemic in three zones of Nepal. Teachers who were not fully equipped with ICT knowledge and the skills required to teach online, had to go through the learning process quickly in order to teach their students, especially in inaccessible areas of the given zones. The purpose of the study was to measure educational development and, therefore; professional development in terms of ICT skill and their using it in their virtual classroom during the pandemic. Using the mixed methods approach, this study analyzed 64 high school teachers' responses in Bagmati, Gandaki and Lumbini zones of Nepal. This research aims to fill the gap created by geographical distance; and therefore, in knowledge base. In agreement with what was hypothesized, it was found that a large number of teachers (*M = 4.00*) augmented their ICT skills and used them frequently during the pandemic whereas the same participants did not use ICT applications frequently (*M = 2.78*) to teach in their classroom before the pandemic. The study finds that teachers' using ICT tools in such remote areas indicates that teachers had to go through intensive learning during the pandemic.

Keywords: Teacher, Education, COVID, ICT-in-Education, Educational-Development.

Introduction

The context of the study comes from the ongoing impact of COVID-19 lockdown in Nepal. Teachers were obliged to adopt virtual instrumentation to teach as an alternative medium. "Information and communication technology, or ICT, is defined as the combination of informatics technology with other, related technologies, specifically communication technology" (Velmurugan, 2010, p. 3). In the remote rural areas, teachers did not normally include ICT software tools in their pedagogy due to inaccessibility to the internet. This study aims to find out if the teachers used the ICT software tools in their pedagogy during the COVID-19 pandemic lockdown in Bagmati, Gandaki and Lumbini zones of Nepal. The rationale of engaging in the given zones lies in the fact that the researcher has a strong network with teachers in these zones. Among many, one aspect of teachers' development is to be equipped with ICT skills. Teachers' ICT education directly correlates to their pedagogical activities. ICT tools simplify teachers' work and make learners comfortable with the subject. Schools in cities of Nepal are facilitated with ICT tools. However, remote parts of Nepal are not as widely equipped with ICT facilities. The COVID-19 pandemic lockdown was hard hitting across all parts of Nepal; therefore, teachers had to adapt online mediums as alternatives to teach their students. The obligation, caused by the pandemic, forced teachers to learn and use ICT tools in their classroom.

National Information and Communication Technology (ICT) Policy Nepal, 2015 envisioned to implement ICT in the classroom (ICT Policy of Nepal, 2015). However, this has not been achieved till date (Giri, 2019). This study regards educational development as outlined by Bell & Gilbert (1994). However, teachers' education without equipping them with ICT skills has become outdated in today's world. By this logic, the research takes ICT

education as an essential element of the professional development of teachers. Teachers, with and without ICT education, are clearly distinguishable. Envisioned by the new system of education and confident academic belief in Nepal at present, there had to be improved level of educational facilities in the research sites. Even this research had not been possible had there not been COVID-19. COVID-19 forced many local governments to provide internet facilities in the schools. The widening gap of such academic aloofness and scholarly indifference had to be addressed to narrow down the gap. Therefore, the main objective of this paper is to find out if educational development took place in Bagmati, Gandaki and Lumbini zones of Nepal during the COVID-19 lockdown with the help of ICT instrumentation.

Literature Review

COVID-19 lockdown has had a huge impact on teacher education all over the world (Flores & Swennen, 2020). Schools and universities were shut down for a longer period. 1.598 billion students from 194 countries had to stay home due to closure (Aristovnik et al., 2020). "These unprecedented events raised multiple questions for education globally" (Kidd & Murray, 2020). The pandemic was not only hard hitting on teachers, but it also brought an opportunity for teachers to learn further. Teachers in the UK and other parts of the world moved to online teaching methods from home (Kidd & Murray, 2020). Such migration to virtual teaching forced teachers to learn a new technology if they had not already learned. This learning moved educational activities into next level of academic achievement.

