BLENDED LEARNING THROUGH FLIPPED CLASSROOMS IN THE CAREC REGION:

Designing a Data-Driven Flipped Classroom Program

CAREC & IsDB (2025)
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BB	Broadband
BL	Blended Learning
CAREC	Central Asia Regional Economic Cooperation
CAPI	Computer-assisted Personal Interviewing
CIS	Commonwealth of Independent States
CL	Computer Lab
CP	Course Plan
CS	Census and Survey
EDA	Exploratory Data Analysis
Ed-Tech	Education Technologies
FCR	Flipped Classroom
FCM	Flipped Classroom Model
FGDs	Focus Group Discussion
GDP	Gross Domestic Product
GP	Dame player
GPS	Global Positioning System
HDI	Human Development Index
ICT	Information and Communication Technology
ID	Identification
IDC	International Data Corporation
IsDB	Islamic Development Bank
IT	Information Technology
IVR	Interactive Voice Recordings
LF	Labor Force
LMS	Learning Management System

MD	Mobile Data
MM	Multimedia
MoFEP	Ministry of Federal Education and Professional Training
PC	Personal Computer
PM	Personal Mobile
Q&A	Question and Answer
SB	Smartboard
SDT	Self Determination Theory
SED	School Education Department
SP	Smartphone
STEM	Science, Technology, Engineering, and Mathematics
STI	Science, Technology and Innovation
TV	Television
UNICEF	United Nations International Children's Emergency Fund
UNPAN	United Nations Public Administration Network
US	United States
USB	Universal Serial Bus
VL	Video Lecture

ACRONYMS

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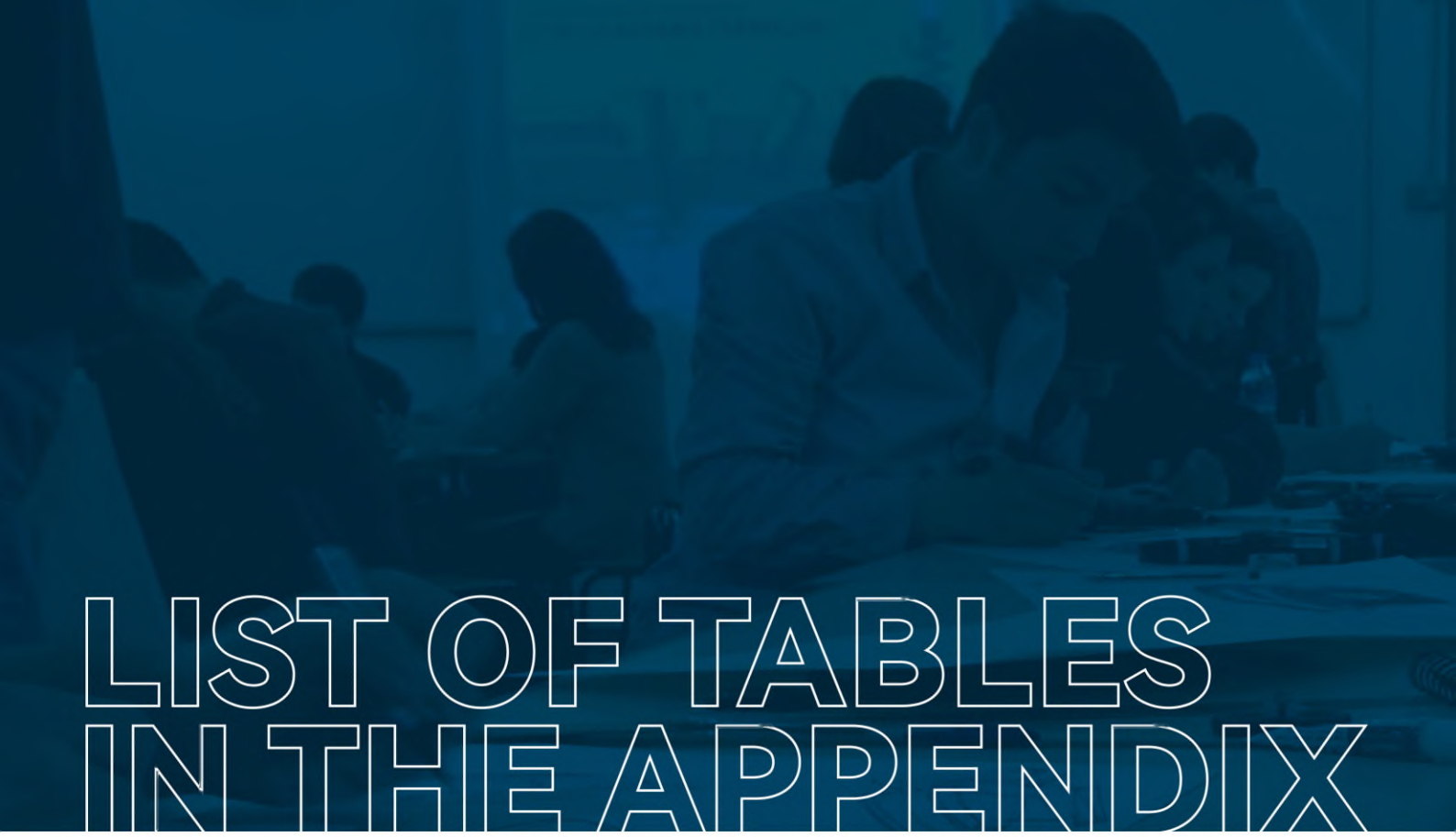

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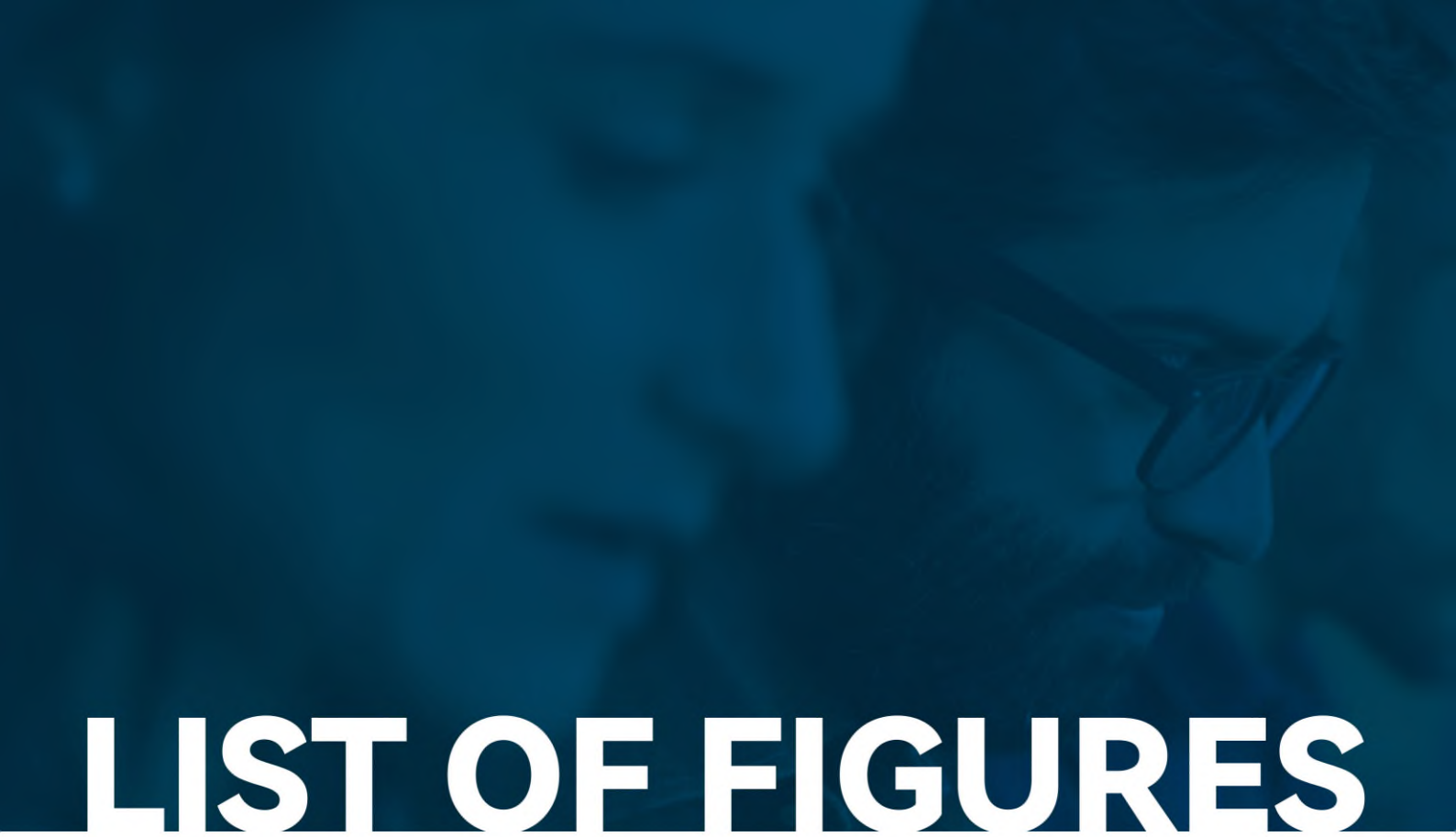

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AZERBAIJAN FOLK DANCE ENSEMBLE
CHINAR

FOREWORD

Education is the cornerstone of sustainable development, and in the face of a global learning crisis, innovative approaches such as blended learning are essential to transforming education systems to meet the challenges of the 21st century. The blended learning model leverages the use of ICT to complement in-person learning, enabling students to grasp complex STEM subjects more effectively. Students can also access top global and regional educational resources, bridging critical learning gaps and fostering a more inclusive and effective educational experience.

The Islamic Development Bank (IsDB) and the CAREC Institute are proud to present this comprehensive study on the implementation of blended learning techniques, specifically the Flipped Classroom Model, across four CAREC countries—Kazakhstan, Pakistan, Tajikistan, and Uzbekistan. This report reflects our shared commitment to enhancing educational outcomes by leveraging technology to improve the quality of classroom learning and create equitable opportunities for learners across the region. The findings highlight critical areas of focus, from bridging gaps in digital infrastructure to improving teacher training and fostering digital literacy. They underscore the importance of localized digital content, affordable internet access, and collaborative efforts among governments, educational institutions, the private sector, and international organizations. Recognizing the diverse socioeconomic landscapes, cultural contexts, and technological capabilities

of these countries, the recommendations pave the way for building resilient, future-ready education systems that can adapt to evolving challenges and opportunities.

The IsDB and CAREC Institute remain steadfast in their dedication to supporting evidence-based initiatives that drive educational reform. By investing in innovative and scalable education solutions, we aim to empower the youth in the CAREC region with the skills and knowledge necessary to thrive in a rapidly changing world. This report serves as a foundation for meaningful dialogue and partnership, inspiring collective action toward a shared vision of inclusive and quality education for all.

We extend our heartfelt gratitude to all contributors, stakeholders, and partners who have played a pivotal role in making this study possible. Together, we can harness the transformative power of education to unlock the potential of millions and shape a brighter future for the CAREC region and beyond.

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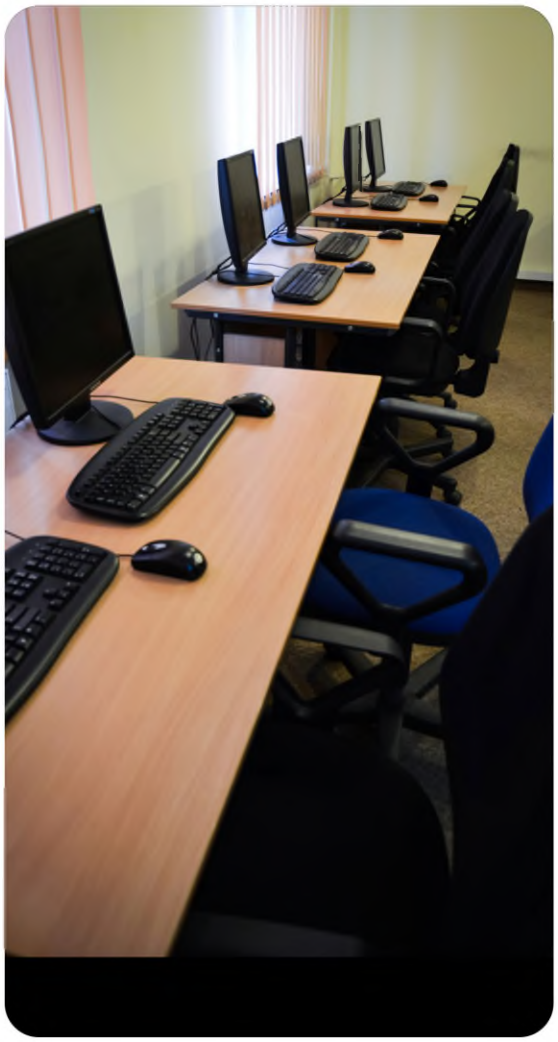
EXECUTIVE SUMMARY

Blended learning (BL) approaches, such as the flipped classroom model(FCM), are increasingly recognized as effective strategies to address the global learning crisis, though their success depends on adapting to each country's unique socioeconomic context. This study develops a customized blended learning module for four CAREC countries—Kazakhstan, Pakistan, Tajikistan, and Uzbekistan—to serve as a foundation for future educational policy and implementation. The study provides an evidence-based approach to designing region-specific blended learning strategies based on data collected from 362 students (grades 9 and 10), 60 teachers, and 20 school administrators through structured questionnaires and computer-assisted personal interviews. The findings, enriched by data analysis and insights from a virtual policy dialogue with key stakeholders, offer tailored recommendations to enhance blended learning adoption, ensuring alignment with local educational needs and priorities. The country-wise findings are summarized as follows:

Kazakhstan is well-prepared to adopt flipped classroom model and blended learning, with 100% internet penetration, reliable broadband (BB) connectivity, and minimal cost barriers for students. Schools are equipped with robust information technology infrastructure, including computers, smartboards (SBs), and multimedia (MM) devices, and both students and teachers actively use technological tools and platforms like YouTube and Google Classroom. However, gaps remain in power backup, digital libraries, information technology (IT) equipment, and training for both students and teachers, which are critical for successful flipped classroom model implementation. Teachers and students prefer concise video lectures (VLs) (5–20 minutes) and emphasize the importance of incorporating problem-solving and interactive content. Subjects like physics, chemistry, mathematics, and English are seen as ideal starting points for flipped classroom model, with a gradual expansion to other disciplines. Despite an ideal student-teacher ratio (11:1) and significant government support for information technology infrastructure, there is a need for targeted investments in teacher training, digital libraries, and equitable resource distribution. Local languages are favored for video leactures to enhance comprehension, and a blended approach combining online and in-person activities is widely supported to optimize learning outcomes.

In Pakistan, integrating the flipped classroom model and blended learning faces significant challenges due to limited internet connectivity, high costs, inadequate IT infrastructure, and a high student-teacher ratio. Most schools lack broadband access, digital libraries, and information technology equipment, while teachers and students report minimal use of technological tools. However, there is a strong recognition of EdTech's potential to improve learning, particularly in priority subjects like mathematics, physics, chemistry, and English. To ensure effective implementation, key recommendations include investing in reliable internet connectivity and IT resources, enhancing teacher training in modern pedagogical methods, and developing localized, interactive video lectures. A balanced flipped classroom model workload, short video durations (5–15 minutes), and using local languages for content delivery are essential to student engagement. Addressing infrastructure gaps and fostering teacher motivation through financial incentives and professional development programs will be critical to overcoming barriers and creating an equitable, dynamic learning environment in Pakistan.

Uzbekistan demonstrates significant potential for adopting the flipped classroom model and blended learning due to high internet connectivity and strong device penetration rates. However, regional disparities in internet access, low broadband installation at homes and schools, and financial constraints on families pose challenges to widespread implementation. Teachers and students are equipped with IT infrastructure and frequently use tools like smartboards and multimedia, yet inconsistencies in device availability persist. Respondents prioritize internet quality improvement, balanced workloads, and training for effective flipped classroom model deployment. Uzbek schools benefit from small student-teacher ratios and qualified teachers, but a lack of pedagogical training limits instructional innovation. Students favor using flipped classroom model in Computer, Chemistry,Physics, Mathematics and English, emphasizing video lectures in their native language for better comprehension. A well-designed, accessible platform and collaborative teacher-student planning can enhance the flipped classroom model experience. Despite government efforts to strengthen infrastructure, continued investment in IT resources and professional development is essential for inclusive and effective implementation of flipped classroom model.



Tajikistan's educational landscape shows potential for implementing the flipped classroom model and blended learning but faces barriers such as limited broadband access at home, inconsistent internet connectivity, and a lack of advanced IT infrastructure in schools. While 100% of schools have broadband, inconsistent IT device usage and inadequate technical support hinder adoption. Financial constraints also burden families, making low-cost solutions essential. Respondents highlight the importance of balancing online and in-person activities, utilizing diverse video lecture formats, and delivering content in local languages to enhance comprehension. Teachers play a critical role in flipped classroom model's success but require training, incentives, and infrastructural support to integrate modern pedagogies effectively. Students and teachers favor platforms that ensure accessibility, collaboration, and secure communication, and respondents advocate for prioritizing flipped classroom model implementation in core subjects like chemistry, mathematics, and physics. To address gaps, strategic investments in IT infrastructure, professional development, and flexible learning resources are necessary for a robust and equitable flipped classroom model rollout.

Overall, implementing flipped classroom models across the CAREC region effectively requires addressing critical gaps in digital infrastructure, ensuring reliable and affordable internet access, and providing robust training for educators and students. However, true transformation hinges on tailoring these interventions to the unique cultural, linguistic, and socioeconomic contexts of each country. Contextualized digital interventions—such as localized content development, user-friendly online platforms, and practical workload management strategies—are essential to ensure meaningful engagement and long-term impact.

The Islamic Development Bank (IsDB), with its deep commitment to advancing digitalization and fostering innovation in its member countries, is strategically positioned to lead this transformative effort. Through targeted investments in infrastructure upgrades, teacher capacity-building, and the creation of context-specific digital resources, IsDB can catalyze modernization across the region. Additionally, the Bank's financial and technical expertise can bridge critical funding and knowledge gaps, ensuring that solutions are not only innovative but also sustainable. Furthermore, fostering global partnerships with international organizations, private-sector technology leaders, and educational institutions will amplify these efforts, promoting innovation and resource sharing. This strategic, multifaceted approach will enhance educational delivery and ensure the sustainability and inclusivity of digital transformation, equipping the CAREC region's education systems to meet the demands of the 21st century.

Keywords: Edu-Tech; Blended Learning; Flipped Class Room: CAREC Region

01

CHAPTER ONE

BACKGROUND AND INTRODUCTION

Learning is the fundamental objective of education, yet the high levels of learning poverty indicate that educational institutions are failing to develop essential skills. This gap hinders students from reaching Sustainable Development Goal 4 of providing inclusive, high-quality education for all by 2030. Consequently, young people struggle to acquire the technical and higher-order skills needed to thrive in competitive labor markets, while countries face challenges in building the essential human capital for inclusive economic growth (World Bank, 2022).

The World Bank and UNESCO introduced the learning poverty index in 2019 to draw attention to the worldwide learning challenge. Approximately 250 million children worldwide are affected, with over half considered 'learning poor,' which negatively impacts their prospects and development. Even before COVID-19, 48 percent of the world's children—and 90 percent of children in low-income countries—were learning poor: unable to read and understand a simple text by age ten (World Bank, 2019). The COVID-19 pandemic has exacerbated the existing learning problem and increased the learning poverty rate to 71 percent in low- and middle-income nations and 86 percent in Sub-Saharan Africa. The epidemic has also impeded worldwide advancements in addressing learning poverty, resulting in an increase in global learning poverty in 2022. The prevalence of global learning poverty suggests that the education systems

in developing nations have failed to provide effective learning (World Bank, 2022). The pervasive lack of education among youngsters poses a significant risk to their nations' future and economic potential. There is an urgent need for coordinated efforts to combat learning poverty, with every society prioritizing the wellbeing of today's children (World Bank, 2022).[1]

One of the main reasons for learning poverty in developing countries is the shortage of qualified teachers and adequate school facilities. Many schools in these regions are overcrowded and lack basic resources such as textbooks, study guides, and technology. Moreover, girls are often disadvantaged owing to cultural norms prioritizing the education of boys. The curriculum in some countries may not be tailored to the needs and abilities of students, further exacerbating the problem of learning poverty. Technological advancements, such as BL, can help improve critical thinking, problem-solving, and collaboration skills.

Educators use personalized instruction to maximize learning through technology to meet individual student needs, allowing them to identify weak points. This includes distinguishing the needs and capabilities of individual learners, making instruction meaningful and relevant, providing flexibility in scheduling assignments, and catering to students' diverse needs and pace of learning (Keefe, 2007). Personalizing instruction aims to replace traditional education models with customized instruction to assist students who require additional time to acquire knowledge and skills. BL effectively maintains children's engagement beyond the confines of the classroom environment. Traditional

[1] Report: The State of Global Learning Poverty: 2022 Update

classrooms cannot always provide this type of differentiation, which leads some educators to recommend a BL environment (Dziuban, 2004; Garrison & Kanuka, 2004; Cornelius & Gordon, 2008; Verkroost et al, 2008; Patterson, 2016), which incorporates technology to 'flip' the classroom (Bergmann et al, 2012).

In an FCM, students watch recorded or online lectures as pre-classwork before participating in discussions, peer teaching, presentations, projects, problem-solving, computations, and group activities during the actual class period. In other words, this method flips the typical content presentation, in which lectures are covered in class, and problem sets or group projects are assigned for homework (Roehling & Roehling, 2018). The FCM uses online and offline learning—two opposite ends of the spectrum—to significant effect (Roehling, 2017).

The major barriers to digital learning persist, with factors such as lack of electricity, internet connectivity, affordable data, devices, and parents' lack of literacy and digital skills impeding equitable access. Additionally, children from the poorest families feel less confident coping with digital learning activities. However, BL/FCM instruction may exacerbate learning inequality owing to a standardized curriculum and evaluation not tailored to region-specific needs. The lack of competency among all instructors to implement BL/FCM techniques effectively, along with insufficient or unequal access to digital infrastructure and varying levels of digital literacy among learners, further contribute to this disparity. A potential conflict may exist between the adherence to

standards and the promotion of competency-based advancement and student choice. Designing content for specific contexts around learning goals is vital for effective learning platforms (UNICEF, 2021).[2]Additional obstacles include the constrained timeframe within the academic calendar for personalized learning and uncertainty and resistance to change (Cobo et al., 2023).

The socioeconomic landscape of the countries plays an immense role in determining the application, adaptability, acceptance, and performance of technology-assisted learning tools (World Bank, 2022). Conversely, country- and region-specific BL modules must incorporate region-specific dynamics while integrating technology into the education system. Against the above backdrop, this study was designed primarily to provide a region-specific BL module that aims to improve the quality of education through FCM. The study was conducted in four CAREC[3] countries with a mixed level of technology integration ranging from less use of technology to advanced levels in countries like Kazakhstan.[4]

[2] Policy Brief: Digital Learning For Every Child: Closing The Gaps For An Inclusive And Prosperous Future

[3] The Central Asia Regional Economic Cooperation (CAREC) Program, a collaboration of 11 countries and development partners, aims to accelerate economic growth and poverty reduction through cooperation. Since 2001, it has invested US$51.02 billion in projects, establishing multimodal transportation networks, increasing energy trade, and facilitating free movement. CAREC Institute transitioned to BL with a fully functional eLearning platform in 2020, transitioning from traditional face-to-face workshops to cascading and blended programs.

[4] Pakistan, Kazakhstan, Uzbekistan, and Tajikistan

1.1 STUDY OBJECTIVES

This study developed a blended/FCM to improve access to quality education and learning in the CAREC region by integrating affordable digital technologies. To achieve this, the objectives of the study comprised the following:

a) Identify the critical requirements for developing an FCM in CAREC countries

b) Assess the feasibility of adopting the different BL/FCM models

b) Develop policy and program-based recommendations for BL in CAREC

1.2 STUDY SCOPE

This study aims to develop a region-specific BL module for FCM in four CAREC nations: Kazakhstan, Pakistan, Tajikistan, and Uzbekistan. Two districts per country and two schools per district were selected for sample selection. The selection of districts was determined by each country's average human development index (HDI) to represent the medium level of socioeconomic development. However, we specifically chose schools where minimal educational technologies were already being used to gather informed responses on BL techniques.

An equal gender representation of boys and girls was maintained in the sample to explore gender dynamics. About 362 students, 20 school administrators, and 60 teachers were interviewed from the selected schools. The study focused on public sector school students in grades 9 and 10 as well as teachers and administrators in those schools. Public schools were selected since the study aimed to inform policymakers on the current readiness of FCM and the key features needed to utilize technology effectively to improve the quality of education in public schools.

The rest of the report is organized as follows: chapter 2 covers the education context by country, detailing the status of the education systems in the four countries. Chapter 3 explains the study methods, including data collection, sampling selection, management, and analysis. Chapter 4 details the features of the proposed FCM for the CAREC region, while Chapter 5 discusses the study findings. Chapter 6 provides a summary of the findings and recommendations.

02

CHAPTER TWO

COUNTRY EDUCATION CONTEXT

The CAREC region is currently focusing on digitalizing the education sector, with Kazakhstan leading the way with initiatives like the 'Digital Kazakhstan' program. On the other hand, Uzbekistan, Pakistan, and Tajikistan face infrastructure and connectivity challenges. Despite these challenges, there is growing recognition of the importance of digital literacy and online learning platforms. As CAREC prioritizes regional cooperation, sharing best practices and collaborative efforts could lead to a more technologically advanced educational landscape. This subsection briefly provides the profiles of the four selected countries: Uzbekistan, Pakistan, Tajikistan, and Kazakhstan. The details of digitalization, with some facts and figures for these selected countries, are provided in the following subsections.

2.1 KAZAKHSTAN

Kazakhstan's information and communication technology (ICT) sector has witnessed remarkable growth, particularly in its application within the education sector (Sembekov et al., 2021). This development indicates a robust digital transformation strategy, as evidenced by the significant impact of ICT interventions in enhancing learning outcomes within the education sector.

On the other hand, Toimbek (2022) highlights Kazakhstan's recent developments in digitalization, while shedding light on the progress made in integrating technology across various sectors. However, the study also identifies several significant obstacles to achieving comprehensive digitalization, such as infrastructure gaps, limited digital literacy, and insufficient technological capabilities, among others. The study also indicates that Kazakhstan lags behind other countries in leveraging digital communication technology to advance the education sector. As a result, enhancing the ICT sector has become a key focus of the state's policy, recognizing its critical role in driving progress and innovation in education. Table 1 presents a summary of key digital indicators for Kazakhstan.

Table 1:Summary of main development indicators of Kazakhstan

E-government development index	Ranked 24th globally
Internet speed index	Ranked 43rd globally; mobile: 34.07 Mbps; fixed BB: 44.94 Mbps
Internet penetration rate	91 percent
Digital skills gap index	Ranked 76th globally
Available education platforms	BilimLand, Kundelik, Daryn Online

Source: UNPAN (2023), Speedtest (2024), Dataportal (2023), Wiley (2021)

The government has launched initiatives such as the 'Digital Kazakhstan' program to accelerate the digitalization of the education sector. This ambitious program, aims to integrate advanced digital technologies into educational systems and boost IT service exports to US$1 billion annually by 2026 (IDC, 2023). Furthermore, Kazakhstan is implementing the 'Affordable Internet' project to improve its digital infrastructure. The country is committed to advancing 5G technology and aims to achieve 75 percent population coverage by 2025. AstanaHub, a prominent technology park in Kazakhstan, plays a crucial role in fostering innovation by offering various incentives to the IT industry including tax exemptions and support for startups. This initiative is part of the government's broader strategy to strengthen the IT sector and position Kazakhstan as a leading regional tech hub. The pandemic exacerbated the digital divide, highlighting the need for ICT access, literacy, and meaningful outcomes in digital education, particularly in schools transitioning to online platforms. Bokayev et al.'s (2021) study on Kazakhstan's distance learning strategy revealed challenges like weak internet infrastructure, ineffective stakeholder engagement, and unreliable data, causing a disconnect between policy intentions and educational outcomes. The UNICEF and World Bank report emphasizes the need for learner-centered approaches in digital and BL. The education sector is rapidly adopting BL models to meet diverse needs and improve learning outcomes. However, challenges like teacher training persist, highlighting the need for a more cohesive approach (Ussipashim & Niyazova, 2019; Bedebayeva et al., 2022).

2.2 PAKISTAN

The education system in Pakistan faces significant challenges, including inequity, poor quality, and a lack of universal inclusivity, particularly for girls. Gender disparities and the rural-urban divide in access to education, infrastructure, and quality are prominent issues. Millions of children either leave school or drop out early in their education. Systemic problems such as an outdated curriculum, inadequate teacher training, limited resources, and a substandard infrastructure contribute to Pakistan's poor education indicators. Schools need help with chronic issues like underfunding, ineffective management, and corruption, resulting in a lack of essential physical and human resources. The disparity between public and private schools is also widening, further exacerbated by the inherent deficiencies in the public education system.[5]

Nonetheless, obstacles, including financial limitations and limited internet access, impede education in remote areas (Guraya et al., 2021). In response, the country turned to educational technology (EdTech) tools such as TV, radio, and mobile phones for remote learning. The Ministry of Federal Education and Professional Training (MoFEPT) and the School Education Department (SED) of Punjab launched education TV programs Taleem Ghar and TeleSchool (World Bank, 2021a). As a result, in recent days, ICT inclusion has been more pronounced in Pakistan. The education sector has introduced new reforms in online learning—such as combining online materials with

[5] Nurturing creativity in Pakistani education: Challenges and solutions, Cutting Edge, 18(32-33) https://weeklycuttingedge.com/nurturing-creativity-in-pakistani-education-challenges-and-solutions/

traditional classroom methods—to enhance its education (Maham, 2022). Pakistan has implemented digital education initiatives like e-Learn Punjab, TeleSchool, and Radio School to boost literacy and educational outreach. MoFEPT launched a BL initiative in collaboration with Knowledge Platform, TeleTaleem, and Robotmea to ensure continuity during the pandemic (Syed et al., 2021).

Pakistan has successfully implemented BL and digitalization in schools, with support from organizations like the World Bank, UNESCO, and UNICEF. However, challenges like internet connectivity and lack of digital infrastructure still need to be addressed. Table 2 provides details of Pakistan's leading development indicators (UNICEF, 2021).

Table 2:Summary of main development indicators of Pakistan

E-government development index	Ranked 150th globally
Internet speed index	Ranked 76th globally; mobile: 10.15 Mbps to 15.5 Mbps; fixed BB: 10.15 Mbps to 15.5 Mbps
Internet penetration rate	36.7 percent
Digital skills gap index	Ranked 94th globally
Available education platforms	Khan Academy, Sabaq.pk, and Ilmkidunya

Source: UNPAN (2023), Speedtest (2024), Dataportal (2023), Wiley (2021)

Pakistan's 150th position in the e-Government Development Index underscores the pressing need for digital transformation and highlights a critical opportunity to enhance public service delivery through ICT. While the country's internet speed ranges from 10.15 Mbps to 15.5 Mbps, sufficient for data-intensive activities like online learning, its low internet penetration rate of 36.7 percent reveals a significant digital divide. This divide could limit the effectiveness of online education initiatives and exacerbate educational disparities. Pakistan ranks 94th globally in the Digital Skills Gap Index, indicating a significant digital skills gap that must be addressed to support its digitalization goals.

Pakistan faces significant challenges in digitalizing its education sector, primarily due to various socioeconomic constraints. Among these, limited internet connectivity issues in rural and underserved areas remain a major barrier, restricting access to online learning resources for a significant portion of the population. The lack of adequate digital infrastructure further compounds the issue, as many schools and institutions are not equipped with the necessary tools, such as computers, MM devices, or functional learning management systems (LMS). Public confidence in digital education remains low, often due to limited exposure and familiarity with technology among educators, students, and parents. The shortage of qualified specialists to implement and maintain

digital systems, coupled with inefficient government funding for digital initiatives, exacerbates the problem (World Bank, 2021b).

The Federal Ministry of Education has introduced several new initiatives for schools in the capital city (Islamabad), including the development of digital content in line with the national curriculum set by the Education Ministry and an LMS portal where students and teachers can sign up. The contents are also available in the local language, and students can learn the concepts at their own pace. The teacher is given access to monitor several metrics, including enrollment, attendance, and performance, among others. The LMS portal in Pakistan can be accessed by the school principal and the country's Education Secretary, offering a comprehensive platform for managing educational activities. However, this system has only been introduced exclusively in Islamabad. To ensure that students nationwide can benefit, the Education Ministry needs to launch awareness campaigns to promote the platform's advantages and accessibility.

2.3 UZBEKISTAN

The education system in Uzbekistan has encountered numerous obstacles, such as an outdated curriculum, insufficient teacher competence, discrepancies between rural and urban areas, gender inequality, inadequate budgets, ineffective school management

and governance, poor adoption of technology, and uneven policy enforcement. Access to high-quality education is constrained in rural areas because of the need for better trained teachers, insufficient infrastructure, and restricted finances (World Bank, 2021). Uzbekistan has made significant progress in implementing ICT in public and private schools, focusing recently on inclusivity and tailored instruction. The country has created a robust BL environment with the support of organizations like UNICEF. However, Uzbekistan's digital transformation is moderate, ranking 69th in the e-Government Index. The Ministry of Public Education has introduced several in-house digital platforms to enhance the quality and accessibility of education across the country. These platforms include Talim.uz, EduMarket, Eduportal, and Kitob.uz. These platforms are part of Uzbekistan's broader effort to modernize its education system by leveraging digital technologies. Uzbekistan has an internet penetration rate of 76.6 percent, which shows progress but still leaves room for improvement. The country ranks 76th globally on the Digital Skills Gap Index, highlighting the urgent need for further investment in digital literacy and skills development to ensure that all citizens can fully benefit from digital advancements.

In 2019, UNICEF intensified its technical assistance to the Government of Uzbekistan, assisting with curriculum reforms based on a competency-based approach (UNICEF, 2021). When the COVID-19 pandemic disrupted education for approximately 6.2 million learners in Uzbekistan, UNICEF and the government quickly implemented BL programs and individualized remedial learning to address learning losses. These programs aimed

to reorient teachers and instructors and group students according to their learning levels. Since September 2020, these programs have reached 9,825 schools, benefiting 4,437,262 students from Grades 1 to 11. From 2018 to 2020, the proportion of Uzbekistan's population equipped with essential digital skills increased from 13.6 percent to 14 percent, while those with standard digital skills rose from 6.8 percent to 8 percent. Over these three years, an additional 300,000 people gained digital skills, followed by another 500,000. Despite this progress, Uzbekistan still lags behind the CIS-leading countries.

Overall, Uzbekistan's progress in digitalization is commendable. However, many obstacles hinder the use of ICT in the education sector, including the digital divide, poor training, and insufficient ICT infrastructure. Meanwhile, further enhancements are needed to ensure universal access and the effectiveness of digital educational platforms. Development indicators of Uzbekistan are expressed in Table 3.

Table 3:Summary of main development indicators of Uzbekistan

E-government development index	Ranked 69th globally
Internet speed index	Ranked 95th globally for mobile and 90th for fixed BB speeds
Internet penetration rate	76.6 percent
Digital skills gap index	Ranked 76th globally
Available education platforms	The Ministry of Public Education lists its in-house platforms, including Talim.uz, EduMarket, Eduportal, and Kitob.uz

Source: UNPAN (2023), Speedtest (2024), Dataportal (2023), Wiley (2021)

2.4 TAJIKISTAN

Tajikistan's education system is vulnerable to uncertain situations, leading to increased educational inequality and functional illiteracy. Factors such as demographic growth, insufficient digital literacy, low teaching prestige, and chronic underfunding in public schools hinder the digital transformation. In addition, students from low-income families, remote areas, minorities, and those with special needs are the most vulnerable. The availability of ICT in these areas is limited, resulting in a significant fraction of the population being deprived of access to digital educational platforms. The weak digital skills of teachers contribute to the challenges of BL implementation. Table 4 gives development indicators for Tajikistan.

