DIGITAL DIVIDE AND EFFECTIVENESS OF E-LEARNING DURING COVID-19 PANDEMIC

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Abstract

The COVID-19-induced halt in in-person classes in Nepal led to a paradigm shift in the educational process as the classes began to run through online platforms. However, literature suggests that not everyone could fully benefit from it, especially in developing countries like Nepal. In this regard, the paper investigates the digital divide in e-learning amongst secondary-level students of community and institutional schools and the extent to which e-learning is effective for them. The assessment captures differences in terms of the availability of hardware elements, approach to software elements, and adaptation by meatware (human) elements. A comparative study, using a questionnaire as a primary tool for data collection, was carried out on three community (public) schools and three institutional (private) schools in Kathmandu. The study finds that students from both types of schools do not have adequate access to e-learning. Nonetheless, in consistency with the established knowledge, it is found that the general tendency of students of institutional schools being marginally better off in terms of access to relevant devices, and diverse e-learning platforms. Moreover, they demonstrated greater adaptability to e-learning platforms compared to their community schools' counterparts.

Keywords : Institutional Schools, Community Schools, Hardware, Software, Meatware

1 Introduction

The COVID-19 pandemic, among its numerous global disruptions, significantly impacted the education sector as well. With no alternatives, the crisis necessitated a major shift to online education worldwide, as schools abruptly transitioned to virtual learning platforms. This involved the process of teaching, learning, and assessment procedures transitioning to online platforms. During this time, technology served as the primary facilitator of educational progress (OECD, 2022). Its role was not limited to simply transmitting educational content; it also reshaped the pedagogical landscape, influencing new norms for engagement, assessment, and interaction in the educational process (Çelik & Baturay, 2024). However, literature indicates that this rapid digitization widened digital divides, with students from disadvantaged backgrounds lacking adequate access to technologies and skills needed for remote learning. The intensity of such digital learning divides correlates with societies' socio-economic and developmental status. Students from lower-income communities have faced particular challenges in effectively utilizing e-learning tools (UNESCO, 2024). In this line, it is critical to explore the impact of such divides in Nepal, particularly between community (public) and institutional (private) schools to understand the disparities in access and utilization of e-learning tools.

In Nepal too, the COVID-19 pandemic halted in-person classes, instigating a major shift in the educational landscape. In this regard, firstly, many students lacked access to necessary digital devices and infrastructures, limiting online class access to a few urban students (Acronis Cyber Foundation, 2024). During the pandemic, with only 20% of its population online, as compared to 87% in developed countries, Nepal struggled to meet its citizens' educational needs (Gautam & Gautam, 2021). Moreover, of the 72% with internet access, 60% primarily used mobile data, according to Nepal Telecommunications Authority (Internet Society, 2020). However, Gurung & Paudel (2021) found that students in private schools have greater access to Information Communication Technologies (ICT) materials than those in community schools in Nepal.

Secondly, the digital divide also covers the students' ability to effectively utilize the available devices through

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the use of proper software. While some private schools with qualified teachers have successfully utilized learning management platforms, many students still struggle to optimize their usage. According to Ghimire (2020), virtual learning was found ineffective for 64.3% of students surveyed in Nepal, primarily due to the limited proficiency of both teachers and students in using software platforms.

Thirdly,merely having devices and software is not enough; there is a need for the skill to use these technologies effectively. The limited usage of ICT in the pedagogical process before the pandemic in Nepal left teachers unprepared for facilitating students' usage (Laudari et al., 2021). Additionally, the Ministry of Education (2013) claims thatdigital literacy was primarily introduced at the secondary level in community schools, while institutional schools provided digital literacy from early grades, contributing to a gap in users' ability to operate technologies and widening the digital divide between institutional and community schools.

Addressing the digital divide in all aforementioned areas, the objectives of the research are mentioned as follows:

(i) To identify differences in the availability of hardware elements to the students.

(ii) To trace differences in the approach to the software elements by the students.

(iii) To estimate differences in adaptation to hardware and software elements by meatware (students).

While extensive research has been conducted regarding the impacts of COVID-19 on education systems to examine the digital divide, the major focus has been on broad, generalized impacts. To address this gap by narrowing down the focus, this study explores the digital divide in e-learning between Kathmandu's community and institutional schools by identifying disparities in hardware and software access among students along with students' proficiency in using ICTs. The findings will raise awareness about the existing disparities, facilitate the implementation of existing policies, inform the development of new policies tailored to specific school needs, and enhance preparedness for future adversities. and ensure equal access to education.

2. Literature Review

The study is grounded in Bourdieu's Social and Cultural Reproduction Theory, which asserts that social and cultural capital significantly contributes to educational inequalities. Social capital involves benefits from social networks, while cultural capital pertains to advantages stemming from one's cultural background. These forms of capital, more prevalent in higher social classes, enable them to have better educational opportunities, thereby perpetuating economic disparities across generations (Livesey & Blundell, 2019).

In this regard, Ragnedda & Laura Ruiu (2017) found that digital and social capital are interconnected, with the creation of virtual communities relying on users' ability to translate their existing social capital into virtual capital. This reinforces existing inequalities, reflecting the offline social structure and depicting how the education system maintains the status quo, hindering efforts to bridge the digital divide.

Building upon these concepts, this study examines how these forms of capital and societal structures translate into the realm of digital technology, thus influencing the dimensions and depth of the digital divide. In Nepal, economically disadvantaged population predominantly attend community schools while those from comparatively wealthier background mostly attend institutional schools (Adhikari & Pasa, 2021). Hence, through the lens of Bourdieu's theory, this study seeks to explore how these socioeconomic disparities contribute to the digital divide in educational access and outcomes between community and institutional schools in Kathmandu, Nepal. This exploration aims to provide nuances of the mechanisms through which social and cultural capital impact digital inclusivity and learning opportunities.

2.1. The dimensions of the digital divide

The digital divide entails access to technologies, usability, and empowerment dimensions. Dijk (2020) depicts how these dimensions are interconnected (see Figure 1).

Fig. 1: *A model of successive kinds of access to digital technologies*

Note: Adapted from "The Network Society" by J.A.G.M. van Dijk, 2020, p. 136.

These dimensions are further explained as follows.

2.1.1. Physical and material access dimension.

Economic factors significantly drive the digital divide as some groups cannot afford digital devices and the internet connection (Joshi et al., 2024). While the cost of computer equipment has decreased over the years, other expenses such as connection costs, software, and peripherals remain barriers for the financially disadvantaged (van Deursen & van Dijk, 2019). Moreover, some devices meet only the minimum requirements, hindering users

from optimizing their utility. For example, students prefer laptops over mobile phones for distance learning due to screen size, battery life, and keyboard complexity (Dey, 2022). Microsoft Education Team (2018) suggests that a few students' lack of access to better devices forced teachers to use the lowest common denominator, adversely impacting education quality.

