ROLE OF HEADTEACHER IN HARNESSING TECHNOLOGY TO ENHANCE ECE QUALITY; A CASE STUDY OF A COMMUNITY-BASED SCHOOL IN HUNZA

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ABSTRACT

The research article has emerged from the PhD thesis research conducted by the first author and supervised by the second author at the Department of Education Karachi University. It focuses on exploring the role of the headteacher in harnessing the technology to enhance ECE quality at a community-based school in Hunza – a rural area of Pakistan. The qualitative case study intends to explore the strengths and challenges of harnessing technological potential for ECE quality enhancement in the rural context, and develop perspectives on headteachers' capacity building to mitigate challenges and capitalize upon the strengths. Interviews, school audit, classroom observations and document analysis were used as data collection tools. Thematic analysis has been used to analyze data, and literature has been referred to develop insights. The research findings suggest technology is a crucial indicator of the ECE quality enhancement phenomenon. It may be used to improve teaching and learning practices, develop human resources, enrich the curriculum, improve planning, leadership and management practices, and develop an integrated ECE system. The research indicates that an under-developed electronic infrastructure, power disruptions, lack of training and human resource capacity, and policy gap have emerged as factors hindering the use of technology and integration of ICT at the ECE level in the school in reference. The research recommends that school, and system-level interventions be required to harness the technological potential for ECE quality. It may include a paradigm shift of school leadership towards ECE and technology, stakeholders' training and capacity building, resource allocation, and enhanced facilitation to community-based schools by the Government, regulations, policy provisions, oversight and support.

KEYWORDS
ECE quality; educational technology; ICT integration; harnessing technology; technological context; headteachers and technology; Education in Gilgit Baltistan; ECE in Hunza, AI and education; technology and education management; technology in rural areas; education in rural areas; technology in Pakistan

INTRODUCTION

This research article has emerged from the PhD thesis research conducted by the first author and supervised by the second author at the Department of Education, Karachi University, Pakistan. The PhD thesis is a qualitative case study research focused on exploring the educational leadership practices of a headteacher in teaching quality enhancement at the ECE level in a community-based school in Hunza. Quality enhancement was investigated as a phenomenon influenced by four indicators linked to ECE: context, inputs, processes, and outcomes. The technological context was one of several dimensions of context indicators. The research article in reference focuses on the role of the headteacher in harnessing the technological context for ECE quality enhancement.

The three-dimensional relationship between the technological context, the role of the headteacher, and ECE quality enchantment may be explored from multiple perspectives – ethical (Beycioglu, 2012), social (Avgerou, Smith, & Besselaar, 2008), economic (Stromquist, 2002), and educational leadership (Garland & Tadeja, 2013). This research article focuses on the academic leadership perspective of harnessing technological potential at the ECE level.

Background and rationale

ECE quality enhancement is a dynamic and complicated phenomenon and is influenced by many interventions, stakeholders, and factors in the internal and external context of the school (Coe, 2015). Among all aspects, the technological context of the school appears to be critical in influencing the ECE quality enhancement phenomenon at the ECE level (Yu, Niemi, & Mason, 2019; Khaki & Safdar, 2010; Sergiovanni, 1996). Technology has been changing the education landscape exponentially for the last several decades. On the one side, the new research in brain sciences and genetics is opening new horizons for Early Childhood Education and Development (ECED). Conversely, Information Communication Technology (ICT), Artificial Intelligence (AI) and the big-data are reshaping pedagogy and educational management. In this situation, headteachers working in rural or underdeveloped areas are expected to play a critical role in ECE quality enhancement through ICT integration, improved communication, human resource capacity building, resource mobilization, effective management and automation (Yu, Niemi, & Mason, 2019). Since the ECE and technological potential is a new area of educational discourse in Pakistan (UNESCO,

2021), an in-depth- qualitative research study is necessary to bridge the knowledge gap. It may also contribute to the discourse on practices and strategies that may help headteachers to effectively improve and harness the technological potential to enhance ECE quality in schools located in rural areas.

