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Jang Bahadur Singh
Indian Institute of Management Tiruchirappalli, Tiruchirappalli, Tamilnadu, India, jbs@iimtrichy.ac.in

Sujeet K. Sharma
Indian Institute of Management Tiruchirappalli, sujeet@iimtrichy.ac.in

Prashant Gupta
Indian Institute of Management Tiruchirappalli, prashant@iimtrichy.ac.in

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Jang Bahadur Singh
Indian Institute of Management Tiruchirappalli
jbs@iimtrichy.ac.in

Sujeet K. Sharma
Indian Institute of Management Tiruchirappalli
sujeet@iimtrichy.ac.in

Prashant Gupta
Indian Institute of Management Tiruchirappalli
prashant@iimtrichy.ac.in

Abstract:

The coronavirus disease of 2019 (COVID-19) pandemic has changed the way we work, learn, and interact with others in society. Academic institutions have responded to the pandemic by shifting face-to-face teaching to online instruction. However, whether online instruction succeeds also depends on students' social and physical learning environment, particularly in developing countries. In this paper, we discuss how learning space challenges exacerbate the digital divide. We argue that weak digital infrastructure, combined with family and social dynamics, create learning space inequality that negatively influence learning outcomes. We provide recommendations on how academic institutions can reimagine content delivery, evaluation, and student support to mitigate learning space inequalities.

Keywords: COVID-19, Digital Divide, Learning Space Inequality, Online Learning.

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1 Introduction

We received the following comments[1] from students as classes shifted online during the last trimester of the 2019-20 academic year and we tried to conduct the remaining classes and evaluations online:

> *A learning space is a must need to concentrate on classes. People at home are not used to leaving us undisturbed for a long time; also, space constraints and a good table and chair are not available at most houses.*
>
> *I have 11 people at home and peacefully studying among all the chaos is something which I cannot do.*
>
> *There is usually some tension between family members. This does not allow a healthy studying environment…. My home background did not matter when I was studying on campus.*

These observations highlight the challenges that educators face in teaching online and the resource gap among students from diverse backgrounds when they returned to their homes after the nationwide lockdown in India due to the coronavirus disease of 2019 (COVID-19) pandemic. Government-funded higher education institutes in India welcome students from disadvantaged socio-economic backgrounds through affirmative actions that the law mandates (Borooah, Dubey, & Iyer 2007). Policymakers have been mindful of the digital divide in India and have implemented various programs such as providing free laptops to students (The Hindu, 2020) and deregulating the telecommunications sector to make available affordable mobile data at some of the cheapest rates in the world (Roy, 2019). However, access to digital infrastructure alone does not say much about how effectively individuals (particularly individuals at the edges of the economic strata) use it. The internet has become one of the most domesticated technologies of our times (Scheerder, van Deursen, & van Dijk 2019), but people do not experience the digital spaces that it creates in a vacuum; rather, they are embedded in users' immediate physical environment. Online classes are immersive and require engagement over a longer period than, for example, online shopping. Also, unlike in ecommerce, if something interrupts an audio/video class, instructors cannot go back to the previous step. In this situation, digital learning spaces merge with users' physical surroundings to produce lived learning spaces. Here, digital and physical spaces have equal importance for effective outcomes.

The digital divide notion has continuously evolved over the past two decades: whereas researchers once saw it as a gap between digital have and have nots, they now also see that it includes a skill- and use-based divide and an outcome divide (DiMaggio, Hargittai, Neuman, & Robinson, 2001; Riggins & Dewan, 2005; Wei, Teo, Chan, & Tan 2011; Singh & Vimalkumar 2019; Vimalkurmar, Singh, & Sharma 2020). Recent research on the digital divide (van Deursen & van Dijk, 2019) indicates that differential access to various devices (mobiles, tablets, and laptops) and modes of Internet access (mobile vs. broadband) also widen existing inequalities related to Internet skills, use, and outcomes. However, even though researchers have come to understand digital inequality in such a nuanced manner, they have paid little attention to learning space inequality (especially in developing countries where learning space inequality exists more prominently)[2]: that is, how do digital spaces interlink with physical spaces and how does that interlinking affects users' access and outcomes? We need to consider such questions for the future of online education. Challenges concerning digital artifact access combined with learning space inequality may shape participation patterns, online engagement, and learning outcomes; thus, understanding the nuances of such inequality is paramount for academic administrators and instructors. Such an understanding will help educators redesign pedagogy and online educational systems to address emerging issues such as participation and engagement divides.