Moreover, motivational factors also influence access to ICTs, with some individuals choosing not to use these technologies (Pierce, 2018). Dijk (2020)refers to this group as "want-nots" and identifies reasons like lack of perceived significance, lack of skills to operate ICTs, etc. The educational level and cultural background play a significant role in this apathy (Dijk, 2020). van Deursen & van Dijk (n.d.) suggest that low educational backgrounds lead to computer anxiety and technophobia.

In this line, access to digital tools is a significant challenge, particularly among the students attending community schools in Nepal due to economic constraints and parental unfamiliarity with the importance of technology (Gurung & Paudel, 2021). Gurung and Shrestha (2023) suggest that, unlike their counterparts in private schools, who often have better access to technology, community school students' grapple with limited digital infrastructures.

2.1.2. The usage dimension.

Merely providing digital devices doesn't address the digital divide; individuals must also possess the skills for managing hardware and software (Dijk, 2020). According to Marius (2021), computer literacy, network literacy, information literacy, and digital fluency are crucial for digital literacy and bridging the digital divide.

Despite the wide availability of digital devices, many struggle to fully benefit due to usage complexities (UNESCO, 2023). Tenya et al. (2023) also claim that insufficient digital fluency impacts the effective use of software applications. For online classes, Google Meet is considered more effective than Zoom, considering setup, usability, and cost (Sevilla, 2020). Some teachers hesitate to adopt effective tools like Google Classroom and Google Slides due to a lack of competencies and training (Winter et al., 2021). Raman and Yamat (2014)assert that this results in students getting limited to a lower common denominator in their e-learning experience, depicting that having a digital device or internet connection does not guarantee optimal utilization for even those who have better access to such products.

Institutional schools in Nepal usually have more resources and thus could use a wider variety of online learning tools, and digital teaching methods. On the other hand, community schools struggle to get devices and also find it hard to use them effectively for teaching and learning. This is because they have less access to training on using these digital tools and less support to help with technology (Gurung & Shrestha, 2023).

2.1.3. The skill dimension.

Apart from access to relevant hardware and software, the digital divide also encompasses the lack of skills to effectively operate digital devices (Taylor, 2023). Dijk (2020) identifies instrumental, strategic, and informational, skills as crucial digital competencies. He defines instrumental skills, also known as operational skill as an ability to work with hardware and software; strategic skills as "the capacities to use computer and network sources as the means for particular goals and for the general goal of improving one's position in society". Operational skills can be divided into formal information skills, (the ability to work with the formal characteristics of computers and the Internet) and substantial information skills ("the ability to find, select, process, and evaluate information in specific sources following specific questions") (ibid). For Dijk (2020), the lack of these skills widensthe digital gap between those proficient in these competencies and those who are not.

A study in 20 low-income countries revealed that around 65% of underutilization of the Internet was linked to education and skills, (Teltscher, 2019).In Nepal, the disparity in ICT access between private and public school students subsequently impacts their ability to develop digital literacy skills (Joshi, 2023). The research claims that private school students in Nepal benefit from enhanced ICT access, and a better conducive environment for the acquisition of technological competencies than their counterparts from community schools.

Similarly, in a study of teachers, some expressed difficulties in using ICT due to a lack of skills (Adhikari, 2021).In Nepal, (Phyak et al., 2019) revealed that 64.3% of public school teachers avoid using ICT in classrooms mainly because their schools lack digital devices, while 59.5% admit their reluctance is due to the lack of knowledge on how to effectively use these tools in an education setting. This lack of confidence and competence in teachers could directly negatively impact students' ability to handle technology, widening the digital gap.

2.2. Review of empirical literature

Before the pandemic, Joshi's (2017) research on ICT usage among secondary students in Nepal provides direct evidence aligned with the research question regarding digital divides between community (public) and institutional (private) schools. The study of 106 students in Kathmandu showed the difference in the usage of ICT at home among private and public school students, emphasizing home technology access gaps. While the study demonstrates the digital divide, the sample size is limited to 106 students from 3 schools in Kathmandu. Thus, the present study expands upon Joshi's findings by taking 210 students from 6 schools in Kathmandu.

Azubuike et al., (2020) in Nigeria, a country comparable to Nepal in terms of development status, found pronounced disparities in remote learning access between public and private schools during the pandemic. The study found that among 64% of students who faced difficulties while learning online, 54% belonged to public schools and 46% belonged to private schools. The study also highlighted the positive correlation between socioeconomic background and parental involvement, as wealthier parents were able to provide better support for education compared to those with fewer means (Azubuike et al., 2020). This aligns with the research question on the digital divide between community (public) and institutional (private) schools in Nepal, providing a reference point highlighting how socioeconomic status influences digital accessibility in countries like Nepal, thereby validating the need for context-specific investigation in schools of Kathmandu.

Gautam and Gautam's (2021) research on students' perception of online higher education in Nepal during the pandemic also provides evidence of digital divides, finding many lacked proper infrastructure for e-learning at home including internet, devices, and electricity. As this study was conducted among higher education students and could differ from secondary school learners, the present study will build upon their work by focusing specifically on hardware, software, and adaptation divides between community and institutional schools in Kathmandu.

Lamichhane (2023) identified digital divides in internet access and ICT tools through a SWOT analysis of online learning in Nepal during the pandemic. The review of 33 studies where the strengths, weaknesses, opportunities, and threats (SWOT) of online learning in Nepal during the pandemic using the 2x2 matrix were assessed. It revealed that insufficient connectivity, lack of proper e-learning technologies, and absence of hands-on learning as major barriers. This aligns with the research objectives of investing in hardware, software, and adaptation divides. However, the SWOT analysis methodology provides limited detail on the specific nature and extent of divides between different schools and lacks nuanced insights into how digital divides manifest distinctly across groups. Nonetheless, as the study highlights the existence of digital disparities, it provides ground for the present study to build upon these findings by utilizing methods tailored to examining specific digital divides between community and institutional schools.

2.3. Addressing the existing research gap

While existing studies provide important insights into digital divides in education, they lack depth on the socioeconomic impacts on access to e-learning in developing countries like Nepal. Such limitation around representative samples, context specificity, and assessment frameworks point to the need for further investigation. Furthermore, there is a need for research that examines the interplay between various dimensions of the digital divide (access to hardware and software, and adaptation by users) and their collective impact on educational effectiveness during the pandemic. This research addresses these gaps by capturing real-time data during the COVID-19 period.

The research has employed a mixed-method approach, combining descriptive, exploratory, and analytical research designs. Secondary-level students were selected for the survey for their insights on the current pandemic situation and the purpose of virtual classes. Their experience with in-person classroom settings allowed them to effectively analyze the differences between in-person and virtual classes. The respondents were selected from diverse socio-economic backgrounds.