> Teachers also had to adapt to new pedagogical concepts and modes of delivery of teaching, for which they may not have been trained. In particular, learners in the most marginalized groups, who don't have access to digital learning resources or lack the resilience and engagement to learn on their own, are at risk of falling behind (Schleicher, 2020, p. 2).

This obligation to learn a new technology became mandatory for teachers wherever they live in the three zones. There might be various reasons for teachers to learn a new technology; however, it adds up in teacher education and their personal development in the community of practice. Some teachers used social media (Facebook and Twitter) to capitalize the situation immediately and some learned meeting applications such as Google Meet, Microsoft Team and Zoom wherever applicable. A study has found that "using Twitter in educationally

relevant ways can increase student engagement and improve grades, and thus, that social media can be used as an educational tool to help students reach desired college outcomes" (Junco et al., 2011, p. 12). According to Guzacheva (2020), "the online distance learning tools are changing the world we live in and the way we learn to live. One of the new original software-based conference room solutions is Zoom technology" (p. 2). These studies adequately illustrate that online tools assisted in teaching-learning to a great deal during the COVID-19 pandemic. In May 2020, the World Bank studied three schools in Africa and looked at how the teachers are coping with the situation. The report stated that the principal of the school helped teachers to learn the new technology to protect teachers from the circumstances of the pandemic (Beteille et al., 2020).

Because ICT plays a significant role in both teaching and learning, teachers with ICT integration in their education can perform better in the classroom. The usage of ICT makes a major difference in teaching and learning (Mikre, 2011). UNESCO recognized ICT education as a strong infrastructure to elevate education to the next level (Rani, 2017). Scholars in India say that "ICT helps the teacher to update the new knowledge, skills to use the new digital tools and resources" (Bhattacharjee & Deb, 2016). In China, microlecture competition is held nationwide. Linqiong Lu used ICT technology to develop lectures and accepted the challenge of using technology in teaching (2018). Thus, today, teachers live in a digital world where ICT usage becomes omnipresent in education. Teachers with ICT education can better serve the subject than the teacher who doesn't have ICT skill. This helps to reduce the digital gap in the society, especially in the remote parts of Nepal.

Mixed methods research has been estimated to have started in 1980s with several publications that focused on defining it (Creswell & Clark, 2018). Mixed methods research has been broadly defined "as research in which the investigator collects and analyzes data, integrates the findings, and draws inferences using both qualitative and quantitative approaches or methods in a single study or a program of inquiry" (Tashakkori & Creswell, 2007, p. 4). Mixed methods engages into interpretation by mixing methods, approaches, and other paradigmatic characteristics. "The emergence of mixed methods research design (MMRD) is based on the assumption that it can weaken the loopholes and strengthen the brighter aspects of the monomethod designs like quantitative or qualitative alone" (Neupane, 2019, p. 85). Mixed methods research complements the procedure with each other. Mere quantitative technique is masculine in nature and qualitative

feminine in nature. Conducting mixed methods research completes the circuitry of masculinity and femininity. It becomes significant to use a mix of them wherever possible. Results from quantitative and qualitative research are matched thematically and simultaneously. Therefore, it appears to be justifiable to conduct a mixed methods research in this area. Such research was limited to the city area of Nepal. It was important to conduct research where no research of this kind has been conducted to find out the real world situation of the teachers. Thus, the study expands the area of the research in the given domain, where the study opens up a path for similar future research.

Method

This study adopts the mixed method research to analyze the primary data collected from the convenience sample. A survey of eleven questions was designed in collaboration with Khagedra Acharya, PhD. After migrating the questions to google form, the questionnaire was sent to K-12 teachers who were spread over Bagmati, Gandaki and Lumbini zones of Nepal. The survey did not collect personal information of the participants to respect the privacy of the respondents. The survey, designed to collect the categorical and text data, received sixty-four responses from respondents. The researcher migrated data to SPSS for further analysis. Frequency of male and female participants, Chi Square test, Independent Sample test, Cohen's D and Correlation were analyzed in the process. A *p* value has been set to *0.05* (Salkind, 2010).