A preliminary literature review (Garland & Tadeja, 2013; Tan & Hew, 2017; Burris, Rosen, & Karno, 2021) indicates that the usage and integration of technology in education at all levels have become increasingly prevalent in recent years. Contrary to the developed world, technological integration in education is a recent phenomenon in Pakistan, triggered and accelerated by the Covid-19 pandemic in 2019 and onwards (Anwar et al., 2023). The technological context and its relationship to education in general and the ECE quality, in particular, is complex and multifaceted. It includes aspects of the technological profile, requirement of funding and investments, creativity and out-of-the-box thinking, e-infrastructure, digital divide, software, human resource capacity, troubleshooting and automation etc.

The use of technology and its integration into ECE programmes has increased over the last couple of decades (Tan & Hew, 2017). Developed countries such as the USA, Canada, Singapore, Japan, UK, UAE and serval other countries in Europe Union have developed infrastructure, mechanisms and processes to integrate technology in pedagogy, human resources, finance, information management systems, distance learning, assessment, marketing, stakeholder communication, and quality control (Selwyn, 2013). Studies focusing on developed countries (Tan & Hew, 2017; Joseph, Whitney Randy, 2016; Rosen & Jaruszewicz, 2009) indicate that the use of technology, and integration of ICT in early childhood education and development has positively influenced motivation, student engagement, teacher development, and learning outcomes. However, there is a knowledge and research gap about technological usage and ICT integration, its relationship to teaching quality enhancement at the ECE level, and the role of the headteacher in harnessing the technological potential in developing countries. Analysis of six education journals (PJERE; PJE; JESS; PJER; BER; IJDEL) published in Pakistan between 2018 -2022 indicates two types of knowledge and research gaps, respectively:

1. Quantitative researches have been conducted on pedagogy and Pakistan's infrastructural dimension of technology. However, qualitative perspectives on technology, ECE teaching and its relationship to educational leadership and management practices are missing. Most of the studies conducted after 2019 seem to be triggered by a sudden increase in technology use during and after the Covid-19 pandemic.

2. Most of the studies were conducted in the areas (primarily urban areas) that

have had internet access, and the rural and underdeveloped regions, where e-infrastructure is fragile, have limited representation in the research discourse in Pakistan. This research intends to respond to both types of knowledge gaps. In addition, there is a need to develop insights into how headteachers can support teachers in using technology effectively in ECE classrooms and use the technology for teacher development, resource mobilization, and stakeholder communication in the remote and underdeveloped areas of Pakistan. Robinson (2021) argues that headteachers, as gatekeepers of quality, are expected to capitalize upon the technological context (e-infrastructure, ICT, connectivity, data systems and technological resources) to improve pedagogy, train teachers, orient parents, and to enhance their own leadership and management capacity.

Compared to urban areas, harnessing the technological potential in rural areas has different dynamics. This research will explore how a headteacher in a remote area in Pakistan uses technology, what are the technological challenges and opportunities, and how harnessing technological potential may help enhance the ECE quality.

LITERATURE REVIEW

The technology may enable ECE teachers to make teaching and learning an interactive and exciting experience and encourage critical thinking and problem-solving skills. It may enhance the ability of headteachers to communicate and collaborate with internal and external stakeholders effectively. It may improve resource mobilization and facilitate maximum utilization of resources through automation and data integration (Visvizi, Lytras, & Daniela, 2018). If used effectively – a variety of conventional and modern technologies may help headteachers to improve the overall quality of ECE in a school in developing areas (Ashraf, 2018; Asian Development Bank, 2017). It's crucial to understand that technology may facilitate teaching and learning rather than replace interactive activities, play and human engagement, which is the essence of the ECE. The other critical consideration is age appropriateness for the technology and devices being used at the ECE level (Liu, & Audran, 2017). While analyzing the data for this research, an effort has been made to develop a field-based perspective on how technology may be used "if at all" to facilitate human interaction, and play-based learning, instead of replacing it.