3. Methodology

The sampling frame consists of 6 schools selected based on geographic and institutional diversity. Community schools, which do not charge fees up to the secondary level, were randomly selected for their popularity within their respective communities. To select the institutional schools, 3 clusters were separated based on fee levels (below average, average, and above average), and 3 schools were randomly selected among those clusters. Table 1 mentions the selected schools.

Table 1 : Selected institutional schools for the study

Type of School	Selected for Study	Fee Structure	Popularity	
Community Schools	Gandhi Aadarsa Higher Secondary School	-		Notable in Community
	Shree Siddheshwar Secondary School	-		Notable in Community
	Shree Budhanilkantha Secondary School	-		Notable in Community
Institutional Schools	Samata Siksha Niketan	Low Fees	-	
	Aksharica School	Average Fees	-	
	Pathshala Nepal Foundation	High Fees	-	

The number of probable respondents in every school was between 60 to 120 in private schools and 40 to 150 in public schools. A quota of 35 respondents for each school was estimated, ensuring representation. The sample size of 210 respondents was determined with a stratified sampling method applied to ensure representation across different school types, grades, and socio-economic backgrounds. The sample size also took into consideration the constraints in time, resources, and budget.

3.1 Analytical Framework

The analytical framework (see Figure 2), investigates the gap or accessibility on three levels: availability of hardware elements to the students, approach to software elements, and adaptation by meatware (human) elements. At each level, the gap between community and institutional schools is assessed.

The framework especially draws upon the formative work of Dijk's (2020) comprehensive model of the digital divide, which outlines access not merely in terms of physical availability but also entails skills and usage dimensions. It was validated by digital sociology experts. The application of this framework has revealed detailed differences in digital access and usage. This preliminary test suggests it could be useful in similar future studies.

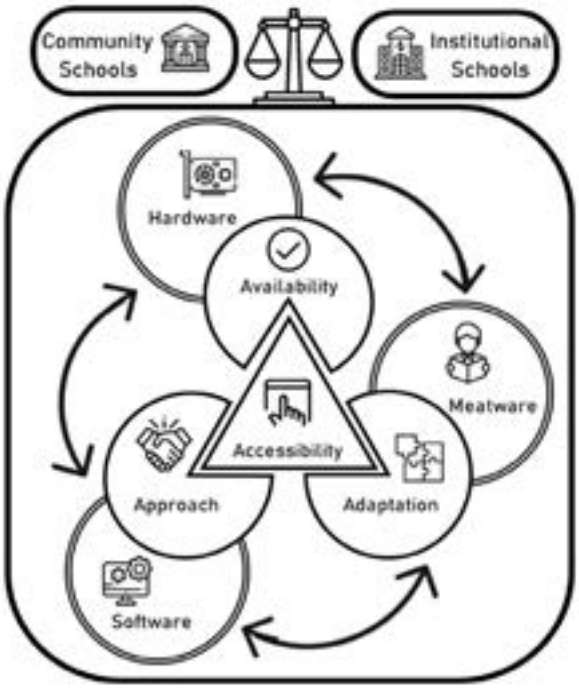


Figure 2: *Framework model for 3-As approach to finding the digital divide*

Note: The framework is developed by the authors.

3.2. Data Collection and Analysis

Primary data for this study were gathered over the 20 days during the pandemic via questionnaires using a Google Form. As there were no pre-existing questions suited to this unique situation of pandemic, the questions were prepared from the ground up. This involved reviewing literature and integrating insights from educational and technology experts to ensure comprehensive coverage. A pilot test was conducted to eliminate any ambiguities. Data collection utilized a structured questionnaire, divided into sections to access demographic information, access to digital resources, and e-learning experiences. The instruments (see Appendix 8.2) included both closed and open-ended questions, along with rating scales to evaluate e-learning effectiveness. Questionnaires were disseminated during Zoom, Google Meet, and MS Teams meetings.

For data triangulation, parents' and teachers' perspectives were viewed via secondary sources. Secondary data were obtained through a desk study, encompassing sources like school websites, newspapers, journals, research papers, and government reports. The other review highlighted topics like the dimensions of the digital divide, the influence of socio-economic background on the digital divide, statistics on access to education, and policies and guidelines for the operation of online classes.

The qualitative data were collected through Google Form and recorded in Google Sheet. Data analysis was conducted using Google Data Studio. The qualitative data were transcribed and categorized based on themes. Descriptive statistics such as mean and percentage were used to analyze the data.

4. Results

The findings of the study are divided into 4 sections: availability of hardware elements to the students, students' approach to software elements, adaptation to hardware and software elements by meatware, and comparison of virtual classes with in-person classes. Each of these findings provides a detailed understanding of the research questions and lays a robust foundation for the discussion that follows.

4.1. Availability of hardware elements to the students

This section provides details on the data obtained regarding the possession of hardware elements by the students of institutional and community schools.

4.1.1. Usage ofthe primary device for e-learning.

Figure 3 depicts that 80% of the students attending community schools use smartphone devices, whereas only 50.5% attending institutional schools use the same. On the other hand, while 41% of the students in institutional schools use laptops, only 16.2% of the students from community schools use them. The students from institutional schools using the desktop stand at 6.7%, while the ones attending community schools do not have its access at all.