The number of male participants was *38 (59.4%)* and female *26 (40.6%)*. Participants come from the age range of *21* to *50* years; out of which 22 *(34.4%)* teachers fell under the category of 21 to 30, *24 (37.5%)* teachers fell into 31 to 40 and *18 (28.1%)* participants fell into the 41 to 50 age group. As education level plays a vital role in learning interest, it was also categorized into 4 groups: Intermediate/Plus 2, Bachelor's Degree, Master's Degree and Above Master Degree. Among the participants, 8 teachers *(12.5%)* fell under the first group, *17 (26.6%)* under the second group, *25 (39.1%)* under the third group and *14 (21.9%)* fell under the fourth group category. Likewise, participants were categorized in service period groups. *14 (21.9 %)* participants were in 0 to 4 years of service, *14 (21.9%)* participants were in 5 to 9 years of service, *11 (17.2%)* were in 10 to 14 years of service, *12 (18.8%)* were in 15 to 19 years of service and *13 (20.3%)* were in above 20 years of teaching experience group. The first question attempts to seek how aware the respondents were before the pandemic, how frequently they

used ICT during the pandemic. The second and third question attempts to seek what they learned during the pandemic. The question inquires what level of satisfaction the respondents receive upon learning new technology. The last question measures if they could fix technical issues raised during class.

Various statistical tools were applied to test the result and its reliability. The tools applied to get to the conclusion indicates the same findings.

The open-ended question "What would you improve if you could?" has been analyzed thematically based on semantic criteria outlined by Braun and Clarke (2006). In such thematic approach, the researcher takes an active role to discern the meaning out of textual data (Braun & Clarke, 2006). This model allowed the researcher to focus on investigating participants' education, service period group and context to coincide the quantitative data and extract the relevant themes. This study pledges a greater emphasis on quantitative survey data and relates to the thematic analysis. The following hypotheses were tested during the research:

1. H_0: the teachers did not use ICT tools frequently in Bagmati, Gandaki and Lumbini zones during the COVID-19 pandemic.
2. H_1: the teachers used ICT tools frequently in Bagmati, Gandaki and Lumbini zones during the COVID-19 pandemic.

The demographic questions are not included in this paper to avoid lengthy reading to the readers. The following agenda were sought to be addressed in this research:

1. Were the participants self-aware of ICT tools in pedagogy before the pandemic and how often did they use such tools in pedagogical activities before and after THE COVID-19 pandemic?
2. What ICT applications did they learn during the COVID-19 pandemic?
3. How satisfied were the participants upon upgrading their ICT knowledge and skills during the COVID-19 pandemic?
4. How many teachers were able to address the technical issues raised during class?

Results

A Pearson Chi Square test was conducted against research question one. It was found that the number of ICT tools users increased three times more (*p = .003, df = 16*)

druring the COVID-19 pandemic. A p value lower than <= *0.05* is considered statistically significant (Verhagen et al, 2004) and indicates the stronger evidence to reject the null (H_0) hypothesis that teachers did not frequently use ICT tools in thier pedagogy during the COVID-19 pandemic. Therefore, the investigation demonstrates that there is statistical significance in using ICT tools during the COVID-19 pandemic. As cited by Hubbard and Bayarri (2003), "The rational human mind did not discard a hypothesis unless it could conceive at least one plausible alternative hypothesis" (p. 5). Thus, the researcher alternatively hypothesized (H_1) that the COVID-19 pandemic enforced teachers to learn ICT skills.