The technological context in ECE is evolving and rapidly changing globally. The use of technology has increased, and the mode of teaching and learning has become dynamic – no longer confined to classrooms and a single teacher. It includes teacher assisted blended learning at schools with the help of the internet, computers, offline audio-visual devices, and interactive whiteboards. It also provides distance learning that may occur beyond classrooms through learning portals, personal tablets, learning management systems, AI, and interactive learning software (Morabit, 2019; Mulenga

& Marban, 2020).

The technological context in Pakistan is complex and evolving. Explaining the complexities associated with the technological context of the country, the State Bank of Pakatan (n.d) considers the digital divide a critical area of concern. They argue that some technological progress has been made in urban areas. Technology integration in various sectors during the Covid1-19 crisis has helped the Government minimize the pandemic's social and economic fallout. However, further development is needed and harness the technological potential to decrease the digital divide between urban and rural areas.

Similarly, in a survey report developed for the Digital Rights Foundation, Pakistan, Huma (2021) claims that the internet connectivity profile of the country is low, with 35% of the population having internet access. The country has scored low on indicators pertaining to affordability – ranking at 90 out of 100 compared to 76 in 2019. The frequent internet shutdown due to security reasons in parts of Khyber Pukhtoon Khawah, Kashmir and Gilgit Baltistan is another factor hindering technological integration in education. Lastly, the report claims that socio-economic disparities also prevent families from taking advantage of the technological potential for health, education and various aspects of life.

The technological context in the urban areas of Pakistan is relatively better than in the rural areas, where there is a lack of technological facilities and human resource capacity (Huma, 2021). Government and NGOs are trying to improve the technological context for urban and rural areas, but Arshad-Ayaz (2011) believe that much of the discourse on technological integration is based on rhetoric. There is a lack of understanding at the policy level about the philosophical, social, political, and cultural realities of a heterogeneous population frame. In this situation, headteachers as instructional leaders and teachers as pedagogical leaders may play their leadership role in diverse situation, and at the grassroots level. They may come up with contextualized solutions to harness the technological potential for ECE quality enhancement.

The above mentioned-literature review suggests that the technological context has its own challenges and issues in Pakistan. The Urban areas have access to technology, but there is a lack of policy clarity and programme capacity to integrate technology for quality enhancement. On the other hand, lack of access, quality and ability hinder the use and integration of technology in the ruler areas of Pakistan (UNESCO, 2021). The review also indicates that there is a knowledge gap about the role of educational leadership, technological context, and the way technology may be used to enhance ECE quality in rural areas like the Hunza district in Gilgit-Baltistan. The qualitative

data has been analyzed to bridge the knowledge gap, and insights are developed.

RESEARCH OBJECTIVES

1. The research aims to identify challenges and strengths associated with the technological context in schools working in rural areas of Pakistan.
2. Intends to explore the role of headteacher in harnessing the technological potential to enhance ECE quality in a school in rural Pakistan.
3. Generate an academic discourse on ways to improve the role of the headteacher in utilizing and integrating technology for ECE quality enhancement.

RESEARCH QUESTION

1. What role does the headteacher play in harnessing the technology to improve teaching quality at the ECE level in a community-based school in Hunza?

RESEARCH METHODOLOGY

This research article has been produced using the qualitative research methodology and case study as the research method. The sample included the headteacher, ECE learning coordinator, four ECE teachers, twelve parents, and twelve students. The data collection method included in-depth structured interviews with six primary respondents (headteacher, ECE learning coordinator and ECE teachers), focused group discussions with ECE students and parents, school audit, classroom observations extended over seven days, and internal documents' review. Post-data collection stakeholder discussions (via telephone) were conducted with two Government officials at the Department of Education-Gilgit Baltistan to triangulate some of the findings. Deductive thematic analysis was used to identify themes, and the literature review was employed to infer meaning and develop insights.