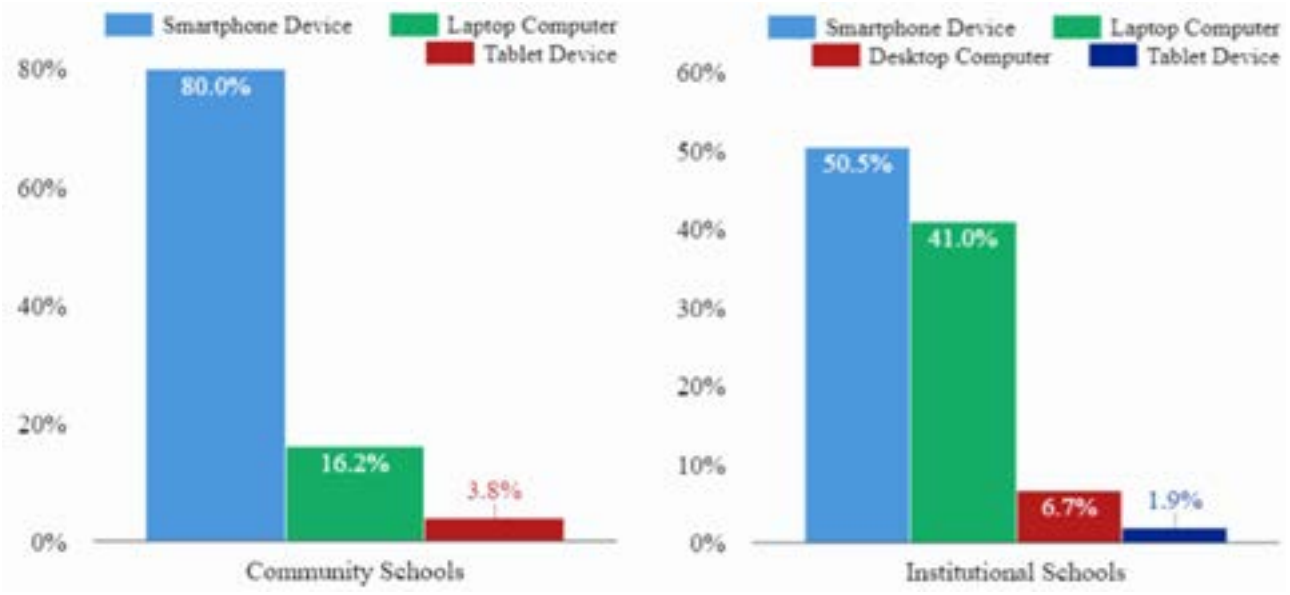


Figure 3: *Usage of the primary device for e-learning*

Concerning economic class, as shown in Table 2 and Table 3 respectively, 46.7% of students belonging to middle-class families from community schools and 32.4% from institutional schools use smartphone devices. But, 19% of students of the same economic class attending institutional schools use laptops highly outweighing their counterparts from community schools, who stand at just 5.7%. Similarly, a difference can be observed for upper-middle-class students with 14.3% of institutional schools using laptops compared to only 1.9% of community schools. Desktop computer access is limited to institutional school students only across different economic classes. On the other hand, tablet devices are used by 3.8% of students from community schools, while only 1.9% of institutional schools use them (see Table 2 and Table 3).

Table 2: Economic class-wise usage of the primary device for e-learning for community schools

School Type	Class	Smartphones	Laptops	Tablets
Community School	Middle Class	46.7%	5.7%	1.9%
	Lower Middle Class	13.3%	1.0%	1.0%
	Working Class	11.4%	2.9%	1.0%
	Upper Class	3.8%	4.8%	-
	Upper Middle Class	3.8%	1.9%	-
	Poor class	1.0%	-	-
	Total	80.0%	16.2%	3.8%

Table 3: Economic class-wise usage of the primary device for e-learning for institutional schools

School Type	Class	Smartphones	Laptops	Desktops	Tablets
Institutional School	Middle Class	32.4%	19.0%	1.9%	1.9%
	Upper Middle Class	10.5%	14.3%	3.8%	-
	Upper Class	2.9%	4.8%	1.0%	-
	Working Class	1.9%	1.9%	-	-
	Poor Class	1.0%	1.0%	-	-
	Lower Middle Class	1.9%	-	-	-
	Total	50.5%	41.0%	6.7%	1.9%

4.1.2. Problems faced in using the primary device.

On average, the level of problems that students of community schools face while using the primary device to access online classes is 4.9 out of 10 (see Figure 4).In contrast, institutional school students experience a lower

level of problems, averaging at 4 (see Figure 5).

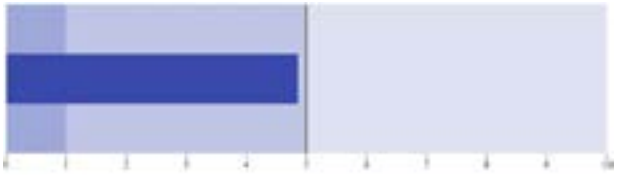


Figure 4: *Level of challenges faced with primary devices among community school students.*

Note: 1 is the least level of challenge faced with primary device and 10 is the highest.

Figure 5: *Level of challenges faced with primary devices among institutional school students*

Note: 1 is the least level of challenge faced with primary device and 10 is the highest.

4.1.3. Sharing of primary device for e-learning. As shown in figure 6, 61.9% of students of institutional schools do not share the primary device for e-learning, as opposed to 46.67% of their counterparts from community schools. From the institutional schools, 14.29% share it with their parents whereas 29.52% from community schools do the same. Similarly, 6.67% of institutional school students share with both parents and siblings, compared to 9.52% of community school students.

Figure 6 *: Sharing of primary device for e-learning*

With regards to device sharing concerning grades, only 19% of students of grade 9 of community schools use the devices themselves only as opposed to 34.3% of their counterparts from institutional schools, exhibiting a digital gap between them. On the other hand, 27.6% of students of grade 10 of both types of schools use the primary device they access online classes with by themselves only (see Table 4 and Table 5).

Table 4 : Grade wise sharing of primary devices in community schools

School Type	Device Sharing	9	10
Community Schools	Seld-use only	19.0%	27.6%
	With parent(s)	18.1%	11.4%
	With sibling(s)	4.8%	8.6%
	With parent(s) and sibling(s)	7.6%	1.9%
	With other user(s)	1.0%	-
	Total	50.5%	49.5%

Table 5 : Grade wise sharing of primary devices in institutional schools

School Type	Device Sharing	9	10
Institutional Schools	Seld-use only	34.3%	27.6%
	With parent(s)	5.7%	9.5%
	With sibling(s)	6.7%	7.6%
	With parent(s) and sibling(s)	3.8%	2.9%
	With other user(s)	1.0%	1.0%
	Total	51.4%	48.6%

4.1.4. Type of Internet Connection. The figure 7 shows that 44.8% of the students of institutional schools have access to fiber cable connection whereas only 33.3% of their counterparts from community schools do so. 7.6% of the students from institutional schools rely upon mobile phone data whereas 19.2% of the students from community schools rely upon it. However, 18.1% of students from institutional schools and 19.8% from community schools do not know the type of internet connection they have been using to access online classes.

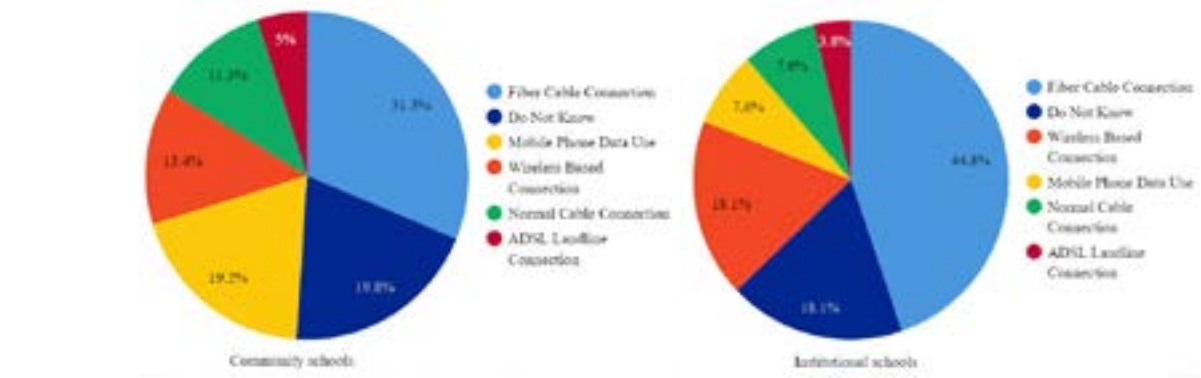


Figure 7: *Types of internet connection*

4.1.5. Internet setup and resolving related problems.

The students from institutional schools who have internet-connected solely to their households outnumber the students from community schools by 20% (see figure 8). Furthermore, while 28.57% of the students from institutional schools share their connection among two or more households, 36.19% of their counterparts from community schools do the same. 6.67% from institutional schools as opposed to 19.05% did not respond as most of them rely upon mobile data or other similar alternatives for accessing virtual classes.