Table 4:Summary of main development indicators of Tajikistan

E-government development index	Ranked 129th globally
Internet speed index	Ranked 136th globally; mobile: 5.45 Mbps to 8.15 Mbps; fixed BB: 26.35 Mbps to 27.28 Mbps
Internet penetration rate	35.44 percent
Digital skills gap index	Ranked 94th globally
Available education platforms	E-Maktab, eDonish, Kitobkhana.tj, Kitobdust, Omuzgor mobile

Source: UNPAN (2023), Speedtest (2024), Dataportal (2023), Wiley (2021)

Tajikistan has one of the lowest fixed-line penetrations in Asia (40.8 percent) and one of the lowest BB penetration rates worldwide, with 59 percent of the population still offline. With only 35 percent of the population using the internet, the country faces challenges in basic information and digital literacy, including knowledge and skills in digital and information security. In 2007, the Ministry of Education imposed a ban on phones and tablets in schools, citing concerns over the potential negative impact they could have on students' focus and academic performance. The government believed that the widespread use of these devices could lead to distractions, hinder the learning process, and promote cheating during exams. The policy was part of broader efforts to regulate the use of technology in educational settings, where traditional teaching methods were still dominant, and there was little emphasis on digital tools in classrooms. However, this decision has faced criticism in recent years as the world increasingly embraces digital learning. In the context of the ongoing digital transformation, particularly the shift toward blended and online learning, the ban has been viewed as an obstacle to equipping students with the digital skills needed to succeed in the modern world.

Tajikistan is now transitioning to digital education in an effort to modernize its education system, align with global digital trends, and address the growing demand for technological literacy among its citizens. The transition is being implemented in three distinct stages, each with its own set of objectives, timelines, and milestones. The first phase is the Initial Implementation stage (2023-2026), focusing on upgrading infrastructure, training educators, and introducing digital tools into schools. The

government is prioritizing internet connectivity and equipping schools with essential ICT resources. The second phase - Expansion (2027-2030), aims to expand digital education to rural and underserved areas, improving internet infrastructure, introducing digital tools, and strengthening e-learning platforms. The final phase - Full Integration (2030-2040), aims for a fully integrated digital education system, blending traditional classroom instruction with online content. The focus is on continuous digital content evaluation and enhancement, encouraging lifelong learning and participation in the evolving digital economy. In 2022, the first innovative training and educational center opened in Dushanbe to provide digital training to students and teachers. In December 2023, Tajikistan took a significant step toward improving its digital infrastructure by connecting to the Chinese internet. This move marks an important milestone in the country's efforts to address its digital connectivity challenges and expand its access to global online resources. Tajikistan's decision to connect to China's internet is largely driven by its need to overcome its internal connectivity limitations. For many years, Tajikistan's internet access has been hampered by poor infrastructure and geographical challenges, particularly in rural areas. The country has relied on limited external internet connections, primarily through neighboring countries, which has often resulted in slow and unreliable service. By connecting to China's internet, Tajikistan can tap into China's well-developed digital infrastructure, which has been a global leader in the expansion of high-speed internet and digital connectivity.

03

CHAPTER THREE

STUDY METHODOLOGY

This chapter outlines the methods for sample selection, data collection, interview and survey management, and the type of analysis used for data synthesis and analysis.

3.1 SAMPLING FRAMEWORK

Pakistan, Kazakhstan, Uzbekistan, and Tajikistan from the CAREC region[7] were selected for data collection, targeting public sector school students in grades 9 and 10. The school selection was based on middle school and above, where children become more independent and less dependent on their parents at age 13 and above. Furthermore, global standardized testing results like PISA are also available for this age group. The

[7] These four CAREC nations—Uzbekistan, Tajikistan, Pakistan, and Kazakhstan—represent Central and South Asia and were chosen for their diversity in geography and culture.

academic literature suggests that a suitable starting point for independent learning is middle school (grades 6 to 8) and high school level (9 and 10), which is considered the fourth stage of cognitive development, according to Piaget's theory, spanning 12 to 15 years (Ahmad et al., 2016). This level often marks a transition period for students, where they can benefit significantly from BL's increased engagement and personalized learning opportunities. Therefore, the study selected grade 9 and 10 students as the target population.

The study targeted public sector schools in the selected countries owing to their outreach to most of the population. The Global Education Monitoring Report (2021) highlights that most countries (over 80 percent) prefer public education provision. There are three prime reasons for selecting public schools for the study. The main justification for choosing public schools is their provision of universal access, as they serve most students, especially in low-income countries. By prioritizing public schools, governments can strategically focus on diverse individuals, including marginalized and low-income populations, to guarantee that efforts to alleviate educational inequalities are comprehensive and fair.

Because of their substantial scale and widespread influence, public schools can implement policies to improve educational outcomes for a large and diverse population (World Bank, 2018[8]). In addition, children attending public schools, particularly in low-income countries, face a greater incidence of learning poverty owing to intrinsic inadequacies in the education system. The problem is related mostly to the system, requiring significant modifications in education policy, allocation of resources, and

[8]World Development Report 2018: Learning to Realize Education's Promise

management of schools. Third, public schools are directly responsible to government institutions and, thus, to the broader public. The presence of accountability ensures a focused endeavor toward attaining educational standards and improving outcomes, which is essential for reducing the gap in learning (World Bank, 2019[9]).

The districts were selected based on HDI scores representing the country's average socioeconomic development. Kazakhstan's average score was very high compared to Pakistan's, so the selection was based on the country's average. Districts from highly advanced or highly marginalized/underprivileged zones/regions of the country were avoided since they already occupy extreme quintiles in IT infrastructure and represent only a small portion of the population. Conversely, districts with the lowest socioeconomic status were not selected due to inadequate school and household IT infrastructure. If students are unfamiliar with educational technologies, the study's goal of evaluating student perceptions of BL techniques will be ineffective. However, a little variation in district selection was made, and schools were selected based on previous use of BL techniques to collect well-informed responses from the target population.

The sample selection process involved the use of three-stage random sampling techniques. In the first stage, two districts were chosen from each country. In the second stage, one boys' school and one girls' school, or two coeducational schools, were selected from each district. In the third stage, 17 to 18 students, three teachers, and one school administrator were chosen randomly from each school for the interviews.

[9] Ending Learning Poverty: What Will It Take? (2019)

The study followed a random sampling technique for data collection and divided data into clusters at district level in each country. A simple random sampling method was employed to calculate the necessary sample size, ensuring that each member within the target group had an equal probability of being selected. This approach facilitated the acquisition of a representative sample, which was crucial for ensuring the validity of the study's findings.

The sample size was determined by considering the population size, required degree of confidence, and margin of error to assure statistical reliability (Thomas, 2023). The sample was calculated using the standard sample calculation formula given below:

$$\text{For infinite population:} \quad n = \frac{z^2+\hat{p}(1+\hat{p})}{\varepsilon^2}$$

where confidence level(z-score) = 1.96, population proportion (p) = 50 percent and ϵ (margin of error) = 5.05 percent. The sample calculated is 362 students. However, the study's total sample was 442, including teachers and administrators, which further reduced our margin of error to 4.66 percent. To generate a representative sample that aligns with the population proportions, we determined the weight of each group in the sample by calculating their proportion in the population and applying it to the sample size. This weight was then utilized to choose individuals from each country; however,

owing to heavy differences in population size in Pakistan and the other three countries, the weights were adjusted to avoid overrepresentation from Pakistan.

Table 5:Sample with exact/assigned population weight

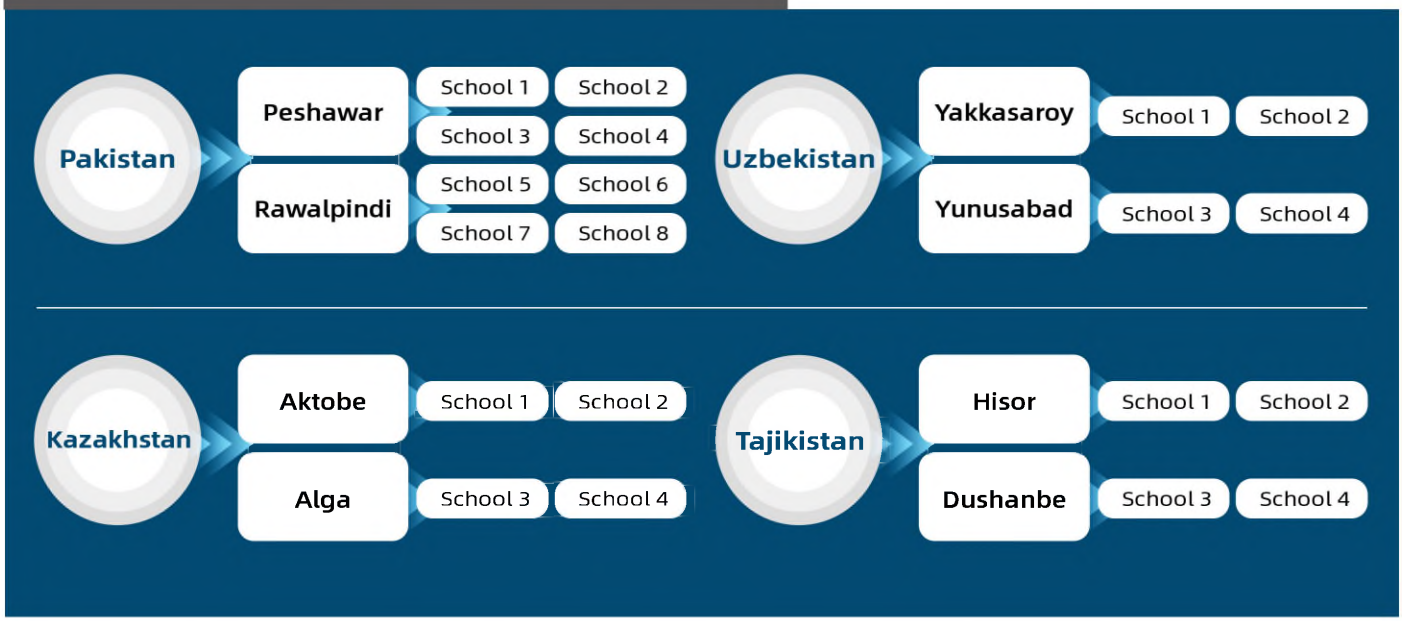
Country	Population weight (%)	Assigned weight (%)	Students	Districts	Schools	Teachers	Administrators
Pakistan	0.782	0.4	140	4	8	24	8
Tajikistan	0.036	0.2	70	2	4	12	4
Kazakhstan	0.065	0.2	70	2	4	12	4
Uzbekistan	0.117	0.2	70	2	4	12	4
Total	**1.000**	**1.0**	**350**	**10**	**20**	**60**	**20**

Note: The sample for Pakistan was double that of the other countries. The budgetary and time constraints have limited our sample size to 20 schools only.

This methodology ensures the sample accurately represents the population, allowing for reliable conclusions based on the analysis. Accordingly, we assigned 40 percent of the total weight to Pakistan and 20 percent to each other country based on their respective population weight. Table 5 indicates the samples assigned per country. To account for gender dynamics, one male and one female school from each district was selected. The study interviewed 362 students: 148 from Pakistan, 70 from Kazakhstan, and 72 each from Tajikistan and Uzbekistan. A total of 59[10] teachers were interviewed; 24 were from Pakistan, 11 were from Kazakhstan, and 12 were each from Tajikistan and Uzbekistan (Table 5).

10 The teacher responses were one fewer than planned owing to availability issues.

Figure 1: Sampling framework



Source: Prepared by the authors

Figure 1 shows the hierarchy of the sample selection, detailing the districts and schools selected. Based on the criteria stated earlier, the sampling from the selected countries is given in Table 5.

Table 6:Student sample (district, gender, age, and grade)

Country	District	Mean age	Students	Male	Female	9th	10th	Total
Pakistan	Rawalpindi	14.80	75	39	36	76	0	151
	Peshawar		73	37	36	19	53	145
Kazakhstan	Aktobe	15.27	34	17	17	23	11	68
	Alga		36	15	21	16	20	72
Uzbekistan	Yunusabad	15.73	36	12	24	16	20	72
	Yakkasaroy		36	19	17	25	11	72
Tajikistan	Hisor	15.79	36	19	17	17	19	72
	Dushanbe		36	18	18	17	19	72
	Total	**15.40**	**362**	**176**	**186**	**209**	**153**	**724**

The student respondent data was evenly split between male (49%) and female (51%) respondents. Of the students, approximately 42 percent were in grade 10, while 58 percent were in grade 9. Moreover, one administrator/principal and three teachers from each school were also interviewed (Table 6).

Table 7:Respondent division (district, gender, and subject specialization)

Country	District	Teachers	Male	Female	National language	English language	Computer	Science	Arts	Total
Pakistan	Rawalpindi	12	6	6	2	2	2	4	2	12
	Peshawar	12	6	6	0	2	0	8	2	12
Kazakhstan	Aktobe	6	1	5	0	2	0	4	0	6
	Alga	5	1	4	0	2	2	1	0	5
Uzbekistan	Yunusabad	6	0	6	2	1	1	2	0	6
	Yakkasaroy	6	0	6	2	2	0	2	0	6
Tajikistan	Hisor	6	3	3	1	0	2	2	1	6
	Dushanbe	6	3	3	0	2	0	3	1	6
	Total	**59**	**20**	**39**	**7**	**13**	**7**	**26**	**6**	**59**

Of the teacher respondents, 34 percent were male and 66 percent female (Table 7). In the administration sample, 29 percent of the respondents were male, while 71 percent were female.

3.2 DATA COLLECTION PROCESS

3.2.1 Study instrument design

The data was collected through structured questionnaires. Separate questionnaires were prepared for students (Grades 9 and 10), teachers, and administrators. The survey instruments were developed, taking insights from the literature and the fact sheets prepared for the target countries. The first drafts were shared with the country consultants for validation; their feedback was incorporated into the second drafts of the instruments. The instruments were then piloted in all four countries, and the findings led to the final design of the instruments. The student questionnaire covered the socioeconomic profiles of students and demand-side factors such as barriers, access, and usage of technology by the students and their perceptions, as well as their experience regarding FCM and other technology-assisted learning tools. The teacher questionnaire covered supply-side factors such as teacher instruments, training requirements, and technology usage by the teachers. Respondent perceptions and experiences regarding FCM and other technology-assisted learning tools were also recorded. The administrative instruments included questions about technology infrastructure, cost, feasibility, and coordination from the relevant governments.

3.2.2 Interview method

The survey was conducted through face-to-face interviews using the Computer-

Assisted Personal Interviewing (CAPI) method. Separate applications were developed for students, teachers, and administrators. To ensure the country consultants used the CAPI applications effectively, a training session was conducted by the international consultant. The surveys were conducted by the country consultants, supported by two enumerators in each country. The fieldwork in all four countries was conducted between 20 April and 10 May 2024.

3.4 SURVEY AND DATA MANAGEMENT

A rigorous approach was adopted to ensure data quality and management. The use of CS entry enabled the integration of a GPS feature into the applications that facilitated tracking interview locations, start times, and end times. This ensured that the enumerators were present in the designated areas during the interview. The enumerators were instructed to synchronize the interviews daily to monitor real-time entry and ensure the smooth execution of the survey. Country consultants were also stationed at their respective locations to personally oversee the surveys and ensure data integrity. To maintain data consistency, skip patterns and logical checks were integrated into the CS applications. A backup system was also set up on the international consultant's PC to store and update data daily. When the survey was completed, the data was exported into Stata and Excel sheets for analysis. Finally, the data was carefully reviewed for inconsistencies, and errors were rectified with the assistance of callbacks to the enumerators and country consultants.

3.5 DATA SYNTHESIS AND ANALYSIS

The data was imported into Stata for cleaning and sorting. Each entry was verified and matched with the respondent ID to resolve discrepancies and remove duplicates. Missing data was carefully checked to distinguish skipped entries from errors, with follow-up calls made to correct data entry mistakes. Text responses were standardized by removing extra spaces and unifying text cases. The data was further validated by checking for logical consistency and correcting outliers (e.g., student ages outside 10-30) through follow-ups with enumerators.

Stata-16 is utilized for data analysis. The study employs a three-fold aggregation of the findings: Descriptive statistics summarize and organize the results, providing insights into the frequency distributions, means, and ranges. Exploratory data analysis (EDA) was conducted to examine the data without relying on a predefined model. Through visualizations, patterns were identified, and key findings were highlighted. Together, these methods provided a thorough understanding of our dataset's characteristics and facilitated meaningful interpretation of results.

The transcripts from open-ended questions from the three study instruments are analyzed through content analysis. The insights from this qualitative analysis are used to refine the policy suggestions and the design of the proposed regional program.

Following the draft report, a virtual policy dialogue was organized with key stakeholders from all participating countries to discuss the study findings and country-specific recommendations. The feedback received from the stakeholders was used to refine the policy recommendations for each country included in the study.

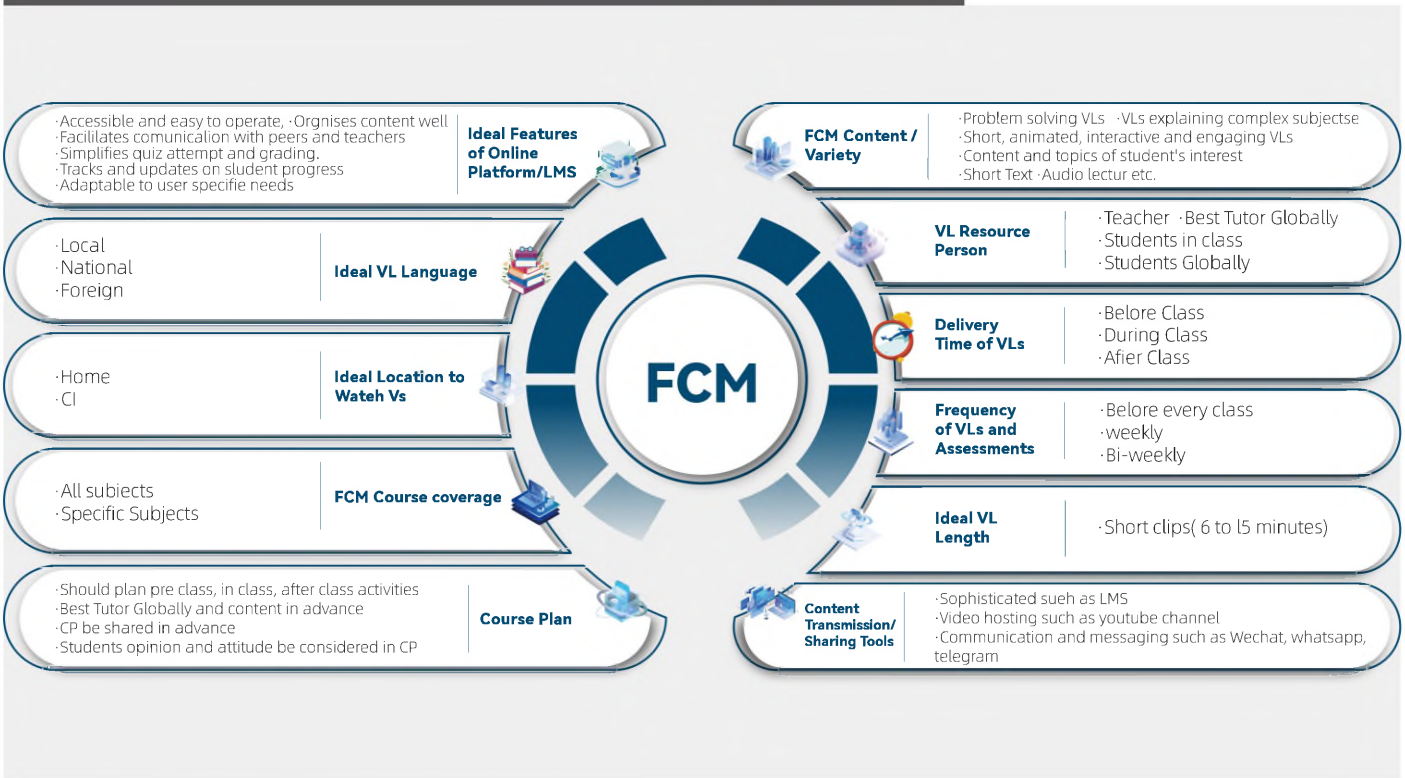
04

CHAPTER FOUR

STANDARD FEATURES OF THE FCM

This section presents the theoretical background of some of the features explored in the study. Figure 2 presents some key features of FCM that are usually discussed in the literature for implementing FCM. It summarizes key debatable features of FCM that are well explored by the existing literature; these usually revolve around content delivery time, ideal location to watch, course coverage, content variety, development, course plan (CP), frequency of online workload, length and language of video resources, and factors to implement FCM effectively. We explain them in detail after Figure 2 by taking insights from the academic literature.

Figure 2: Theoretical features of FCM



4.1 VL SHARING TIME

The first feature is the delivery time of the VL resources to the students, which may be before, during, or after class. The literature suggests that each time slot has its reasoning, content specification, activities, and outcomes.

Before class: The FCM concept entails students acquiring fundamental material before class to prepare for in-class activities, referred to as self-paced learning, self-directed learning, or self-regulated learning. Self-paced learning empowers learners to manage their study schedules and exercise autonomy in selecting the content they wish to engage with. Self-regulated learning enables individuals to effectively manage and purposefully direct their learning activities to optimize long-term well-being and success. For content given before-class, it is essential to provide learning activities with well-defined objectives, to enable students work at their own pace to maximize their focus and effort, and offer self-assessment tools to assist students in tracking their progress in learning. Research indicates that students can proficiently acquire knowledge independently using diverse methods, including commercially available textbooks, reading material created by instructors, instructor-produced videos, or animations (Schmidt & Ralph, 2016; Persky & Pollack, 2010).

During class: The FCM depends on active participation during class, necessitating students to come prepared. To incentivize students to complete pre-class study, educators should communicate their expectations, incorporate self-assessment questions within the material, utilize pertinent examples, visuals, or videos, and ensure that students are responsible for their learning. Evidence suggests that students can learn foundational content independently, and clear communication, accountability, interactive activities, and efficient material design can enhance instructor engagement. Active learning in an FCM can foster higher-order thinking skills, collaborative skills, and self-awareness.

To optimize learning, instructors should align their activities with pre-class learning and course objectives, using real-world examples and challenges to illustrate the relevance of pre- and in-class activities. Instructors should provide scaffolding or intellectual support to transition from simple concepts learned before class to complex ideas and applications during class (Freeman et al., 2014).

After class: The design of after-class work necessitates complexity, appropriate spacing, and defined time constraints. Attaining mastery can be accomplished by commencing with uncomplicated exercises and gradually incorporating more intricate elements. Concentrated and repetitive practice can also facilitate the transfer of learning, which involves solving new issues in similar or distinct situations (Dupuis & Persky, 2008). Diversifying after-class events enables students to apply their skills to different contexts and disciplines. In conclusion, active learning in an FCM can enhance student understanding, problem-solving, and self-awareness. Instructors should adhere to the flipped model during class and provide flexible learning opportunities to support student motivation and retention after class (Persky & McLaughlin, 2017).

4.2 FEASIBLE LOCATION TO WATCH VLS

The choice of venue for students to view VLs can substantially influence their academic achievement and level of motivation in an FCR environment. The self-determination

theory (SDT) posits that selecting a comfortable and voluntary environment for video consumption can augment one's autonomy, competence, and sense of connection with others. Cognitive load theory posits that the surrounding environment has the potential to either increase or decrease distractions, hence improving the understanding and memory of the material. Environmental psychology posits that physical qualities such as illumination, noise levels, and comfort can influence cognitive processes and motivation. A calm, well-illuminated, and comfortable environment is more likely to enhance knowledge acquisition. These theoretical viewpoints and studies emphasize the significance of a favorable learning environment for pupils (Moore et al., 2011; Talbert, 2014). Depending upon the school's specific situation, the pupils may decide on the ideal location that best suits their level of comfort and satisfaction.

4.3 FCM CONTENT/COURSE COVERAGE

Creating a curriculum in the FC requires a focus on developing high-quality content that aligns with the learning objectives and promotes active engagement. The content should be carefully designed to cover core concepts in a concise, structured, and captivating manner. Pre-class materials, such as VLs, tutorials, demonstrations, and readings (e.g., articles and book chapters), should deliver essential information efficiently. Videos, for instance, should ideally range between five and 15 minutes, balancing brevity with comprehensiveness to maintain student attention. Similarly, written materials

should be focused and relevant, avoiding unnecessary complexity. To enhance student engagement, it is recommended to include interactive elements such as embedded questions, quizzes, or prompts within the materials. The course content must cater to diverse learning styles by ensuring accessibility in multiple formats and across platforms. For instance, videos should include captions, and readings should be provided in accessible formats. The material must be sequenced logically, with each module or unit building upon the previous one to ensure a coherent learning progression. Quizzes, assignments, and other assessment tools must directly align with the learning objectives and reflect the content covered in pre-class materials.

To support effective implementation of FCM, the content must incorporate real-world relevance and applicability. This approach is particularly important in disciplines like STEM, business, and language acquisition, where hands-on application and interactive learning are key. For these subjects, content should include problem-solving tasks, case studies, and scenarios that foster critical thinking and collaboration. Tailoring content to the readiness and needs of the target learners is also essential. For example, older students, who are generally better equipped for self-directed learning, may benefit from more complex and autonomous content. In contrast, younger learners might require simplified materials with additional

guidance to ensure comprehension and engagement. Regularly revising course content based on feedback and student performance data is vital for maintaining its relevance and effectiveness (Bergmann & Sams, 2012; Bishop & Verleger, 2013; Fulton, 2012; O'Flaherty & Phillips, 2015; Zainuddin & Halili, 2016).

By focusing on the structure, accessibility, and alignment of the content with learning objectives, FCM can optimize learning outcomes across diverse subject areas and student populations.

4.4 IDEAL VL LENGTH

According to the cognitive load theory, learners have a finite capacity for processing new information. Reducing the length of films aids the management of cognitive load by dividing intricate content into more easily digestible segments. The attention span and information processing theory posits that pupils have limited attention spans, and shorter videos can enhance engagement and facilitate better information retention. To

enhance the process of acquiring knowledge, it is advisable to divide lengthy educational material into several concise video segments. Additionally, including interactive components such as quizzes or prompts is beneficial in creating top-notch content with distinct audio, graphics, and a well-structured presentation. This strategy helps pupils sustain concentration and strengthens the process of acquiring knowledge.

4.5 IDEAL VL LANGUAGE

The academic literature recommends that FCM VLs be preferably 6 to 15 minutes long. Cognitive stress theory and attention span studies both support this recommendation. Shorter videos are advantageous for maintaining student engagement and enhancing learning outcomes (Guo et al., 2014; Brame, 2016; and Cheng & Sharma, 2016.

It is crucial to consider the language requirements of diverse student populations. This can be accomplished by translating study resources into native languages, adding subtitles to films, translating texts for readings and interactive modules, and using culturally relevant examples to increase the significance of the subject matter (Kurt, 2017). To improve understanding and educational results in an FCR, delivering VLs in the student's mother tongue is advisable. This approach aligns with cognitive load theory, Krashen's input hypothesis, and Vygotsky's sociocultural theory. John Sweller's

cognitive load theory suggests students can effectively handle cognitive loads using familiar language. Stephen Krashen's material hypothesis states that the most effective way to acquire language is by exposing learners to comprehensible, more advanced material than their current level of competence. To ensure clear and understandable information, it is essential to use the primary language of instruction in educational environments. Levi Vygotsky's sociocultural theory emphasizes the importance of social contact for cognitive development. It suggests that using the native language of the student enhances social connection and facilitates better understanding. The influential studies conducted by Mayer & Moreno (2003), Sweller, Ayres, & Kalyuga (2011), Krashen (1982), and Vygotsky (1978) provide empirical support for the advantages of using a familiar language to reduce cognitive load and improve learning outcomes.

4.6 VL RESOURCE PERSON

In an FCM, the resource person, typically a course instructor or subject matter expert, creates recorded VLs. The social presence theory posits that the perception of personal connection and social presence within a learning environment can augment student engagement and happiness. To ensure the effectiveness of VLs in the FCM, selecting the right resource persons is paramount. They should possess a deep understanding of their subject, be able to clearly explain complex concepts, and align their expertise with curriculum requirements. Effective communication skills are essential, and resource

persons must articulate ideas clearly, engage audiences with a dynamic speaking style, and demonstrate proficiency in the language of instruction. Cultural sensitivity is another vital aspect, as resource persons should tailor examples and language to local contexts, fostering inclusivity and relevance for diverse audiences. A student-centered approach that prioritizes practicality by connecting theoretical content to real-world applications is essential, and lectures should address student queries while adapting the content to the students' level of comprehension.

The literature on VL creation for FCM highlights diverse perspectives on the styles and preferred authors. Vieira et al. (2014) developed mathematics VLs for online courses using voice and presentation styles, analyzing other styles like traditional, talking head, and interactive. They concluded that promoting student interaction, producing short lectures, avoiding abrupt transitions, and providing interactive links is crucial. Brecht (2012) tested three VL designs: traditional, with graphics and sounds, and voice and presentation with interactive elements. Students performed better with voice and presentation style with interactive elements. Gilard et al. (2015) presented five VL styles: voice and presentation, image, voice and presentation, traditional, SussexDL, and personal.

Whether class teachers, global experts, high-performing students, or a combination of these should develop content, is subjective and offers distinct advantages and challenges. Class teachers, deeply familiar with their students' needs, can tailor content effectively and ensure continuity between pre-class and in-class learning. However, their

time constraints and varying proficiency in digital tools may limit VL quality. Global experts bring high-quality, polished content and exposure to advanced teaching methods, yet they risk being culturally or contextually misaligned with the curriculum and students' needs. Peer-led VLs, created by high-performing students, offer relatable perspectives and cost-effectiveness while inspiring peers but often lack the pedagogical depth required for comprehensive instruction. A hybrid approach, combining contributions from teachers, experts, and students, balances expertise with contextual relevance and scalability, albeit requiring meticulous coordination. The research underscores that the choice of resource person should align with learning objectives, available resources, and student demographics, with hybrid models emerging as particularly effective in maximizing engagement and learning outcomes.

4.7 FREQUENCY OF VL SHARING UNDER THE FCM

Regular and frequent sharing of VLs is crucial for good learning and retention in an FCM. The idea aligns with spaced repetition, cognitive load, and constructivist learning concepts. Spaced repetition and distributed practice suggest that the retention of knowledge is enhanced when it is presented at intervals over some time. John Sweller's cognitive load theory emphasizes the management of cognitive load, while Jean Piaget's constructivist learning theory posits that learners acquire knowledge through firsthand experiences. Consistent and well-spaced VLs facilitate gradual information acquisition

and enhance student engagement in classroom activities (Fiorella & Mayer, 2016).

The scholarly literature emphasizes the need to share VLs before every session, preferably on a class-by-class basis rather than on a weekly or bi-weekly schedule. Bergmann & Sams (2012) and Abeysekera & Dawson (2015) propose making pre-class movies available to students to prime them for engaging in active learning exercises during class sessions. Regular and focused content distribution maintains student interest and enables them to expand their knowledge gradually. Abeysekera & Dawson (2015) endorse disseminating content before each class to enhance cognitive load, as it enables students to digest information in manageable segments, enhancing retention and comprehension. Bishop & Verleger (2013) emphasize that distributing videos before each class is more effective in preparing students for in-depth, interactive class sessions. This approach encourages ongoing engagement and active participation in class discussions and activities.

4.8 VL VARIETY

To enhance student understanding of FCM, it is advisable to produce a variety of VL formats, including instructional, demonstration, explainer, lecture capture, interactive, animation, problem-solving, and case study films. Cognitive load theory, MM learning theory, dual coding theory, active learning theory, constructivist learning theory,

and transactive memory theory back these methods. Scholars propose combining forms and integrating many genres of films to cater for various learning preferences and sustain student engagement. The researchers suggest utilizing interactive films, assessments, and interactive elements to augment acquiring knowledge and ensure explicit instructions. Moreover, all videos must include unambiguous objectives and precise guidelines to guide students through the topic. Further, video content should be regularly renewed and updated to ensure its relevance and maintain viewer interest. The study by Mayer (2009), provides a theoretical foundation for these strategies and demonstrates their efficacy in enhancing student learning.

4.9 ONLINE PLATFORM AND SHARING TOOL

In most circumstances, the implementation of FCM necessitates the use of an online platform. Integrating new technologies into the educational process leads to a syncretism that blends traditional approaches, such as classroom communication and collaboration, with methods involving technology resources (Bersin, 2004). When sharing VLs with students, it is crucial to use a platform that is readily available, reliable, and conducive to learning. Scholarly literature identifies several key characteristics of an optimal LMS for facilitating interactive learning experiences. The foremost requirement

is a user-centric design that enhances accessibility and usability. The LMS should be user-friendly, require minimal training, and be inclusive, accommodating individuals with disabilities (Al-Fraihat et al., 2020; Kent, 2015).

The system should be adaptable and capable of accommodating various forms of content, including text, audio, video, and assessments. This flexibility allows teachers to present a diverse range of learning materials. The tools for organizing content into modules and units should be easily manageable and reconfigurable to facilitate user engagement (Alvarez et al., 2009). The LMS should support the seamless posting of various assessments, such as quizzes and assignments, and provide a user-friendly interface for grading and feedback. This functionality enables students and teachers to monitor progress easily (Swan, 2003).

4.10 TIME ALLOCATION BY STUDENTS AND FACULTY UNDER FCM

The LMS should include up-to-date features that facilitate effective collaboration and communication among peers and instructors, such as discussion forums and Q&A boards. Incorporating video conferencing or chat capabilities also enables real-time interaction between learners and educators (Bower, 2019). Moreover, the system should include tools for tracking student progress and generating customized performance reports, which are essential for ensuring the LMS's effectiveness in facilitating learning

(Siemens & Long, 2011). The literature further emphasizes the importance of mobile compatibility, allowing users to access the platform from any location and at any time (Corbeil & Corbeil, 2007).

LMS like Moodle, Canvas, Blackboard, and Google Classroom offer robust capabilities for sharing VLs, easing content distribution, monitoring student progress, and including interactive elements like quizzes and discussion forums. Video hosting platforms such as YouTube, Vimeo, and Panopto offer features such as automated captioning, seamless integration with LMS, and detailed viewing analytics. Cloud storage systems like Google Drive, Dropbox, and OneDrive allow easy sharing and access to video recordings, but they may need the educational features found in LMS platforms. Efficient means of communication, such as email, can be utilized to share links to videos hosted on different platforms. On the other hand, messaging applications like WhatsApp and Telegram can provide swift access to links and reminders, but they need to be more suitable for arranging extensive instructional content (Wong, 2016).

4.11 ASSESSMENTS (QUIZZES AND ASSIGNMENTS) AND WORKLOAD MANAGEMENT

When adopting the FCM, it is essential to consider both the availability of time and resources. FCM learning requires significant time; hence, students should manage their time effectively. Persky & McLaughlin (2017) have proposed a ratio of 0.75:1.0:0.5

for pre-class, in-class, and directed post-class activities. Under the FCM, students are urged to allocate their time to pre-class preparation by interacting with VLs and literature outside the classroom. Pre-class engagement with the content will empower them to engage in activities conducted within the classroom actively. Bishop & Verleger (2013) suggest that effectively managing workload involves evenly distributing the pre-class work and thoroughly reviewing concepts afterwards to guarantee a comprehensive understanding of the material. Teachers should be responsible for creating or selecting pre-class content, while in-class activities should emphasize higher-order thinking skills. Teachers should allocate time for both these activities. Abeysekera & Dawson (2015) argue that successful workload management necessitates finding a harmonious equilibrium between subject preparation, facilitating participatory class activities, and delivering prompt student feedback.

4.12 COURSE PLAN

FCRs may require a shift in assessment methods to optimize student outcomes. It is suggested that students should be responsible for pre-class learning, which is crucial for applying knowledge during class. Formative (conducted weekly or bi-weekly) and summative evaluation (conducted after the end of every unit) methods can be used to provide feedback to instructors and students, especially in pre-class online courses. The type and magnitude of evaluation should align with the course objectives, and instructors should communicate expectations and provide detailed information on assessing evaluations. This approach aims to foster advanced cognitive abilities (Caldwell, 2007).

A new lesson plan design is required owing to the differentiation between pre-class, in-class, and post-class instruction. According to the literature, lesson designing is the deliberate and organized process of determining student learning content and methods. It is a crucial responsibility of teachers in various educational systems globally (Cicek & Tok, 2014). When examining the fundamental elements of an effective lesson plan, three key sections are critical: learning objectives or desired outcomes, learning activities, and assessment of knowledge or demonstration of learning (Bush et al., 2014). The CP in FCM includes four activities: i) pre-class material sharing, ii) review of pre-class material in class, iii) in-class activity, and iv) assessment of learning from pre-class and in-class content.