FINDINGS

The research site is a community-based school located in an underdeveloped and rural district of Pakistan in the extreme north, at the borders of Pakistan and China. The education statistics shared by the office of District Education Officer Hunza (Int. DEO. September 08, 2021), and the Multiple Indicator Cluster Survey 2016-17, conducted by the Government of Gilgit Baltistan (Government of Gilgit Baltistan, 2017) indicate improved access trends and provision of ECE services by public, private and community-based schools in Hunza district. It suggests that the Hunza district tops among other districts in Gilgit Baltistan with 83.5% ECE enrollment at the ECE level. The increased access results from collaborative efforts by civil society organizations, local communities, and the Government of Gilgit Baltistan. However, Benz (2013) and Ali (2019) indicate that despite the fancy pictures of Hunza painted by the media and enthusiasts, the local communities are facing multiple challenges, including a lack of dynamic economic opportunities, political representation at the centre, digital divide

and disconnect, and a rapid social change trigging rapture. These challenges can negatively influence various aspects of human development, including education quality in Hunza. The data analysis (interviews, focused group discussions, literature review, and internal document analysis) indicates that along with several other context-related challenges, an unfavorable technological context seems to be affecting the educational quality in general, and the ECE access and quality in particular. The following four themes have emerged from the data analysis linked to the ECE quality and the associated role of the headteacher at the research site.

The underdeveloped electronic infrastructure:

During the interview with the headteacher, it was revealed that the Special Communications Organization (SCO), a government entity, was the sole internet provider at the time of data collection in 2019-20, with limited connectivity services provided by other cellphone networks. The headteacher (Int. HT. July 07, 2019) and ECE teachers (Int. T2 &T3. July 06, 2019) stated that the electronic infrastructure was underdeveloped in the area. The connectivity disruptions, slow internet speed for 3G network, lack of easy access, higher data costs, and timely availability of spare-parts of the hardware for troubleshooting was a hurdle to integrating the technology for ECE teaching and learning.

Post-data collection follow-ups with the stakeholders indicate that the Government of Pakistan is trying to improve the electronic infrastructure in the remote areas of Gilgit-Baltistan, including parts of Hunza. According to a press release by the Ministry of Information and Telecommunication, Government of Pakistan (2020), the president of Pakistan has advised stakeholders to ensure the provision of quality internet services in rural areas of Pakistan, including Gilgit-Baltistan. Amin (2020) has highlighted several initiatives taken by the Special Communications Organization (SCO) to improve E-infrastructure and access to the Internet in Gilgit Baltistan, and it includes:

- The SCO has a mobile coverage of 90% of the population in GB.
- The first broadband internet service (DSL / DXX) in Gilgit-Baltistan (GB) was initiated by SCO in 2007; it has continuously been updating and expanding its services across GB, including in Hunza.
- The 3G/4G internet services were initiated by SCO in 2017.
- Customers in Gilgit Baltistan have access to the internet through Fiber Optic Connectivity projects completed under Pakistan-China Economic Corridor

Haider (2022) has identified several projects initiated by the Government of Gilgit-Baltistan, under the leadership of the Chief Secretary of GB, that have contributed to enhancing the E-infrastructure and developing human resource capacity; integrating technology in commerce, health and education. The establishment of Business

incubation centers, freelancing training and facilities, and establishment of IT labs in government schools are some of the key initiatives. The interview with the ECE learning coordinator at the research site indicates that the school development initiatives taken by the government for technological integration are focused on the public schools, and there is a policy and facilitation gap from the Government for the private and community-based schools in Hunza.