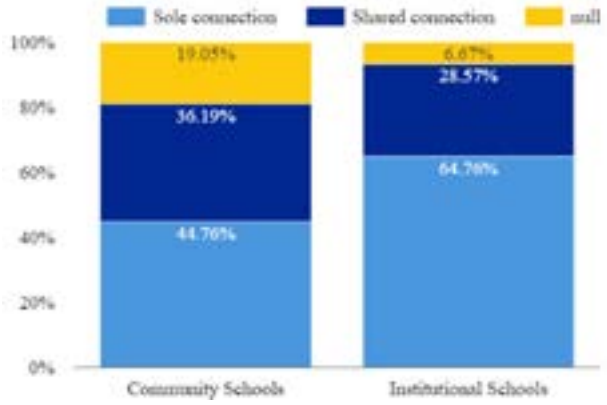


Figure 8 : *Internet setup*

The figure 9 depicts that 50.48% of students from institutional schools or their families can contact the service provider themselves as opposed to 32.38% of their community schools' counterparts. For 20.95% of community school students, the internet related problem is solved by the primary connection holder, whereas the same goes for 12.38% of institutional schools' students.

Figure 9: *Access to resolving internet related problems*

4.2. Students' approach to software elements

This section analyzes the differences in software usage between community school students and institutional school students. It examines access to e-learning platforms, assignment management, utilization of audio-visual learning in the classroom, and provision of dedicated emails to students.

4.2.1. E-learning platforms.

Figure 10 depicts that in institutional schools, the ones who get to learn through Zoom Meetings, Google Meet, and Microsoft teams all stand at 33.33% respectively. On the other hand, in community schools, the ones who get to learn through only Zoom Meetings is 66.67% whereas the ones who get to learn through both Zoom Meetings and Google Meet is 33.33%. Regarding the usage of platforms other than the compulsory ones, 23.6% of the students from community schools reported using none compared to 15.3% of the ones from institutional schools. 11.8% from community schools used Mero School compared to 6.5% from institutional school. Some other platforms that students from both types of schools used were My Second Teacher, Khan Academy, and Kullabs.

Figure 10: *E-learning platforms used by schools*

The tables (see Table 6 and Table 7) show that the satisfaction level relating to e-learning platforms differed based on the type of device primarily used for e-learning. The ones who use tablet devices from institutional schools have an average satisfaction level of 8.5 out of 10 as compared to 4.75 from community schools. However, there is a moderate difference in satisfaction levels between institutional school students (average: 6.58) and community school students (average: 6.12) regarding the usage of laptop computers.

Table 6: Usage of devices in community schools and associated satisfaction level

School Type	Main Device	Satisfaction with e-learning platforms
Community Schools	Laptop Computer	6.12
	Smartphone Device	5.88
	Tablet Device	4.75

Note: 1 is the least level of satisfaction with e-learning platforms and 10 is the highest.

Table 7: Usage of devices in institutional schools and associated satisfaction level

School Type	Main Device	Satisfaction with e-learning platforms
Institutional Schools	Tablet Device	8.5
	Desktop Computer	7.14
	Laptop Computer	6.58
	Smartphone Device	6.04

Note: 1 is the lowest level of satisfaction with e-learning platforms and 10 is the highest.

4.2.2. Correlation between primary device for e-learning and e-learning platforms.

The Pearson Correlation between the main device used for e-learning and the e-learning platforms accessed is -0.007, (see Table 8) indicating no significant correlation. The Sig. (2-tailed) value of 0.919 which is greater than 0.05, suggests the lack of statistically significant association between the types of devices students use and the variety

of e-learning platforms they access, i.e. students' access to e-learning platforms is not dependent on the type of device they primarily use for e-learning.

Table 8: Correlation between primary device for e-learning and e-learning platforms

		Main device	E-learning platforms
Main device	Pearson Correlation	1	-.007
	Sig. (2-tailed)		.919
	N	210	210
E-learning platforms	Pearson Correlation	-.007	1
	Sig. (2-tailed)	.919	
	N	210	210

4.2.2. Assignment conduction, submission, and related training. In terms of assignment conduction, figure 11 shows that all the students from community schools write their assignments on paper, scan or take photographs, and submit them. Though 67.62% of students of institutional schools follow the same, 32.38% of them have the opportunity to either write or type the assignments for different subjects.

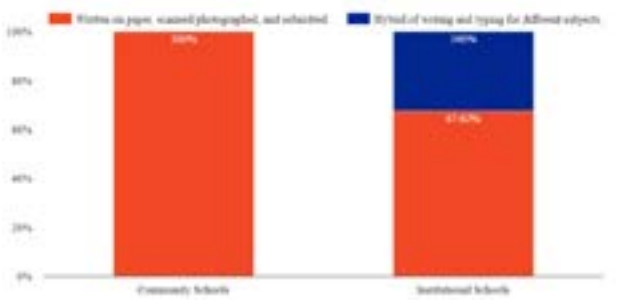


Figure 11: *Method of assignment conduction*

In terms of assignment submission, figure 12 shows that in institutional schools, those who submit their assignments via Google Classrooms or Microsoft Teams stand at 60%, and the ones who submit them via Facebook Messenger, Viber, or WhatsApp stand at 38.1%. On the other side, in community schools, 57.14% submit it via Viber-like applications only, and 39.5% submit it via Google Classrooms or Messenger.