The first research question sought to find out self-perceived awareness, knowledge and skills about ICT tools in the pedagogy of the participant before and after the pandemic. A 2 × 2 experimental design was assessed using Independent Sample Test. It was found that those who had knowledge of ICT tools utilized it in their pedagogy (*M = 3.04, SD = 1.33*) than those who did not have (*M = 2.11, SD = .90*) ICT knowledge and skills before the pandemic; which is apparently expected at this point. In the Pearson Chi Square Test p value was found significant (*p = .003*) in independent sample test, indicating a statistical difference in the variable. The code reference book prepared for the first and second research question reads *1 = rarely used, 2 = sometimes used, 3 = often used, 4 = frequently used, 5 = always used*. For the purpose of readability, Table 1 has been presented in percentage measure. The number of participants who reported *rarely used (14.1%), sometimes used (31.3%), often used (29.7%)* ICT tools in pedagogy decreased after pandemic (second highlighted row in Table 1) which indicates that their usage of ICT tools in pedagogy moved to either *frequently used* or *always used* category, which further indicates that the number of teacher who did not use ICT tools before the pandemic started using it during the pandemic. This measure illustrates that the pandemic forced teachers to learn the necessary ICT tools to use in their virtual classroom. The number of teachers (12.5%) who reported they *frequently used or always used before* pandemic increased three times to 37.5% during the pandemic, indicating that they had an obligation to learn ICT tools and use in their online class.

To assess if there is significant difference across teachers' self-perceived usage of ICT tools before and after the COVID-19 pandemic in virtual classroom, a repeated measure ANOVA was conducted. There was a significant difference in the score of using ICT tools before (*M=2.78, SD=1.21*) and after (*M = 4.0, SD =1.05*) conditions; (*t (63) = 8.20, p = .001)*. Therefore, teachers' using ICT tools did not happen by chance, but the pandemic lockdown circumstantially forced them to learn and use ICT. Teachers were using ICT tools before the pandemic significantly less than during the pandemic. Using ICT tools in pedagogy before the pandemic may not be mandatory, but the pandemic brought an obligatory situation in which non-users (teachers) of ICT tools must now learn to use it in the classroom.

Table 1: Usage of ICT tools before Covid-19 and during

		Usage of ICT tools before Covid–19 Pandemic					Total
		1	2	3	4	5	
Male	Count	3	13	12	4	6	38
	% of Total	4.7%	20.3%	18.8%	6.3%	9.4%	59.4%
Female	Count	6	7	7	4	2	26
	% of Total	9.4%	10.9%	10.9%	6.3%	3.1%	40.6%
	Count	9	20	19	8	8	64
	% of Total	14.1%	31.3%	29.7%	12.5%	12.5%	100.0%
		Usage of ICT tools before Covid–19 Pandemic					Total
		1	2	3	4	5	
Male	Count	1	1	7	12	17	38
	% of Total	1.6%	1.6%	10.9%	18.8%	26.6%	59.4%
Female	Count	2	1	4	12	7	26
	% of Total	3.1%	1.6%	6.3%	18.8%	10.9%	40.6%
	Count	3	2	11	24	24	64
	% of Total	4.7%	3.1%	17.2%	37.5%	37.5%	100.0%

The largest number of participants (*96.9%)* who never taught online classes before the pandemic learned about meeting applications such as Google Meet, Zoom, WebEx, and Microsoft Team. About one third of the participants (*31.3%*) learned how to prepare PowerPoint slides for the class. Half of the participants (*51.6%*), who did not have to correspond with their students in the physical class, learned to use email communication. More than half of the participants (*65.9%*), who did not use social media such as Facebook and YouTube for pedagogy, learned to use them for the purpose of teaching.

A Pearson correlation test was conducted to examine the relationship of variable before pandemic and after. There is a significant positive relationship between usage of ICT tools before and after pandemic (*r (62) =.45, p=.01*). The effect size (Cohen's D) was calculated by using a calculator by taking the Mean difference (*1.219*) from Paired Sample Correlation test and divided by Standard Deviation (*SD = 1.188*). Thus, Cohen's D (*d=1.02*) was found which indicates the larger effect size. Cohen's D of more than (*0.08*) is regarded as having a larger effect size (Sawilowsky, 2009).