The Focused Group discussions with Parents (FGD. P6 & P10. July 06, 2019) and interview with the headteacher (Int. HT. July 07, 2019) indicate that, despite the claims made by the Government and internet service providers, the slow speed and inconsistent connectivity, higher cost of internet service and the lack of troubleshooting facilities remain to be hindering factors to use and integrate technology for teaching and learning at schools. The headteacher's statements suggests that he sees the fragility of electronic infrastructure as a political and system-level challenge and expressed disparity and helplessness. However, some of parents (FGD. P3, P9, P12. July 06, 2019) and a teacher (Int. T1. July 06, 2019) argued that the they should not wait for the politicians to fix the system, rather they may try to find solutions at their own. They suggested that the political participation, community-based and alternate solutions, stakeholder engagement, advocacy, partnerships, application of business models for internet service provision, and use of alternate modes of offline technologies for learning, may help overcome the connectivity and infrastructure related challenges.

Data analysis indicates that despite the system-level challenges, community awareness, parents' motivation and cooperation, and the dynamic civil society of Hunza present opportunities for headteachers to address some of the challenges related to infrastructure development. The headteacher may need to develop a stakeholder engagement, consultation and communication strategy to seek the help of notables, political leaders, advocacy groups and NGO representatives in addressing these issues.

Electricity breakdowns and prolonged load-shading:

Focused group discussions with parents (FGD. P1, P3, P6, July 06, 2019) and ECE teachers (Int. T2 &T3. July 06, 2019) indicate that the electricity breakdowns and prolonged load-shading are a critical challenge that affect their will and capacity to harness various forms of technology (both online and offline) for teaching and learning quality enhancement at ECE, in the classrooms and at homes. Expressing her concern, an ECE teacher stated:

"Kids in my class love to listen to animated stories and poems. We want to use learning videos and pictures in our lesson plans, but we cannot do that because, most of the time, we have no electricity in our area. We want to use the internet to download

learning materials and develop activities, but when there is slow internet and no electricity, how can we do that" (Int.T3. July 06, 2019)

Parents made similar comments in a focused group discussion, and one of the parents shared that the area was facing power cuts and sustained load-shading that prevails not for hours but days and weeks. Expressing her frustration over a question about the utilization of technology for learning at home, one of the parents stated:

"Saying that we should use computers and other electronic devices for learning is easy, but how can we do that when we don't have electricity for so many days? We have the power supply for only two to three hours after days and weeks. Leave alone using devices we don't have electricity to iron the uniform of our children" (FGD. P4. July 06, 201).

According to the headteacher, the power interruptions in the areas is a real issue affecting teaching and learning quality at school for all level. He suggested that the lack of funding, political will, and local political dynamics hinder the efforts to opt for alternate energy sources (Int. HT. July 06, 2019).

In his view, be it E-infrastructure or power supply and generation, both are more significant system-level issues that leave him and his team with limited options to harness the technological potential for ECE quality enhancement. It reflects a fixated management approach and may require a paradigm shift to look at various issues from a strategic management perspective – analyzing the situation, looking for alternatives, and developing strategic interventions.

Stakeholders' exposure and capacity to use technology

The data analysis indicates that insufficient training, lack of exposure to various forms of technology and misconceptions of parents and teachers about negative effects of technology on young children emerged as factors hindering the headteacher's efforts to harness the technological potential at the ECE level. The cross-segment analysis of interview data for the headteacher (Int.HT. July 07, 2019) ECE teachers (Int. T1, T3, T4. July 06, 2019) and FGD with parents (FGD. P3, P4, P8. July 06, 2019) indicates three types of training gaps which include:

1. The headteacher needed further exposure to education management software, systems, and IT tools for data management, integration, planning and monitoring, using learning management system (LMS), communication and networking tools

2. ECE teachers lack the capacity and training to integrate technology for teaching and learning (pedagogy), student assessment, self-development, and learning resource

development.

3. Lack of exposure and awareness of parents and students about various online and offline learning platforms, learning tools, and resources.