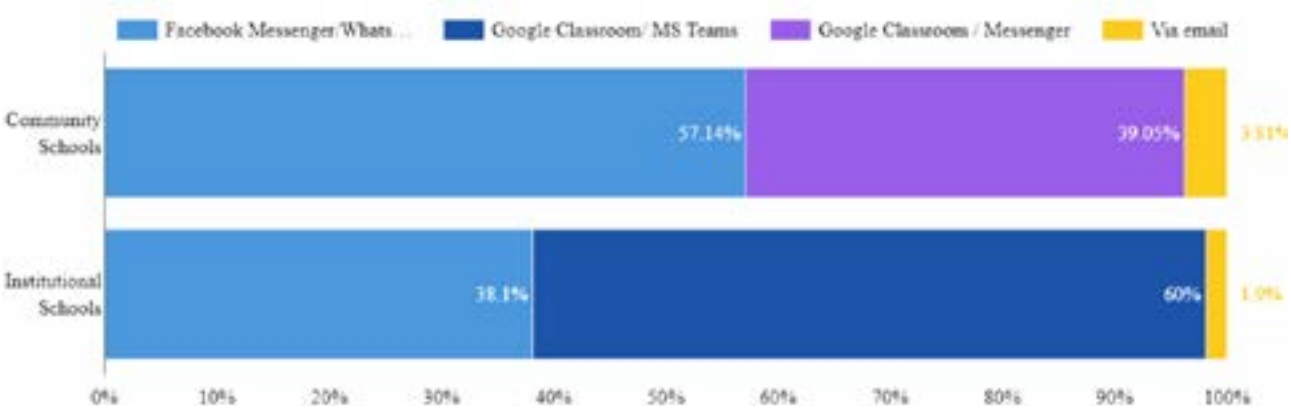


Figure 12 : *Method of assignment submission*

Figure 13 shows that in terms of training provided to the students for virtual classes, only 32.4% of students from the community schools were provided with training or lessons by their teachers to use related software and applications like MS Word, PowerPoint, Google Docs, Google Slides, and so on for assignment purposes compared to 42.9% in the institutional schools.

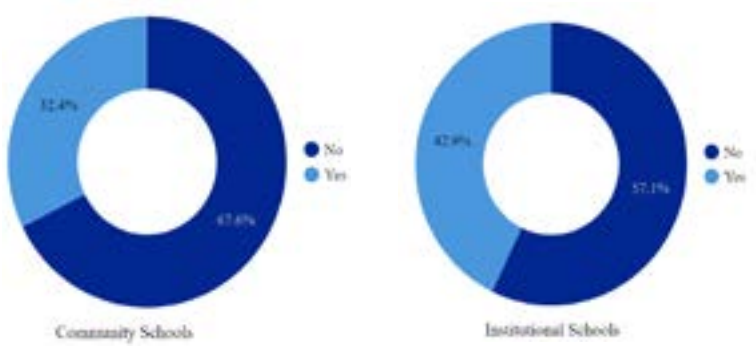


Figure 13 : *Relevant training provided for e-learning*

4.2.3. Teachers' usage of audiovisual technologies.

As shown by figure 14 and figure 15 respectively, the students of community schools rated their teachers' usage of audiovisual technologies to be 5.6 out of 10 whereas the students of institutional schools rated it to be 6.3 out of 10 on average.

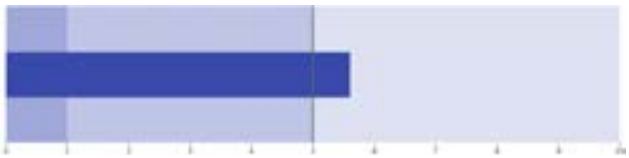


Figure 14 : *Audiovisual technology usage by community school teachers*

Note: 1 is the least level of usage of audiovisual technologies by teachers in students' perception and 10 is the highest.

Figure 15 :*Audiovisual technology usage by institutional school teachers*

Note: 1 is the least level of usage of audiovisual technologies by teachers in students' perception and 10 is the highest.

4.2.4. Provision of dedicated emails for students.

Figure 16, shows that none of the students from community schools have been provided with the dedicated personal email (for example, edu.np). In institutional schools, however, only 33.33% of the students have dedicated personal email addresses.

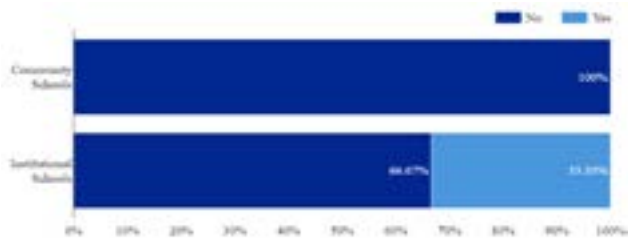


Figure 16 : *Provision of dedicated emails for students*

4.3. Adaptation to hardware and software elements by meatware

This section examines the differences in adaptation to hardware and software elements among students from different schools. It analyzes student's familiarity with their main devices, keyboard usage, web browser proficiency, application usage, and the technical support that they receive to become familiar with these aspects.

4.3.1. Adaptation to hardware elements.

In terms of familiarity with the primary device that the students use for accessing online classes, the community schools students rated it to be 6.0 out of 10 on an average as compared to 6.8 from the institutional schools (see figure 17 and figure 18).

Figure 17: *Community school students' familiarity with the primary devices*

Note: 1 is the least level of familiarity with the primary devices and 10 is the highest.

Figure 18 : *Institutional school students' familiarity with the primary* **devices**

Note: 1 is the least level of familiarity with the primary devices and 10 is the highest.

Table 9 suggests that female students from community schools are better off in terms of familiarity with the usage of primary devices than the ones from institutional schools with respective to their male counterparts, though the difference is not highly significant. On the other side, both male and female students from institutional school are better off than their counterparts from community schools.

Table 9 : Gender wise familiarity with usage of primary device

School Type	Male	Female
Community Schools	5.5	6.29
Institutional Schools	7.13	6.47

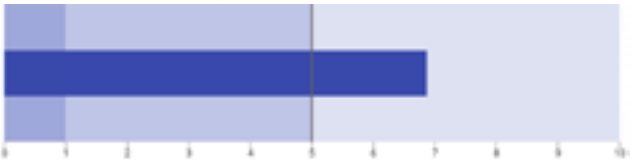
Note:1 is the lowest level of familiarity with the usage of primary device and 10 is the highest.

As shown in the figure 19 and figure 20 respectively, the students from community schools' average level of familiarity with using the keyboard for e-learning is 5.4 as compared to 6.9 out of 10 from institutional schools.

Figure 19: ***Community school students' familiarity with usage of keyboard***

Note: 1 is the lowest level of familiarity with the usage of keyboard and 10 is the highest.

Figure 20 : *Institutional school students' familiarity with usage of keyboard*



Note: 1 is the lowest level of familiarity with the usage of keyboard and 10 is the highest.

In terms of gender, as depicted by table 10, male students from both the community and institutional schools are better off than their female counterparts in terms of usage of keyboard. However, both genders from institutional schools are better adept with keyboard usage than their counterparts from community schools.

Table 10: Gender wise familiarity with usage of keyboard

School Type	Male	Female
Community Schools	5.4	5.38
Institutional Schools	6.98	6.77

Note:1 is the lowest level of familiarity with the usage of keyboard and 10 is the highest.

4.3.2. Adaptation to software elements. Figure 21 and figure 22 respectively depict that out of 10, on average, students from community school's familiarity with a web browser is 5.5 as compared to 7.1 from the students of institutional schools.

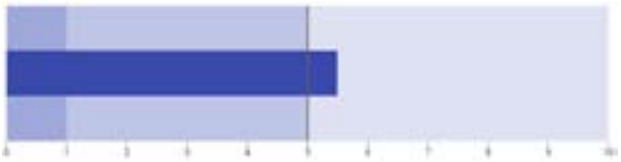


Figure 21: *Community school students' familiarity with web browser*

Note: 1 is the lowest level of familiarity with web browser and 10 is the highest.