This paper proceeds as follows: in Section 2, we discuss existing research and nuances in material inequality concerning online learning technologies. In Section 3, we problematize users' learning space inequality and its possible interaction with the digital space. We also highlight how material and learning space inequality create participation and engagement divides. In Section 4, mindful of the fact that learning space inequalities are unlikely to be addressed in the short term, we provide recommendations for inclusive pedagogy, suitable learning materials, and other facilitating conditions that educators can create to minimize its adverse impact. Finally, in Section 5, we conclude the paper.

[1] Two co-authors collected feedback and suggestions from students on online classes through an open-ended feedback survey and discussed various issues related to online learning with class representatives and students.

[2] We thank the associate editor for suggesting the term *learning space inequality*. It indicates users' varied surroundings and includes the availability of private and functioning physical spaces and household environment.

2 Material Inequality and Online Education

Digital divide research since its early days (DiMaggio et al., 2001, p. 314) has emphasized that "inequality in the adequacy of hardware, software and connections" may limit how users employ the internet. Researchers originally expressed concern that the limited availability of digital infrastructure in many disadvantaged regions would limit the benefits that the Internet could provide to users. Advances in computing in the last decade that have led to widely available affordable and miniaturized quality computing devices such as smartphones and tablets have somewhat addressed this concern. However, the advances have also led to new material divides among users (laptops, tablets, mobile phones) with different underlying software (open vs. closed) and connection types (mobile network vs. broadband). van Deursen and van Dijk (2019) have pointed out that this new inequality has appeared because different devices and technical apparatus provide different opportunities for users. For example, due to smaller screen sizes and an increased scrolling requirement, mobile phones induce more cognitive load (Murphy, Chen, & Cossutta, 2016), which ultimately contributes to lower levels of user engagement and content creation (Napoli & Obar, 2014). For this reason, Napoli and Obar have expressed concern that a "mobile underclass" has risen among the marginalized sections of society and in disadvantaged regions. Online classes should be an immersive experience, and devices such as tablets and smartphones cannot offer the same experience quality as desktops and laptops. In developing countries such as India, low-cost phones constitute the primary means to access the Internet. As per a report (IAMAI, 2019), only six to eight percent of households accessed the Internet via desktops and laptops. Issues concerning the connection mode (mobile vs. broadband) also exacerbate the digital divide in developing countries where, even if people have access to laptops and desktops, they often access the Internet via mobile hotspots. Mobile-based connections have less reliability than wired broadband connections due to fluctuations in network coverage and interruptions due to battery discharge, phone calls, messages, and so on.

Material inequality in current digital divide research exclusively focuses on the technical apparatus that people use to access the Internet and pays no attention on supporting services such as whether they continuously have electricity to the internet. Longer online classes make the continuously available facilitating services such as electricity important. Globally, 1.1 billion people around the world do not have access to electricity, a general-purpose technology that has wide-reaching impacts for the economy (International Energy Agency, 2017). Furthermore, most of that population lives in South Asia, Sub-Saharan Africa, and Latin America (Williams, Jaramillo, Taneja, & Ustun 2015). Uninterrupted electricity supply constitutes another critical challenge in these countries. For example, in India, electricity is available for only 12 to 14 hours daily on average (Mission Antyodaya, 2019).