Instructors can assign a video for students to watch before class to introduce or reinforce fundamental concepts and prepare them for in-person activities. This video should cover essential content, engage the audience, be concise (ideally between six to 15 minutes), and align specifically with the course topic (Bishop et al., 2013). During class, students participate in activities that involve watching a brief video to review and deepen their understanding of the material covered before class. This activity typically occurs at the beginning of the lesson and lasts about five to ten minutes (Abeysekera & Dawson, 2015). PowerPoint presentations can highlight key points and clarify complex topics discussed in the VL. These presentations should be concise, lasting approximately ten minutes, and include interactive elements such as Q&A sessions and discussions to enhance student comprehension.

In-class exercises reinforce pre-class topics through various activities, including exercises, problem-solving assignments, case studies, and collaborative work. These activities promote the development of critical thinking skills, encourage collaboration among participants, and facilitate the practical application of knowledge. Students may work independently, in pairs, or in small groups with guidance and support from the teacher. These exercises typically last 15 to 20 minutes, depending on class time. Lastly, a five to ten-minute brief assessment evaluates student comprehension of the subject matter and reinforces key concepts. The course materials include pre-class VLs, PowerPoint presentations, and in-class exercises. Assessments can be conducted on paper or online and are designed to provide prompt feedback (Hwang & Chen, 2019).

05

CHAPTER FIVE

STUDY FINDINGS AND DISCUSSIONS

5.1 SOCIOECONOMIC RESPONDENT PROFILES

The study findings in Table 8 offer detailed insights into the demographic characteristics and backgrounds of 362 students across four countries: Pakistan, Kazakhstan, Tajikistan, and Uzbekistan. The average age of the respondents is 15 years, ranging from 12 to 18 years. This age group is crucial for FCM educational interventions, as students typically transition from primary to secondary education during these years. The gender balance among the students indicates an inclusive approach to education, which is essential for promoting equality in learning opportunities. Most of the study's students (90 percent)

come from urban areas, suggesting that educational resources and opportunities may be more concentrated in cities. This urban bias raises concerns about disparities in FCM educational access and quality for students residing in rural areas, thereby underscoring the necessity for targeted initiatives to bolster rural education. Furthermore, most students are local and national language speakers, with unique Pashto and Uzbek speakers being the most prominent; this linguistic diversity highlights the importance of developing culturally relevant educational materials and teaching methods that effectively cater to the varying language needs of students.

Table 8: Summary of student profiles

Dimension	Male (%)	Female(%)	Pak	Kazakh	Uzbek	Tajik	Total	Percent
Locality								
Rural	10.29	8.84	4	2	0	26	32	8.84
Urban	88.00	91.98	144	68	70	44	326	90.06
Semi-urban	1.71	0.53	0	0	2	2	4	1.10
Residential status								
Own	10.29	8.84	4	2	0	26	32	8.84
Rented	88.00	91.98	144	68	70	44	326	90.06
Sharing	1.71	0.53	0	0	2	2	4	1.10
Disability								
No	93.14	90.37	125	68	68	71	332	92.00
Yes	4.00	8.56	20	1	2	0	23	6.00
Not disclosed	2.86	1.07	3	1	2	1	7	2.00
Level of education: father								
Illiterate			29	1	3	0	33	9.12
Primary			22	1	3	0	26	7.18
Secondary			64	33	12	38	147	40.61
Tertiary			33	35	54	34	156	43.09
Level of education: mother								
Illiterate			44	0	1	3	48	13.26
Primary			24	2	4	1	31	8.56
Secondary			47	19	26	43	135	37.29
Tertiary			33	49	41	25	148	40.88

Table 8:Summary of student profiles (continued)

Dimension	Male (%)	Female(%)	Pak	Kazakh	Uzbek	Tajik	Total	Percent
Employment status: father								
Currently working			109	57	66	64	296	81.77
Unemployed			18	5	1	6	30	8.29
Retired			8	3	3	0	14	3.87
Not working (out of LF)			13	5	2	2	22	6.08
Level of education: mother								
Currently working			30	57	45	31	163	45.03
Unemployed			29	4	12	18	63	17.40
Retired			2	0	1	0	3	0.83
Not working (out of LF)			87	9	14	23	133	36.74
Source of income: father								
Agriculture			16	3	0	6	25	6.91
Business			40	13	22	17	92	25.41
Public employee			26	15	33	22	96	26.52
Private employee			23	26	8	4	61	16.85
Daily wager			19	0	1	14	34	9.39
Source of income: mother								
Business			8	7	6	2	23	6.35
Public employee			15	32	26	17	90	24.86
Private employee			7	11	11	8	37	10.22
None			39	9	21	19	88	24.31

The study also indicates that, except in Pakistan, most parents are literate and employed, with 40 percent of mothers identified as housewives. This finding suggests a generally supportive home environment for education, although the high percentage of homemakers may reflect the limited economic participation of women in certain regions. Parents' educational level is a critical factor, as higher parental education typically correlates with improved educational outcomes for children; indeed, a significant proportion of both fathers and mothers possess tertiary education, which positively influences the academic performance and aspirations of their offspring.

Moreover, an impressive 92 percent of students reported being healthy and free from disabilities, a positive health status crucial for facilitating engagement in learning and extracurricular activities. However, the presence of disabilities among 6 percent of respondents underscores the urgent need for inclusive FCM education program designs that accommodate all learners.

The primary sources of income for families predominantly stem from public or private employment and business ventures, indicating that students come from various socioeconomic backgrounds, which may significantly influence their educational experiences and aspirations. The data on employment status reveals that a substantial

majority of fathers are currently employed, potentially providing financial stability for families and supporting their children's education. In contrast, the employment status of mothers indicates a higher percentage of those not working, suggesting the existence of barriers to women's economic participation that may further impact family dynamics and educational opportunities.

The mean age of the teachers is 39 years, with 66 percent female and 34 percent male. The average qualification of teachers in the sample is a master's degree, and about 50 percent possess some form of vocational or IT diploma, indicating their strong foundation in educational training. The finding also implies that 50 percent of teachers are not adequately trained and lack the knowledge and abilities to implement FCM and teaching in general successfully. Nevertheless, it is imperative to promptly offer vocational or IT training to the remaining portion to ensure efficient education delivery (see appendix-Table I).

Most teachers (93%) are employed full-time and have work experience ranging from one year to 46 years. The permanent nature of a job fosters dedication among teachers. Their varied range of experience demonstrates their extensive expertise, which can be crucial for delivering high-quality education, particularly in the context of FCM. By offering cutting-edge vocational and IT training to all staff members, schools can enhance and refine their skills to fulfill the requirements of FCM and the ever-evolving educational environment. Most teachers are in urban areas, indicating a concentration of educational facilities in urban areas. Teachers from the medium income group possessing a personal

residence indicate their financial stability and provide essential information to the school administration and government. This information helps provide targeted support and resources to meet their individual needs.

Over 50 percent of teachers are content with their salary structure, while over 45 percent of male and 25 percent of female teachers depend on additional sources of income. The ratio suggests that most teachers are dissatisfied with their pay, which leads to financial instability and the need to pursue other income opportunities, resulting in increased burdens. The dissatisfaction and inadequate compensation may undermine the motivation and commitment of teachers towards their responsibilities, thereby affecting the quality of education they provide. Because most teachers fall into the middle-income bracket, there are very few opportunities for them to allocate resources toward professional development.

We conducted interviews with administrators, 71 percent of which were male and 29 percent female. The age range of the administrators examined is between 24 and 70 years old. The administrative personnel possess a wide range of experience from three to 39 years. Approximately 57 percent of them have received technical or vocational training. The expertise of the administrative personnel is essential for the efficient management of school affairs, and vocational training provides the necessary skills for their specific responsibilities. However, almost half of the administrative staff need more training, which requires investment and dedication to the professional growth of school staff. Administrative staff have a wide range of educational qualifications and language

skills. Therefore, it is necessary to customize professional development programs based on staff qualifications and consider language proficiency to ensure effective training outcomes (see appendix-Table II).

5.2 TYPE, QUALITY, AND ACCESS TO THE INTERNET BY STUDENTS, TEACHERS, AND SCHOOLS

Kazakhstan

This subsection presents findings on internet access specific to each country, while other sections in the report focus on comparative analyses. The individual country focus here allows for a clearer understanding of context-specific challenges and variations regarding the quality, availability, and cost of internet access across the homes of students and teachers, as well as in schools, which may be less visible in a strictly comparative view (see appendix Table III and IV).

In Kazakhstan, the internet penetration rate is 100 percent, with MB and BB being the primary sources of internet connectivity reported by students (Table 9). The internet offered to students is consistently reliable, with speeds ranging from ordinary to exceptional. The expense of internet service is not a matter of worry; only two students occasionally perceive financial difficulty within their families to meet the cost of internet

access. Teacher comments are consistent with pupil responses and indicate they can access high-quality internet. Nevertheless, educators perceive internet expenses as a less common concern, but the financial burden of educational and daily necessities is a recurring issue for their households. Overcoming technological and financial barriers is crucial for teachers to focus on their work and student learning. According to the survey, BB is the primary provider of internet services in Kazakh schools. The internet is dependable, consistent, and quick, with quality ranging from average to excellent, as reported by all schools surveyed. Of schools, 75 percent do not consider internet cost a problem, whereas 25 percent of administrators perceive it as a matter of worry.

The finding portrays a positive outlook on internet accessibility and quality in the country, indicating that the internet would not hinder the implementation of BL teaching methodologies. The students' high access rate to the internet, quick speed, consistency, and reliability indicate that they are well prepared for the FCM in terms of internet usage. The absence of financial burden related to student internet expenses further strengthens the argument for introducing FCM. However, to provide affordable access to all schools nationwide, additional government funding is necessary to improve the internet infrastructure in schools. Kazakh schools may seamlessly integrate online learning resources into their teaching methods without worrying about internet connectivity. Consequently, the country is on the correct path to implement FCM. With the support of the government and educational institutions, Kazakh schools can continue to improve internet infrastructure and accessibility for students, ensuring that all learners have the resources they need for successful online learning.

Table 9: Type, quality, and cost of the internet at home (students)

Type	Male (%)	Female (%)	Pak	Kazakh	Uzbek	Tajik	Total	Percent
MD	44.3	40.00	67	14	7	48	136	37.57
MDBB	25.5	18.29	3	38	27	2	70	19.34
BB	25.5	37.71	30	18	34	22	104	28.73
BBOT	0.0	0.57	0	0	1	0	1	0.28
OT	4.7	3.43	12	0	1	0	13	3.59
No internet	0.0	0.00	35	0	2	0	37	10.22
Internet quality (students)								
Excellent	26.85	33.52	34	25	23	17	99	30.46
Good	31.54	44.89	46	24	30	26	126	38.77
Average	35.57	18.75	28	15	16	27	86	26.46
Poor	4.03	2.27	4	3	1	2	10	3.08
Bad	2.01	0.57	1	3	0	0	4	1.23
Internet speed								
Always	48.99	45.45	35	51	39	28	153	47.08
Frequently	36.24	43.18	61	15	24	30	130	40.00
Less frequently	13.42	9.66	16	3	6	12	37	11.38
Never	1.34	1.70	2	0	1	2	5	1.54
Internet consistency								
Always	44.30	39.20	26	51	36	22	135	41.54
Frequently	32.89	42.61	57	13	23	31	124	38.15
Less frequently	16.78	16.48	21	5	10	18	54	16.62
Never	6.04	1.70	10	0	1	1	12	3.69

Table 9: Type, quality, and cost of the internet at home (students) - continued

Type	Male (%)	Female (%)	Pak	Kazakh	Uzbek	Tajik	Total	Percent
Internet reliability								
Always	49.66	52.27	24	63	48	31	166	51.08
Frequently	33.56	34.09	66	2	15	27	110	33.85
Less frequently	14.77	11.36	20	3	6	13	142	12.92
Never	2.01	2.27	4	1	1	1	7	2.15
Internet cost								
Always	27.78	5.11	19	2	2	2	25	7.69
Frequently	16.67	24.43	58	10	5	12	63	19.38
Less frequently	27.78	14.20	21	57	63	5	48	14.77
Never	27.78	56.25	16	0	0	53	189	58.15
Financial stability								
Always	56.00	56.15	41	62	57	43	57	56.08
Frequently	21.14	31.02	60	4	9	22	9	26.24
Less frequently	13.14	6.42	28	3	2	5	2	9.67
Never	9.71	6.42	20	0	4	2	4	8.01

Note: MD = Mobile data, MDBB =Mobile data and broadband, BB = Broadband, BBOT = Broadband and others, OT = Others

Pakistan

The rate of internet connectivity for students in Pakistan is low, with 10 percent of the sample reporting no access to the internet. This lack of access poses a significant hurdle for integrating BL methodologies in the country. Most individuals depend on mobile data (MD) for internet access, while BB access is limited. The internet service is of high quality, yet many students believe that the expense of the internet is a burden for their families. In addition, the survey participants perceive that covering the educational costs of children in Pakistan is a substantial financial hardship. Data from teachers also indicates limited internet availability, with MD being the primary source of online connectivity. Teachers also perceive the cost of the internet as a burden on their finances and often encounter difficulties covering their daily expenses. Of schools in Pakistan, 50 percent still lack BB installation, which indicates the bleak state of the country's IT infrastructure. While the majority perceive the quality of internet accessible at schools to be reliable, quick, and consistent, school administrators face difficulties meeting the fees associated with internet services.

The absence of complete internet connectivity for students and teachers and BB installation in all schools could pose a significant obstacle to implementing BL integration in the country. The lack of internet facilities would prevent students and instructors from accessing online resources. The exorbitant expense of internet access poses a significant challenge, impacting both educational institutions and individuals, exacerbating the pre-

existing digital divide for economically disadvantaged populations and marginalized regions within the country. Ultimately, the need for internet connectivity is impeding the country's ability to implement innovative educational approaches.

Uzbekistan

The rate of internet connectivity for students in Uzbekistan is good. Only two students from the sample reported no access to the internet. Although this is a small number in this sample, the problem may be more pronounced in the underdeveloped regions of the country, posing a significant hurdle for integrating BL methodologies in the country. The Uzbek students use MD and BB equally, implying that BB installation at home and school in the country is still low. The internet service is of high quality, and many students believe that the expense of the internet is not a burden for their families. However, survey participants perceive that covering children's educational costs is a financial burden for parents. The data from teachers indicates complete internet availability, with BB being the primary source of online connectivity. The teachers do not perceive the cost of the internet as a burden on their finances; however, they often encounter difficulties in covering their daily expenses.

While the majority perceive the quality of internet accessible at schools to be reliable, quick, and consistent, school administrators always face difficulties meeting the fees

associated with internet services. Only 20 percent of administrators from the country stated that internet cost is not an issue for their school. The lack of comprehensive internet access for pupils could substantially hinder BL integration throughout the country, preventing students and instructors from gaining access to online resources. Adopting high-cost BL technologies may be impeded by the financial strain on families for educational expenses. Therefore, it is imperative to pursue low-cost solutions to prevent families from incurring additional expenses.

Tajikistan

The rate of internet connectivity for students in Tajikistan is complete in the sample. MD is a major internet source, meaning BB installation at homes in the country is still low. The internet service is of high quality, and many students believe that the expense of the internet is not a burden for their families. However, survey participants perceive that covering children's educational costs is a financial hardship for their parents. The data from the teachers indicates complete internet availability, with MD being the primary source of online connectivity. Around half of most teachers rated their internet quality as poor or good; very few believe it to be excellent. About 50 percent of teachers do not perceive the cost of the internet to be a burden on their finances, and they often encounter difficulties in covering their daily expenses. In Tajikistan, 100 percent of schools have BB installation, and most perceive the quality of internet access to schools to be reliable, quick, and consistent. School administrators sometimes face difficulties meeting the fees associated with internet services. Only 25 percent of administrators from the country stated that internet cost is not an issue for their school or that it is not applicable.

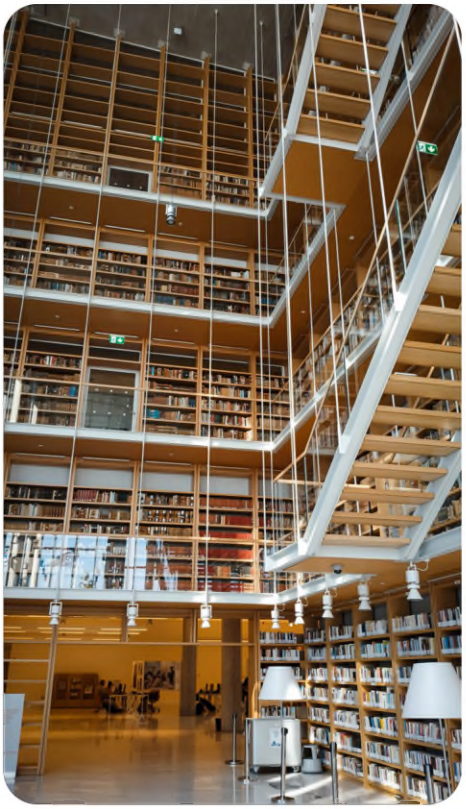
The absence of BB infrastructure at home and the poor quality of the internet could be a substantial barrier to adopting BL in the country. This lack of BB would impede students and instructors gaining access to online resources. Adopting high-cost BL technologies may be impeded by the financial strain on families for educational expenses. Therefore, it is imperative to pursue low-cost solutions to help families avoid additional expenses.

5.3 SCHOOL INFRASTRUCTURE, TEACHING PRACTICES, AND USE OF EDUCATIONAL TECHNOLOGIES

The study examined how participants perceived the quality of school amenities, infrastructure, and IT facilities at selected schools. The findings offer valuable insight into both student and teacher attitudes regarding school buildings, infrastructure, and IT facilities. From this point, we will examine the findings by country to investigate variations and similarities between countries (see appendix-Table V to XI). The analysis in this section will enable us to develop and analyze policy responses in later stages.

Kazakhstan

Schools in Kazakhstan provide a favorable atmosphere for pupils, as they are generally content with primary school facilities. The power backup, digital library, transport, and dispensary at schools require attention due to teacher and student dissatisfaction with these services. The authorities must ensure the availability of digital library access to facilitate access to online resources. Students and instructors are satisfied with internet accessibility at school, while the proportion of pupils expressing pleasure with school internet is lower compared to teachers, which could indicate limited internet accessibility for students.



Additionally, 27 percent of pupils expressed a need for improvement in the usage of IT equipment in schools. In general, the facilities of Kazakhstan schools are acceptable; however, there is a need for development in internet connectivity, power supply, and access to digital libraries, as these are essential for successfully applying BL methodologies. Teachers and students highly prioritize the internet and digital library as crucial resources and have expressed the need for enhancements in these facilities. Therefore, investing in technology enhances the student learning experience.

The survey data from Kazakhstan revealed that over 90 percent of students reported using SB, MM, and CL regularly, daily, weekly, or just occasionally; only a tiny minority of two to five students from the sample reported never having used these technological tools at school. The teacher statements indicate that these devices are readily accessible and frequently utilized in their classes; none mention the absence of these devices. The sole factor preventing gadgets in school is low availability, chosen by just 20 percent of student respondents. This finding suggests that students and teachers are proficiently utilizing technology in the educational environment, with teachers incorporating IT devices into their regular classroom practices. In general, incorporating technology in Kazakh schools is reasonable, with only a minority of students experiencing restrictions that emphasize the necessity for further enhancement in the utilization and general state of IT infrastructure in schools.

Over 75 percent of students believe that school facilities contribute to an enhanced learning experience and express satisfaction with the teaching approaches employed by their teachers. Nevertheless, almost 50 percent of students believe that utilizing IT gadgets will only enhance their performance to a certain degree. Varied student perspectives regarding the factors contributing to academic success indicate that schools must provide personalized and diverse learning experiences. Kazakh students perceive physics, chemistry, and mathematics as challenging disciplines and advocate using BL strategies to enhance comprehension in science courses and English. Hence, the FCM implementation may start with these specific subjects and expand to all disciplines later. The data from administrative staff reveals that Kazakh schools have nearly all physical

and IT infrastructure amenities except power backup, watercoolers, and LMS. The surveyed school needed a conference room and a server system.

The student-teacher ratio in the country is ideal and for every 11 students, one teacher is available in Kazakh schools. The ratio depicts an ideal situation because teachers can give individual attention and monitor individual students in small classes. Although most teachers possess a master's degree, the ratio of teachers holding IT/vocational diplomas is small. This implies a greater need for training and faculty development programs to equip teachers with up-to-date teaching novelties and EdTech.

Schools are well-equipped with IT infrastructure; each has an average of 256 computers, 13 SBs, and 8 MM devices for 38 classrooms. The schools frequently use SBs, MMs, and CLs for instruction, which shows the efficient use of technology in the country schools. Furthermore, teachers occasionally or weekly consult online sources and distribute pertinent online resources. Kazakh schools employ IT devices for every grade level and have dedicated IT professionals to address equipment-related concerns. Of administrators, 75 percent confirmed they possess essential equipment for implementing FCM; however, they emphasized the need for faculty members to have the requisite degrees and training to utilize FCM effectively. Kazakh schools have sufficient government support through financial assistance and IT resources. The government has also initiated several projects to enhance the technological infrastructure of schools. Although schools have a lot of IT and devoted staff, more are needed to ensure the success of FCM because technology in the classroom will only succeed with teacher training and support(Table 10 to 14).

Table 10:Student satisfaction with school facilities

Facility	Satisfied (%)						Needs improvement (%)					
	Male	Female	Pak	Kazakh	Uzbek	Tajik	Male	Female	Pak	Kazakh	Uzbek	Tajik
Digital library	0.09	0.07	0.15	0.06	0.01	0.09	0.23	0.22	0.26	0.19	0.11	0.33
Library	0.39	0.45	0.56	0.45	0.21	0.39	0.22	0.23	0.34	0.04	0.17	0.24
Standard of education	0.49	0.56	0.58	0.51	0.38	0.49	0.23	0.25	0.27	0.13	0.33	0.21
Use of IT gadgets	0.38	0.35	0.40	0.38	0.43	0.38	0.30	0.26	0.15	0.14	0.33	0.60
Basic facilities	0.41	0.35	0.28	0.52	0.60	0.41	0.14	0.18	0.11	0.09	0.14	0.36
Power supply	0.16	0.14	0.19	0.12	0.06	0.16	0.16	0.17	0.11	0.03	0.44	0.13
Internet	0.24	0.24	0.26	0.45	0.22	0.24	0.31	0.24	0.12	0.23	0.26	0.65
Healthy environment	0.40	0.34	0.29	0.26	0.43	0.40	0.05	0.08	0.07	0.04	0.07	0.08
Sports/playgrounds	0.42	0.40	0.21	0.67	0.56	0.42	0.16	0.13	0.11	0.04	0.10	0.36
Transport	0.11	0.03	0.09	0.13	0.06	0.11	0.16	0.18	0.10	0.09	0.32	0.24
Dispensary	0.10	0.05	0.11	0.06	0.01	0.10	0.11	0.07	0.07	0.04	0.10	0.17
Building	0.37	0.42	0.31	0.52	0.40	0.37	0.12	0.12	0.09	0.06	0.18	0.19
Proximity	0.33	0.38	0.16	0.52	0.43	0.33	0.04	0.03	0.04	0.03	0.06	0.00
Other	0.02	0.01	0.01	0.00	0.04	0.02	0.07	0.06	0.02	0.04	0.22	0.04

Pakistan

Students and teachers in Pakistan consider the standard of instruction, library facilities, IT gadgets, school buildings, basic amenities, and general health of environment to be satisfactory. There is a need to improve libraries and digital libraries in schools because most respondents were dissatisfied with these basic learning requirements. Digital library access is pertinent to accessing online resources and integrating technology into the education system. The internet facility available in schools in Pakistan is unsatisfactory, and respondents strongly demand that it be improved.

Only 26 percent of students from the target audience, although coming from a highly developed district, express a favorable opinion of the internet quality, representing a significantly low ratio. Only 16 percent of teachers in the study have a favorable opinion of the internet facility. The situation in mid and low development regions will be more pronounced, which calls for policy attention. Without access to good quality internet, no FCM modality will be effective; hence, there is an urgent need to invest in internet provision/BB installation at schools to ensure good quality internet. Students voiced their aspiration to enhance the library, digital library, and fundamental amenities of the school.

The use of IT devices—such as SBs, MM tools, and other similar gadgets—in schools is significantly limited. Students have limited access to CLs, while most students and teachers have never used any IT gadgets such as SBs and MM. Some have never used CLs, indicating a very challenging situation in school infrastructure. The average number of school computers is 14, with just one or two MM tools and SBs available. The country has a low frequency of online resource utilization and limited government support and funding for IT equipment. Respondents claimed that these IT devices are either unavailable, non-functional, or of limited capacity. Even a lack of teacher skills to operate IT equipment was reported by students. Thus, schools need investment in IT equipment and faculty development to keep them up to date and deliver a well-rounded education. Respondents have a positive assertion regarding education technologies because approximately 67 percent of students responded positively to the statement regarding

the potential of technology and gadgets to enhance their learning. They also expressed satisfaction with their teachers' teaching techniques. Hence, respondents value EdTech as a promising tool to improve their learning environment, but schools currently lack the necessary IT and human resources to integrate BL.

In Pakistan, students consider mathematics, physics, chemistry, and English language to be the most challenging subjects to comprehend; they prefer learning mathematics, physics, English language, and biology using FCM or BL approaches. This preference entails the adoption of FCM for specific subjects, which is most suitable in the country, owing to preferences and the limited infrastructure.

Most schools in Pakistan lack IT-related infrastructure, which is crucial for implementing FCM. Schools lack library facilities, server systems, LMS, e-library resources, YouTube channels, and school websites. All these facilities are important to create a healthy learning environment and provide online access to resources for students and educators. However, schools in Pakistan need major investment to increase the current level of necessary infrastructure.

Another problematic concern in Pakistani schools is the high student-teacher ratio, where one teacher is available for 46 students in the surveyed schools. The high pupil-teacher ratio creates a congestion problem, so that individual attention and teacher monitoring of students becomes impossible. Teachers become overburdened, which in turn leads

to poor delivery of instruction. Although most teachers hold master's degrees, they lack professional training, which limits their ability to provide quality education equipped with modern and up-to-date teaching methodologies. Hence, training programs for students and teachers must be planned and tailored according to the specific needs of the Pakistani context for the effective implementation of FCM.

Table 11:Frequency of usage of IT gadgets at schools

Type	Students						Teachers					
	Pak	Kazak	Uzbek	Tajik	Total	Percent	Pak	Kazak	Uzbek	Tajik	Total	Percent
SB												
Daily	17	31	31	21	100	27.62	9	6	6	2	23	38.98
Weekly	21	17	13	16	67	18.51	0	4	4	3	11	18.64
Occasional	22	16	27	10	75	20.72	6	1	2	1	10	16.95
Never	68	5	1	6	80	22.10	7	0	0	3	10	16.95
Unavailable	21	0	0	19	40	11.05	2	0	0	3	5	8.47
MM/projector												
Daily	13	12	12	24	61	27.62	1	4	5	2	12	20.34
Weekly	17	18	20	16	71	18.51	5	3	3	3	14	23.73
Occasional	39	29	33	7	108	20.72	9	4	4	1	18	30.51
Never	57	9	7	4	77	22.10	7	0	0	3	10	16.95
Unavailable	23	1	0	21	45	11.05	2	0	0	3	5	8.47
CL												
Daily	26	15	12	5	58	16.02	7	5	4	1	17	28.81
Weekly	33	37	49	52	171	47.24	4	3	4	5	16	27.12
Occasional	50	15	11	4	80	22.10	7	2	4	3	16	27.12
Never	32	2	0	8	42	11.60	6	1	0	3	10	16.95
Unavailable	8	0	0	3	11	3.04	0	0	0	0	0	0.00

Table 11:Frequency of usage of IT gadgets at schools (continued)

Type	Students						Teachers					
	Pak	Kazak	Uzbek	Tajik	Total	Percent	Pak	Kazak	Uzbek	Tajik	Total	Percent
Any other online learning tool/digital resources												
Daily	14	15	7	2	38	10.50	2	2	1	0	5	15.25
Weekly	17	21	14	2	54	14.92	2	2	1	0	5	13.56
Occasional	29	31	43	3	106	29.28	6	2	7	1	16	37.29
Never	64	2	4	26	96	26.52	10	4	3	7	24	23.73
Unavailable	17	0	4	36	57	15.75	0	0	0	0	0	0.00

Uzbekistan

Schools in Uzbekistan are in good condition and have satisfactory levels of playgrounds, buildings, use of IT devices, and a healthy environment. The utilization of IT devices in schools shows excellent potential, as none of the pupils reported the absence of SBs, MM, or CLs at their schools. The teacher's viewpoint consistently supports the students assertion that they frequently utilize these devices in their classes. The most frequently used gadget in the country is an SB, which is used virtually daily. The primary obstacle to using IT gadgets in Uzbek schools is the kids' report of restricted availability.

Table 12:Reasons for not using IT gadgets at school

Type	Students						Teachers					
	Pak	Kazak	Uzbek	Tajik	Total	Percent	Pak	Kazak	Uzbek	Tajik	Total	Percent
SB												
Non-functional	21.0	0.0	1.0	2.0	24.0	6.63	3.0	0.0	0.0	2.0	5.0	8.33
Teachers do not know its use	13.0	0.0	3.0	0.0	16.0	4.40	0.0	0.0	0.0	0.0	0.0	0.00
Students do not like it	6.0	0.0	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	0.00
Teachers are not allowed to use	5.0	0.0	2.0	1.0	8.0	2.20	0.0	0.0	0.0	0.0	0.0	0.00
Available for limited use	9.0	20.0	51.0	14.0	94.0	26.00	1.0	0.0	0.0	0.0	1.0	1.70
Other reason	0.0	4.0	14.0	4.0	22.0	6.10	0.0	0.0	0.0	1.0	1.0	1.70
MM												
Non-functional	27.0	6.0	2.0	3.0	24.0	10.5	1.0	0.0	0.0	1.0	2.0	3.3
Teachers do not know its use	11.0	0.0	1.0	0.0	16.0	3.3	0.0	0.0	0.0	0.0	0.0	0.0
Students do not like it	6.0	4.0	0.0	1.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0
Teachers are not allowed to use	6.0	1.0	0.0	0.0	8.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0
Available for limited use	7.0	19.0	56.0	11.0	94.0	25.7	0.0	0.0	0.0	0.0	0.0	0.0
Other reason	2.0	4.0	12.0	2.0	22.0	5.5	0.0	0.0	0.0	1.0	1.0	1.7
CL												
Non-functional	16.0	0.0	1.0	2.0	19.0	5.3	3.0	0.0	0.0	0.0	3.0	5.0
Teachers do not know its use	19.0	0.0	0.0	0.0	19.0	5.3	0.0	0.0	0.0	0.0	0.0	0.0
Students do not like it	5.0	0.0	0.0	0.0	5.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0
Teachers are not allowed to use	7.0	0.0	0.0	0.0	7.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0
Available for limited use	24.0	16.0	61.0	32.0	13.0	3.6	0.0	0.0	0.0	3.0	3.0	5.0
Other reason	3.0	5.0	6.0	4.0	18.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: SB = Smart board MM = Multimedia CL = Computer lab

However, teachers have not reported such issues at their respective schools; they reported using SBs and MM on a daily to weekly basis. Teachers also constantly consult online resources and share pertinent VLs with students. Students are satisfied with the quality of instruction delivered by their teachers. Henceforth, schools and teachers are well equipped with the infrastructure and skills they already use for technology-integrated instruction delivery.

Respondents from Uzbekistan generally see the presence of school facilities and the utilization of technology as significant contributors to academic performance. Conversely, the remaining 50 percent believe these factors may have only a limited impact on grades. Uzbek students consider physics, chemistry, and mathematics the most challenging subjects. They desire to learn science, mathematics, English language, and social studies using the BL technique that, again, like other countries, highlights the urgency of implementing FCM for these specific subjects (Table 14).

Most schools have IT experts and equipment to facilitate the adoption of FCM. Schools have many teachers,[12] which ensures dedication and personal attention from instructors as well as quality instruction. Teachers normally have master's degrees, but many lack professional or pedagogical training; the teachers themselves feel their schools lack highly qualified instructors.[13] Although Uzbek schools have the necessary number of teachers, as shown by their small student-teacher ratio, there is a need to implement faculty development programs for school teachers to upgrade the academic and vocational skills of the instructors.

[12] The student-teacher ratio is 14, averaging 62 teachers for 41 classrooms.
[13] Of teachers, 91 percent believe their school suffers from a shortage of highly skilled instructors.

Despite all the infrastructural advancement, there are some areas of improvement identified by the study—such as internet quality, the lack of a digital library, dispensary, transportation, reliable power supply, a server system, LMS, a YouTube channel, a website, an electronic library, and electricity backup. Most facilities—such as the internet, LMS/Website/YouTube channel, and digital library—are crucial for accessing online resources and implementing FCM. Although internet facilities are available at schools, respondents demanded improved internet quality. They reported that the government's allocation of resources for IT equipment and finance needs improvement. Although several initiatives initiated by the government to enhance technological infrastructure are in progress, the government needs to invest in ensuring the availability of all deficient physical and human resources to improve the learning environment at schools.

Tajikistan

The level of physical infrastructure presents a generally good state, and the respondents are satisfied with the sports facilities, well-constructed buildings, proximity to their homes, high educational standards, a healthy environment, and access to IT gadgets at their schools. The administrator survey revealed that, on average, schools have 76 computers, 14 SBs, and 14 MM tools. Of administrators, 60 percent also expressed that MM and SBs are used daily in their schools. However, this data is in contrast with the opinions of the teachers and students. For example, approximately 35 percent of students reported that they have never utilized SBs or MM or that these resources are accessible at their school.

Similarly, approximately 50 percent of instructors indicated these devices are inaccessible, and CL is utilized only weekly or infrequently at their school. The reason for not using CL daily is the restricted availability for its use. The CL was unavailable in one of the surveyed schools. IT specialists are available in only 50 percent of schools to handle technical issues related to IT equipment. This contrast of opinion highlights the limited availability of IT devices at schools and the need for infrastructural investment to ensure 100 percent access by all students and teachers.

The study found a need to strengthen transportation, medical facilities, electrical backup, internet access, e-library resources, school websites/YouTube channels, utilization of IT devices, recreational spaces, and essential amenities. There was most demand for

improving internet access and quality in schools. The soft infrastructure is mostly lacking in schools and may pose a significant challenge to implementing BL teaching methodologies.

Tajikistan respondents believe that the presence of well-qualified teachers and the utilization of school resources and technology enhance their academic performance and learning. Although the student-teacher ratio is not quite as high in the country, the teachers have master's qualifications, but they lack pedagogical skills and training, which can limit their potential to implement FCM effectively. Like their Uzbekistan counterparts, Tajikistan teachers also believe their school lacks highly skilled teachers. Lack of IT and human skills has resulted in a low adoption rate and referencing of online resources (Table 13). Tajikistan students perceive chemistry as the most challenging subject to comprehend, with mathematics, physics, and English following suit (Table 14). They prefer acquiring computer, chemistry, physics, mathematics, biology, and English

knowledge through BL approaches. This finding implies, like all other countries, that there is an urgent need to implement FCM for these specific subjects; however, without closing the IT and human resource gap, it will not be possible. Although the government has initiated several IT projects to bolster the IT infrastructure of schools, the school administrators perceive it as limited.