4. Analysis of the school development plan for 2020 and beyond indicates limited focus on technology infrastructure development, ICT integration, and capacity building and training of key stakeholders. Interviews with teachers (Int. T2, T3. July 06, 2019) indicate their limited understanding of the importance, use, challenges and opportunities offered by technology and ICT integration at the ECE level.

Similarly, the analysis of the ECE curriculum indicates that aspects of technology integration are missing. Focused group discussions with parents reflect a cynical approach towards technology, considering it harmful for younger children. Parents identified that they might need training and exposure to the safe and effective use of technology to educate their younger kids at home. These findings identify the need for capacity building, training, and awareness programmes to be conducted at school for teachers and parents of ECE children to harness the technological potential for quality improvement.

Lack of ICT policy provision

A lack of ICT and technology-related policies was evident at two levels, respectively; at the school (research site) and education sector level (GB-Education department). Internal document analysis (school development plan) and the Interview with the headteacher revealed that the school has no ICT policy. Responding to an interview question about technology policy and its integration into ECE classrooms and management practices, the headteacher stated:

"No, we don't have any ICT policy available, but we are trying to use whatever limited resources are available. Our teachers use TV and audio devices in ECE classrooms. We have an IT facility, but due to electricity and internet connectivity issues, we rarely use these to teach ECE students and develop teaching and learning resources. We maintain our teachers' and students' data, and financial details and plans on computers, but it is not integrated yet to be used for planning purposes" (Int. HT. July 07, 2019).

Stakeholder discussion with the Deputy Director-Model/Private schools, Government of Gilgit Baltistan (Int. DDM/Ps. February 18, 2023) reflects two dimensions of the policy gap at the system level:

The first dimension indicates that the generic policies and frameworks are developed by the Government of Gilgit-Baltistan to regulate and facilitate various aspects of

education in government schools. For instance, the Gilgit Baltistan education strategy, 2015- 2030 (Education department, Gilgit Baltistan, 2014).), was developed in 2014 and was under midterm review when this research paper was produced in April 2023. These documents are based on need analysis and broader education policies, frameworks and indicators developed by the Federal Ministry of Education. However, policy provision for specific aspects of pedagogy and technological integration at the school level is lacking.

The 2nd aspect of the policy gap at the system level is the lack of policy provisions for the private and community-based schools, providing education to more than half of the student population in District Hunza. According to the District Education Department Hunza, no specific policies are available to facilitate and regulate technology integration in private-or commute-based schools in Hunza. The Deputy Director-Model/Private schools (Int. DDM/Ps. February 18, 2023) informed the researcher that the Government of Gilgit-Baltistan has approved the 'Gilgit Baltistan Private Educational Institutions' regulatory act 2020' (Government of Pakistan, 2020), and policy and programme proposals are under consideration to further regulate and facilitate private schools in GB. The analysis of the regulatory act indicates that it is generic and the specific policy guideline are yet to be developed for private/community-based schools.

The lack of policy provisions at the school and system level may limit headteachers' role in effectively integrating technology for ECE quality enhancement. It may require policy dialogue, stakeholder discussions, policy documentation at the system level, and capacity building of headteachers to develop and implement various policies at the school level.

The following is the summary of the key findings:

- An underdeveloped and a fragile-electronic infrastructure in Hunza (a rural area of GB) hinders the efforts made by the headteacher to harness the technological potential to enhance ECE quality.
- Internet system disruptions, lack of easy access, slow internet speed for 3G networks, timely availability of hardware, and higher data costs are some challenges affecting technology integration in the community-based school in Hunza.
- The school-based E-infrastructure is improving for the Government schools, and limited facilitation from the Government was evident for the community-based school in reference.
- Electricity breakdowns and prolonged load-shading is a critical challenge that affects the will and capacity of the headteacher to harness the technological

potential for ECE quality enhancement.