The above discussion sheds light on the prevailing inequalities surrounding access to the Internet, which have now become more visible due to the ongoing COVID-19 pandemic, as the Internet has become the only reliable mechanism to ensure social distancing while performing various socio-economic tasks including accessing education.

3 Beyond the Material Access: Learning Space Inequality

van Dijk's (2005, 2006) resource appropriation theory of the digital divide posits that categorical and positional inequalities in society produce an unequal distribution of resources, which subsequently leads to unequal access to the Internet. Though the theory acknowledges that structural inequalities in society (gender, race, and, for example, caste in India) shape users' resources, several empirical studies focus exclusively on the distribution of income in explaining access (van Dijk, 2020). We argue that other resources are also relevant in the online education context such as the availability of private and functioning spaces. Income alone does not determine the availability of usable space that people can use to effectively access technology as its distribution depends on the number of household members, room availability, and a household's Internal control structure. Even if the household owns all the diverse digital and material artifacts required for Internet access, one may still not know whether all the members have equal access to it, where the devices reside in the household, or how interruptions and competition for access among members affect its use. In the online education context, one cannot conceptualize learning spaces cannot exclusively as virtual spaces as they are embedded in users' physical surroundings. However, current digital divide research ignores the linkages between virtual and real spaces in shaping technology-use outcomes. In this context, inequality will deepen due to the combination of material and learning space inequality. Also, the learning space inequality may not be taken into consideration since "digital" or "online" is almost exclusively understood as "virtual" in nature without reference to the physical

learning environment. Such an understanding has its roots in early binary conceptualizations of physical and virtual spaces (Castells, 1996) and the popular conception of the Internet as escaping time and space constraints. However, as digital technologies become increasingly embedded in our "being and doing", boundaries between the physical and digital blur. Whether digital interactions succeed will not only depend on access to quality digital artifacts but also on the availability of usable spaces around them. From this perspective, effective online participation will also depend on access to a physical space to use the technology. Without a physical space to use the technology, the user risks being consigned to spectating and not participating.

Our discussion underlines that, for users to actively participate in online classes, they must overcome both material and learning space inequality. Leaving these inequalities unaddressed will contribute to expanding knowledge gaps. Our discussion highlights important dimensions that prior research and policy debates have not emphasized.

4 Recommendations

We will not likely eradicate the engagement challenges (particularly learning space inequality) that online learning communities face in the current crisis in the near future. However, we can attempt to mitigate these challenges by engaging academic institutions, redesigning curricula, and developing digital content. Academic institutions must upgrade their software and hardware infrastructure to support online teaching and learning. While such actions will help smoothen content delivery from the institution's side, we must also consider learning material and learning space inequalities on the user side.

We recommend that educators keep several factors in mind important for delivering classes online. To begin, we adopt the concept of embodied facilitation that Hornecker and Buur (2006) proposed, which recognizes the fact that digital spaces bring their own constraints and human-computer interactions are always embedded in real spaces. Embodied facilitation involves creating enabling conditions to mitigate those challenges. Below, we provide our suggestions based on our experience dealing with these inequalities.

4.2 Shorter Duration of Class Sessions

Many faculty members face inevitable and unforeseen challenges in engaging users during the transition phase due to their limited technological capabilities; at the same time, users may face challenges related to interruptions due to technical issues (unreliable connection, small screen size, etc.). Classes usually last from 75 to 90 minutes in physical settings; however, considering the above challenges, faculty members must reduce that time to overcome barriers that prevent disadvantaged groups from participating. In our experience, 45 to 60 minutes per class constitutes an appropriate choice for effective delivery. As such, the number of sessions may vary from the original teaching plan but that will not impact the total contact hours that individual programs prescribe and require. Hence, the change will not conflict with accreditation bodies such as the Advance Collegiate Schools of Business (AACB) and the EFMD Quality Improvement System (EQUIS) or regulatory bodies.