Table 13:Student and teacher perceptions regarding technology, school facilities, and teachers

	Male (%)	Female (%)	Pak	Kazak	Uzbek	Tajik	Total	Percent	Male (%)	Female (%)	Pak	Kazak	Uzbek	Tajik	Total	Percent
	Students								Teachers							
Yes	0.33	0.27	99	28	35	55	217	59.90	50	53.90	9	10	8	4	31	52.5
No	0.03	0.06	23	3	4	2	32	8.84	20	5.13	4	0	0	2	6	10.2
TSE	0.11	0.16	17	33	31	15	96	26.50	30	41.00	11	1	4	6	22	37.3
	digital learning facilities increase learning								school digital facilities increase student learning							
Yes	0.37	0.37	120	54	35	58	267	73.80	85	89.7	18	10	12	12	52	88.10
No	0.02	0.05	16	3	3	4	26	7.18	5	0.0	1	0	0	0	1	1.69
TSE	0.09	0.10	13	12	34	10	69	19.10	10	10.3	5	1	0	0	6	10.20
	Satisfaction with teaching methodologies								School has well-qualified teachers							
Yes	0.35	0.38	120	55	38	57	265	73.20	5	0.0	1	0	0	0	1	1.69
No	0.04	0.04	16	1	5	3	27	7.46	85	89.7	20	11	11	10	52	88.10
TSE	0.10	0.09	13	13	29	12	70	19.30	10	10.3	3	0	1	2	6	10.20

Note: TSE = to some extent

Table 14:Subject preference for BL and difficulty level

Subject	Most difficult subjects to understand								Preferred subjects for BL technique							
	Male (%)	Female (%)	Pak	Kazak	Uzbek	Tajik	Total	Percent	Male (%)	Female (%)	Pak	Kazak	Uzbek	Tajik	Total	Percent
English	6.91	8.01	28	9	7	10	54	14.92	16.85	23.20	40	34	36	35	145	40.06
NL	3.59	4.70	13	7	3	7	30	8.29	9.67	8.01	23	11	7	23	64	17.68
Mathematics	21.55	18.23	79	20	29	16	144	39.78	21.82	18.78	76	28	8	35	147	40.61
Physics	15.75	19.06	34	41	39	12	126	34.81	22.93	17.68	69	24	14	40	147	40.61
Chemistry	19.34	18.78	34	33	32	39	138	38.12	19.61	16.30	53	19	13	45	130	35.91
Biology	8.56	4.97	14	12	16	7	49	13.54	18.51	12.71	34	25	20	34	113	31.22
SS	2.21	4.42	20	0	1	3	24	6.63	11.05	10.50	19	8	31	20	78	21.55
IS	0.28	0.28	1	0	0	1	2	0.55	3.31	3.04	13	0	7	3	23	6.35
Computer	0.55	0.83	2	0	1	2	5	1.38	10.22	7.46	8	2	4	50	64	17.68
Other	2.76	1.93	1	4	4	8	17	4.70	2.76	4.42	6	4	7	9	26	7.18

Note: SS = social studies, IS = Islamic studies, NL = national language

The viewpoints of students and teachers regarding learning styles and preferences show some variation, with the majority favoring visual methods. Most students—62 percent to be exact—have a distinct inclination towards visual learning, particularly through captivating films. Text-based and aural modes are also favored, although to a lesser extent(Appendix Table VI). Teachers also chose graphics and captivating films as efficacious instructional techniques. Approximately 64 percent of respondents are acquainted with the FCR approach, and the training for its implementation differs throughout countries. Kazakhstan excels in conducting training sessions, but Pakistani instructors report receiving the least amount of help in terms of training. Video lessons are extensively distributed, particularly in Kazakhstan and Uzbekistan, although the exchange of resources is restricted in Pakistan and Tajikistan.

5.4 ACCESS, USAGE, AND TRAINING REQUIREMENTS OF IT DEVICES AND ONLINE PLATFORMS

This section presents our findings regarding the access and digital literacy of respondents in the study. We have investigated the access, usage, and training requirements for different devices and platforms by students and teachers. The findings are reported in Tables 15 to 18 below(also see appendix-tables XII to XXI).

Kazakhstan

The device access rate in Kazakhstan is over 90 percent, a high penetration level in the country. One (or more than one) device—such as SP or TV, laptops, iPads/tablets, and even PCs—are available and accessible to most respondents who have already used SP and laptops for educational purposes.[14] In most cases, there is one laptop per family, including parents. Therefore, in large families, if students have to do homework on a laptop at home, it may pose challenges. However, there is still a need to impart training on using these devices before implementing FCM because teachers and students have expressed the need for training. The most often used platform by students in the country are internet browsers; YouTube; messaging apps such as WhatsApp, such as WhatsApp and Telegram; MS Office; Google Classroom; Daryn Online; and Similar to devices, training of platforms will be crucial before implementing an FCM framework.

[14] Over 90 percent of pupils in Kazakhstan have access to TV and smartphones (actually own them), and 20 percent to 50 percent have access to laptops, PCs, tablets, or iPads. Over 70 percent have used smartphones and laptops for educational purposes. Pupils and teachers (50 percent) require PC (45 percent) and SP (25 percent) training to use them for educational purposes.

Pakistan

Device accessibility in Pakistan ranges from low to moderate. The device penetration rate in the country is between 50 and 60 percent.[15] Most accessed gadgets are TV and SP, while access to laptops, PCs, and tablets is limited. The accessibility of devices will be lower in middle- and lower-income districts, creating a significant barrier to adopting FCM. The finding highlights the country's wide-ranging digital technology gaps that further widen learning poverty and the learning gap among poor and rich segments of society. In addition to accessibility, the digital literacy of the people with access is low, and that of those who do not have access may be zero. The most widely utilized platforms in Pakistan by students and instructors are internet browsers, YouTube, WhatsApp, and MS Office. These platforms serve both leisure and educational purposes. Over half of students—specifically 50 percent—and a quarter—precisely 25 percent—of teachers will require training to utilize these platforms for educational purposes effectively. There is a need for willful policy intervention and investment to enhance the device access rate and close the digital literacy gap for a more inclusive and equitable learning environment.

Uzbekistan

The device penetration rate for students and teachers in the country is quite high, between 90 percent and 100 percent.[16] Both learners and educators have access to one or more of the devices required for BL and have already utilized them for educational

[15] Over 60 percent of students have access to television, 51 percent possess smartphones, 24 percent own laptops, and 18 percent have tablets or personal computers. Of students, 30 percent have personal smartphones, while 42 percent have used them for educational purposes. Approximately 20 percent to 30 percent of students will require instruction to utilize devices for educational purposes effectively. Device access and literacy rate among instructors is a little higher than among students; however, 50 percent require training to use devices for educational purposes.

[16] Of respondents, 90 percent have access to television and online platforms, while over 60 percent have access to laptops and basic mobile phones. Over 60 percent of individuals have previously used television, laptops, smartphones, and iPads for educational purposes. Approximately 20 percent to 25 percent of individuals will require instruction to use devices and platforms—specifically of PC, MS Office, and Google Classrooms—for educational purposes.

purposes. The finding depicts a promising picture for implementing FCM, and the high access device rate may significantly contribute to the smooth implementation of the FCM. The primary platforms utilized by the respondents include internet browsers, YouTube, messaging applications, MS Office, Google Classroom, Kitobkhona, EduMarket, and Eduportal. Uzbek respondents have already utilized national educational platforms that can simplify the FCM implementation process because most stakeholders are already familiar with the online platforms. However, there is still a need to impart training on devices and platforms before implementing FCM for more inclusive and effective implementation.

Tajikistan

The smart device penetration rate in Tajikistan is over 90 percent,[17] and the most commonly utilized devices in the country are laptops, SPs, and PCs that they have previously accessed and used for educational purposes. The most commonly used platforms in the country include internet browsers, YouTube, messaging apps, MS Office, and eDonish. Although the access and usage of devices and platforms are admirable in

[17] 47 percent have access to and ownership of computers. Between 60 percent and 90 percent of students have previously utilized top-tier technological devices for educational purposes. Over 50 percent require instruction in utilizing MS Office, internet browsers, YouTube, laptops, PCs, tablets, or iPads for instructional and educational purposes.

the country, the study found there is still a need for professional training to use them for educational purposes.

Table 15:Device access by students (%)

Device	Male	Female	Pak	Kazak	Uzbek	Tajik	Total
TV	88.57	88.24	67.79	91.30	98.61	91.67	83.15
Laptop	47.43	47.59	24.83	56.52	68.06	47.22	43.92
PC	30.86	31.55	18.12	24.64	37.50	31.94	25.97
Tablet/iPad	29.14	27.81	18.12	27.54	33.33	33.33	25.97
SP	80.57	70.01	51.01	98.55	100.00	90.28	77.62
Basic Phone	49.71	48.13	37.58	33.33	62.50	31.94	40.61
Game Player	21.14	14.44	13.42	13.04	18.06	18.06	15.19
Other	8.57	4.28	2.68	0.00	16.67	8.33	6.08

Table 16:Device access by teachers (%)

Device	Male	Female	Pak	Kazak	Uzbek	Tajik	Total
TV	65.00	87.18	66.67	90.91	91.67	83.33	79.66
Laptop	60.00	84.62	62.50	100.00	100.00	58.33	76.27
PC	20.00	28.21	16.67	18.18	58.33	16.67	25.42
Tablet/iPad	20.00	30.77	12.50	27.27	41.67	41.67	27.12
SP	65.00	84.62	54.17	90.91	100.00	91.67	77.97
Basic Phone	35.00	35.90	20.83	45.45	58.33	33.33	35.59
Game Player	5.00	5.13	4.17	0.00	0.00	16.67	5.08
Other	5.00	0.00	0.00	9.09	0.00	0.00	1.69

Table 17:Top platforms used before for educational purposes (students %)

Platforms	Male	Female	Pak	Kazak	Uzbek	Tajik	Total
Internet browser	77.14	68.45	48.99	81.16	97.22	88.89	72.65
YouTube	69.71	67.38	46.31	78.26	97.22	76.39	68.51
Chat/WhatsApp	60.57	59.89	48.99	65.22	76.39	62.50	60.22
MS Office	51.43	52.92	30.87	37.68	97.22	65.28	52.21
Google Classroom	16.00	20.32	16.78	21.74	30.56	5.56	18.23
Daryn Online	13.71	14.97	2.01	71.01	0.00	0.00	14.36
Kitobkhona.tj	11.43	12.82	1.34	0.00	56.94	1.39	12.15
Talim.uz	10.29	9.63	1.34	0.00	49.28	0.00	9.94
Eduportal	12.57	11.76	2.01	0.00	56.94	0.00	12.15
EduMarket	11.43	8.56	2.01	0.00	45.83	0.00	9.94
E-Maktab	8.57	7.49	2.01	1.45	34.72	0.00	8.01

Table 18:Platform use for educational purpose (teachers %)

	Male	Female	Pak	Kazak	Uzbek	Tajik	Total
Internet browser	80	97.44	62.50	100.00	100.00	83.33	81.36
MS Office	70	84.62	58.33	100.00	91.67	75.00	76.27
YouTube	65	89.74	45.83	100.00	100.00	66.67	71.19
Chat/WhatsApp	65	84.62	50.00	81.82	83.33	66.67	66.10
Google Classroom	10	48.72	20.83	81.82	66.67	0.00	35.59
LMS	15	17.95	12.50	36.36	25.00	0.00	16.95
Daryn Online	10	17.95	4.17	72.73	8.33	0.00	15.25
Kitob.uz	5	20.51	4.10	12.73	0.00	0.00	15.25
Bilimland	10	17.95	0.00	63.64	0.00	0.00	15.25
eDonish	0	20.51	0.00	9.09	0.33	41.67	13.56
E-Maktab	5	17.95	0.00	9.09	50.00	0.00	13.56
Eduportal	0	17.95	0.00	0.00	58.33	0.00	11.86
Ilm ke Dunya	5	23.08	0.00	0.00	50.00	0.00	10.17
Kitobkhona.tj	0	15.38	0.00	0.00	50.00	0.00	10.17
EduMarket	0	15.38	0.00	0.00	50.00	0.00	10.15
Kitobdust	10	7.69	0.00	0.00	0.00	5.33	8.47
TedEd	0	15.38	4.17	9.09	25.00	0.00	8.47
Bilim Media Group	0	10.26	12.50	27.27	0.00	0.00	6.78

5.5 COUNTRY-WISE FCM FEATURES

In this section, we asked students and teachers about the various features of FCM, including the type of FCM they would like to experience and whether it would benefit their performance. We posed 17 questions to teachers and students about different FCM features and recorded their responses. In addition, we asked students, teachers, and administrative staff general questions regarding FCM, which are analyzed below. Tables 19, 20, and 21 below(also see appendix- tables XXII and XXIII) present the findings regarding the FCM features. We report respondents' opinions country-wise to understand the FCM modalities preferred by the sample population in our study. The chi-square test in the study reveals that respondent choices vary significantly by country, but differences across genders are not significant in the sample.

Table 20 offers an insightful breakdown of student preferences regarding the timing of VLs sessions across various countries, revealing notable trends and insights into how students prefer to engage with their learning materials. Among the different time options presented, "during class" stands out as the most favored choice, with approximately 50% of students across the surveyed countries endorsing this option. This inclination is particularly pronounced in Kazakhstan, where around 53.62% of students preferred this timing, and even more strikingly in Tajikistan, with a preference rate of 54.17%. This preference suggests that students benefit from the structure and support of having

VLs integrated into the classroom environment, allowing for immediate clarification and teacher guidance. In stark contrast, the options regarding VLs delivered "before class" and "after class" were met with considerably less enthusiasm. Specifically, the "before class" option garnered notable interest in Pakistan, where 28.36% of students chose it, while "after class" received a slight preference in Kazakhstan, with 24.64% selecting this time frame. This discrepancy indicates that, while a segment of students values the potential flexibility of engaging with VLs outside of structured class times, the overwhelming majority still lean towards the supervised environment of the classroom for their educational experiences. Interestingly, the "any time" option received notable backing, specifically in Uzbekistan, suggesting that students there may have a more pronounced inclination toward self-paced learning than their counterparts in other regions.

Delving into content distribution, a striking preference emerges for using Messenger as the predominant communication tool for accessing learning materials. This is particularly evident in Kazakhstan and Uzbekistan, where usage rates soar to remarkable levels of 91.43% and 90.28%, respectively. This heavy reliance on instant messaging channels underscores students' desire for swift, accessible methods of communication for receiving flipped classroom materials. Other tools, such as email and USB drives, showed moderate popularity, with email being utilized by about 35% of students and USB being favored by 30%. Email stands out in Pakistan, where 41.22% of students prefer it, while the USB option is relatively popular in Uzbekistan, with 33.33% of students choosing this

method. These preferences highlight the varying levels of technology access and the diverse communication habits among students in different countries.

When accessing VLs, YouTube Channels emerge as the preferred platform, with students in Kazakhstan and Uzbekistan particularly gravitating towards it. This trend can be attributed to YouTube's widespread accessibility, intuitive user interface, and established reputation as a valuable learning resource among students. Following YouTube, School Websites are the second most popular choice for accessing learning materials, displaying particularly high levels of engagement in Uzbekistan, where 79.17% of students report frequent use. This indicates that resources managed by schools play an essential role in students' online educational journeys. LMS has found favor in Pakistan and Kazakhstan, highlighting a significant reliance on structured, institutionally managed platforms to facilitate learning.

In terms of preferred VL-sharing formats, students overwhelmingly articulated preference for VLs shared with study materials, especially in Uzbekistan (87.5%) and Kazakhstan (81.43%). Such preferences underscore the vital role of supplementary resources that help to

deepen students' comprehension and reinforce the learning material. Moreover, short VLs that include homework assignments resonate well with students, particularly in Kazakhstan, where 67.14% favor this combination. This format effectively addresses the need for concise learning modules coupled with practical assignments, thereby enabling students to solidify their understanding of core concepts. Problem-Solving VLs garner significant interest, with roughly half of the respondents expressing a preference for this format. Strong preference rates are noted in Kazakhstan, where 75.71% of students favor problem-solving sessions, and in Uzbekistan, with 62.5% indicating a liking for this approach. This trend illustrates that students highly value VLs that encourage active participation and the practical application of learned material, making the learning experience more engaging and relevant.

To enhance student interest and engagement, the advanced sharing of CP materials emerges as a key factor, particularly in Uzbekistan (84.72%), as it allows students to prepare and engage more deeply during VL sessions. Furthermore, the strategy of dividing content equally into online and in-person formats is regarded highly, notably in Kazakhstan (60%) and Uzbekistan (63.89%). This indicates that many students see the value in a BL approach that combines the benefits of both traditional classroom settings and online learning. In exploring the preferred settings for consuming VLs, students overwhelmingly favor watching these sessions in a home environment, primarily due to fewer distractions. This preference is especially significant in Pakistan, where 60.14% of students desire to engage with VLs at home, and in Uzbekistan, 62.5% echo

similar sentiments. For many students, the comfort of learning at home offers a more conducive atmosphere for concentrating on their studies. A notable 87.5% of students in Uzbekistan particularly highlight that their home setups provide a more comfortable learning environment. While some still express a preference for classrooms with fewer distractions—evident in Pakistan, where 58.78% favor this option—overall, the data suggests that most students increasingly prefer the flexibility and comfort that comes with accessing VL content from the familiarity of their homes.

Table 19:FCM feature: student perceptions (%) , part A

	Pak	Kazakh	Uzbek	Tajik	Male	Female	Total
Delivery options for VLs							
Before class	28.36	13.04	0	13.89	20	13.37	16.43
During class	52.99	53.62	34.72	54.17	44.38	54.01	49.53
After class	15.67	24.64	1.39	23.61	16.25	16.04	16.14
Any of these times	0	1.45	43.06	0	7.5	10.7	9.22
FCM sharing tools							
Messenger	56.76	91.43	90.28	70.83	72.57	73.26	73
Email	41.22	34.29	31.94	25	33.71	35.83	35
USB	36.49	15.71	33.33	26.39	26.86	32.62	30
Bluetooth	24.32	24.29	1.39	12.5	13.71	20.86	17
Other	8.78	5.71	6.94	2.78	5.71	7.49	6
Preferred access points for VLs							
School website	38.51	64.29	79.17	48.61	49.14	57.75	53
LMS	51.35	52.86	22.22	18.06	36	42.25	39
YouTube channel	58.78	84.29	81.94	37.5	66.29	62.03	64
Online, other than school resources	37.84	58.57	38.89	37.5	42.29	41.71	42

Table 19:FCM feature: student perceptions (%) , part A continued

	Pak	Kazakh	Uzbek	Tajik	Male	Female	Total
Sharing VLs							
VL with study material	66.22	81.43	87.5	40.28	69.71	66.84	68
Short VL and related homework	59.46	67.14	40.28	36.11	53.71	51.34	52
Only VL as homework	43.92	32.86	18.06	12.5	30.29	30.48	30
Only VL and no in-person class	29.73	12.86	13.89	6.94	16.57	20.86	18
Lecture-related short text	41.22	62.86	38.89	25	33.71	49.2	42
Problem-solving VL	36.49	75.71	62.5	41.67	49.14	51.34	50
Audio lecture	31.08	62.86	38.89	20.83	38.86	45.99	37
Animated VL	32.43	58.57	65.28	25	34.29	39.04	42
VL includes activities of student interest	20.27	58.57	75	26.39	40	39.57	40
Enhancing student interest and engagement							
CP, including FCM material, shared in advance	57.43	67.14	84.72	52.78	68.57	59.36	63.81
CP equally divided into online and in person content	56.08	60	63.89	38.89	53.71	56.15	54.97
Student opinions considered in the CP	62.84	72.86	41.67	29.17	48	59.36	53.87
Student attitudes considered in the CP	52.7	52.86	70.83	13.89	41.71	55.08	48.62
Reasons for preferred VLs access points							
At home, fewer distractions	60.14	51.43	62.5	25	51.43	52.41	51.93
At home, more comfortable environment	56.76	62.86	87.5	31.94	56	62.03	59.12
At CL, fewer distractions	58.78	37.71	12.5	13.89	38.86	33.69	36.19
At CL, more comfortable environment	44.59	55.71	47.22	45.83	41.14	53.48	47.51
Anywhere during free time	41.89	25.71	13.89	13.89	24	31.02	27.62

Table 21 highlights key preferences among students regarding virtual learning (VL), focusing on aspects such as who should record the VLs, the preferred language, content coverage, and ideal length. The data reveals a strong preference for VLs recorded by top tutors globally, with 56% of students favoring this option. This preference is particularly pronounced in Uzbekistan (79.17%), Kazakhstan(61.43%) and Tajikistan (61.11%).

This trend indicates that students highly value insights and expertise from subject-matter experts outside their regular classroom environment, viewing these recordings as opportunities to gain broader perspectives and specialized knowledge. There is also considerable support for teachers recording VLs privately, with 54% of students expressing this preference. This inclination is especially strong in Uzbekistan and Kazakhstan, suggesting that students feel a level of trust and comfort with their familiar instructors, as they believe their own teachers best understand the curriculum and learning goals.

Recording VLs during class is moderately favored, with Pakistan showing the highest support at 52.7%. This preference may stem from the perceived benefits of capturing interactive, real-time explanations, which some students find valuable for reinforcing concepts. While less favored than teacher-led recordings, peer-to-peer learning also receives significant support, particularly when recordings are made by fellow students globally. This preference is more pronounced in Uzbekistan, Kazakhstan, and Pakistan. This reflects students' appreciation for collaborative learning and interest in hearing explanations from peers who understand similar challenges. However, preferences for student group discussions and student-generated content are generally lower.

In terms of language, local language is the top preference (65.75%), particularly in Uzbekistan (83.33%) and Pakistan (66.89%). This strong preference suggests that students are more comfortable and engaged when VLs are in a language familiar to them, which likely enhances understanding and makes the material more relatable. The national language is moderately popular (45.3%), as it provides a standardized form of communication, though it may not feel as accessible or personal as the local language. Interestingly, VLs that are explicitly helpful for understanding difficult concepts receive very high support in Kazakhstan (91.43%) and Uzbekistan (95.83%), emphasizing that students value clarity and comprehensibility over the specific language used, particularly for complex topics.

Regarding content coverage, students express varied preferences. A majority prefer VLs that cover all subjects (49%), with the highest interest in Uzbekistan (59.72%) and Pakistan (54.73%), indicating a desire for a comprehensive approach. However, VLs focusing on specific subjects are also a popular choice (47%), particularly in Kazakhstan (55.71%), suggesting that students may want focused support in subjects they find challenging or essential for their academic goals. The lower preference for covering all contents of subjects and specific topics indicates that while some students appreciate in-depth content, others prefer a balanced approach rather than diving deeply into every detail. Surprisingly, the preference for longer VLs (over 30 minutes) is quite high, at 72%, particularly in Kazakhstan (90%) and Tajikistan (88.89%). This finding suggests that students in these regions value detailed, in-depth explanations and are comfortable with extended learning sessions that allow for comprehensive topic coverage. Although

shorter VLs are less preferred, a notable number of students from Pakistan (62.2%) favor VLs of 15 to 20 minutes. This indicates that while most students find shorter sessions insufficient for comprehensive learning, they can still be effective for specific, concise topics.

Table 20:FCM feature: student perceptions (%) ,part B

	Pak	Kazakh	Uzbek	Tajik	Male	Female	Total
VL resource person/source							
Teacher privately	52.03	55.71	81.94	26.39	60.57	47.06	54
Teacher during class	52.7	34.29	43.06	19.44	41.71	39.57	41
Students during group discussion	42.57	58.57	36.11	19.44	44	35.83	40
Students globally and available online	45.95	64.29	44.44	25	37.14	52.41	45
Best tutors globally and available online	40.54	61.43	79.17	61.11	53.14	59.36	56
Ideal language of the VLs							
Local language	66.89	58.57	83.33	52.78	64.57	66.84	65.75
English	52.7	20	44.44	23.61	36	41.71	38.95
National language	59.46	41.43	36.11	29.17	44	46.52	45.3
Helpful to understand difficult concepts	45.95	91.43	95.83	30.56	57.71	65.24	61.6

Table 20:FCM feature: student perceptions (%) , part B)- continued

	Pak	Kazakh	Uzbek	Tajik	Male	Female	Total
VLs content coverage							
All subjects	54.73	31.43	59.72	43.06	47.43	50.27	49
Specific subjects	49.32	55.71	51.39	29.17	47.43	46.52	47
All contents of the subjects	46.62	10	51.39	11.11	29.14	37.43	33
Specific topics	33.78	5.71	61.11	30.56	31.43	34.76	33
Other	10.14	0	0	0	2.86	5.35	4
Ideal length of the VLs							
More than 30 mins	68.89	90	72.22	88.89	76	68.98	72
15 to 20 mins	62.2	4.88	31.71	7.78	26.29	23.53	29
5 to 10 mins	44.44	4.88	18.89	1.22	18.29	26.74	12
Less than 5 mins	1.69	4.44	2.99	0	25.14	33.69	2

Table 21 provides insights into the extent to which students feel burdened by different frequencies and volumes of Virtual Lectures (VLs), online quizzes, and assignments. Across demographics, daily sharing of VLs, quizzes, or assignments is the most overburdening, with Kazakhstan (57.14%) and Pakistan (51.35%) reporting the highest stress levels. This indicates that daily academic demands may exceed students' capacity to manage their workload, potentially impairing their overall learning efficiency due to cumulative mental and time strain. In contrast, fewer students feel overburdened when content is shared weekly (25%) or for specific subjects (18%). Kazakhstan and Tajikistan students report very low burden levels with weekly sharing (1.43% and 1.39%,

respectively). This frequency likely allows better pacing and reinforces understanding without overwhelming them. Similarly, sharing content for only specific subjects alleviates stress by limiting engagement demands, though Pakistani students still report feeling relatively burdened (28.38%) under this approach, perhaps due to differences in subject loads or variations in academic support structures.

Frequent quizzes and assignments appear particularly taxing for Uzbekistan students, where 72.22% report feeling overburdened, and an equal percentage feel overburdened by frequent assignments. This suggests consistent, high-frequency assessments are perceived as intense and challenging, potentially impacting students' academic confidence and well-being. The gender analysis also highlights that male students experience a slightly higher burden (41.14% for quizzes, 37.43% for assignments) compared to female students, indicating that frequent assessments may contribute disproportionately to stress in certain demographic groups. However, when quizzes and assignments are uploaded only occasionally, students feel less burdened (20% overall). Kazakhstan students report feeling the least burdened in this scenario, suggesting that occasional assessments may better align with their expectations or learning preferences. Sharing VLs, quizzes, or assignments for every subject also appears burdensome (35%). Tajikistan and Kazakhstan students feel this burden more acutely, with 41.67% and 40%, respectively, compared to a more moderate impact among other groups. This suggests that multi-subject assignment schedules may lead to workload stacking, which could be overwhelming, especially for students managing multiple subjects with overlapping deadlines.

To enhance engagement and motivation, students have varying preferences for who should lead discussions on Virtual Lectures: Teacher-Led Discussions in Class are the most preferred option (68.51%), suggesting that students find value in having instructors facilitate these discussions to reinforce learning. Uzbek students show the highest preference (93.06%), highlighting the importance of teacher interaction in their learning culture. This preference is consistent across genders, though females (67.91%) show slightly less preference than males (69.14%). Substantial preference is also given to student-led discussions in class. Uzbekistan students again report a higher preference, indicating that peer discussions may further enhance engagement in their region. Tajikistan students (20.83%) show relatively low preference for this method, possibly due to differences in classroom culture or student confidence in peer-led discussions. Individual reflection has a moderate preference level, with students from Uzbekistan again showing a strong preference (79.17%). This might imply that these students value personal study and reflection, potentially due to cultural or educational expectations around individual responsibility. While still valued, group discussions are the least preferred. Tajikistan students slightly prefer this mode (34.72%), indicating that collaborative discussions may not be as effective in all contexts.

Offering incentives is a highly effective strategy for motivating students to watch and learn from VLs, with Uzbekistan students showing the highest preference (87.5%), indicating that rewards can significantly drive engagement. Female students favour this approach slightly over males, suggesting that incentives might be particularly impactful

in encouraging participation. Additionally, students value active encouragement from teachers, indicating that verbal or relational motivation also plays a key role in engagement. Making VLs mandatory for final assessments has a moderate impact, yet it especially motivates Uzbekistan students (43.06%), who appear more responsive to the academic importance placed on VLs. In contrast, Tajikistan students show the least preference for this approach, which may reflect differing perceptions of VLs' role in assessments or varying educational priorities. This variation underscores the need to tailor motivation strategies to fit cultural and educational contexts effectively.

The results indicate that VLs are valued across different regions and genders for their flexibility and potential to enhance learning outcomes. Allowing students to watch VLs at their convenience (Anytime) is considered the most beneficial factor, with the highest preference in Uzbekistan (93.06%) and Kazakhstan (78.57%). This suggests that flexibility in accessing VLs accommodates diverse schedules and learning preferences, likely enhancing retention and comprehension. Female students show a slightly stronger preference for this feature compared to male students. The ability to use VLs for revisiting and clarifying concepts is also highly valued, with Uzbekistan students again showing strong support. it suggests that VLs serve as a helpful resource for reinforcing

knowledge and allowing repeated exposure to complex material, which may support better academic outcomes. Students also appreciate being able to learn at their own pace through VLs, particularly Kazakhstan students. The ability to replay VLs to enhance understanding is another important feature. This indicates that precise, repeated review may help students grasp complex topics, suggesting that the capability to replay is particularly beneficial in regions where educational systems emphasize comprehensive understanding.

Teacher involvement through feedback, grading, and tracking has a varied impact on student performance, with certain actions emerging as more supportive across different regions. Regular feedback is seen as highly beneficial, especially among Kazakhstan (84.29%) and Uzbekistan students (79.17%), indicating that constructive, timely guidance from teachers is crucial for student improvement. This finding suggests that consistent feedback can reinforce learning, clarify misunderstandings, and motivate students. Students in Kazakhstan show a strong preference for tracking in-class activities (68.57%), which may help keep them engaged and focused during lessons. Tracking out-of-class activities is moderately beneficial across all groups but with less emphasis. These findings indicate that structured monitoring in different settings helps maintain consistency in students' academic efforts. Rating quizzes solely by marks is less favored, especially among Uzbek (19.44%) and Tajik students (22.22%), suggesting that students may prefer assessment methods considering effort and understanding. Ratings based on both marks and learning attitude are more appealing, particularly for Uzbek students (75%), as this balanced approach might more accurately reflect a student's engagement and comprehension.

To implement a FCM effectively, students strongly prefer specific online platform features that support accessibility, organization, and interaction. An accessible and user-friendly platform is the top preference for students across all the surveyed countries. Uzbekistan and Kazakhstan students indicate the highest preference for this option. This highlights the importance of intuitive design in ensuring consistent engagement with online resources, as complex or cumbersome platforms could hinder learning. Moreover, students prefer a platform with well-organized course content, with notable emphasis shown by students from Uzbekistan (80.56%) and Kazakhstan students (74.29%). This indicates that clear structure enhances the learning experience by making materials easier to navigate and locate. This organization likely benefits students by reducing cognitive load and time spent searching for materials. The preference for platforms that adapt to individual needs is notably high among Uzbek (79.17%) and Kazakh students (70%), suggesting that adaptability is essential in accommodating different learning paces, styles, and requirements. This aligns with FCM's goal of personalized learning, where students have control over the pace and depth of their study.

Table 21:FCM feature: student perceptions (%), part C

	Pak	Kazakh	Uzbek	Tajik	Male	Female	Total
Ideal Frequency of VLs, online quizzes, and assignments							
If shared daily	51.35	57.14	44.44	33.33	45.14	49.73	48
If shared weekly	27.97	1.43	25	1.39	28	22.46	25
If shared for every subject	33.11	40	26.39	41.67	34.86	34.86	35
If shared for a specific subject	28.38	4.29	23.61	2.78	18.86	16.58	18
If frequent quizzes are uploaded	28.38	52.86	72.22	15.28	41.14	37.43	39
If frequent assignments are uploaded	27.03	28.57	72.22	12.5	37.43	33.16	33
If quizzes and assignments are uploaded occasionally	18.92	2.86	37.5	20.83	20	19.79	20

Table 21:FCM feature: student perceptions (%), part C

	Pak	Kazakh	Uzbek	Tajik	Male	Female	Total
Preferred VLs discussant after watching							
Teacher in class	57.43	74.29	93.06	61.11	69.14	67.91	68.51
Students in class	54.05	60	73.61	20.83	54.29	50.8	52.49
Individually	56.76	48.57	79.17	18.06	53.14	50.8	51.93
Group discussion	50	50	61.11	34.72	44.57	53.48	49.17
Teacher's role in motivating students to watch and learn from VLs							
If teachers motivate students to watch VLs	57.43	55.71	59.72	44.44	59.43	50.8	54.97
If teachers verify that students have watched the VL	58.11	40	41.67	9.72	50.8	41.18	41.71
If the teacher provides an incentive to watch VL	55.41	60	87.5	30.56	56.57	58.82	57.73
If watching and learning from VL is compulsory in the final assessment	37.84	38.57	43.06	23.61	34.29	37.97	36.19
If VLs provide more time for extracurricular activities	43.24	24.29	26.39	31.94	31.43	36.36	33.98
Other	20.27	5.71	4.17	0	9.14	11.23	10.22
VL's impact on student performance							
Because they can watch VLs at anytime	60.81	78.57	93.06	47.22	66.29	69.52	67.96
They may revise concepts	62.84	71.43	79.17	45.83	65.14	63.64	64.36
They may learn at their own pace	57.43	71.43	62.5	43.06	57.14	59.36	58.29
They can replay VLs for a precise understanding	55.41	57.14	79.17	33.33	49.71	62.03	56.08
Other	20.27	0	13.89	0	9.71	12.3	11.05
Teacher feedback, grading and tracking of student performance							
If the teacher provides frequent feedback for improvement	57.43	84.29	79.17	47.22	66.86	63.1	64.92
If the teacher rates quizzes based on a mark	52.7	31.43	19.44	22.22	36	35.83	35.91
If the teacher rates quizzes based on learning attitude	45.95	31.43	31.94	18.06	36.57	33.16	34.81
If the teacher rates quizzes on both basis	43.92	42.86	75	16.67	45.71	43.32	44.48
If the teacher tracks out-of-class activities	46.62	58.57	51.39	30.56	43.43	49.73	46.69
If the teacher tracks in-class activities	49.32	68.57	61.11	29.17	46.86	55.61	51.38
If the teacher tracks to speed up pending tasks of the students	47.3	40	33.33	30.56	33.14	45.99	39.78
If teacher tracks students for their workload management	42.57	45.71	51.39	18.06	37.71	42.25	40.06

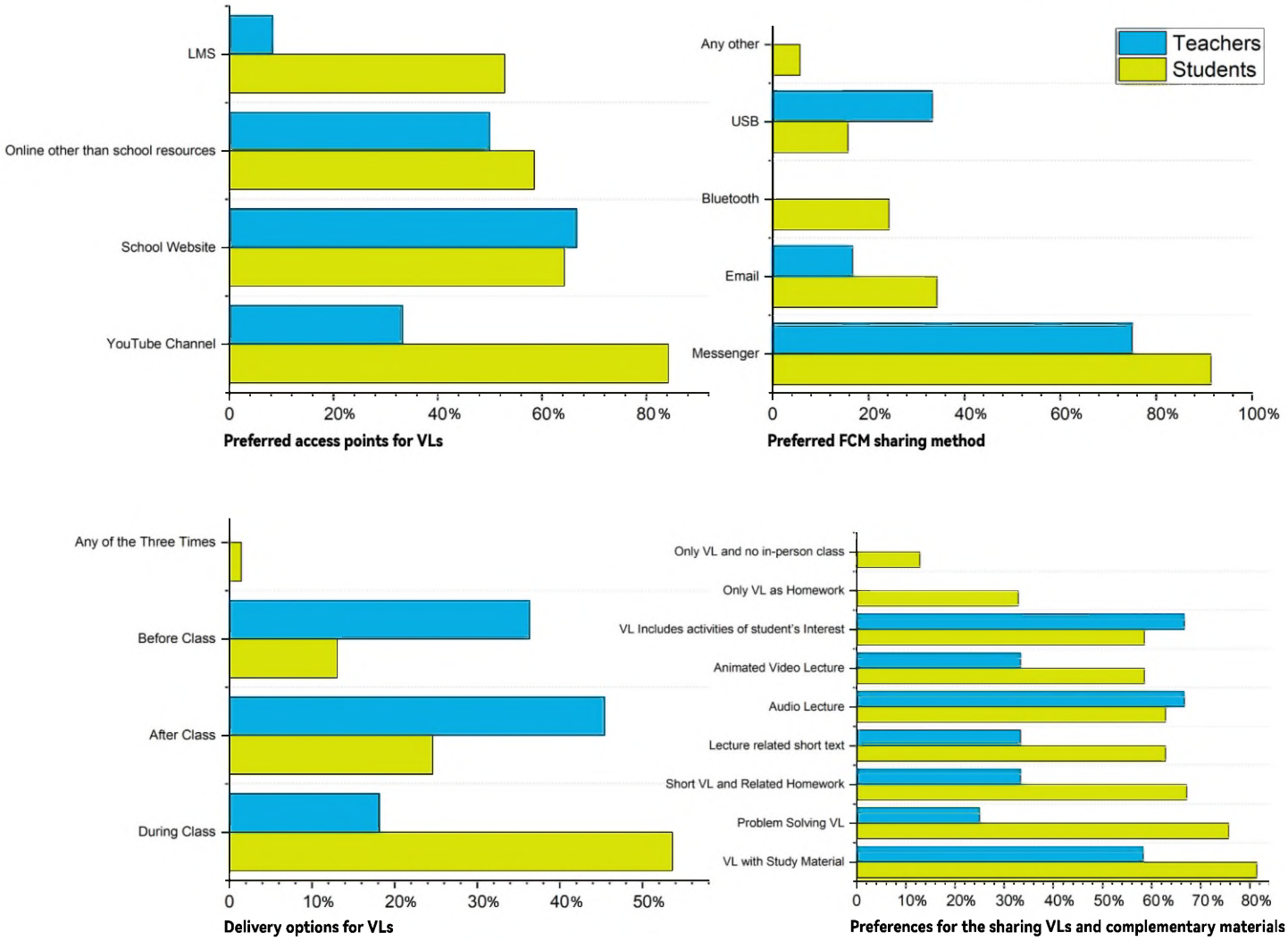
Table 21:FCM feature: student perceptions (%), part C

	Pak	Kazakh	Uzbek	Tajik	Male	Female	Total
Ideal features of the online platform							
A platform that is accessible and easy to use	58.78	84.29	95.83	65.28	71.43	73.26	72.38
A platform that organizes course content well	59.46	74.29	80.56	31.94	58.29	63.64	61.05
A platform that facilitates communication with teachers	56.76	70	56.94	25	53.14	52.94	53.04
An interactive platform	43.24	55.71	79.17	15.28	42.29	53.48	47.24
A platform that makes quizzes easy to attempt	43.24	70	61.11	23.61	45.14	49.2	48.07
A platform that secures privacy	39.86	61.43	87.5	25	48.57	52.41	50.55
A platform that tracks progress frequently	49.32	68.57	47.83	23.61	45.14	49.2	47.24
A platform that provides teacher feedback easily	42.57	67.14	59.72	25	42.29	51.87	47.24
A platform that adapts well to student needs	40.54	70	79.17	25	46.86	54.55	50.83
A platform that provides technical support on need	36.49	60	50	25	35.43	47.06	41.44
A platform that allows collaboration withpeers	37.84	64.29	56.94	33.33	40	51.34	45.86

Preferred VL features Kazakhstan

Figure 3 shows student and teacher responses to four FCM features, and Tables 22 and 23 present a summary of country-wise findings along with chi-squared values. Kazakh students prefer watching VL either during or after class. However, teachers have emphasized that VL delivery should occur before or after class. Although students may perceive watching VL during class as more convenient, teachers emphasize the significance of students arriving to class equipped with the information obtained from the VL.