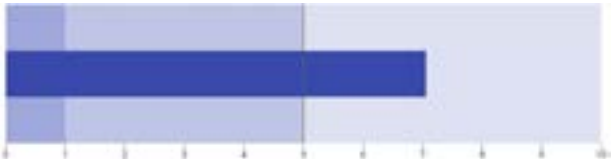


Figure 22: ***Institutional school students' familiarity with web browser***

Note: 1 is the lowest level of familiarity with web browser and 10 is the highest.

Figure 23 and figure 24 respectively convey that in terms of downloading applications, community schools' students' familiarity stands at 5.7 out of 10 on an average as compared to 7.0 of their counterparts from institutional schools.

Figure 23: ***Community school students' familiarity with downloading applications***

Note: 1 is the lowest level of familiarity with downloading applications and 10 is the highest.

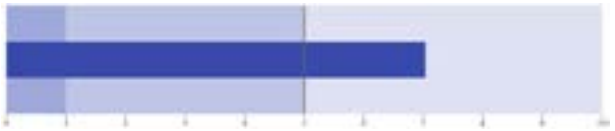


Figure 24: *Institutional school students' familiarity with downloading applications*

Note: 1 is the lowest level of familiarity with downloading applications and 10 is the highest.

4.4. Comparison of virtual classes with in-person classes

This section includes the analysis of different types of schools' students' evaluation of variation and difficulty level in teaching processes for online classes than in-person classes, their satisfaction level with academic performance, and learning preferences during the COVID-19 pandemic.

4.4.1. Satisfaction level with academic performances in virtual classes.

As suggested by figure 25, in the community schools, 46.67% of students are satisfied with their academic performance in virtual classes compared to in-person classes. In institutional schools, the satisfaction rate is 40.95%. Satisfied community school students appreciated the opportunity to continue learning despite the pandemic and find online exams easier, resulting in better grades. However, unsatisfied students faced challenges such as internet and device issues, household distractions, and difficulties in concentrating due to background noise. In institutional schools, satisfied students value the increased learning opportunities offered by online classes and also find online exams advantageous. Unsatisfied students in institutional schools cited problems with internet, devices, lack of proper assignment checking, and distractions at home.

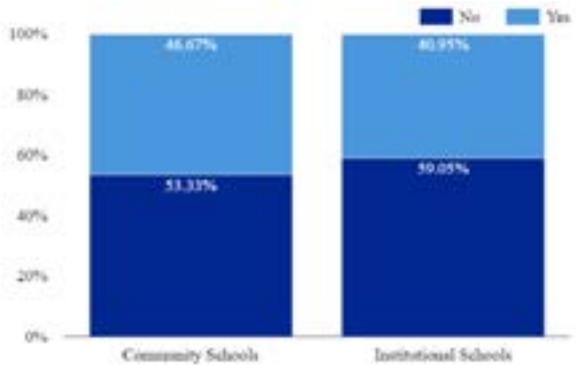


Figure 25: ***Satisfaction level with academic performance in virtual classes***

4.4.2. Learning style preferences.

Figure 26 shows that a significant majority of both community school students (78.1%) and institutional

school students (80.95%) are dissatisfied with virtual classes and prefer in-person classes. The main reasons for dissatisfaction among students from both types of schools include limited interaction with teachers and peers, as well as the absence of practical tasks like science lab experiments. Community school students specifically mention the time restriction of 40 minutes per class in Zoom Meetings, which hampers their ability to clarify doubts. On the other hand, one common reason for satisfaction with virtual classes among students from both types of schools is the absence of social anxiety, leading to improved performance. Students also appreciate the time saved and the opportunity to learn independently.

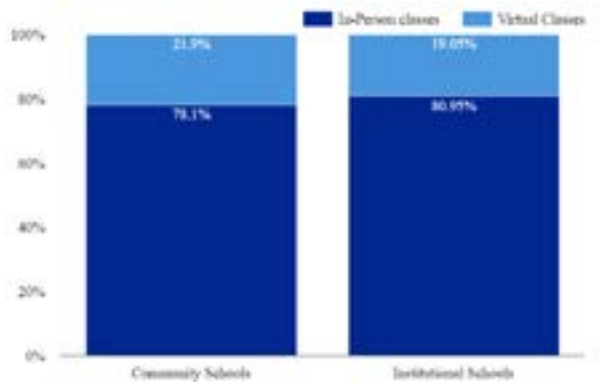


Figure 26: *Learning style preferences*

4.5. Teachers' and Parents' Perspective:

During the COVID-19 pandemic, a common theme among teachers was that they reported facing difficulties in maintaining active student participation during virtual classes, parental support to the students, their well-being, and in-person communication among others (An et al., 2021). Moreover, Khanal et al. (2021) suggest that educators in private schools experienced de-motivation during this time due to disruptive student behavior, job instability, and limited opportunities for professional development. Similarly, according to Baraily et al. (2021), teachers from community schools in Nepal reported that learning mechanisms were ineffective during the pandemic. They claim that family support, the economy, disturbances in the internet, and students' attitudes were the major barriers.

Regarding parents' input, Ojha (2022) highlights a dual experience during the pandemic: some parents closely monitored their children's online class progress, whereas parents who still had to work outside left their children unsupervised. The author claims that this is the same group who faced the extra financial strain of providing their children with the necessary technology for online learning. Similarly, according to Chapagain and Neupane (2020), the impact of a pandemic on families notably differed based on their economic and educational backgrounds. They claim that the ones with lower income saw school closures as a direct threat to their children's education due to limited resources, and the privileged ones adapted to online learning quicker, and explored new learning methods at home.

5. Discussion

This section analyzes the study's findings through the lens of existing literature on the dimensions of the digital divide. It highlights how the results provide additional evidence and insights into public-private difference pertaining with access to devices, diversity of e-learning platforms, differences in adaptation, and comparison of virtual and in-person classes. The analysis examines how the findings relate to and expand upon prior research on factors driving digital divides in education globally and within the Nepali context. The discussion also emphasizes the urgency of targeted interventions and preparedness to uphold educational equity during crisis.

5.1. Public-private difference in access to devices

In conformity with the existing knowledge by Gurung and Shrestha (2023), and Gautam and Gautam (2021), this study found notable differences in the availability of hardware devices for online classes between students from community and institutional schools. The findings provide additional evidence that community school students primarily rely on smartphones, while institutional school students have access to more convenient devices like laptops and desktop computers. This aligns with prior research and is likely driven by affordability differences between public and private school students, as institutional school students generally come from more privileged backgrounds and can afford sophisticated digital devices (Azubuike et al., 2020). The study further demonstrates this by showing that more students from middle-class families in institutional schools utilize laptops, allowing for more efficient learning compared to their community school counterparts.