- There was a lack of clarity and vision to explore alternate sources of energy and power supply solutions.
- Lack of stakeholder awareness, capacity and training to use technology has emerged as a critical aspect that hinders the integration of technology at the ECE level.
- Two levels of policy provision gap hinder technological integration at the ECE level, i.e., a lack of policies at the school level, and a lack of ICT and technology-related policy at the system level.

The practices and role of the headteacher seem to be fixated, which needs to be replaced with strategic leadership, guided by systematic thinking in addressing system-level issues such as E-Infrastructure, power crisis or stakeholders' capacity.

DISCUSSION

The findings suggest that the headteacher may harness the technological potential at two levels. At the first level, they may use technology to improve the teaching practice and learning outcomes. Fisher (2013) argue that technology has offered enormous learning opportunities for all stakeholders, including teachers and students. It has shifted the learning symmetry from the centre to the peripheries. Once, teachers and textbooks were at the centre of learning at school, learners had a limited option of learning and interacting with teachers or caregivers in their immediate context– in the school, playground, and home.

Over the last several decades, the pedagogy and learning symmetry has shifted from centre to peripheries because of the access to the global frame of knowledge and enhanced spectrum of learning interactions, and opportunities offered by modern technologies such as ICT. Curriculum reforms, teacher capacity building, and E-infrastructure development in schools may enable headteachers to improve the quality of teaching and learning at the ECE level.

At the second level, headteachers may use technology to enhance their vision, values and management capacity to improve ECE quality. The technology may help headteachers develop a futuristic vision for ECE. Children born after 2000 are witnessing the era of Artificial Intelligence (AI) and biotechnology. The AI has been offering a new set of opportunities and challenges. According to UNESCO (2023), Artificial Intelligence may be used to address challenges and accelerate progress towards achieving sustainable development Goal-four. It may foster innovative teaching and learning practices, ensure justice and equality in knowledge access, bridge the technological divide, and encourage diverse cultural expressions through a human-centered approach to Artificial Intelligence and new technologies (Miao,

Holmes, Huang, Zhang, & UNESCO, 2021). Headteachers may harness the AI potential for integrating 21st-century literacies, global citizenship and sustainability in the ECE curriculum.

They may facilitate teachers, educators, and parents to prepare young children to function in a sophisticated world of tomorrow driven by innovation, creativity, data and AI. Lewis (2023) argues that once upon a time, we and our children had to compete with fellow humans, but with the recent developments in AI, humans will have to face machine learning, deep thinking system and the AI revolution. He further argues that we don't need to prepare our education and market systems to compete with AI but to enhance our capacity to work in an AI-driven environment. The more significant challenge is not to lose our humanity and the values that make us Human. Ethics, values and morality should accompany technological integration in our schools and education system.

This may require drastic changes to be made to ECE curriculums, community education programs, teachers' development and headteachers/principles' pre-service and in-service education and development programmes so that they can understand the under-currents of change and harness the technological potential for ECE quality enhancement. Stakeholder education, especially the headteachers' training and development programs should include aspects of AI, automation, data analytics, bio-technology and research in neuro sciences, so that they can lead ECE programs in a techno-driven educational context.

Along with the administration, and instructional leadership, 21st century, global citizenship education, suitability and ethics should also be part of headteachers' education and development programmes. Gilgit Baltistan, in general, and Hunza district, in particular, have enormous human resource potential. The community is flexible and ready to accept and facilitate positive changes required to improve the access and quality of education (Benz, 2013). With adequate planning, dedication, and political will – stakeholders (The Government, community, civil society, and school leaders) may collaborate to harness the technological potential at ECE level in Hunza as a success story and a model district for other areas.