4.3 Delivery Mode

Learning space inequality particularly necessitates that faculty members deliver much learning through asynchronous means. They may share pre-recorded lectures with users beforehand to make sessions more interactive and engaging. Making recordings available after the class helps students revisit parts that they might have missed during the real-time session. In addition, faculty members can engage students by creating online discussion groups on social media platforms and other platforms such as Zoom and Webex.

4.4 Multi-modal Evaluation

Instructors may develop alternative and innovative ways to evaluate users' (students) progress in various interaction modes because normal interaction does not constitute a feasible option during pandemic-like crisis scenarios. Possible solutions include online quizzes with randomized questions, discussion evaluations on social media platforms, peer moderation in group projects or assignments, online discussions, online pre-recorded presentations, and virtual labs using cloud services.

4.5 Frequent Feedback

Faculty members need regular and frequent feedback from users to enhance content delivery and other facilitating activities. They should include regular inputs from users to mitigate material and learning space inequalities and, in the process, improve the overall teaching and learning ecosystem.

4.6 Omni-channel Technical Support

An unforeseen challenge concerns users being unable to reach services such as learning portals. In such emergencies, students may have limited or a single means to seek technical help. Academic institutions should be prepared to field support requests made through phone, email, and social media platforms (WhatsApp, Twitter, or Facebook) and should offer viable solutions to users.

5 Conclusion

In this paper, we unmask a new type of inequality related to the digital divide (i.e., learning space inequality), which surfaced during the shift of face-to-face classes to online mode owing to the COVID-19 pandemic. The digital divide has gone beyond access to materialistic artifacts. It appears that eliminating learning space inequality remains a challenge. We provide useful and actionable recommendations to mitigate the impact that learning space inequality has on online learning.

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References

Borooah, V. K., Dubey, A., & Iyer, S. (2007). The effectiveness of jobs reservation: Caste, religion and economic status in India. *Development and Change*, *38*(3), 423-445.

Castells, M. (1996). *The information age, vol. 1: The rise of the network society*. Cambridge, MA: Blackwell.

Hornecker, E., & Buur, J. (2006). Getting a grip on tangible interaction: A framework on physical space and social interaction. In the *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*.

IAMAI. (2019). India Internet 2019. *Nielsen.* Retrieved from https://cms.iamai.in/Content/ResearchPapers/d3654bcc-002f-4fc7-ab39-e1fbeb00005d.pdf

International Energy Agency. (2017). *World energy outlook 2017*. Retrieved from https://www.iea.org/reports/world-energy-outlook-2017

DiMaggio, P., Hargittai, E., Neuman, W. R., & Robinson, J. P. (2001). Social implications of the Internet. *Annual Review of Sociology*, *27*(1), 307-336.

Mission Antyodaya. (2019). Mission Antyodata daily upload progress. *Ministry of Rural Development*. Retrieved from https://missionantyodaya.nic.in/ma2019/preloginMaDataUploadSummaryNational.html

Murphy, H. C., Chen, M. M., & Cossutta, M. (2016). An investigation of multiple devices and information sources used in the hotel booking process. *Tourism Management*, *52*, 44-51.

Napoli, P. M., & Obar, J. A. (2014). The emerging mobile Internet underclass: A critique of mobile Internet access. *The Information Society*, *30*(5), 323-334.

Riggins, F. J., & Dewan, S. (2005). The digital divide: Current and future research directions. *Journal of the Association for Information Systems*, *6*(12), 298-337.

Roy, P. K. (2019). Mobile data: Why India has the world's cheapest. *BBC*. Retrieved from https://www.bbc.com/news/world-asia-india-47537201

Scheerder, A. J., van Deursen, A. J., & van Dijk, J. A. (2019). Internet use in the home: Digital inequality from a domestication perspective. *New Media & Society*, *21*(10), 2099-2118.