Secondly, there were differences in terms of device sharing. More numbers of students from community schools also share their devices with other people, i.e., they have less ownership over it as compared to their counterparts from institutional schools. However, in terms of grade, the difference amongst the students of grade 10 who do not share their devices for e-learning is non-existent. One possible reason for this could be a National Board Examination, namely Secondary Education Examination (SEE)which is taken at the end of 10th grade holding great importance in general, which is why the parents of both schools prioritize their children's' access to classes for better performance in SEE.

Noori (2024) asserts that fiber cable amongst all types of internet connection can handle more data at the fastest

rate. In this line, 11.5% more institutional school students accessed the fastest fiber cable internet connections than the ones from community schools. On the other hand, Rijal (2019) claimed that mobile internet speed in Nepal was very slow. This was right before the pandemic. In this regard, the ones from community schools relying on mobile phone data exceed their counterparts by 11.6%. Further, more students from institutional schools directly contacted the internet service providers, indicating greater access and ownership. Overall, these findings demonstrate pronounced public-private disparities in access to digital devices and internet connectivity, reaffirming the access dimensions of Dijk's (2020) digital divide framework.

5.2. Diversity of e-learning platforms

Regarding the approach to software elements, more diversity can be seen in the usage of e-learning platforms in institutional schools than in community schools. The schools endorse certain teaching-learning platforms and students just get what they are served when it comes to their access to e-learning platforms. In this line, the majority of students from community schools attend classes via Zoom meeting with a time limit of 40 minutes as opposed to most of the students of institutional schools who use e-learning oriented platforms such as Google Meet and Google Classroom, and MS Teams. In this context, Google Meet and Microsoft teams are more viable for virtual education whereas Zoom Meeting not only requires strong network bandwidth but schools need to pay for the service if they are to use it for more than 40 minutes at a time; which many schools cannot afford to pay for (Sevilla, 2020). This study also suggests that the situation of students from institutional schools are slightly better off in having access to good classroom organization in terms of assignments, assessments, and so on thanin community schools, confirming Social and Cultural Reproduction Theory by Bourdieu that the research is grounded in.

Similarly, in conformity with UNESCO's (2023) assertion that many students struggle to derive optimal benefit from the digital devices they have access to because of complexities in understanding proper usage, the study shows that despite changes in modalities of assignment submission in virtual classes as compared to the modalities of in-person classes, around 10% of the students from community schools received less amount of training to use e-learning friendly platforms than the ones from institutional schools. This also explains why the majority of the students from community schools rely on platforms such as Facebook Messenger, Viber, WhatsApp, and so on. This aligns with van Dijk's (2020) usage dimension of the digital divide and demonstrates differences in access to quality virtual learning environments.

Furthermore, none of the students from community schools have the privilege of accessing institution-dedicated emails. However, in an institutional school where students have been provided with a dedicated email by the institution itself, the majority of them were able to manage their academic life in one uniform platform and use the email account to their avail. For instance, a student who has access to the email responded as follows:

"I think having a separate email address is beneficial as the school sends different documents like a newsletter, important notices, exam results, bills, and many more things and since the online classes have started we have been getting all the mentioned things in our email."

Nonetheless, the satisfaction level of students from community schools is marginally higher with e-learning platforms than their counterparts from institutional schools. This could be because the students from institutional schools are better off and thus have high expectations regardless of the facility provided to them.

5.3. Differences in adaptation

In the context of adaptation by meatware (students) to the hardware, and software elements both, proficiency in using the primary devices, keyboard, web browser, and application usage are key skills that impact a student's ability to fully leverage the e-learning resources available to them. In this study, it's apparent that students from institutional schools score higher in these areas, suggesting a more comfortable and effective adaptation to the digital learning environment. This disparity suggests that digital competencies go beyond mere access to technological infrastructure, reaffirming the observations made by Dijk (2020).

The study also sheds light on the gender dynamics in both community and institutional schools, revealing that male students generally exhibit a higher familiarity with digital tools compared to their female counterparts. This pattern may indicate a gender-based digital divide, underlining the need for targeted interventions to bridge this gap.

These findings support the postulation by Teltscher (2019) that a large part of internet underutilization is due to a lack of education and skills. The lower scores in digital skills among students from community schools echo the findings from low-income countries. Inadequate training in digital skills hinders the effective use of the Internet, thereby limiting the potential benefits of e-learning initiatives. As such, this study underscores the importance of not only improving the hardware and software infrastructure but also investing in the development of digital skills among both educators and students. It suggests that strategies to address the digital divide should adopt a comprehensive approach, integrating improvements in physical access to technology with skill-building initiatives.

5.4. Comparison of virtual classes with in-person classes

The comparison of virtual classes with in-person classes

revealed that a higher percentage of students from community schools were satisfied with their academic performance in virtual classes compared to institutional schools. However, the majority of students from both types of schools expressed a preference for in-person classes (78.1% of community school students and 80.95% of institutional school students). Common reasons for dissatisfaction with virtual classes included limited interaction with teachers and peers, absence of practical tasks, and time restrictions. This aligns with Ghimire's (2020) findings regarding virtual learning dissatisfaction in Nepal pertaining to limited proficiency of both teachers and students in usage of available software platforms. Students appreciated the opportunity to continue learning during the pandemic but highlighted the importance of balancing online and offline educational experiences. Further interventions are needed to address student concerns and enhance the effectiveness of virtual learning.

5.5. Limitations of the study

This study had some limitations, including a small sample covering only certain schools in Kathmandu. As such, generalization of the results to the broader Nepali context is beyond the scope of this research. Additionally, due to constraints around resources and access, the study included a limited number of randomly selected schools, rather than a nationally representative sample. Nonetheless, the sampled schools were chosen to represent diverse socio-economic backgrounds. Within these limitations, as the research was a timely intervention amidst the COVID-19 pandemic, it still provides crucial initial evidence and insights into digital disparities between community and institutional schools that can inform policies to expand access, improve preparedness, and enhance educational equity.

6. Conclusion

In conclusion, highlighting the digital divide in e-learning platforms among students in Kathmandu, Nepal, this research reveals disparities in hardware availability, software approach, and adaptation between community and institutional schools. These findings further reinforce the concept of existing inequalities among these schools and emphasize the need for targeted interventions to bridge the digital divide.

The study underscores the importance of effective policy implementation to expand ICT usage in the education sector. It calls for policies that address the specific needs of different school types and promote equal access to education. Additionally, it also emphasizes the significance of preparedness for future adversities and provides insights for maintaining access to education during crises. Finally, as there was a lack of adequate specific literature on digital divide in Nepal, particularly in the context of Kathmandu, this study also represents a crucial step in addressing this gap and providing urgently needed insights into digital disparities between community and institutional schools in Kathmandu. Further research is warranted to explore the digital divide across diverse samples in Nepal and inform future interventions.

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