Figure 3: FCM features Kazakhstan (part A)



To ensure that the educational goals are achieved, reaching a mutually agreeable compromise between both parties is crucial—possibly a point of policy discussion after class that would appear to be a more agreeable option for both teachers and students. Students and teachers predominantly cite Messenger and USB drives as their favorite means of sharing; however, students also find it more convenient to receive VLs through

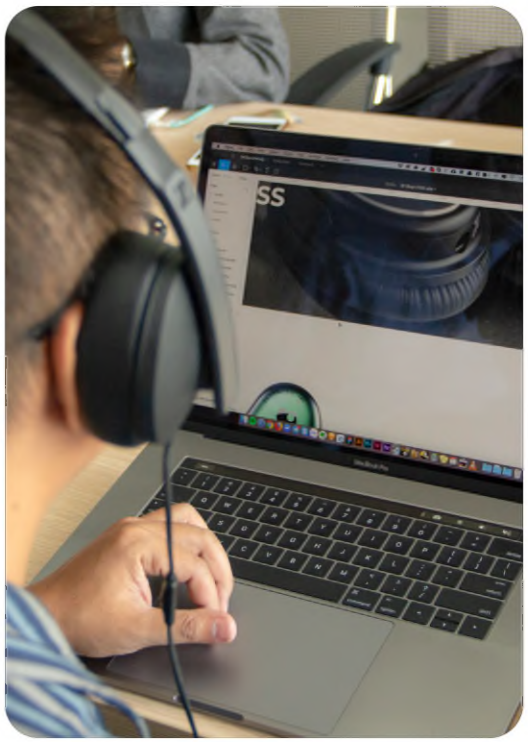
Bluetooth. Therefore, the FCM can utilize various tools such as Messenger, USB drives, email, and Bluetooth to communicate efficiently between students and teachers. These solutions cater to diverse needs and preferences, making it easy to upload files, watch VLs, and access information on students' chosen devices.

Regarding the online platform, Kazakh students prefer having VL resources accessible through YouTube channels, school websites, or other online sources. In contrast, teachers strongly favor the school website and online sources as the preferred platforms for VL availability. According to the student perspective, YouTube appears to enhance the accessibility of online resources, particularly for younger generations who are already familiar with the platform. The teacher viewpoint prioritizes supervision and carefully selecting content on school websites and other sophisticated platforms. Striking a balance between accessibility and quality is crucial to meet student and teacher preferences.

The study found that teachers and students like incorporating various VLs into their lesson plans. A wide variety of VLs can cater to the diverse learning styles of learners and can impact the learning experience of all types of students. For example, students prefer receiving VLs either in the form of study material or a short VL accompanied by relevant assignments. The students also enjoy animated VLs, lecture-related concise texts, and audio lectures. Teachers and students prefer VLs that focus on problem-solving and incorporate activities that align with student interests. Students value many video learning styles, such as lectures supplemented with study material, concise VLs

with interactive components, and videos focused on problem-solving. These formats facilitate student involvement with the information and enhance their comprehension, as various formats ensure effective engagement and deepening of learning.

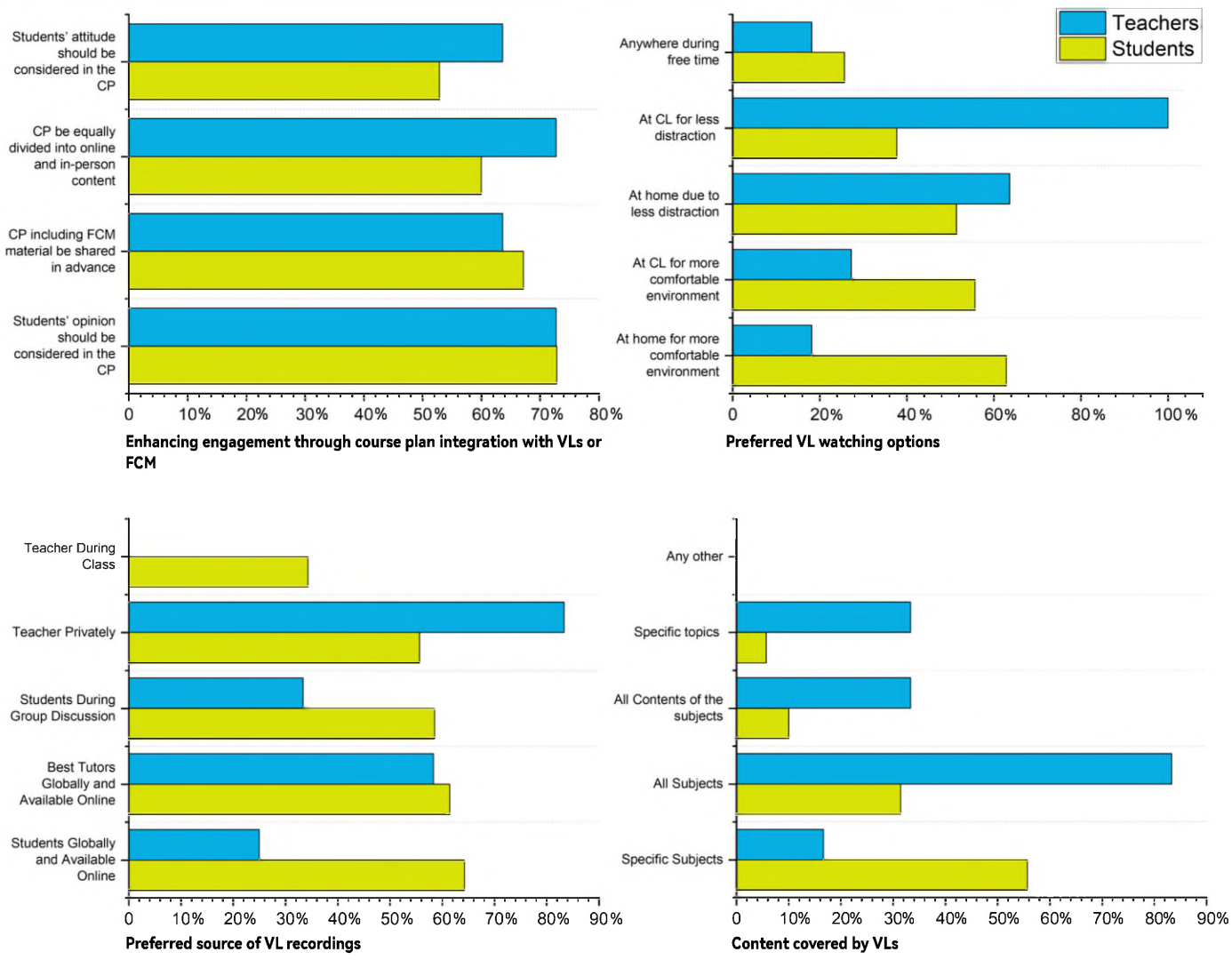
Figure 4 presents FCM features such as VL resource person, content, location to watch, and CP. Students and teachers advocate for including student opinions and attitudes in the CP. Student attitudes should be considered in the CP to ensure that their requirements and preferences are acknowledged. They believe the CP, which encompasses the FCM material, must be disseminated beforehand. Incorporating VLs and FCM plans into the course design and providing them in advance can enhance student preparation and engagement with the topic.



It is advisable to distribute the CP equally between the online and in-person elements. Students can enhance their learning experience by engaging in diverse online and in-person activities, creating a more interactive and dynamic educational environment. Ultimately, instructors can enhance the learning experience by incorporating student views and opinions into the course development process, resulting in a more engaging and inclusive learning environment.

The ideal location, as perceived by respondents from Kazakhstan, is home, as they find it more comfortable. Some students feel that CL offers even greater comfort. However, the instructors believe CL is more suitable for seeing VLs since it offers fewer distractions. Some instructors believe that the home environment is also suitable for minimizing distractions. The debate over where students should watch VLs continues, with some preferring home comfort and others preferring classroom settings. The key is ensuring students fully engage with the material depending upon the mode that the country's infrastructure allows. As far as Kazakhstan is concerned, both schools and students are equipped with the necessary devices and internet access to facilitate watching VLs at a place of student choice. The VLs recorded by top tutors globally or by class teachers are favorite among Kazakh respondents. Some of them also prefer video recordings made by students during group discussions. Students and teachers generally like the convenience and ease of access that online VLs by top tutors provide.

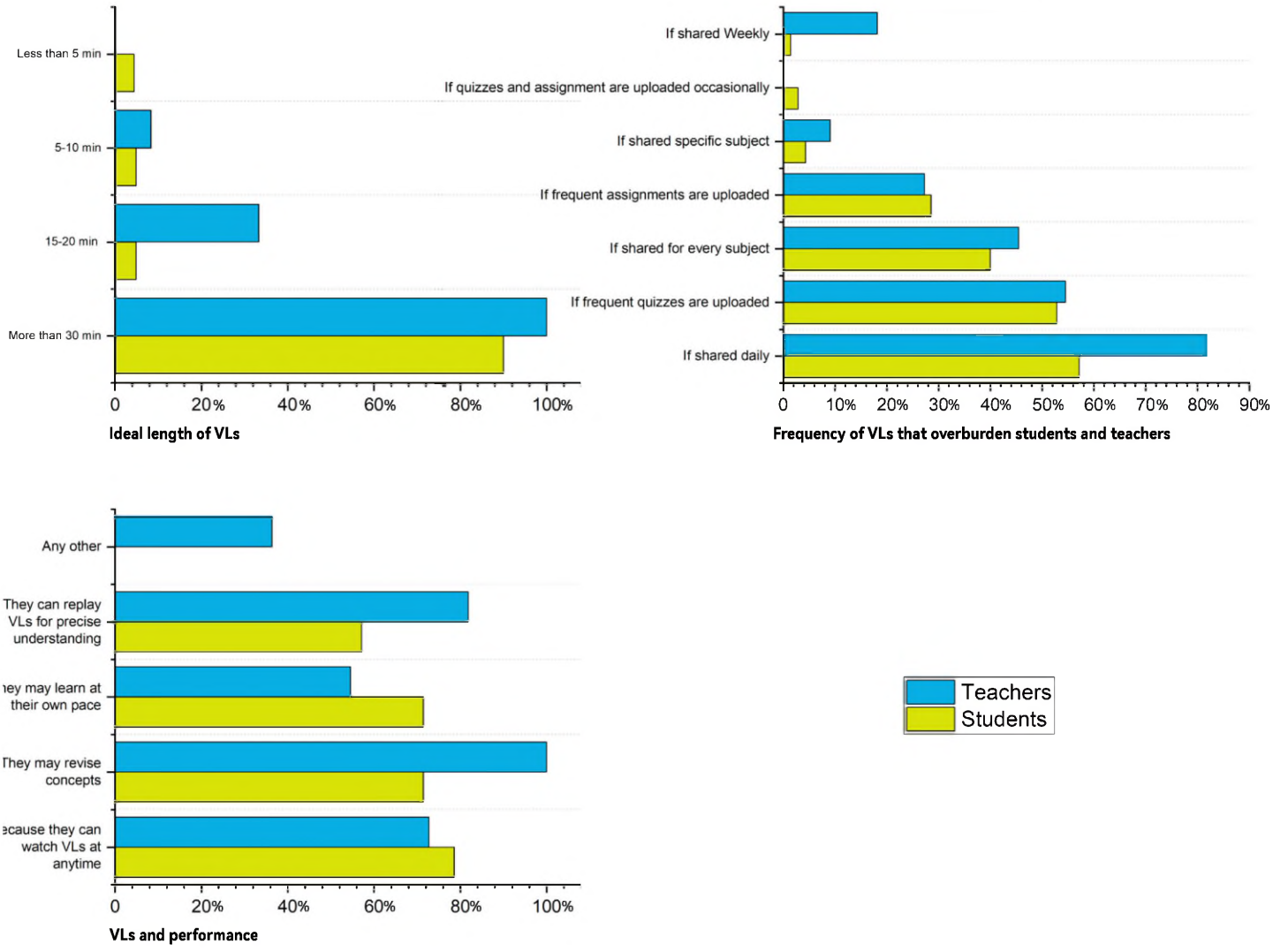
Figure 4: FCM features Kazakhstan (part B)



The coverage of FCM of some or all subjects is also an area of concern while implementing any BL module in schools. As outlined in section 4, the relevant literature normally tends towards using BL techniques for specific subjects. The preferences of Kazakh respondents, specifically students, align with the literature. Most teachers, however, believe that FCM should expand to encompass all topics. To reach a consensus, we can align this choice

with previous data indicating that students preferred to learn science, mathematics, and English language using the BL technique. In that case, initially, the FCM may focus on these specific subjects. However, the model may eventually be extended to include all disciplines based on feedback from teachers and students. This iterative method will eventually improve FCM and student learning results based on feedback and data analysis (Figure 5).

Figure 5: FCM features Kazakhstan (part C)

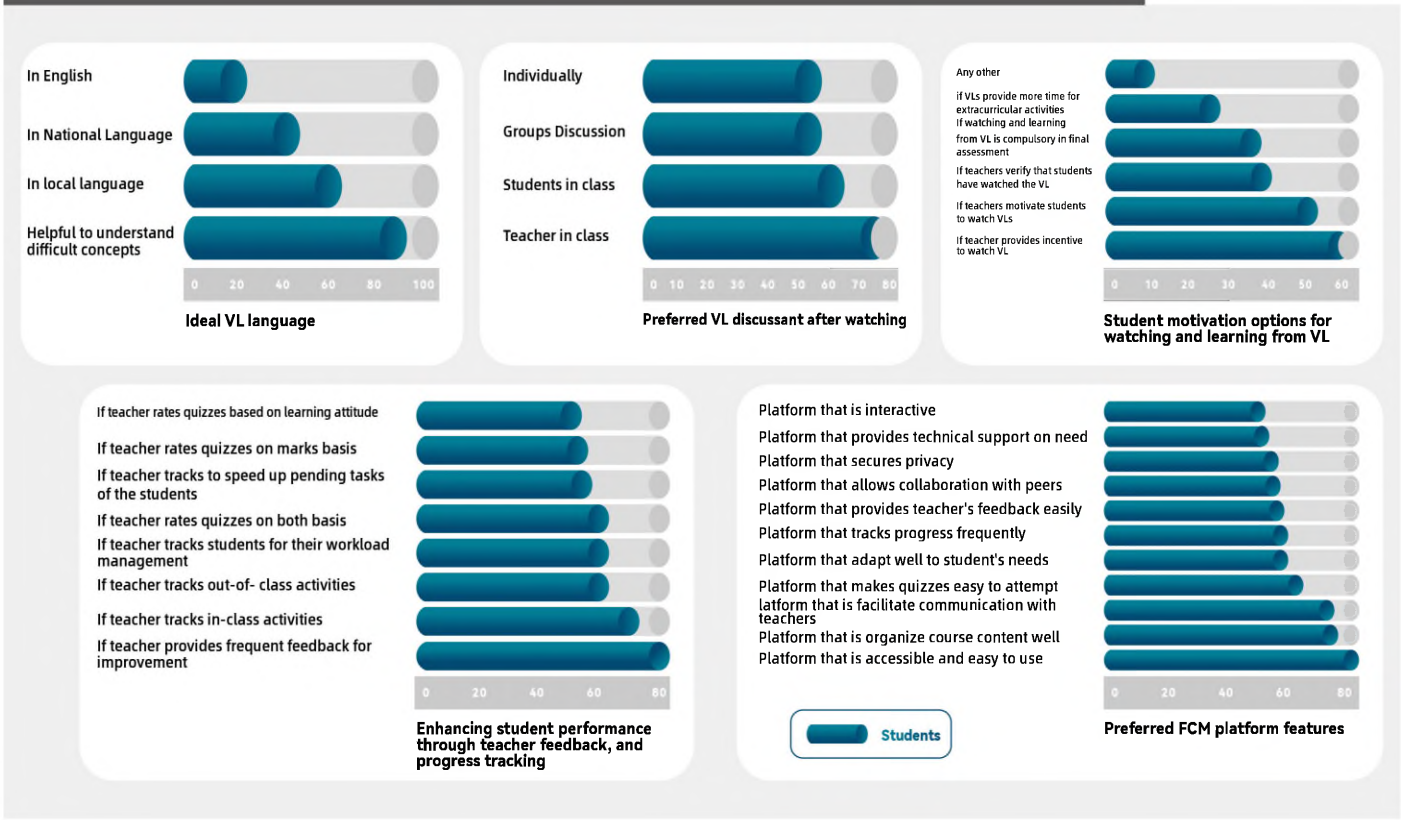


While applying FCM, the length of VL is an important element to consider because an optimal duration for the VL may prevent excessive workload and maintain student motivation. The study found that Kazakh respondents prefer a VL length of under five minutes to up to 20 minutes, which may keep students engaged and motivated to learn. Most teachers and students believe VLs lasting more than 30 minutes will cause students to become bored and potentially lose interest.

It is important to keep the frequency of online workload balanced with in-person activities to avoid overburdening students. Both educators and students believe that the daily exchange of VLs and the increased frequency of tests will place excessive strain on pupils. Nevertheless, weekly or occasional tasks, quizzes, or VLs will incentivize students to remain engaged in the learning process within the FCM. This finding, however, contrasts with the academic literature cited in section 4, which highlights that VLs must be shared before every class. In addition, the online academic workload for specific disciplines does not excessively stress students.

In Figure 6, factors such as the language of VL, group discussion, the role of the teacher, and ideal features of an online platform are presented for Kazakhstan. Students assess the elements that may promote student success in the following order:

Figure 6: FCM features Kazakhstan (part D)



The first advantage of VL is that it allows students to access materials at any time. Second, VL enables students to review concepts repeatedly. Third, VLs accommodate different learning speeds, so students can learn at their own pace. Lastly, students can replay videos to gain a more precise understanding. The flexibility provided by the FCM contributes significantly to enhancing student learning and performance.

The language of instruction, both offline and online, is important in aiding student comprehension. Respondents prefer VLs to be delivered in a language that facilitates the

comprehension of complex subjects and is easily understandable. The local language takes precedence, while the national language is of secondary importance. Utilizing VLs in students' native languages enhances their learning experience by allowing them to understand complex concepts and actively engage with the subject matter. This also fosters a sense of connection to their culture and ancestry, fostering pride and responsibility towards education. While national languages facilitate communication and comprehension, prioritizing local languages can significantly impact student learning, involvement, and drive. Students do not like using English or any other foreign language to communicate in virtual learning environments.

The teacher's discussion of VL materials during class to enhance student interest, motivation, and engagement with the VLs is crucial. Some students believe that students should deliberate in class to discuss the subject matter and the knowledge gained from the VLs. Teachers can significantly enhance the student learning experience within the FCM by engaging students in group discussions. Kazakh students believe their motivation to learn from VLs will increase if their teachers consistently encourage them to watch the lectures, offer rewards for doing so, and verify in class whether they have viewed them. Therefore, the class teacher plays a vital role in ensuring the successful implementation and improved efficacy of the FCM. Students and teachers from Kazakhstan believe that frequent teacher feedback on performance and tracking of activities both inside and outside class contribute significantly to student performance and learning under the FCM.

Online platforms are necessary for any FCM to access and share online resources.

The platforms also aid in assessments, grading, and progress tracking. Both students and instructors appreciate platforms that are user-friendly and accessible, organize course content effectively, facilitate communication with teachers, make quizzes easy to attempt, track student progress, provide easy feedback to teachers, are interactive, update student progress, simplify grading, and protect privacy.

Figure 7: FCM features Kazakhstan (part E)

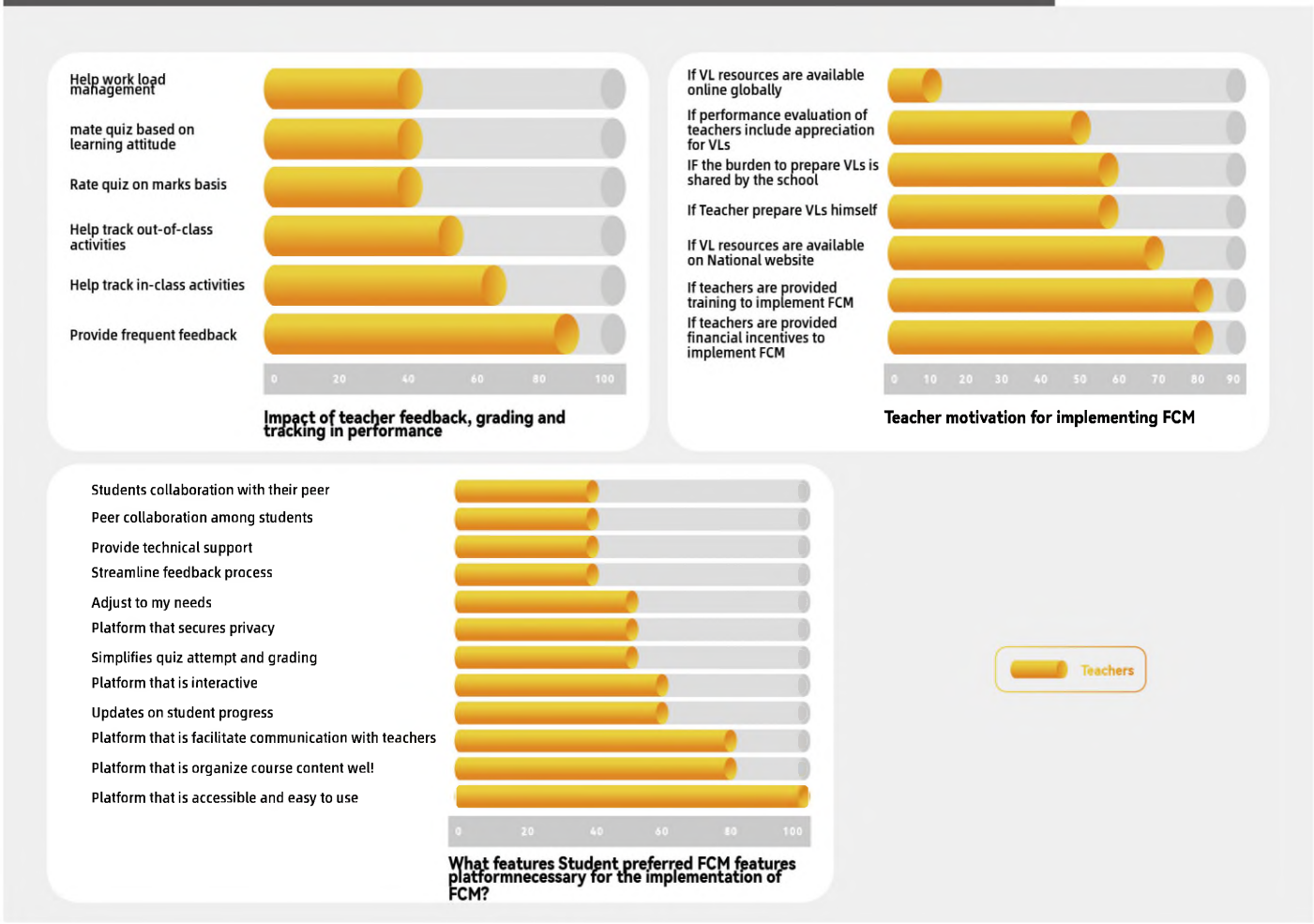


Figure 7 presents three FCM features from Kazakhstan that were inquired about by teachers alone. The teachers also evaluated the factors that enhance their motivation to implement the FCM. Their strong preference was for VL resources to be made available on the national website; secondly, if financial incentives were given for implementing FCM; thirdly if they are given training to implement FCM; fourthly, if the school administration assists in implementing FCM, fifthly, if the teacher prepares the VL themselves, and sixthly if the teacher evaluation includes appreciation for FCM.

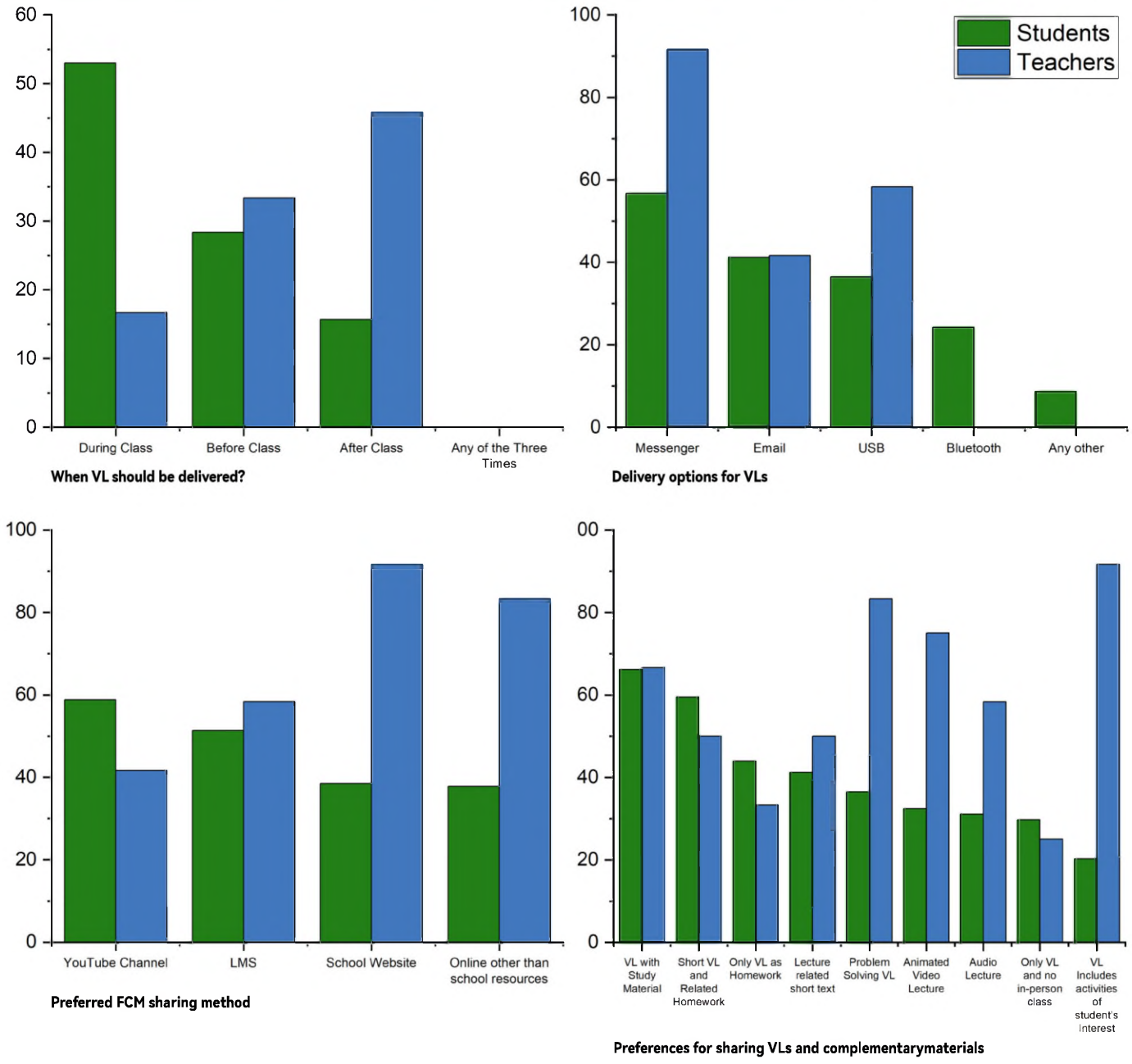
Preferred VL features Pakistan

Figures 8 to 12 present teacher and student responses from Pakistan on FCM features. Students from Pakistan want to receive VLs during class, while most teachers like them to be delivered after class. Respondents like USB drives for transferring and sharing files with students in Pakistan. The balance between instructors and students may strike during the class discussion, and an appropriate time that suits the stakeholders may be worked out. The respondents prefer communication tools like Messenger, email, and USB. Like Kazakhstan, students from Pakistan also prefer the availability of VL resources on YouTube channels or LMS; however, teachers mostly prefer school websites or online sources for the availability of lectures. Again, the younger generation seems to like YouTube for familiarity and ease of access, while instructors like more control over content and assessment granted by sophisticated software such as LMS or school websites.

The students and teachers from Pakistan also favor a diverse range of VLs and sharing methods. These include study materials, brief VLs accompanied by homework, VLs assigned as standalone homework, VLs incorporating activities based on student

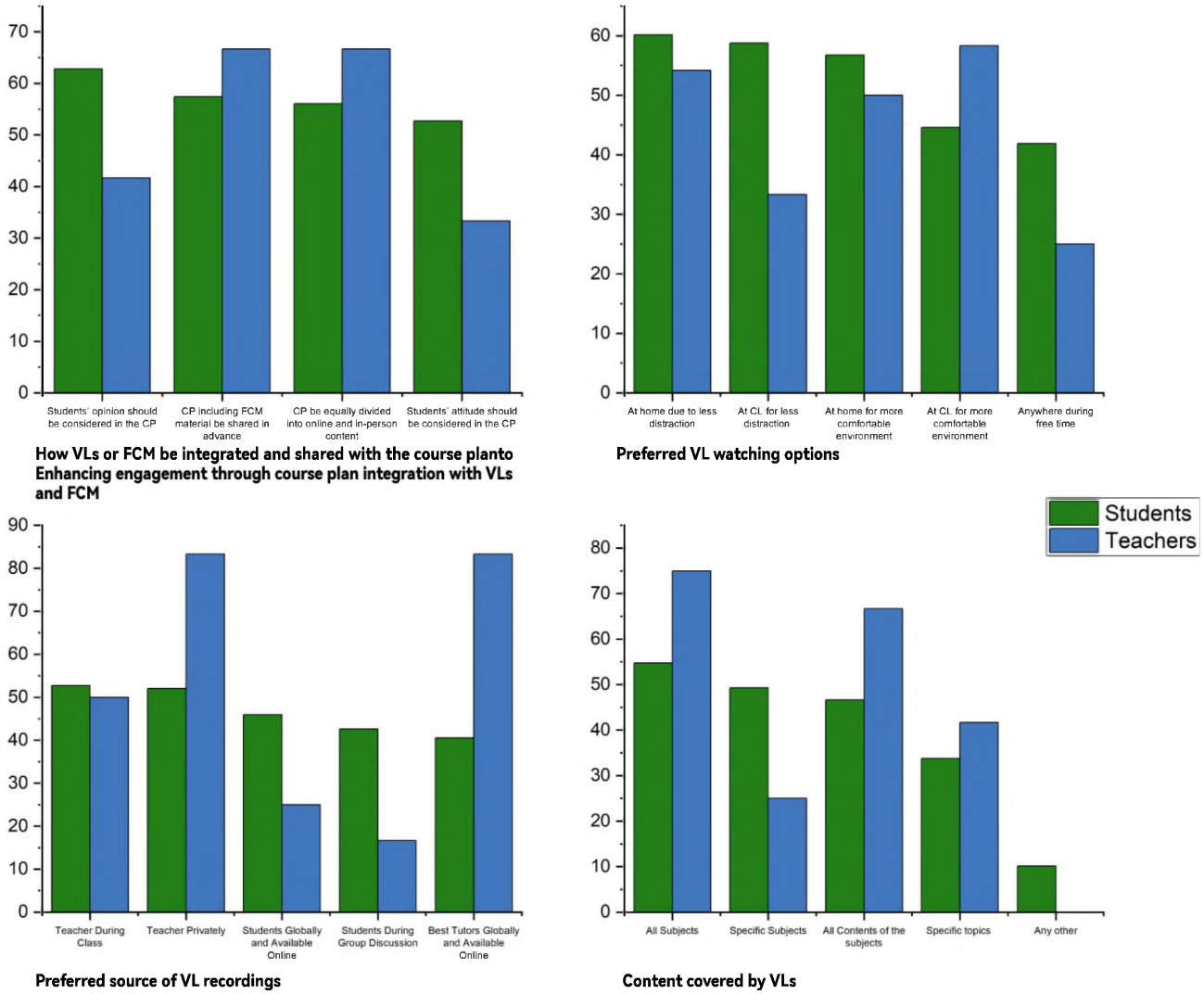
interests, and problem-solving VLs. Various types of VL improve student engagement and motivation by accommodating diverse learning styles and preferences, resulting in a dynamic and interactive learning environment for both students and teachers.

Figure 8: FCM features Pakistan (part A)



In addition, incorporating student opinions and attitudes into the CP to acknowledge their requirements and preferences is also desirable. Respondents believe the CP should be disseminated beforehand, enhancing student preparation and engagement. Furthermore, distributing the CP equally between online and in-person elements is also advocated for Pakistan based on study findings because it creates a more interactive and dynamic educational environment. Instructors can also benefit from incorporating student views and opinions into the course development process, resulting in a more inclusive learning environment. The ideal location to watch VLs may be decided on a school-by-school basis because an equal student majority prefers to watch VLs at home or in the CL for fewer distractions and a more comfortable environment, while teachers feel the CL is more productive owing to its controlled environment having fewer distractions (Figure 9).