Singh, J. B., & Vimalkumar, M. (2019). From mobile access to use: Evidence of feature level digital divide in India. *Economic and Political Weekly*, *54*(2), 60-67.

The Hindu. (2020). *Tamil Nadu government to distribute free laptops to 5 lakh students in 2020-21.* Retrieved from https://www.thehindubusinessline.com/news/tamil-nadu-government-to-distribute-free-laptops-to-5-lakh-students-in-2020-21/article31106316.ece

van Deursen, A. J., & van Dijk, J. A. (2019). The first-level digital divide shifts from inequalities in physical access to inequalities in material access. *New Media & Society*, *21*(2), 354-375.

van Dijk, J. A. (2005). The deepening divide: Inequality in the information society. Thousand Oaks, CA: Sage.

van Dijk, J. A. (2006). Digital divide research, achievements and shortcomings. *Poetics*, *34*(4-5), 221-235.

van Dijk, J. (2020). *The digital divide.* New York, NY: John Wiley & Sons.

Vimalkumar, M., Singh, J. B., & Sharma, S. K. (2020). Exploring the multi-level digital divide in mobile phone adoption: A comparison of developing nations. *Information Systems Frontiers*.

Wei, K. K., Teo, H. H., Chan, H. C., & Tan, B. C. (2011). Conceptualizing and testing a social cognitive model of the digital divide. *Information Systems Research*, *22*(1), 170-187.

Williams, N. J., Jaramillo, P., Taneja, J., & Ustun, T. S. (2015). Enabling private sector investment in microgrid-based rural electrification in developing countries: A review. *Renewable and Sustainable Energy Reviews*, *52*, 1268-1281.

About the Authors

Jang Bahadur Singh is a faculty in the Information Systems and Analytics Area, IIM Tiruchirappalli. He holds a doctorate from IIM Bangalore. His current research focuses on understanding information technology related to societal issues in India (such as digital divide and digital literacy) using large scale publicly available datasets. His interest also encompasses the application of data mining techniques for business decision making. He has publications in reputed peer-reviewed journals like *International Journal of Information Management, Information Systems Frontier, Journal of Knowledge Management, Economic & Political Weekly, and Information Technology for Development.* His papers have also been presented in premier international conferences like ICIS, PACIS, AMCIS, ECIS and EGov.

Sujeet K. Sharma is an Associate Professor in the 'Information Systems & Analytics Area' at IIM Tiruchirappalli. Dr. Sharma has been teaching for more than 20 years in Oman, Bahrain, and India. He has published 30 international journal papers with (ABDC)/(ABS) ranking and indexing in the Scopus database. His ResearchGate score is 30.93 and Google scholar citations stand at 2019 (h-index: 22 and i10-index: 33). His research papers have appeared in well-known refereed international journals including *Technology Forecasting & Social Change*, *International Journal of Information Management, Government Information Quarterly*, *Computers in Human Behavior, Information Systems Frontiers, Behavior and Information Technology*, *Information Systems Management*, *Interactive Learning Environments,* and other reputed journals. In addition, he has presented his research in top-tier conferences held in USA, Italy, Malaysia, and other countries. He won the Best Research Award in 2018.

Prashant Gupta is a faculty member in Finance area at Indian Institute of Management (IIM) Trichy. He has been actively involved in academic administration being Program Director of many programs at different institution and also as Chairman Admissions, Dean-Student Affairs and Dean, School of Management etc., that gives him in depth understanding of academic and teaching learning processes. Dr. Prashant has also been actively involved in training and he has conducted various training programs and trained thousands of middle, senior and top-level executives including Board Members of various companies, Foreign Government Officers/ executives of Private Companies of around 55 countries, and academicians including Professors, Vice Principals, Principals, Deans, Vice Chancellors and BoG Members of more than 80 Universities and Institutions. He has numerous publications in refereed international and national journals and reviews various academic journals. His research area is in corporate finance, corporate governance, and technological advancements' impact on financial services and learning systems.