In the given seven months, the teachers were able to learn to use some ICT applications in their classroom. With the measured significance level, teacher satisfaction level was tested using descriptive statistics. Nearly three fourth of the teachers (*71.8%*) reported that they were satisfied with what they have achieved in the pandemic duration. In comparison to satisfaction level, the fix-issue ability of a teacher is not significant. Less than half (*43.8%*) of the teachers reported that they could fix the issues raised during the live class. More than half (*53.1%*) reported that they would take help from the helpdesk to fix the issue during the live class. Interestingly, *3.1%* of the teachers reported that they would declare the end of the class if technical issues could not be addressed.

Qualitative data collected from the question "What would you improve if you could?", served as supplementary data for the central question. The researcher made two categories of themes: improvement of application and improvement of general ICT knowledge. Three data cases were cleaned as they did not provide comprehensive meaning. Nearly half of the respondents reported that they would improve on the ICT application. Another half of the respondents reported that they would improve their general ICT knowledge such as hardware and internet usage. One participant reported that s/he would learn to code interactive slides so that s/he could teach interactively to students. Thus, qualitative data demonstrates that teachers were willing to learn more

ICT tools to elevate their level of education. The result from quantitative data and finding from qualitative data have harmoniously held with the theme.

Discussion

This study investigated if the pandemic has an impact on educational development in the given three zones of Nepal. It was found that the teachers learned to use ICT tools in their classroom during the pandemic. The teachers who did not use such tools were obliged to learn and use them because they could not meet their students physically in the school. There are many places with no internet access in Bagmati, Gandaki and Lumbini zones. One could imagine the status of education in those areas during the pandemic. However, the pandemic lockdown forced the teachers to manage the ICT network and make it happen despite the hardship. At the time of the survey, the researcher believed that the null hypothesis (H_0) that teachers did not frequently use ICT tools in their pedagogy in the given zones during the COVID-19 pandemic was taken for granted because of inaccessibility of internet facility. However, it turned out to be false at the time of analysis. Variables such as gender, age group, experience and education level were not statistically significant in reinforcing for further learning. The participants (*71.9%*) who reported that they were aware of ICT tools were merely aware of a few social media applications because they did not use those applications as teaching tools. Had there not been a pandemic, the participant teachers would not have had the opportunity to learn further ICT tools. This learning opportunity gave them a chance to augment thier qualification in using ICT tools for educating their students. In educational development along with teacher education, ICT plays a significant role as it is part of it in the digital age (Bhattacharjee et al., 2016). The knowledge and skills learnt during the pandemic can be used frequently in the future. This can change the modality of teaching in the given zones. The teachers had comprehended the distance education mode in a different way before the pandemic. The pandemic provided an opportunity to understand the nature of distance education mode in the real world situation.

The supplementary question assisted to understand the respondents inner interest to learn ICT tools to utilize in their school. However, it seems that they did not have a good opportunity to learn new technology due to financial resources. The COVID-19 pandemic forced stakeholders to act for improvement. In the question, *what would you improve if you could* the respondents expressed the desire to learn advanced ICT instrumentation. The

Implication and Conclusion

The research demonstrated that educational development takes place in various situations; one of them is obligatory circumstances such as the ongoing COVID-19 pandemic lockdown. When the teachers are equipped with ICT tools, the delivery of content takes place well. Understanding and utilizing the next level of ICT tools encourages to initiate and continue distance mode education even in the remotely located district of the given zones. Students need not limit themselves to complete assignments to books and notes. They can now communicate with teachers 24/7. Pandemic has given an opportunity to the large number of students and teachers who were not in such practice before. Teachers' education is not limited to textbooks and notes. In the digital age, a teacher must be equipped with increased ICT knowledge for better delivery. This circumstance has brought an opportunity to narrow down the digital divide in the Gandaki, Bagmati and Lumbini zones of Nepal.

Competing Interest Statement

The author has read and approved the manuscript and takes full responsibility for its contents. No potential conflict of interest was reported by the author(s).

Acknowledgements

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