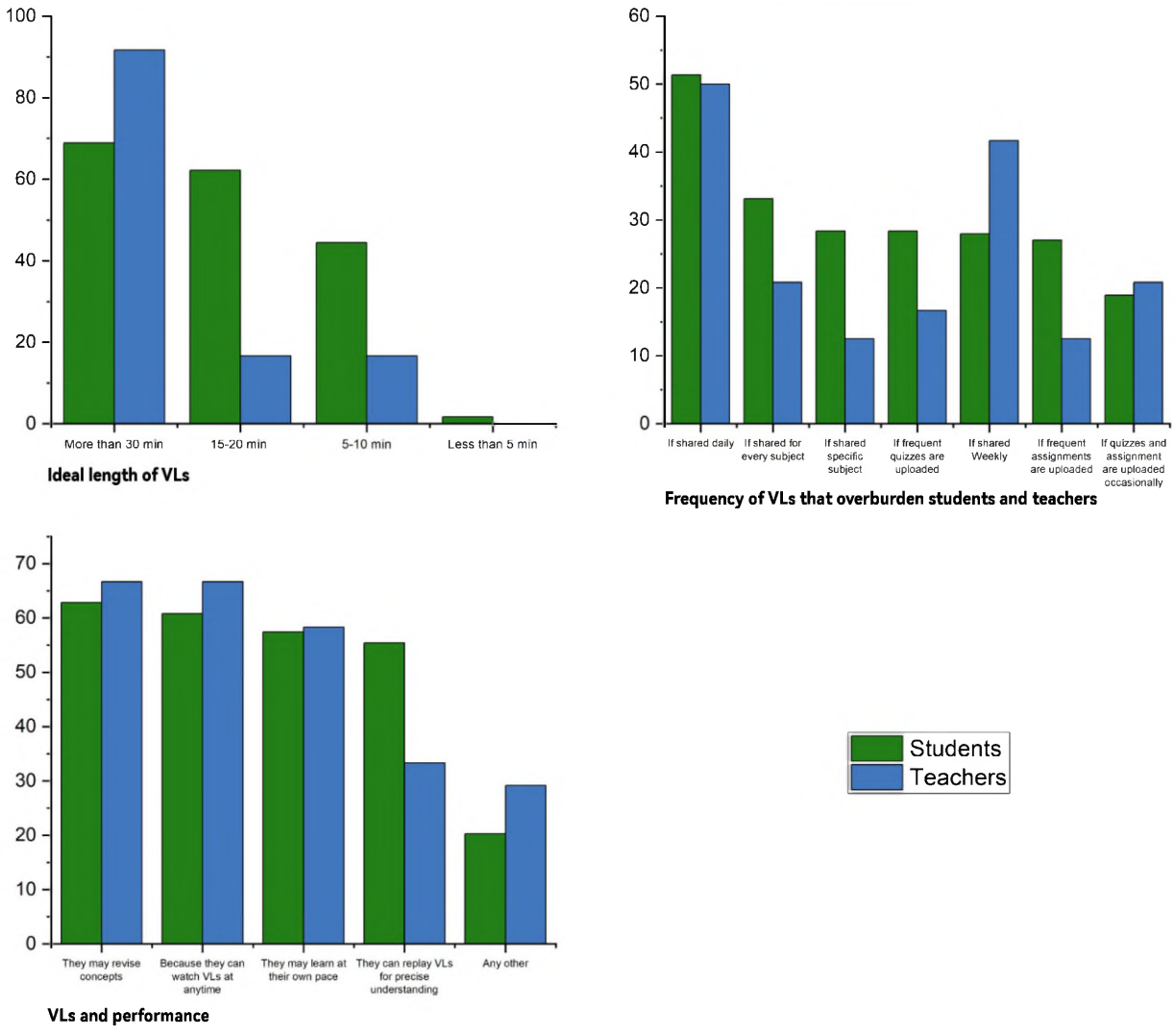
Figure 9: FCM features Pakistan (part B)



The resource person for VLs may be the class teacher or the best tutor globally, as found by the study. The personal appearance of the tutor in VLs increases a sense of communication among students and keeps them engaged. Hence, the teacher must create VLs or adopt (translated/dubbed or with subtitles) VLs from global teachers to be shared with students. Hence, there seems to be an agreement between educators and learners on whether the VLs should come either from the class teacher or the best tutors globally. Respondents from Pakistan want FCM to expand to all disciplines and

all subject content; however, some students want FCM for specific subjects only. The last option aligns more with the literature and responses in earlier sections, where both teachers and students preferred FCM for science, mathematics, and English language. Henceforth, specific subjects may be a safe starting point for implementing FCM and may be expanded after an iterative process and meeting the infrastructural challenges in the country.

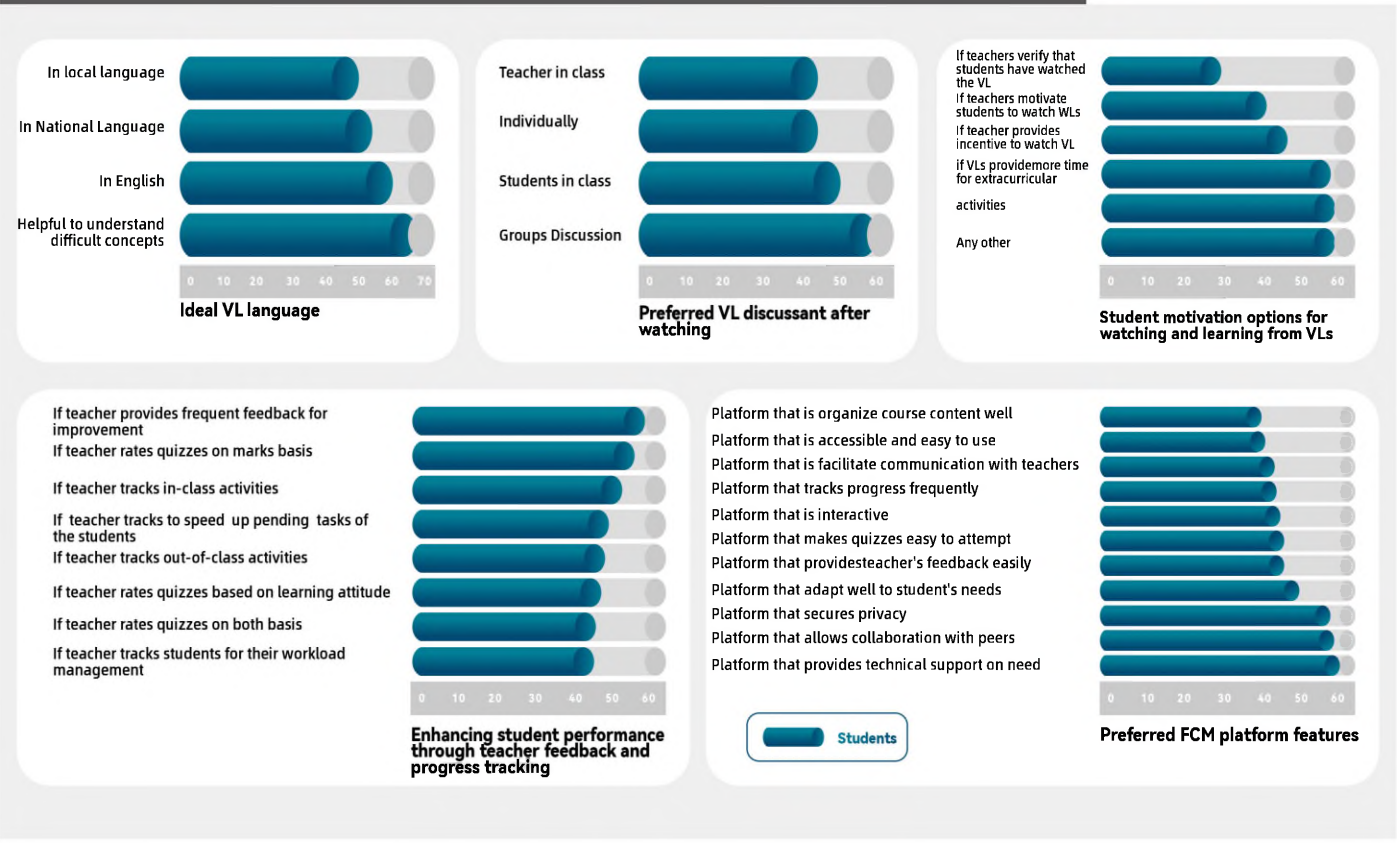
Figure 10: FCM features Pakistan (part C)



Students in Pakistan want VL length to range from under five minutes to up to ten minutes to keep them motivated and engaged. Teachers, however, feel that a VL of 10 to 15 minutes duration will not create boredom among students (Figure 10). Keeping VLs short is more engaging and can improve student learning. Students want the FCM workload to be less frequent and dislike the daily sharing of VLs for every subject—a factor that creates an extra burden for them. This response contradicts the above response that FCM be expanded to all subjects. Teachers feel even the weekly FCM workload frequency will overburden students. The CP must be planned, and all schedules of offline and online activities must be planned ahead of time by keeping the frequency balanced to reduce the sense of overburden among students and teachers.

Students from Pakistan believe that FCM and VLs enhance performance because they allow students to access materials at any time, enable them to review concepts repeatedly, and accommodate different learning speeds so that students can learn at their own pace. Lastly, students can replay videos to gain a more precise understanding. Hence, the flexibility provided by the FCM significantly contributes to enhancing student learning and performance.

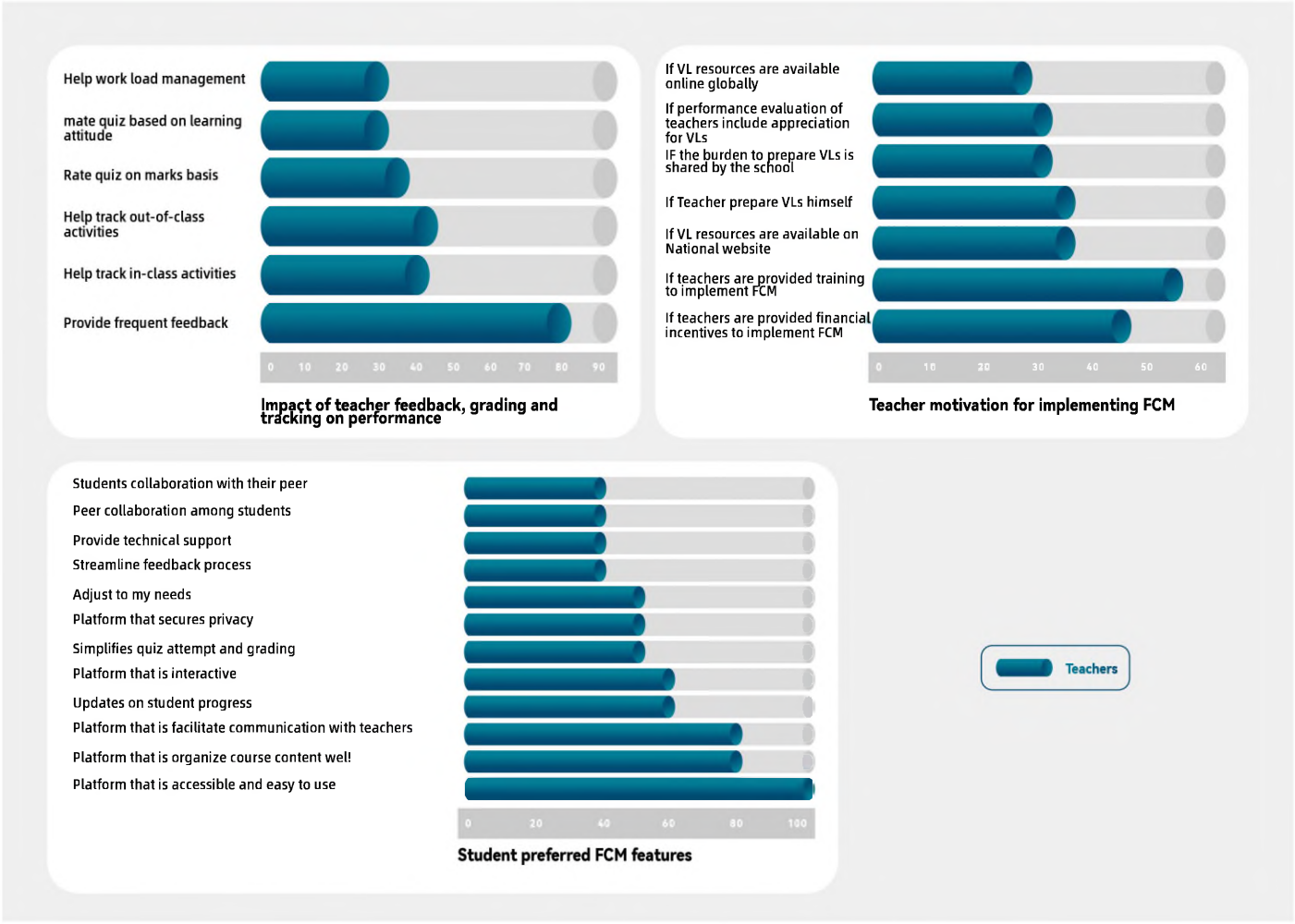
Figure 11: FCM features Pakistan (part D)



Like their Kazakh counterparts, respondents prefer the local language as the VL communication language, and the national language is a second priority. Local language creates a sense of cultural and social connection and is the most effective instruction delivery language, as acknowledged by the academic literature. The students identify the teacher's role as crucial for implementing FCM effectively (Figure 11). Teachers should discuss the VL content in class to assess student learning from the video after watching it. The students may also discuss one by one in class if time allows. Teacher verification

and provision of incentives to watch VLs are acknowledged as motivating factors by the students. Effective learning from FCM also depends on frequent teacher feedback on student performance and tracking student activities—both in and out of class—as reported by most of the students from Pakistan.

Figure 12: FCM features Pakistan (part E)



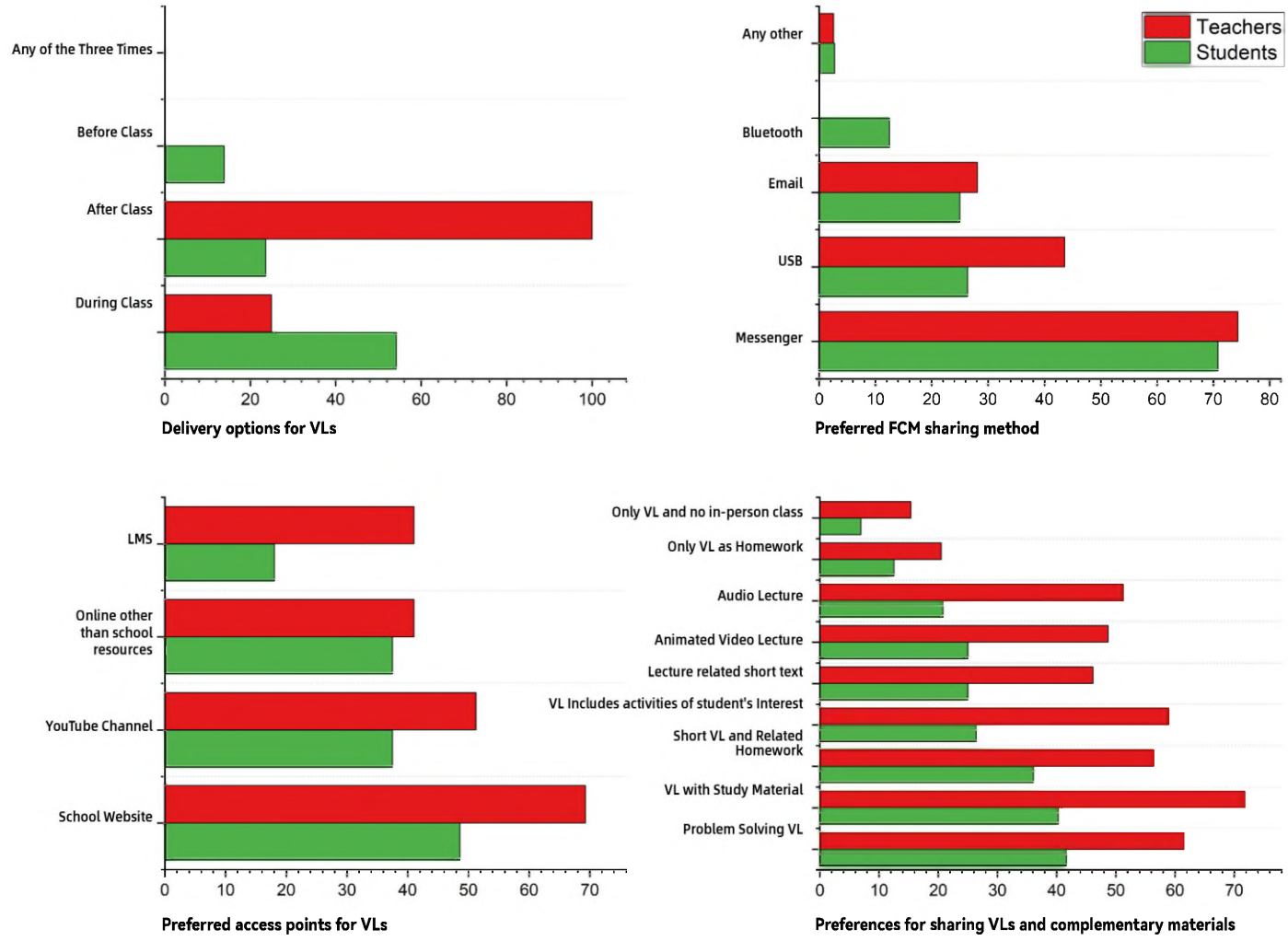
The favorite platform for educators and students from Pakistan is the most accessible and easy to use, organizes course content well, facilitates communication with teachers, provides interactive updates on student progress, simplifies grading, and secures user privacy.

Teachers must also be motivated to implement FCM for the intended benefits of the model. In this regard, we have found the availability of VL resources on national or international forums to be the most motivating factor for teachers in Pakistan. Further VL preparation by the teachers themselves, school assistance in implementing the FCM, and financial incentives are also motivating factors for educators in the country (Figure 12).

Preferred FCM features Uzbekistan

Figures 13 to 17 present FCM features from Uzbekistan. Uzbek students are flexible about VL delivery time and opt to share them any time before, during, or after class. Instructors, however, feel it is more convenient to share VLs during or after class.

Figure 13: FCM features Uzbekistan (part A)



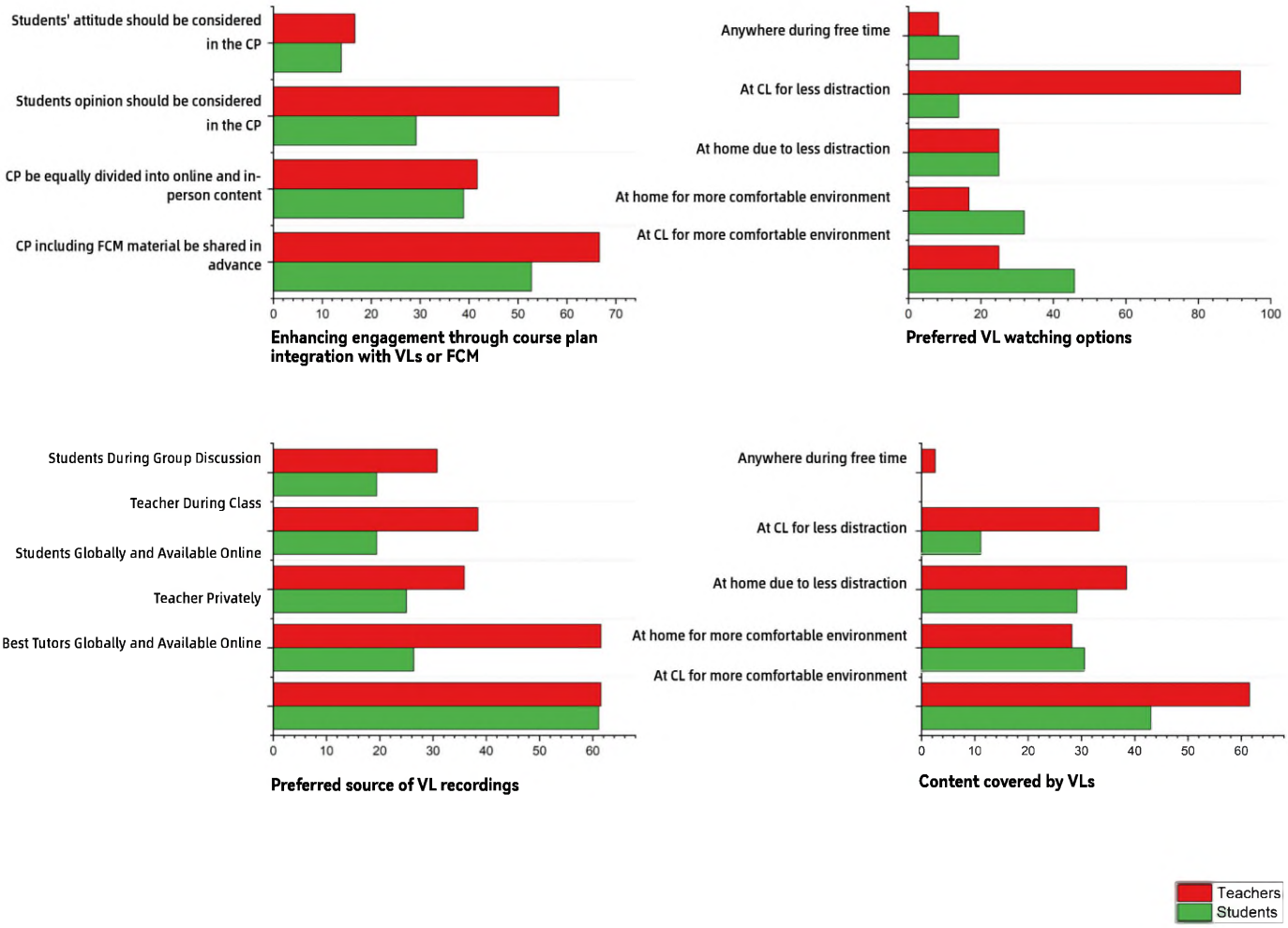
However, the content for before, during, and after class varies slightly and must be kept in mind. Before-class options align more with the literature because they prepare students for class activities and save time for in-class activities.

The sharing tools liked by Uzbek respondents are Messenger and email. However, some students feel receiving VLs through a USB drive is more convenient. Uzbek respondents—in common with other respondents—favor YouTube, school websites, and online sources for the availability of VL resources. Respondents like to receive a wide range of VLs—such as, VLs with study material; VLs that include activities of student interest; animated VLs; short VLs and related homework; problem-solving VLs; and audio lectures to enhance their comprehension of the subject. Instructors may combine multiple types of VL to address diverse student needs and learning styles, thereby improving FCM performance.

The opinions of Uzbek respondents do not differ from those of the previous two countries on these elements of FCM (Figure 13). The CP preferences of Uzbek respondents align with those of their counterparts from Pakistan and Kazakhstan.

Student attitudes and opinions must be considered in the CP to integrate learner needs and styles into the study design. Further, the CP, including FCM material, should be shared in advance to extend more flexibility and time to students and teachers to plan course activities ahead of timelines. The respondents also want the CP to be equally divided into online and in-person content for more balanced workload management and performance. Further, Uzbek students feel that home is a more comfortable place to watch VLs with fewer distractions. However, instructors feel that the controlled environment of a CL is a better place to watch VLs because there are fewer distractions and students will be more focused.

Figure 14: FCM features Uzbekistan (part B)



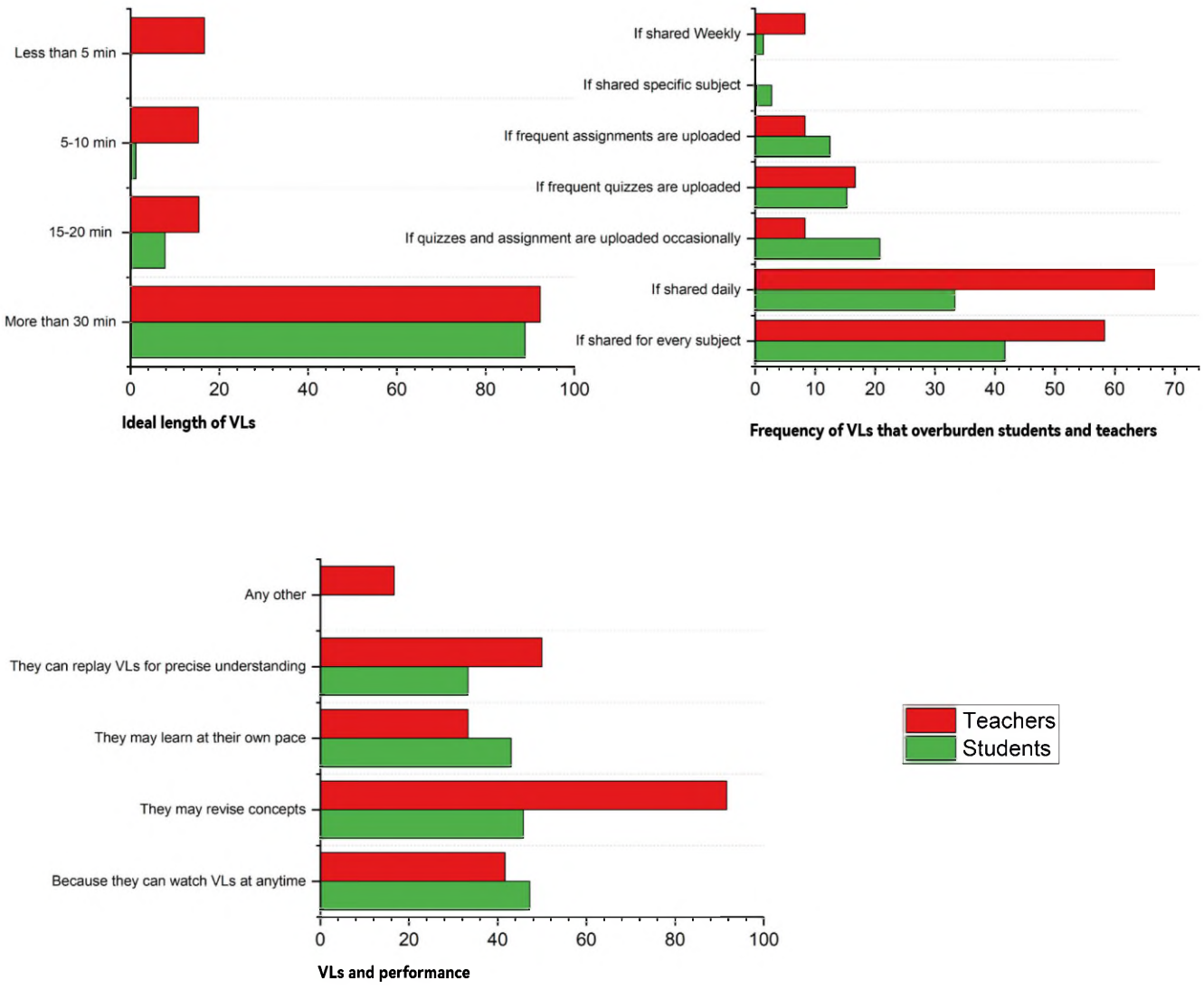
This choice may be left to the discretion of the class teacher, who can decide after discussing with students and appraising the specific environment of CL at the school. The top choices for the resource person of VL are the teacher doing the task privately or VLs from the best tutors globally. Students enjoy listening to VLs that others worldwide have recorded and made available online. VLs from different personnel showcase diverse perspectives and teaching styles, enhancing engagement and interaction. Recording group discussions enhances the learning experience while catering for individual learning preferences (Figure 14).

As far as FCM coverage is concerned, students want it to cover specific topics. However, instructors believe FCM should expand to all subjects and all content. As recommended earlier, starting from specific subjects and then expanding to all disciplines is a more viable option in the face of Uzbekistan's current physical and human resource constraints. It is also important to maintain the workload of students and reduce the burden by keeping VLs at an ideal length and balancing the frequency of the online workload. The optimal VL duration preferred by Uzbek respondents to prevent excessive workload and maintain student motivation may range from under five minutes to 20 minutes. Most teachers and students believe VLs lasting more than 30 minutes will cause students to become bored and potentially lose interest (Figure 15).

Furthermore, Uzbek students and teachers feel that frequent online assignments, quizzes, and the daily sharing of VLs will overburden students. Therefore, there must be a balance between online and in-person workloads to keep students engaged and motivated with academic activity. Students assess the elements that may promote

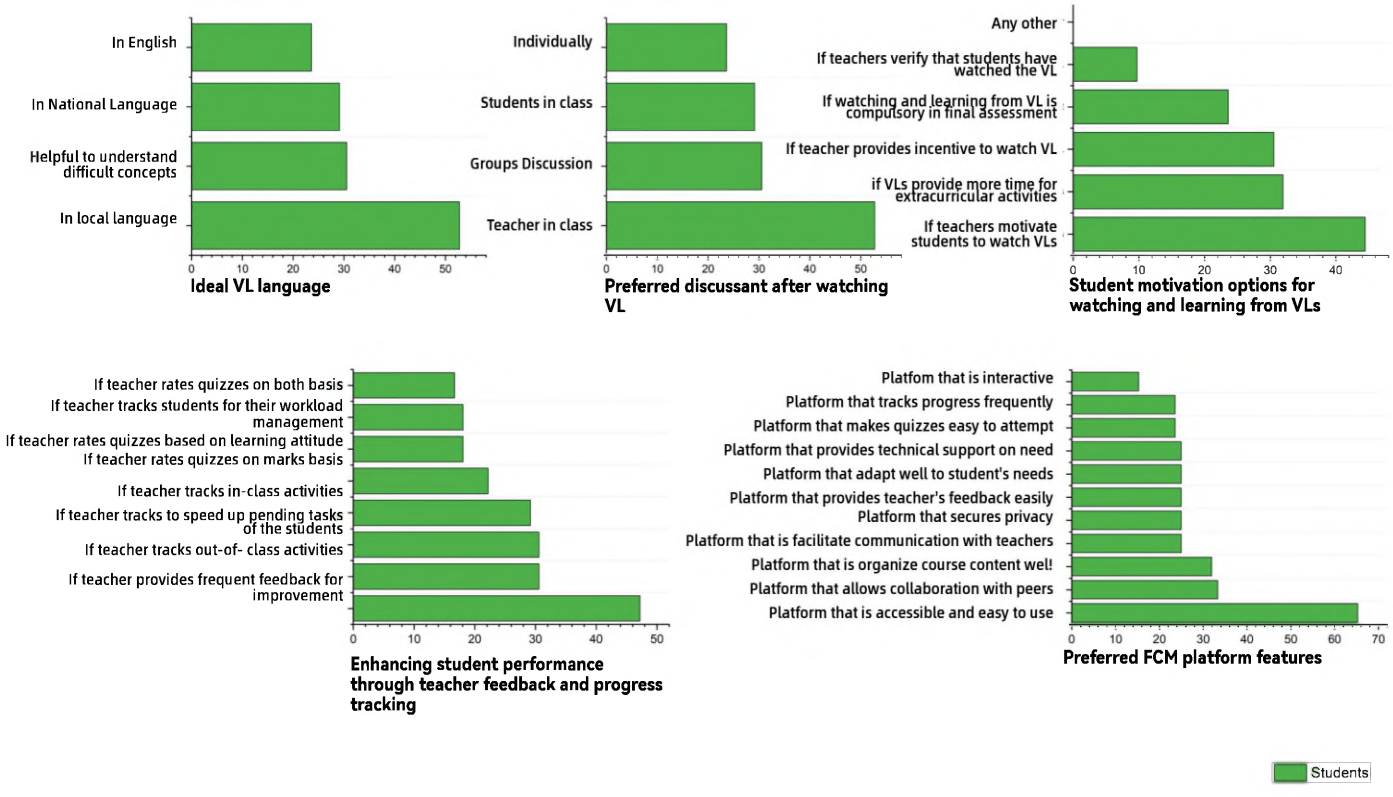
success in the following order: The first advantage of VL is that it allows students to access materials at any time. Second, VL enables students to review concepts repeatedly. Third, VL accommodates different learning speeds so that students can learn at their own pace. Lastly, students can replay videos to gain a more precise understanding. The flexibility provided by the FCM significantly contributes to enhancing student learning and performance.

Figure 15: FCM features Uzbekistan (part C)



Teachers can contribute significantly to maximizing learning from VLs through various interventions. First and foremost, the teacher should discuss VLs in class to assess student understanding. Students—either individually or in groups—should also discuss the content covered in the VLs to revise their understanding of the lecture. Uzbek students believe their motivation will be boosted if their teacher provides an incentive to watch VL, motivates them, makes watching the VL part of the final assessment, and verifies whether they have watched the VL after sharing (Figure 16).

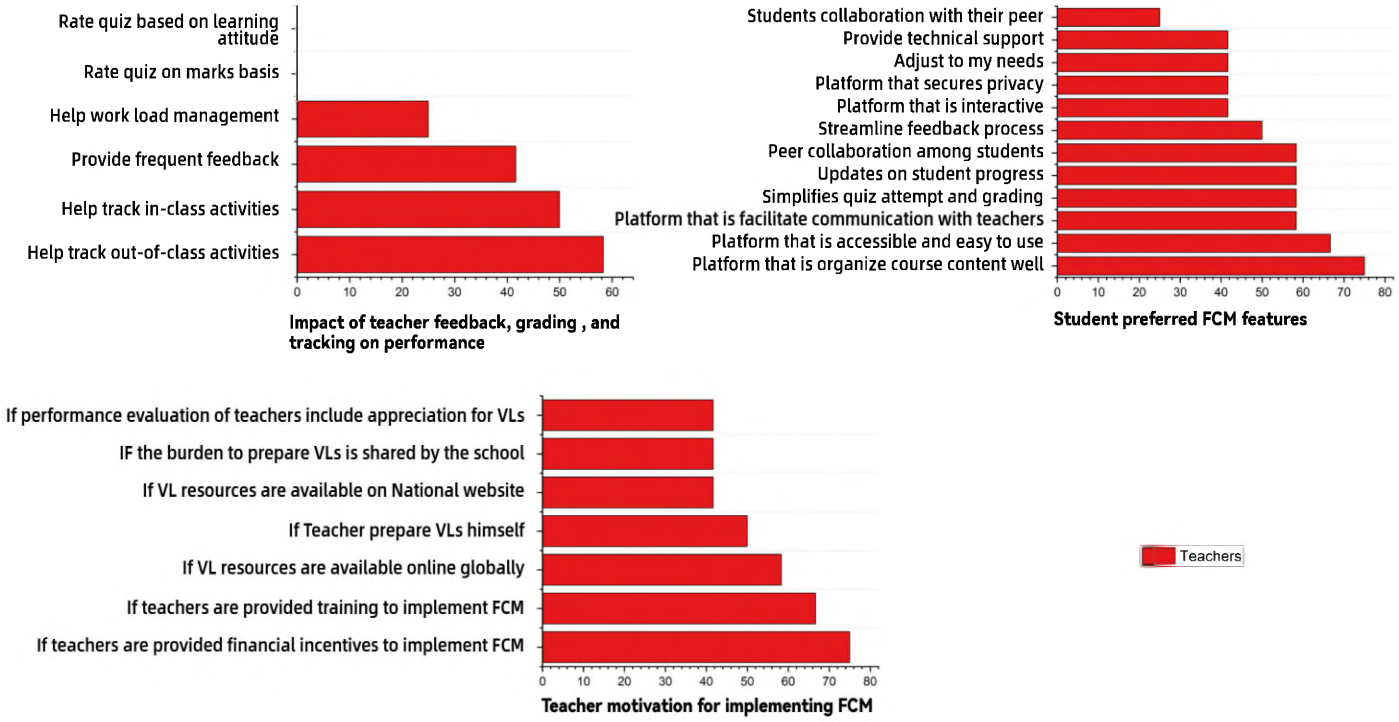
Figure 16: FCM features Uzbekistan (part D)



Students prefer VLs to be delivered in a language that facilitates the comprehension of complex subjects and is easily understandable. The local language takes precedence, while the national language is of secondary importance. Utilizing VLs in students' native language enhances their learning experience by allowing them to understand complex concepts and actively engage with the subject matter. While national languages facilitate communication and comprehension, prioritizing local languages can significantly impact student learning, involvement, and drive. Some Uzbek students favor using English to communicate in VLs because it enables access to diverse information and resources, improves language skills in VLs, and prepares individuals for future international opportunities.

Again, Uzbek students and teachers realize the role of the teacher in bringing the fruits from the FCM content; they believe frequent teacher feedback for improvement, grading based on marks and attitudes, tracking of student activity both in and out of class, and assistance in workload management all help improve student performance.

Figure 17: FCM features Uzbekistan (part E)



A platform that is accessible and easy to use secures privacy, organizes course content well, is interactive, adapts well to student needs, makes teacher feedback easy, facilitates communication with teachers, makes quizzes easy to attempt, tracks student progress, provides updates on student progress, and enables peer collaboration is favorite among the Uzbek learners and educators.

Teachers play a crucial role in the effective implementation of FCM. However, Uzbek teachers believe that to keep themselves motivated, it is essential to provide them with financial incentives, training for implementing FCM, recognition for their efforts in evaluations, and ensuring the availability of FCM resources on national or global websites. Furthermore, teachers will feel more motivated if they can create VLs and if the school administration shares the responsibility of preparing these VLs (Figure 17).