Akhtar (2A022) demonstrates that using technology may facilitate school management in effective reporting, planning, stakeholder communication, and maintaining school discipline. The schools work in a broader social context, so ECE quality enhancement is a joint venture and not an isolated function performed by the headteacher alone. The social context (community, political leadership, and civil society) and the system (The state and Governments) should focus on building an enabling learning ecology for headteachers to perform. Robinson (2021) argues that at the system level, there is a

need to develop human capacity, technological infrastructure, innovative pedagogies, management processes, institutional structures, and mechanisms that may provide young children with digital-age teaching and learning opportunities. It may prepare them for their future, careers, education and citizenship in an uncertain, rapidly changing, globalized and digital world.

The research findings indicate that digital integration in rural areas is not easy because of the system, structural and individual capacity issues. Rahim et al. (2020) proposes a framework to address these issues, which has four aspects: The first aspect is the capacity building and role enhancement of headteachers to formulate and integrate an effective ICT policy. The second aspect is school readiness through awareness, orientation, and allocation of resources. The third aspect is developing ICT integration mechanisms in schools, and the fourth aspect includes developing policy indicators for ICT integration policy.

The above-cited aspects are difficult to achieve without political will, advocacy, and resource allocation. The Government of Gilgit Baltistan may need to develop a multifaceted approach to facilitate headteachers of private and community-based schools to harness the technological potential in the school. It is because the private and community-based schools provide education to almost half of Hunza's student population, and the state may not afford to leave them without support, supervision and policy oversight.

It may require GB Government to develop policies, provide financial support, develop E-infrastructure, train human resources, and initiate curriculum reforms to integrate technology at the ECE level in private and community-based schools. The school leadership and the local community may also look for innovative solutions to the energy crisis and bridge the technological disconnect. It may require out-of-the-box solutions and come out of the fixated approach of "wait and see" management approach. The school leadership and the community may develop partnerships with NGOs, resort to alternate energy sources, and develop local servers and technological hubs that provide learning support as intra-net offline data banks.

Conclusion

Technology is the present and future of education quality at every level. Developed countries harness the technological potential to improve teaching and learning practices, develop human resources, enrich curriculum, improve planning, enhance leadership and management practice, and develop integrated systems at the ECE level. The use and integration of technology in developing areas including Hunza, Pakistan have accelerated after the Covid-19 pandemic, and it continues to be helping teachers and educational managers effectively perform their roles and responsibilities. The case

study of the community-based school indicates that harnessing the technological potential is challenging in rural areas because of underdeveloped electronic infrastructure, energy crises, lack of training and capacity of key stakeholders and lack of policy provisions for the use of technology and ICT integration at ECE level. The community motivation and a dynamic civil society of Hunza may help mitigate some of the issues identified. The research recommends reforms for pre-service and in-service education programmes for headteachers and teachers, integration of technology, ICT and AI, 21st-century literacies for headteachers and teachers, and parents' education programmes. It also recommends that the Government develop a comprehensive strategy to facilitate, regulate and supervise the headteachers and ECE programmers' quality in private and community-based schools.

RECOMMENDATIONS

Along with the above-mentioned systemic, structural, pedagogic and leadership initiatives, the following immediate collaborative steps may help headteachers and educational leaders in Hunza and beyond to harness the technological potential for ECE quality enhancement:

A multilevel (education system, schools, and stakeholders) technological need assessment for both the public and private sectors may need to be carried out in Gilgit-Baltistan, by Government, educational institutions and, or NGOs.

A multi stakeholder policy dialogue needs to be initiated to address Hunza's technology- infrastructure, internet access, and electricity challenges.

A joint committee of educators and researchers from both the private and public (Government) schools to be tasked to review and enrich the existing ECE curriculum and make recommendations for ICT, AI, 21st-century skills, global citizenship, and suitability.

Research needs to be funded and conducted to review existing headteachers, teachers, and parents' education programmes, focusing on futuristic ECE needs and technological potential, and recommend structural and curriculum changes.

There is a need to document and highlight the best practices carried out in different schools and develop mechanisms at local and district levels to share the same with other schools and stakeholders

Technology-related policy development, review and implementation gap-analysis efforts may need to be initiated for Hunza's private/community-based schools.

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