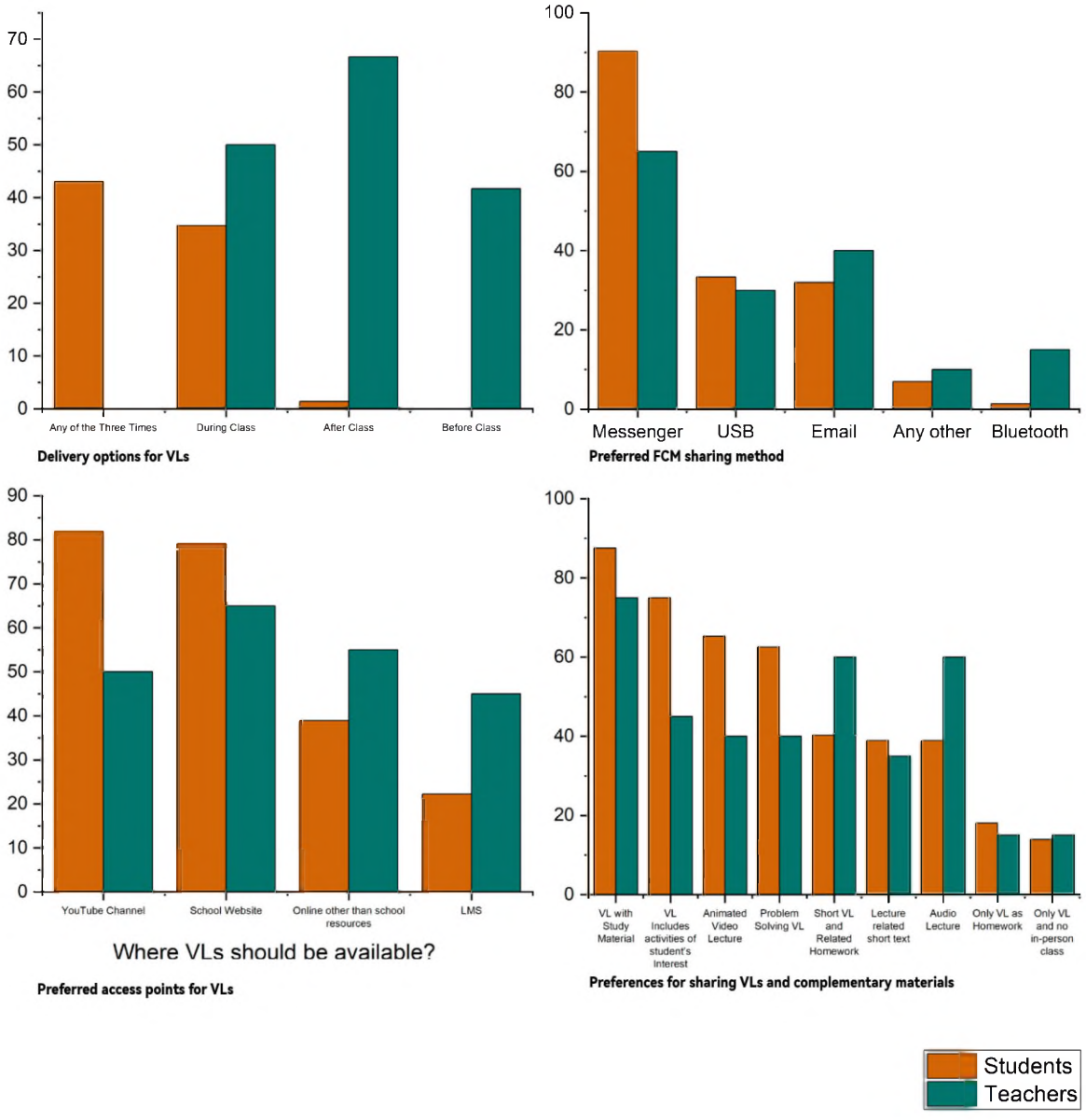
Preferred FCM features Tajikistan

Figures 18 to 22 present teacher and student responses from Tajikistan on FCM features. Preferences regarding the delivery of VLs and course materials for FCM among students and teachers in Tajikistan reveal a notable divergence. While most students prefer to receive VLs during class, most teachers advocate for their delivery after class. This discrepancy suggests that a balance may be achieved through class discussion, allowing both parties to determine a suitable time that accommodates students and instructors collaboratively. Regarding sharing tools, Tajik respondents favor Yahoo Messenger and USB devices for receiving materials, although some prefer email as a means of communication (Figure 18).

Regarding the availability of FCM resources, most Tajik respondents wish to access these materials via the school website or a YouTube channel. While some students favor online sources, teachers prefer accessing VLs through LMS. In line with other respondents, Tajik students would like diverse VLs, including study materials such as problem-solving videos,

short VLs, related homework assignments, and audio lectures. This diversity is essential to accommodate different learning styles and enhance educational experience.

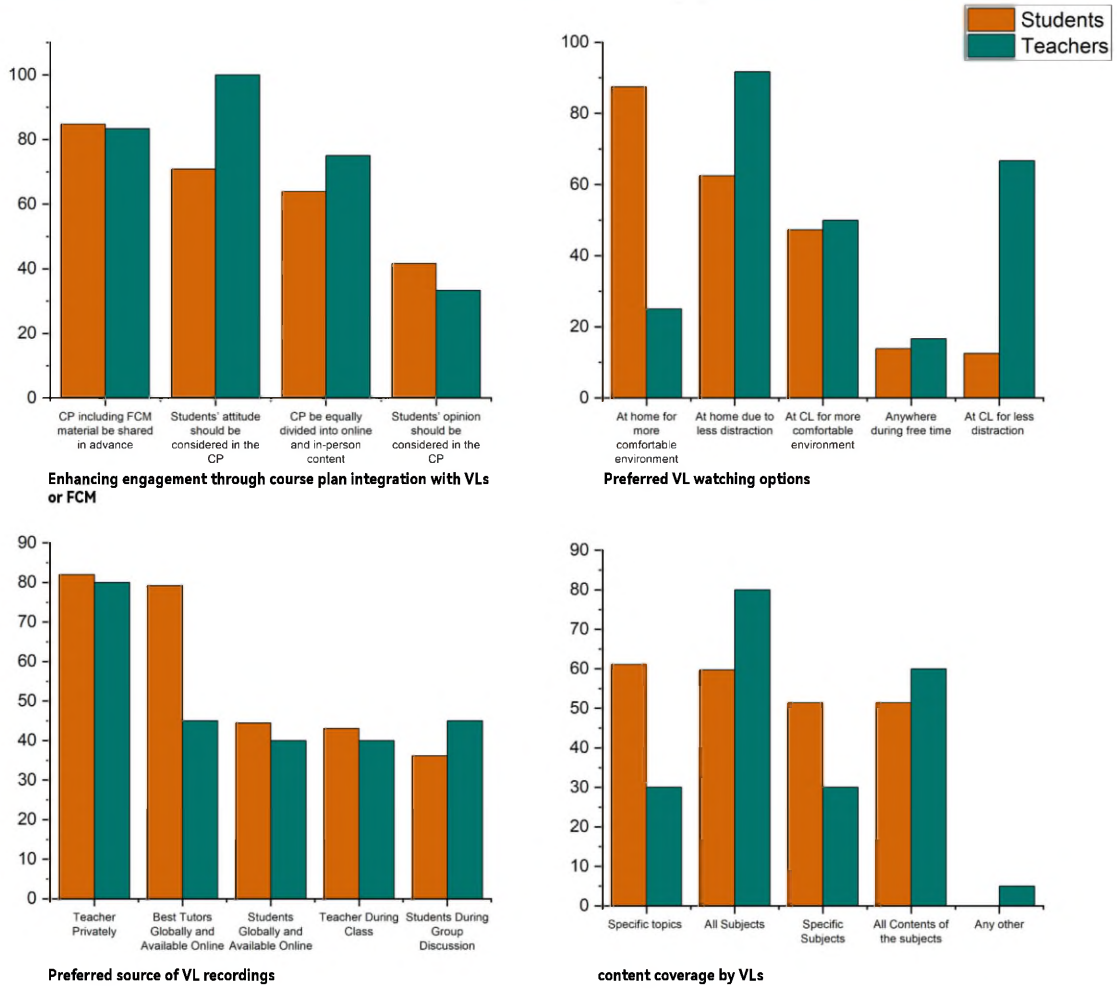
Figure 18: FCM features Tajikistan (part A)



Tajik respondents emphasize incorporating student attitudes and opinions into the CP to increase student interest and engagement. This integration would ensure that learner needs and preferences are reflected in the study design. Respondents suggest that FCM materials should be shared in advance, giving students and teachers greater flexibility and time for effective planning of course activities. They also advocate a balanced content distribution between online and in-person formats, facilitating better workload management and overall performance (Figure 19).

Most Tajik respondents feel that a CL is a more suitable place to watch VLs because there are fewer distractions. Others believe home environments are more comfortable and less distracting. Further, Tajik respondents like watching VLs from the best tutors globally or the class teacher recorded privately or during class. As suggested earlier, globally available VLs must be adapted and translated into local languages to create a sense of connection with the tutor and content for higher understanding and learning.

Figure 19: FCM features Tajikistan (part B)



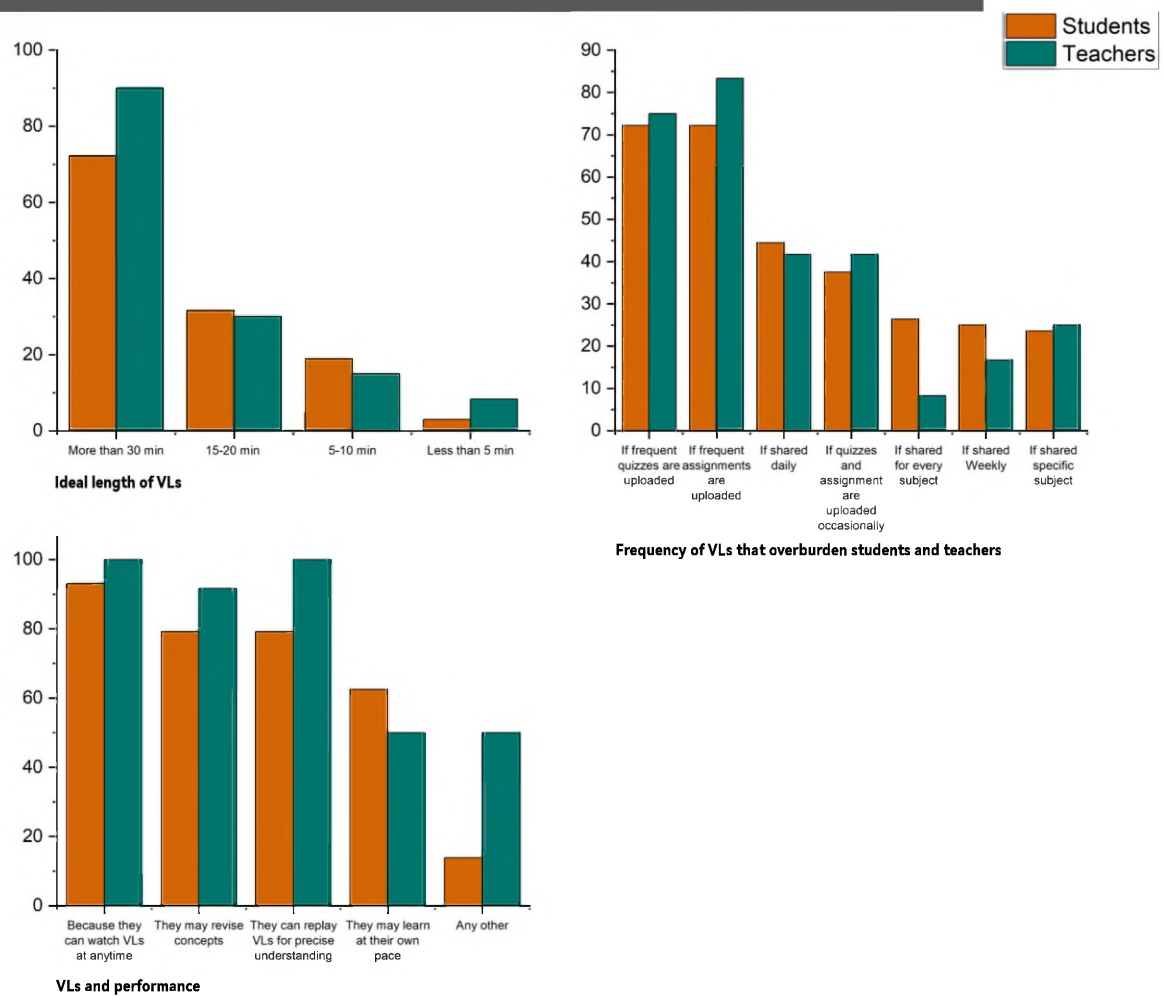
The preferences of Tajik respondents align with those of other respondents regarding expanding FCM to all disciplines,[18] but Tajikistan currently lacks the necessary infrastructure to implement this on a wider scale. Therefore, specific subjects must be considered for BL delivery on a priority basis.

An optimal duration for VLs—to prevent excessive workload and maintain student motivation—may range from under five minutes to up to 20 minutes. Most teachers

[18] Most want VLs to cover all subjects and all contents of a subject. Some respondents want it for specific subjects or topics.

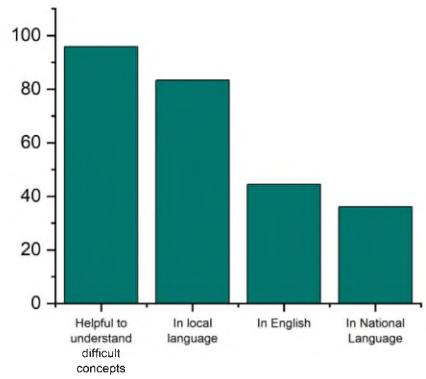
and students believe VLs lasting more than 30 minutes will cause students to become bored and potentially lose interest. Further, Tajik respondents feel that sharing the online workload for every subject or sharing daily will overburden them. Hence, the frequency must be balanced for a more engaged learning environment. Similarly, Tajik students also favor local instruction delivery through VLs (Figure 20). It will create social and cultural connections with students and aid in their comprehension of the content delivered. Furthermore, even the local language must avoid complex terms and use the simplest possible terms that help students understand difficult subjects.

Figure 20: FCM features Tajikistan (part C)

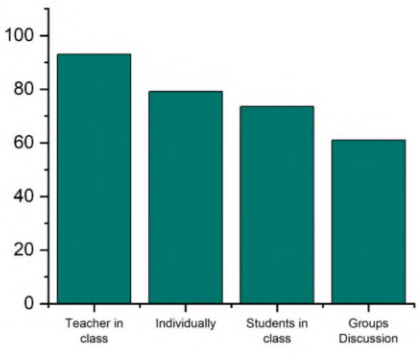


Discussion of VLs by teachers or students in groups is important to revise and precisely understand the content. Tajik students feel the teacher must discuss the VL content in class or in a group discussion. Discussing VLs in class will help students revise and understand the content delivered more precisely.

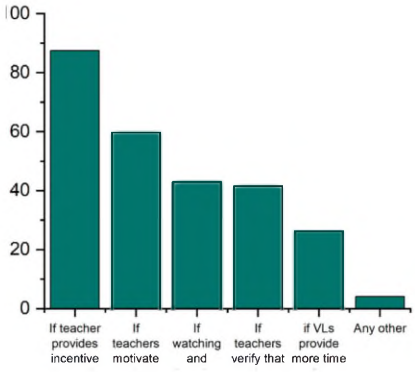
Figure 21: FCM features Uzbekistan (part D)



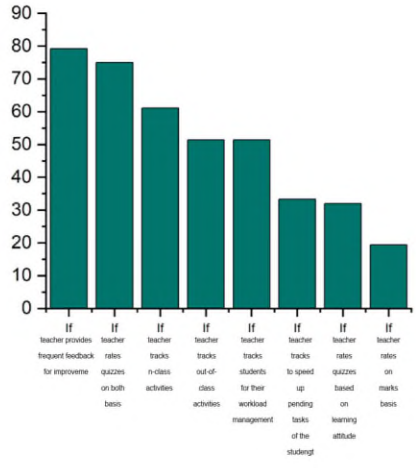
Ideal VL language



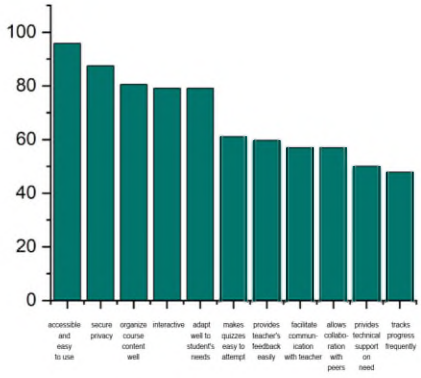
Preferred VL discussant after watching



Student motivation options for watching and learning from VLs



Enhancing student performance through teacher feedback and progress tracking

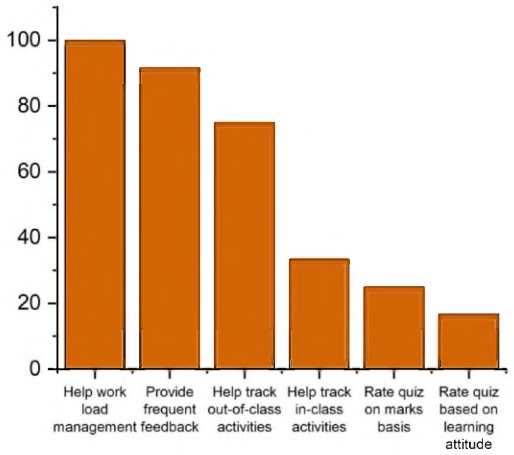


Preferred FCM platform features

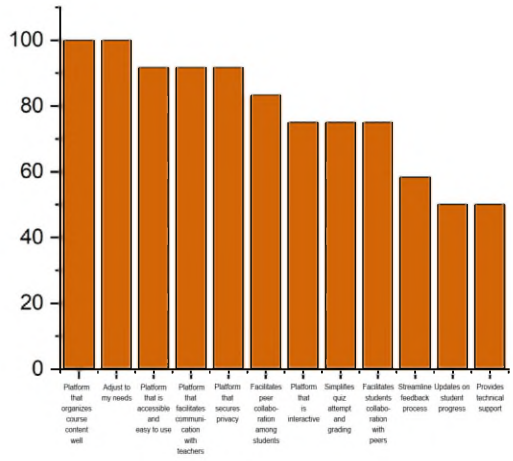
Tajik data reveals that teachers should motivate, provide incentives, and make VL compulsory in the final assessment to keep students on track with the FCM content and increase their learning experience. Further, FCM must extend flexibility in student time schedules, sparing extra time for extra-curricular activities to boost student motivation levels (Figure 21).

Students assess the elements that may promote student success in the following order: The first advantage of VL is that it allows students to access materials at any time. Second, VL enables students to review concepts repeatedly. Third, VL accommodates different learning speeds, so students can learn at their own pace. Lastly, students can replay videos to gain a more precise understanding. The flexibility provided by the FCM contributes significantly to enhancing student learning and performance. Tajik respondents believe frequent teacher feedback, activity tracking both in and out of class, tracking to speed up pending activities, and helping students manage their workload are all important ways to keep students engaged and performing well under the overall FCM framework.

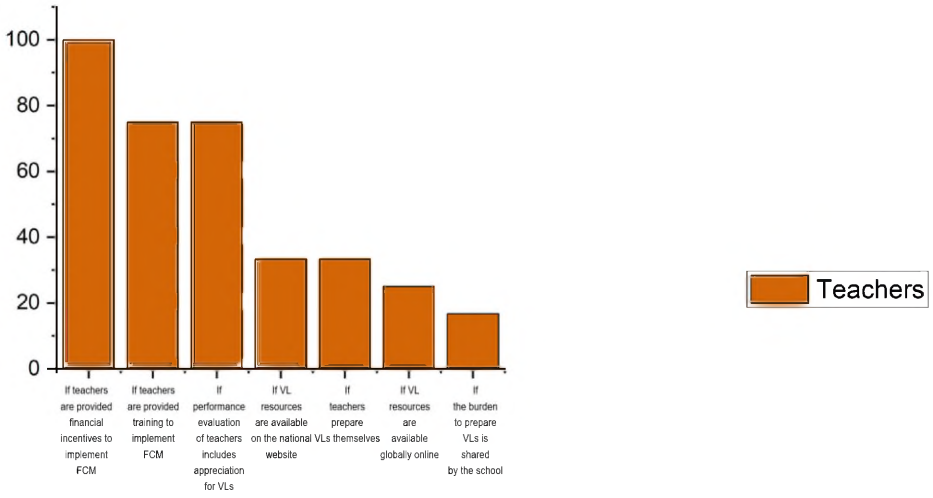
Figure 22: FCM features Tajikistan (part E)



Impact of teacher feedback, grading, and tracking



Student preferred FCM features



Teacher motivation for implementing FCM

Respondents from Tajikistan favor a platform that is accessible and easy to use, enables peer collaboration, organizes course content well, facilitates communication with teachers, makes quizzes easy to attempt, gives updates on student progress, tracks student progress, makes teacher feedback easy, is interactive, simplifies grading, and secures privacy. Overall, the platform features respondents prefer in all four countries are similar, leading to a common recommendation for a platform in the region.

The teacher has a crucial role in the effective implementation of FCM. However, Tajik teachers believe it is important to keep teachers motivated to implement FCM by providing the following: financial incentives, training to employ FCM, appreciation for implementing FCM in their evaluation, and availability of FCM resources on the national website or globally. Further, teachers will be motivated if they create VLs, and the school administration shares the burden of preparing VLs (Figure 22).

5.6 GENERAL OPINION OF RESPONDENTS REGARDING BL AND FCM

Table 22 summarizes the general opinions of students on certain factors related to FCM. Across all countries, a significant portion of students either "strongly agree" or "agree" that their teachers are well qualified for FCM. Pakistani students show the highest confidence, with 87.16% in these combined categories, indicating a strong belief in their teachers' ability to adopt FCM. Most students express confidence in their teachers' ability to use online resources effectively. A combined 83.42% of students overall either "agree" or "strongly agree" that their teachers are effective in using online resources. Confidence is highest in Kazakhstan and Uzbekistan, suggesting that students in these countries view their teachers as competent in integrating digital tools into the learning process. Pakistani students also show slightly stronger agreement (36.49%), indicating a robust confidence in digital resource use that might stem from previous exposure to online platforms.

Students generally view their teachers as proficient in using IT equipment, though their countries have some differences. Most students either "strongly agree" (22.1%) or "agree" (54.7%) that their teachers are proficient with IT gadgets. Pakistani students again show the highest confidence (88.51%), either agreeing or strongly agreeing.

Kazakhstan students show moderate agreement, but only 15.71% strongly agree, suggesting more cautious confidence in IT proficiency among their teachers. Overall, students agree that their parents would provide the necessary resources and gadgets for FCM, with Uzbekistan and Tajik students showing particularly high levels of strong agreement. This indicates that families in these countries may be more proactive in supporting digital learning. Pakistani and Kazakhstan students are also confident, though they show slightly more reservations than students from Uzbekistan and Tajikistan. The high levels of agreement reflect a general parental support for educational needs in the FCM. A few students, particularly in Pakistan, express uncertainty or lack of confidence in parental support for resources. This could reflect differences in resource availability or financial constraints that make it harder for some families to support gadgets and internet needs consistently.

Over three-quarters of students agree that VLs will improve their focus, with Pakistani students showing the highest level of confidence, which suggests that they may view FCM as a structured, distraction-reducing method. Tajikistan students also show high enthusiasm, indicating they may anticipate a focused learning environment in FCM. A higher neutrality rate is seen among Uzbek students (33.33%), which could reflect mixed experiences with VLs or uncertainty about their effectiveness in maintaining focus. There is an overall positive sentiment toward the motivational potential of VLs in an FCM setting. 80.39% of students either "strongly agree" or "agree" that VLs motivate them to learn. Tajikistan (38.89%) and Pakistan (30.41%) students report the highest level of motivation, indicating an optimistic view toward FCM as a motivating approach. Neutral responses are most prevalent among Uzbek (31.94%) and Kazakh students (21.43%), suggesting that some students may feel indifferent toward FCM's motivational impact. Students also indicated that they enjoyed learning through VLs, with Uzbekistan and Tajikistan students showing the highest levels of strong agreement. This suggests that students in these countries may find the interactive and self-paced nature of FCM particularly enjoyable. Pakistani students also report a high level of enjoyment.

Table 22:Student perceptions regarding teachers, parents, and their aptitudes and capacity under FCM (%)

	Pak	Kazakh	Uzbek	Tajik	Male	Female	Total
Availability of well qualified FCM teachers							
Strongly agree	38.51	10	22.22	30.56	34.29	22.46	28.18
Agree	48.65	64.29	61.11	44.44	48.57	57.75	53.31
Neutral	4.05	25.71	15.28	16.67	11.43	14.44	12.98
Disagree	7.43	0	1.39	6.94	4	5.35	4.7
Strongly disagree	1.35	0	0	1.39	1.71	0	0.83
Confidence in teachers' ability to utilize online resources for teaching							
Strongly agree	36.49	21.43	27.78	16.67	30.29	25.67	27.9
Agree	50	58.57	59.72	59.72	54.86	56.15	55.52
Neutral	10.14	17.14	9.72	15.28	10.86	13.9	12.43
Disagree	2.7	2.86	2.78	6.94	3.43	3.74	3.59
Strongly disagree	0.68	0	0	1.39	0.57	0.53	0.55
Teachers proficiency in using IT gadgets for teaching							
Strongly agree	33.78	15.71	13.89	12.5	28	16.58	22.1
Agree	54.73	60	59.72	44.44	50.86	58.29	54.7
Neutral	10.14	20	23.61	26.39	14.86	20.86	17.96
Disagree	1.35	4.29	1.39	15.28	6.29	3.21	4.7
Strongly disagree	0	0	1.39	1.39	0	1.07	0.55
Parents facilitate learning under FCM							
Strongly agree	43.92	48.57	65.28	62.5	28	49.2	52.76
Agree	42.57	42.86	31.94	30.56	50.86	42.25	38.12
Neutral	8.78	2.86	1.39	6.94	14.86	6.42	5.8
Disagree	4.05	5.71	1.39	0	6.29	2.14	3.04
Strongly disagree	0.68	0	0	0	0	0	0.28
Increased focus when learning through VLs							
Strongly agree	31.08	11.43	11.11	34.72	27.43	20.86	24.03
Agree	54.05	64.29	45.83	47.22	45.71	59.89	53.04
Neutral	10.14	17.14	33.33	18.06	22.29	13.37	17.68
Disagree	4.05	7.14	9.72	0	4	5.88	4.97
Strongly disagree	0.68	0	0	0	0.57	0	0.28
VLs motivate learning							
Strongly agree	30.41	14.29	15.28	38.89	28.57	23.53	25.97
Agree	59.46	55.71	48.61	48.61	52	56.68	54.42
Neutral	8.11	21.43	31.94	6.94	15.43	14.97	15.19
Disagree	2.03	8.57	4.17	5.56	4	4.81	4.42

Table 22:Student perceptions regarding teachers, parents, and their aptitudes and capacity under FCM (%) - continued

	Pak	Kazakh	Uzbek	Tajik	Male	Female	Total
learning through VLs is enjoyable							
Strongly agree	32.43	15.71	45.83	44.44	38.29	30.48	34.25
Agree	54.05	60	45.83	45.83	48.57	55.08	51.93
Neutral	10.14	21.43	6.94	9.72	10.86	12.3	11.6
Disagree	3.38	2.86	1.39	0	2.29	2.14	2.21

Table 23 highlights the teachers' perceptions regarding the factors that can enhance student engagement, motivation, and learning within a FCM. Most teachers believe that incorporating VLs into final assessments would significantly encourage student engagement, indicating that they view a direct academic stake as a strong motivator. This sentiment is particularly strong among teachers in Pakistan and Tajikistan, likely reflecting a cultural emphasis on formal assessments. In contrast, Kazakh teachers are more neutral, suggesting some uncertainty about this strategy's effectiveness.

While all teachers agree on the power of incentives, Uzbekistan teachers strongly endorse using academic rewards to boost motivation, reflecting a cultural preference for performance-based incentives. Most teachers support balancing the frequency of VLs to prevent student overload, allowing students to focus effectively across subjects. Tajikistan teachers, in particular, emphasize this balanced approach.

Regarding local language translations, teachers in Tajikistan, and to a lesser extent in Uzbekistan, strongly agree that it would improve engagement, likely addressing language barriers in these regions. Group projects related to VLs are also highly engaging, with Tajikistan teachers especially endorsing them for fostering active learning. Most teachers agree that allowing students to watch VLs individually can accommodate diverse learning speeds, with strong support from Tajikistan and Uzbekistan, highlighting a recognition of varied learning paces. Teachers across regions largely agree that group discussions on VL topics and in-class VL discussions enhance comprehension, reinforcing the importance of peer interaction to deepen understanding. Tajikistan and Uzbekistan teachers show particularly high support for in-class discussions to reinforce learning.

Table 23:Teacher perception of factors to boost student engagement, motivation, and learning (%)

	Male	Female	Pak	Kazakh	Uzbek	Tajik	Total
Confidence in teachers' ability to utilize online resources for teaching							
Strongly agree	55	17.95	37.5	18.18	16.67	41.67	30.51
Agree	40	64.1	62.5	45.45	66.67	41.67	55.93
Neutral	0	15.38	0	36.36	16.67	0	10.17
Disagree	5	2.56	0	0	0	16.67	3.39
Strongly disagree	1.35	0	0	1.39	1.71	0	0.83
Offering academic incentives							
Strongly agree	40	28.21	20.83	0	75	41.67	32.2
Agree	55	61.54	75	81.82	25	41.67	59.32
Neutral	0	5.13	4.17	9.09	0	0	3.39
Disagree	5	5.13	0	9.09	0	16.67	5.08

Table 23:Teacher perception of factors to boost student engagement, motivation, and learning (%) - continued

	Male	Female	Pak	Kazakh	Uzbek	Tajik	Total
Balancing the frequency of VLs							
Strongly agree	50	25.64	37.5	9.09	8.33	75	33.9
Agree	45	64.1	58.33	63.64	91.67	16.67	57.63
Neutral	5	7.69	4.17	27.27	0	0	6.78
Disagree	0	2.56	0	0	0	8.33	1.69
Translating VLs into the local language							
Strongly agree	70	35.9	29.17	27.27	58.33	91.67	47.46
Agree	25	48.72	62.5	45.45	33.33	0	40.68
Neutral	5	15.38	8.33	27.27	8.33	8.33	11.86
Assigning group projects related to VLs							
Strongly agree	60	20.51	37.5	18.18	16.67	58.33	33.9
Agree	40	61.54	58.33	36.36	75	41.67	54.24
Neutral	0	12.82	4.17	27.27	8.33	0	8.47
Disagree	0	5.13	0	18.18	0	0	3.39
Students watching VLs individually to accommodate diverse learning speeds							
Strongly agree	60	28.21	33.33	18.18	50	58.33	38.98
Agree	35	53.85	62.5	72.73	33.33	8.33	47.46
Neutral	0	10.26	4.17	9.09	16.67	0	6.78
Disagree	5	5.13	0	0	0	25	5.08
Strongly disagree	0	2.56	0	0	0	8.33	1.69
Encouraging group discussion among students							
Strongly agree	65	30.77	33.33	18.18	50	75	42.37
Agree	35	61.54	62.5	63.64	50	25	52.54
Neutral	0	5.13	4.17	9.09	0	0	3.39
Disagree	0	2.56	0	9.09	0	0	1.69
Discussion on the VL in class							
Strongly agree	75	41.03	41.67	36.36	66.67	75	52.54
Agree	25	53.85	50	63.64	33.33	25	44.07
Neutral	0	2.56	4.17	0	0	0	1.69
Disagree	0	2.56	4.17	0	0	0	1.69

Table 23:Teacher perception of factors to boost student engagement, motivation, and learning (%) - continued

	Male	Female	Pak	Kazakh	Uzbek	Tajik	Total
Teachers welcome FCM teaching							
Strongly agree	40	15.38	25	27.27	16.67	25	23.73
Agree	50	61.54	75	36.36	58.33	41.67	57.63
Neutral	5	12.82	0	18.18	25	8.33	10.17
Disagree	0	7.69	0	9.09	0	16.67	5.08
Strongly disagree	5	2.56	0	9.09	0	8.33	3.39
Students welcome FCMs learning							
Strongly agree	50	41.03	29.17	9.09	58.33	91.67	44.07
Agree	50	48.72	70.83	72.73	25	8.33	49.15
Neutral	0	10.26	0	18.18	16.67	0	6.78
Availability of well qualified teachers for FCM							
Strongly agree	20	12.82	12.5	9.09	25	16.67	15.25
Agree	50	56.41	75	72.73	33.33	16.67	54.24
Neutral	25	23.08	8.33	18.18	41.67	41.67	23.73
Disagree	5	7.69	4.17	0	0	25	6.78
Lack of technology infrastructure for FCMs							
Strongly agree	30	17.95	25	18.18	0	41.67	22.03
Agree	50	46.15	70.83	45.45	16.67	33.33	47.46
Neutral	5	17.95	0	18.18	33.33	25	13.56
Disagree	15	10.26	4.17	18.18	25	8.33	11.86
Strongly disagree	0	7.69	0	0	25	0	5.08

Finally, teachers in Tajikistan and Uzbekistan are highly optimistic that students will welcome FCM. However, concerns persist regarding technology infrastructure, especially in Tajikistan, where teachers feel more resources are needed for effective implementation. Additionally, variations in perceived qualification suggest areas where further support and training could be valuable for FCM success.

Table 24 presents administrator perceptions regarding FCM. Administration staff believe that FCM increases student learning and promotes active learning among students. Students and teachers will embrace learning under the FCM. Around 50 percent of administrators feel that FCM will place additional demands on students and teachers; however, they disagree that the technology may distract students from learning. Administrative staff believe that the faculty is competent to implement FCM, except from Pakistan. Most administrators believe that careful monitoring is necessary to implement FCM, and that FCM implementation is easy, except for most administrators from Uzbekistan, where 60 percent to 70 percent of staff believe that their school lacks the equipment to implement FCM.

Table 24:Administrator perceptions regarding FCM (%)

	Pak	Kazakh	Uzbek	Tajik	Male	Female	Total
Teachers welcome FCM teaching							
Strongly agree	75	25	0	100	66.67	46.67	52.38
Agree	12.5	75	60	0	16.67	40	33.33
Neutral	12.5	0	40	0	16.67	13.33	14.29
FCM promotes active learning among students							
Strongly agree	37.5	25	0	100	66.67	26.67	38.1
Agree	37.5	75	40	0	16.67	46.67	38.1
Neutral	0	0	60	0	0	20	14.29
Disagree	25	0	0	0	16.67	6.67	9.52
Students likely to embrace learning through an FCM							
Strongly agree	25	0	0	100	50	20	28.57
Agree	37.5	100	100	0	33.3	66.67	57.14
Neutral	12.5	0	0	0	16.67	0	4.76
Disagree	25	0	0	0	0	13.33	9.52
Teachers likely to embrace learning through an FCM							
Strongly agree	37.5	0	0	100	40	30	18.51
Agree	25	100	100	0	40.17	68.61	62.14
Neutral	9.52	0	0	0	16.67	0	4.76
Disagree	25	0	0	0	0	13.33	9.52
FCM can be implemented easily							
Strongly agree	12.5	25	20	25	0	26.67	19.05
Agree	75	75	0	25	66.67	40	47.62
Neutral	12.5	0	20	25	16.67	13.33	14.29
Disagree	0	0	60	25	16.67	20	19.05
Implementation of FCM places additional demands on teachers							
Strongly agree	50	50	0	25	33.33	33.33	33.33
Agree	37.5	25	80	25	50	40	42.86
Neutral	12.5	0	0	0	0	6.67	4.76
Disagree	0	25	0	25	16.67	6.67	9.52

Table 24:Administrator perceptions regarding FCM (%) - continued

	Pak	Kazakh	Uzbek	Tajik	Male	Female	Total
FCM places additional demands on students							
Strongly agree	25	0	20	50	16.67	26.67	23.81
Agree	37.5	25	60	0	33.33	33.33	33.33
Neutral	12.5	50	0	0	0	20	14.29
Disagree	25	25	0	50	50	13.33	23.81
Strongly disagree	0	0	20	0	0	6.67	4.76
Using technology for learning distracts students from their studies							
Strongly agree	12.5	0	0	0	0	6.67	4.76
Agree	25	0	0	0	33.33	0	9.52
Neutral	12.5	0	40	0	0	20	14.29
Disagree	12.5	100	40	75	33.33	53.33	47.62
Strongly disagree	37.5	0	20	25	33.33	20	23.81
Faculty competence to implement FCM							
Strongly agree	25	0	0	0	16.67	6.67	9.52
Agree	12.5	75	40	50	16.67	46.67	38.1
Neutral	37.5	25	40	50	50	33.33	38.1
Disagree	25	0	20	0	16.67	13.33	14.29
Effective FCR implementation requires careful monitoring							
Strongly agree	37.5	50	40	100	66.67	46.67	52.38
Agree	37.5	50	25	0	16.67	40	33.33
Neutral	12.5	0	12.5	0	16.67	6.67	9.52
Disagree	12.5	0	0	0	0	6.67	4.76
Lacks of IT infrastructure for implementing FCM							
Strongly agree	31.08	11.43	11.11	34.72	27.43	20.86	24.03
Agree	54.05	56.29	45.83	47.22	43.71	58.89	53.04
Neutral	10.14	17.14	33.33	18.06	22.29	13.37	17.68
Disagree	4.05	7.14	9.72	0	4	5.88	4.97
Strongly disagree	0.68	0	0	0	0.57	0	0.28

5.7 COMMON FCM FRAMEWORK PREFERENCES

Upon meticulous analysis of the FCM features across different countries, we have discovered that the preferred model for FCRs is almost identical across all countries. Thus, we will condense the main characteristics below. While the features may be similar, the implementation requirements differ from country to country, as explained in the subsequent section. Table 25 summarizes critical features of the feasible FCM for the CAREC countries and outlines some implementation recommendations. Figure 23 presents common features of FCM that may be implemented in the region with little country-specific variations that normally revolve around digital resources and digital content availability in the country. We briefly discuss some policy implications of the proposed features of the FCM for greater clarity for the policy stakeholders.

The ideal delivery time identified by the study is during or after class. Showing VLs before class is favored only by a small majority of teachers in the sample. The content of VLs may vary slightly depending on the time it is delivered or shown to the students. Before class, VLs normally cover key concepts and ideas of the topic so that students get to know the topic beforehand and come prepared. The VLs shown during class are short versions or highlights of the VLs shared before class to revise the concepts delivered earlier, and the VLs shared after class may consist of key concepts or are problem-solving to help students with practical exercises. Hence, it is crucial to plan the delivery time of VLs and decide on the relevant VLs accordingly.

Although most respondents in this study did not favor pre-class VLs, a small quantity of classwork in the form of a short VL containing simple concepts may be delivered to guide and design the in-class activity. Learning activities should be conducted or displayed during class. Complexity, spacing, and time management must be considered for post-class work. Post-class VLs should help with repeating classwork and involve problem-solving exercises ranging from simple to complex. A calm, well-illuminated, and comfortable environment is more likely to enhance knowledge consumption. The study has identified that there is no clear difference in preference for VLs to be watched at home or in a CL among the target population in the study.

The ideal location to watch VLs may vary from school to school and from student to student because of diverse home and CL environments. Respondents preferred both CL and home to reduce distractions and provide comfort. Students must be granted a choice to choose the place where they feel comfortable and less distracted. However, for students who lack access to devices and the internet—required for watching VLs—arrangements must be made at school to facilitate watching VLs in CL or through SB or MM, whatever is possible and available. The study finds that most respondents chose all subjects; however, in the earlier section, respondents from all countries like to study science, mathematics, and English through BL techniques. This finding aligns more with the existing literature suggesting that FCM is more effective in STEM, language, business, and subjects that require interactive and immersive learning (Bishop & Verleger, 2013; Fulton, 2012).

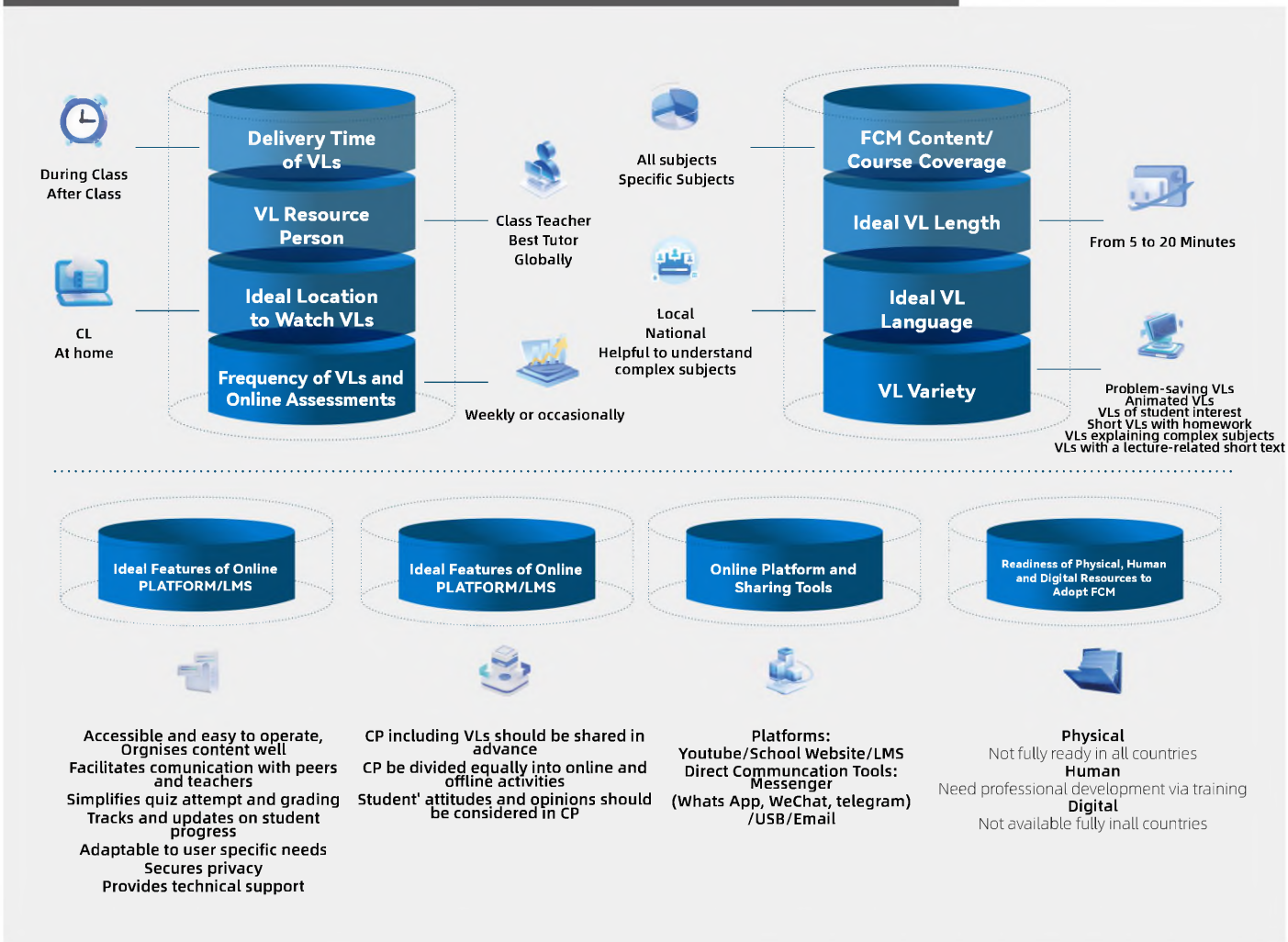
Table 25:Summary of preferred FCM features

Sr No	Feature	Common	Pakistan	Kazakhstan	Uzbekistan	Tajikistan
1	Delivery time of VLs	During class	During class	During class	During class	During class
2	Ideal location to watch VLs	CL	At home	At CL	At home	At CL
3	Delivery time of VLs	All subjects	All subjects	All subjects	All subjects	All subjects
4	Ideal VL length	From 5 to 20 minutes	Under 5 minutes	Under 5 minutes	Under 5 minutes	Under 5 minutes
5	Ideal VL language	Local language	National language	Helpful to understand difficult concepts	Helpful to understand difficult concepts	Local language
6	VL resource person	Class teacher	Teacher privately	Teacher privately	Teacher privately	Best teacher globally,
7	Frequency of VLs and online assessments	Not daily, weekly	Quizzes and assignments are uploaded occasionally	Quizzes and assignments are uploaded occasionally	shared specific subject	Specific subjec
8	Delivery time of VLs	Problem-solving, animated VLs of student interest, short VLs with homework	VL includes activities of student interest, VLs with study material	VLs with study material, problem-solving VL, and audio lectures.	Ls with study material, VL include activities of student interest	VLs with study material, problem-solving VL
9	Online platform and sharing tools	YouTube Messenger (WhatsApp, WeChat, Telegram)	School website Messenger, email	YouTube Tools: Messenger, email	School website, YouTube Messenger, email	School website Messenger, USB
10	CP under FCM	CP, including VLs, should be shared in advance and divided equally into online and offline activities	Student opinions should be considered in CP, including FCM material, shared in advance	Student opinions should be considered in CP, including FCM material.	CP, including FCM material, should be shared in advance	Student opinions should be considered in CP

Table 25:Summary of preferred FCM features (continued)

Sr No	Feature	Common	Pakistan	Kazakhstan	Uzbekistan	Tajikistan
11	Factors to boost student motivation, engagement, and performance under FCM/ Teacher's Role in FCM/	Teacher feedback, progress tracking, tracking student activities in and out of class, VL discussion in class, verification, motivation, encouragement, and granting academic incentives	Frequent feedback Teacher discusses VL in class, students in class Teachers provide incentives to watch VL, motivate students to watch VL	Frequent feedback, help track in-class activities, Teacher discusses VL in class, students in class	Frequent feedback, rate quizzes on both basis, help workload management	Frequent feedback Teacher discusses VL in class, group discussion Teacher motivates students to watch VL, and teacher provides an incentive to watch VL.
12	Factors to boost teacher motivation under FCM	Financial incentives, teacher evaluation appreciation, training to employ FCM	VL resources are available on the national website and online globally.	Teachers are provided with financial incentives and training to implement FCM	Teachers are provided financial incentives and training to implement FCM	Teachers are provided financial incentives and training to implement FCM
13	Preferable features of online platform	Accessible and easily used, organized course content well, facilitates communication, makes quizzes easy to attempt, and secures privacy.	Accessible and easily used, organized course content well, facilitates communication.	Accessible and easily used, organized course content well, facilitates communication.	Organized course content well, adjusted to my needs, accessible and easily used.	Accessible and easily used, organized course content well
14	Readiness of resources to adopt FCM Physical human Digital	Available need professional development via training. Not available fully in all countries	Available need professional development via training. Not available	Available need professional development via training. Available	Available need professional development via training. Limited	Available need professional development via training. Limited

Figure 23: Proposed FCM features based on study findings



We suggest starting FCM implementation with specific subjects and gradually expanding the scope to all disciplines. The ideal VL length to keep learners interested maybe five to 20 minutes. This aligns with the existing literature, finding VL lengths between six and 15 minutes (Brame, 2016). We recommend segmenting longer content into shorter clips, including interesting visuals, charts, quizzes, and questions, and ensuring high-quality videos to increase student interest, comprehension, and motivation. Furthermore, the study found that the ideal VL language preferred by the majority is the local language; some prefer a national language and a language that helps with understanding complex subjects. This finding aligns with the cognitive load, Krashen's input hypothesis, and Vygotsky's sociocultural theories. These theories state that the local language increases student engagement and learning from the content. We recommend prioritizing local language for VLs and online platforms; the platforms and online resources must be translated into local or national language to increase impact. Furthermore, even the terminology used in the local language to explain concepts must be simple and informal to create a social connection with students and thereby aid understanding.

The expertise and presence of resource persons in VL create personal connections and social presence in a learning environment. We recommend that the class teacher personally records VLs to help students connect more with each other owing to personal connections and the common language. However, if VLs from the best tutors globally must be used, they must be translated into a local or national language for impactful learning. Regular and consistent resource sharing improves information retention

among students. We recommend the frequency of online assessments, and VLs must be regularized according to the overall CP. Consistency must be maintained; however, avoiding daily workloads in VLs or online assessments is recommended.

In addition, we recommend that instructors use different formats of online resources to meet the diverse nature of student learning and enhance understanding for all. A combination of different formats of VLs, assessments, and quizzes caters to students' diverse learning styles and promotes a dynamic learning environment. Some of the liked formats include problem-saving VLs, animated VLs, VLs of student interest, short VLs with homework, VLs distributed with study material, VLs explaining complex subjects, and VLs with a lecture-related short text.

The transmission of online resources to learners must be effective and user-friendly. Users in the studied countries favor platforms such as YouTube channels, school websites, and LMS, as well as direct communication tools such as Messenger (WhatsApp, WeChat, Telegram), USB drives, and email for accessing online resources. The platform must be easily accessible and easy to use. It should facilitate communication, track student progress, and simplify assessments and grading. Sophisticated platforms like LMS and school websites may be developed with personalized content to meet school/country-specific needs, and direct communication tools such as Messenger may be utilized for swift and reliable communication.

A new lesson plan design is required because of the differentiation between pre-class, in-class, and post-class instruction. According to the literature, lesson design is the deliberate and organized process of determining student learning content and methods. It is a crucial responsibility of teachers in various educational systems globally (Cicek & Tok, 2014). We recommend that new CPs be designed with balanced online and in-person content and shared with students in advance to give them more control over their learning schedules. Furthermore, student attitudes and opinions should be considered in CP for a more inclusive design and learning environment.

The study also found multiple factors for enhanced student motivation, engagement, and performance under FCM. It concluded that all factors that may boost student motivation, engagement, and performance are essentially linked to the active role of teachers. For example, tracking student progress, their in-class and out-class activities and workload management, VL discussion in a class by the teacher, verification, motivation, encouragement, granting academic incentives for watching VLs, making VLs part of final assessments, balancing online workload frequency—all are essentially deliverables from the teacher. Further, keeping an

ideal length/duration of VL and translating it into the local language are motivating factors for students. Hence, the study recommends elevating and realizing the role of teachers in the FCM and giving them space to bring in the intended benefits from the FCM.

In this regard, it is also essential to keep teacher motivation intact and avoid overburdening them. Teachers have reported that financial incentives, appreciation in teacher evaluation, training to employ FCM, school assistance in managing workload for FCM, making resources available on national or global websites, and giving teachers a role in preparing VLs are all motivating and engaging factors for them. We recommend that any teacher concerns be incorporated into the FCM design to increase their involvement in the process and that excessive workloads should be avoided. However, if teachers' workload is expected to rise under FCM, they must be provided with bonuses or financial incentives to keep them engaged with the process.

Having said all the above, we need to consider the readiness of physical, human, and digital resources to adopt the proposed FCM, which has not been fully ready in all countries. Kazakhstan has a lead and is ready to implement FCM with minimal requirements. Pakistan has the least resources, and Uzbekistan and Tajikistan have a medium infrastructure to implement FCM. We will outline our key recommendations in the concluding section.

06
CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

The study proposes a feasible FCM for the CAREC region. After desk review and analysis of data collected from the sample population, we have developed a proposed FCM that could be implemented in the region with additional requirements. However, scaling up the FCM for the entire population of students will need policy attention by the governments and education departments because it will involve resource development, infrastructural investments, and human resource development through training for learners and educators. We summarize our findings with key requirements and constraints and a scale-up plan. The study surveyed medium to highly developed districts in all four countries and selected schools where little prior use of educational technologies was expected. This information is pertinent to remember while implying study conclusions and recommendations for the whole country because the level of IT infrastructure and education technologies is expected to be low in underdeveloped regions and districts of the same countries.

Overall, we found that the level of school amenities, basic facilities, physical infrastructure, and teaching methodologies are satisfactory in all countries, with few exceptions. The internet is mainly available,

and MD and BB are major internet providers in the four countries with heavy dependence on MD in Pakistan and Tajikistan. All countries reported the available internet quality as satisfactory. However, respondents from all countries generally demanded that schools' internet facilities be further improved. Further, respondents from all countries reported facing difficulties meeting the daytime and educational expenses of their families, implying that any further burden in terms of device, internet cost, or online platform subscription will put an extra burden on students and may become a challenge for the implementation of FCM in the countries studied. Regarding other digital infrastructure required for implementing FCM, almost all countries lack power backup,[19] digital libraries, LMS, school websites, and YouTube channels.

The average qualification of instructors in all countries is 16 years of education, and very few teachers in each country possess any vocational or IT diploma. Although the survey reveals that students generally favor the teaching techniques, respondents believe that their staff are well qualified to implement FCM and that training teachers and students are a standard requirement in all four countries for implementing FCM. The subjects perceived as difficult in all countries are physics, chemistry, biology, and mathematics; both teachers and students feel that all these subjects, as well as English, should be taught through BL techniques. The popular platforms used for entertainment or educational purposes in all four countries are YouTube, MS Office, and Google Classroom, as well as messaging apps such as WeChat, WhatsApp, and Telegram. The finding implies that these platforms can efficiently be utilized to readily share FCM resources because users are already familiar with the apps and platforms.

[19] Power backup is more crucial in Pakistan and Tajikistan where power rationing is imposed. The power outages become more significant during summer in Pakistan and during winter in Tajikistan.

Kazakhstan is the leading country in terms of digitalization in the studied countries. Overall, schools have the necessary physical, human, and digital resources. Only digital libraries and LMS required for FCM are identified as deficient in the surveyed schools. Schools use MM, SB, and CL daily; these gadgets are available for all grades. The country's student-teacher ratio is low;[20] most teachers have 16 years of education. Schools regularly conduct pedagogical and other vocational training for teachers to improve their faculty expertise in state-of-the-art teaching methodologies. Schools have specialized IT experts to deal with IT equipment, and school administrators feel they have all the necessary infrastructure to implement FCM smoothly. The country's device and internet penetration rate is from 90 percent to 100 percent, which provides flexibility for implementing FCM at no further cost. Respondents, however, reported that training is required for educational purposes when using devices and platforms. Students and teachers already use educational platforms like Bilimland and Daryn Online for learning activities. Government support and funding for the digital infrastructure of schools is deemed sufficient by school administrators, which is a good sign for FCM.

The educational landscape regarding technology integration and outreach depicts a grim scenario in Pakistan. The digital divide and low levels of digital literacy are essential constraints in the study sample. Some students, even those from developed districts, need access to the internet, which implies that the problem is even more deep-rooted in the country's less developed regions. MD is a significant source of internet for most respondents, who have identified internet costs as a significant concern. Schools face

[20] This might not be the case for upcoming generations. The country is experiencing a baby boom, and schools are operating in three shifts during the day. Additionally, there is a deficiency of schools that may increase the student-teacher ratio in upcoming days.

difficulties meeting internet costs too, and teachers have demanded improvements in the quality of the internet. Schools also need access to the digital library, YouTube channel, websites, or LMS for online academic activities. The highest student-teacher ratio in the region is 46 students per teacher on average in the sampled schools. Students perceive mathematics as the most challenging subject and believe that mathematics, science, and English should be taught through BL techniques. MM and SB are primarily unavailable in schools, and CL has a very low capacity, averaging 14 computers per school, which is insufficient to cater to the needs of students who are usually numbered in the thousands in an average school in Pakistan. The available gadgets are used only for specific grades, and CL is rare for most students. In the modern era, this is a very bleak situation. Students believe computers must be functional or available in their schools. Some students even think their teachers lack proficiency in operating IT devices. The device access rate by students at home is also the lowest in the region, ranging from 60 percent to 70 percent, meaning that FCM implementation in Pakistan is a challenge on both a personal and a school level. Both teachers and students (around 50 percent) need training to run different devices (PCs, laptops) and platforms for educational purposes.

Schools in Uzbekistan are equipped with physical and IT resources but need more infrastructure to strengthen these resources further and increase access for 100 percent of students. In addition, launching proper faculty development programs to improve vocational qualifications is required to implement FCM. The internet is available in schools, but respondents want its quality to be improved. On average, 24 computers, seven SBs, and five MM tools are available in the sampled schools, and students and teachers report

that using these IT devices at their schools is frequent. However, some respondents stated that these gadgets are available for limited use. Students feel mathematics and science subjects are challenging to understand and want these subjects, as well as English and social studies, to be taught through BL techniques. All schools have an IT expert for technical assistance, and the government provides support in IT equipment and funding to facilitate the digitalization of schools. The device access rate in the country is from 90 percent to 100 percent. Respondents already use educational platforms such as Kitobkhona, EduMarket, and Eduportal. More than 25 percent of respondents believe they need the training to use devices and platforms for educational purposes.

Schools in Tajikistan have the necessary physical, human, and IT infrastructure, but respondents also highlighted some deficiencies. The primary issue in the country is internet availability and cost. MD is the primary internet source, and all respondents feel that the quality and availability of the internet must be improved at home and in schools. Schools do not have any YouTube channels, LMSs, or specific websites for accessing online resources. They need to increase the use of IT devices and techniques. About 76 computers, 14 SBs, and 14 MM tools are available on average in each school, the frequency of usage of CL is only weekly, and MM is used only occasionally. The country's/sample student-teacher ratio is 27, and teachers believe their school lacks highly qualified teachers to implement FCM. Students and teachers from Tajikistan also feel that science subjects, mathematics, and the English language should be taught through BL techniques. The schools have IT experts to deal with technical issues and government

support regarding IT equipment and funding, but the school administration feels it needs to be more. The device access rate in the country is more than 90 percent, and some respondents have already used an online platform, eDonish. Around 50 percent of respondents feel they need training to use devices and platforms (MS Office, YouTube, internet browser) for educational purposes. The education department and government in Tajikistan must first prioritize the provision of an affordable internet facility to move towards implementing FCM or the digitalization of education in the country.

The preferred FCM features in all countries are common with very little variation, which implies that a general FCM framework may be developed for all four countries. However,

the requirements vary from country to country based on the status of the countries' physical, human, and IT infrastructure. We present country-wise recommendations based on the findings from the study. We also discussed these findings in policy dialog with the key stakeholders from all participant countries and incorporated their feedback in our final recommendations. The panelists emphasized the importance of tailoring educational models like the FCM to the local context, particularly in low-income countries with limited infrastructure and access to technology. They raised concerns about the need for differentiated learning and the effectiveness of low-tech alternatives. There was consensus on improving teacher training and ensuring that BL models, such as FCM, address both equity and practical implementation challenges. Collaboration, cost-effectiveness, and aligning digital tools with national curricula were highlighted as crucial for success. They stressed that the next step should involve in-depth research to identify the root causes of educational challenges and evaluate FCM's effectiveness. Conducting a contextual needs assessment in each region is crucial to identifying infrastructure, digital access, teacher readiness, and student engagement challenges. This will guide the selection of the most suitable mix of technological and non-technological solutions. A hybrid approach, combining both digital and non-digital methods, can ensure inclusivity in low-resource settings. Early teacher engagement and continuous professional development are key for successfully implementing both technological and non-technological interventions.

6.1. SPECIFIC RECOMMENDATIONS FOR KAZAKHSTAN

1. Strengthen IT Infrastructure and Internet Connectivity in Schools

Although Kazakhstan enjoys a high internet penetration rate and reliable connectivity, targeted investments in IT infrastructure and digital libraries are necessary to enhance the implementation of the FCM. A few respondents expressed dissatisfaction with access to the school's internet facilities and IT infrastructure, citing issues such as slow connectivity, frequent disruptions, and limited coverage. Schools should upgrade their

IT equipment, improve student internet accessibility within school premises, and ensure uninterrupted power supplies to support digital learning. While most schools report adequate infrastructure, addressing gaps in underserved areas, particularly in rural schools, is critical. The government could allocate additional funding to install high-speed internet connections, provide IT equipment, and establish backup power systems. Monitoring and periodic upgrades will ensure schools maintain infrastructure standards supporting digital education. Kazakhstan is already on the path to strengthening its internet connectivity and has recently installed 1,000 Starlink satellites, mainly in rural areas. This agreement with Starlink aims to boost average internet speeds to 40 Mbps.

2. Expand Faculty and Teacher Training Programs

Kazakhstan boasts state-of-the-art digital and physical resources, as highlighted in the study. However, a critical area that requires immediate attention is improving the digital literacy of both faculty and students. Although most teachers hold master's degrees, there is a noticeable professional and vocational training gap among the faculty. Technological proficiency varies, with some teachers and students needing more skills to use these tools effectively. While three to five training sessions per year are conducted in Kazakh schools, respondents emphasized the need for more specialized training to implement the FCM effectively. Students also reported challenges with the learning curve associated with new technologies, highlighting the need for patience and additional support to gain proficiency. Moreover, they desired greater awareness and training in using specific devices (for example, laptops, PCs) and applications or programs (such

as, MS Office, Google Classroom, and internet browsers). Although some respondents use national platforms like Bilimland and Daryn Online, practical training is essential to maximize their potential.

Comprehensive professional development programs should be introduced to equip teachers with the skills to create, deliver, and manage VLs, integrate digital tools into lesson plans, and engage students effectively. Training programs should include hands-on workshops, access to instructional design resources, and certification in EdTech. Collaboration with international institutions and EdTech companies can bring in expertise and global best practices. Specific platforms for FCM should be selected for the country to train learners and educators to use and benefit from these resources. The academic calendar should also include designated time slots for workshops that teach students and educators how to engage in BL using various gadgets and apps. Prior training is essential before launching any FCM initiatives, while ongoing refresher training should be provided to keep learners and educators updated on new and emerging applications. Kazakhstan will adopt a new education standard by 2026 that will add digital competencies for students in collaboration with ISTE (International Society for Technology in Education), which will aid in training requirements for students and teachers.

3. Localize Digital Educational Content

The study findings highlight the importance of content delivery in the local language for a well-rounded educational environment, as it enhances student comprehension and engagement. VLs should be produced in students' local languages to ensure inclusivity, with secondary options available in the national language for broader communication. The translation process of the VLs available online in foreign languages must be streamlined to increase student motivation, engagement, and involvement in the BL process. National or provincial-level education departments may collaborate with educational content providers to acquire and adapt the already available digital curricula or get help developing school/region-specific digital content. This effort could include partnerships with local content creators, universities, and linguistic experts. Ensuring that content aligns with the national curriculum while being accessible in multiple languages will bridge learning gaps and promote inclusivity. Similarly, assessments—including online quizzes, tests, and assignment submission systems—must be developed or adapted from existing national or international platforms to match Kazakhstan's diverse learning and digital literacy standards. Kazakhstan has made significant investments in digitalizing processes but has not focused enough on digitalizing pedagogy, which should also be a priority for upcoming digitalization initiatives.

4. Optimize Flipped Learning Tools and Platforms

Developing robust, user-friendly online platforms for FCM is vital to ensure effective resource sharing, assessments, and progress tracking. Platforms should allow seamless access to VLs, quizzes, feedback, and privacy protection. In Kazakhstan, multiple online platforms—including the most popular video hosting platform, Youtube, and educational platforms, such as Bilimland.kz, Daryn Online and Kundelik.kz—are used for educational purposes. During the pandemic, Bilimland facilitated distance and hybrid learning for over 7,000 schools, enabling more than 300 million lessons and 2 billion exercises. Students mostly favor YouTube channels; however, there is a need for a sophisticated LMS to functionalize FCM in schools. Both teachers and students should obtain training on platforms like Google Classroom, Daryn Online, and Talim.uz to maximize their potential. The government and educational institutions can collaborate with EdTech firms to refine these platforms, integrate interactive features, and support offline functionality where internet access may be intermittent. Integrating centralized platforms like those offered by Microsoft or Google is also important.

There is an urgent need to adopt a platform that not only meets all ideal criteria identified for an LMs in the study but also supports Kazakh, Russian, and other local languages spoken in the country to meet the diverse needs of the teachers and students across the country. Alternatively, a school website may be created to provide comprehensive information about school activities and offer online BL resources, including instructional materials and assessment tools. The website should accommodate the diverse needs of students and educators, and providing basic training on its use will enable all stakeholders to use it efficiently.

5. Tailor FCM to Prioritize STEM and Language Learning

Kazakh students identify physics, chemistry, mathematics, and English as challenging subjects that would benefit from flipped learning. FCM should initially focus on these areas, leveraging interactive and problem-solving VL formats. This phased approach allows the program to demonstrate its effectiveness in core subjects before expanding to others. Regular evaluation through feedback and data analysis will guide adjustments to improve outcomes, ensuring the scalability of the FCM across all disciplines.

6. Design Effective Workload Management Strategies

Maintaining a balance between online and in-class activities is crucial to prevent student fatigue. VLs should be concise, preferably 5–20 minutes long, and assignments should be distributed weekly to keep students engaged without overwhelming them. Teachers should use group discussions and collaborative projects to reinforce concepts from VLs and actively monitor student participation. Implementing reward systems for consistent VL viewing and participation will boost motivation.

7. Integrate Digital Libraries and Expand Resource Accessibility

Access to digital libraries remains a priority for both teachers and students. Schools should establish digital libraries that provide comprehensive, curated resources to support flipped learning. These libraries should be accessible on campus and remotely, ensuring student equity. Investments in software solutions for resource management and partnerships with international digital library networks will enhance access to diverse educational materials.

6.2. SPECIFIC RECOMMENDATIONS FOR PAKISTAN

1. Government Investment in BB Infrastructure

IT infrastructure in the education sector has areas for improvement that should be the top priority for the government and education ministry of the country. There is a severe lack of BB access in Pakistani schools, half of which still lack BB installation, necessitating the need to invest in robust internet infrastructure. The government should allocate a significant portion of the education budget to fund BB installation in all schools, particularly in underserved and rural areas. Partnerships with telecommunications companies can be explored to facilitate cost-effective internet service packages tailored

for educational institutions. Governments should implement policy measures that reduce internet service costs to ensure equitable access, particularly in lower-income areas, thus narrowing the digital divide. Supporting this infrastructure could enhance the quality of education across Pakistan, empowering students and teachers with the tools necessary to access digital resources and effectively implement BL methodologies.

The schools are significantly overcrowded, limiting student access to resources and facilities. CLs are particularly affected, often equipped with a few computers allocated for use by specific grades and subjects, leaving many students without access. Furthermore, many of these labs are non-functional due to outdated equipment, insufficient maintenance, or a lack of technical support. Even in cases where CLs are operational, the overcrowded nature of the schools further restricts student access, leaving the majority unable to benefit from the technology.

2. Subsidized Devices for Students

The limited access to digital devices is another major barrier to the successful implementation of FCM in Pakistan. With only 50 to 60 percent of students having access to smartphones, laptops, or tablets, the educational divide is deepened. To address this, the government should expand the scope of existing initiatives such as the prime minister laptop scheme, providing subsidized or free devices to students, particularly those from low-income families. These devices, ranging from smartphones to low-cost tablets, would enable students to participate in online learning and access educational

resources. Schools should also be provided with adequate funds to equip classrooms with essential IT tools such as SBs, MM tools, and interactive devices, ensuring all students have access to the necessary hardware to engage in BL.

3. Comprehensive Teacher and Student Training Programs

The successful integration of FCM depends not only on physical infrastructure but also on the digital literacy of both students and teachers. Given the low levels of digital literacy across Pakistan, the government must introduce mandatory training programs for both groups. These programs should focus on educating students and teachers on how to effectively use digital platforms, online resources, and IT devices. For teachers, specialized training in instructional design for BL and FCM, including creating and using VLs, should be a priority. Similarly, students should be trained to use educational platforms like LMS and communication tools like WhatsApp and YouTube for learning purposes. Refresher courses should also be implemented to keep teachers and students updated with the latest tools and methodologies, ensuring that BL is a sustainable and scalable model in Pakistan.

4. Subsidization of Internet Costs

The high cost of internet services in Pakistan remains a significant financial burden for students and their families. To ensure equitable education delivery via digital platforms, the government should consider subsidizing internet services for students and teachers. Collaborations with telecom companies could lead to affordable and tailored internet

packages for educational purposes. This should also include subsidized internet costs for schools, ensuring that institutions, especially those in rural or underserved regions, are not financially burdened by internet service fees. A nationwide initiative to reduce the digital gap will significantly improve access to online educational resources, supporting the successful adoption of FCM and similar BL approaches.

5. Creation of Digital Libraries and Educational Content

Access to educational content is vital for the success of FCM in Pakistan. The survey indicates that students and teachers alike are dissatisfied with the availability of physical and digital library resources in schools. To address this, the government should invest in digital libraries that offer a wealth of learning materials, ranging from textbooks to interactive content and VLs. These digital libraries could be housed on school websites, local servers, or cloud platforms, ensuring teachers and students have uninterrupted access to high-quality learning materials. Further, integrating locally relevant and culturally appropriate educational content into regional languages would significantly increase the engagement and effectiveness of digital learning tools, particularly in rural areas where access to mainstream educational content may be limited.

6. Balanced BL Workload and Schedules

While students express enthusiasm for BL, particularly FCM, concerns about workload and schedule burdens must be addressed to ensure its success. Students report feeling overwhelmed when VLs are assigned too frequently and prefer a balanced schedule that doesn't place excessive pressure on them. Therefore, it is crucial to design and implement a balanced BL schedule that includes a mix of in-person and online activities, ensuring that students have ample time to absorb content without feeling overburdened. Teachers must collaborate in designing these schedules and provide feedback on workload management. FCM implementation should initially be tested with a limited number of subjects (such as mathematics, science, and English) and gradually expanded based on the system's efficiency and feedback from students and teachers.

7. Support for School Infrastructure Upgrades

The lack of adequate infrastructure, including CLs, IT devices, and MM tools, in Pakistani schools hinders the implementation of modern educational approaches like FCM. The government needs to allocate specific funding for renovating and upgrading school infrastructure to meet the demands of a digital learning environment. This includes equipping schools with functional computers, laptops, tablets, and MM tools to facilitate the use of online resources. Schools should be provided with modern server systems, LMS, and internet connectivity to enhance the overall learning experience. Moreover, the government could establish a dedicated fund for schools in remote or economically disadvantaged areas, ensuring they are not left behind in the digital education revolution.

8. Localized and Contextualized Educational Content

To increase engagement and improve learning outcomes, digital content used for FCM must be tailored to local contexts and languages. Given Pakistan's diverse linguistic landscape, using local languages in video lessons and educational materials will foster a stronger connection to the content. Students from different regions have different learning needs, and it is essential that the content reflects these local preferences. For example, offering VLs and online resources in both the national language (Urdu) and regional languages would help bridge cultural and educational gaps, particularly in rural areas. To create more engaging educational experiences, schools could encourage local teachers to develop or adapt content for FCM while utilizing global educational resources, ensuring that students benefit from the best of both worlds.

9. FCM Implementation Modalities

Two strategic approaches may be adopted to implement BL in Pakistan. First, initiating a pilot study in existing schools, targeting grades 8 and 9 by delivering one to two blended classes monthly and then expanding to grade 10 once sufficient experience is gained. Second, there is a need to address the needs of out-of-school children (OOSC), of which there are approximately 26 million aged 5 to 16, particularly in grades 9 to 12. BL could be an effective solution for children aged 13 to 14; however, the primary challenge lies in ensuring reliable internet connectivity, as many students rely on cellular networks that often prove unreliable during times of network disruption.

We recommend testing BL in selected schools and universities to assess its feasibility in varied educational contexts. Collaboration with the Islamic Development Bank (IsDB), which is already funding poverty alleviation projects in Pakistan's underserved districts through the Ministry of Poverty Alleviation and Social Safety, could facilitate the implementation of the FCM in grades 8 to 12, allowing us to evaluate its viability and adapt it to local conditions. To enhance the effectiveness of BL in Pakistan, a multifaceted policy approach addressing several key areas may be adopted. First, given the ongoing challenges of internet connectivity, the development of offline learning modules as a viable solution. The government should leverage the recently launched mobile app, which provides broader access than the previous Tele-School Project, to disseminate educational content. Digital content developed under the Ministry of Education and funded by the World Bank is already available, including local language resources, which the Federal Government can help facilitate. This digital content, aligned with the National Curriculum from Nursery to 12th grade, should be utilized to support curriculum delivery.

We advocate for the expansion of the E-Taleem portal, which offers virtual teacher training, student registration, and performance tracking, ensuring it reaches schools across all provinces. To maximize its impact, continuous awareness campaigns by the Ministry of Education are essential to inform stakeholders—schools, teachers, students, and principals—about the portal's features and benefits via social, print, and electronic media. Finally, while the initiatives undertaken in Islamabad (capital city) may not

represent the entire country, they serve as valuable best practices that can be highlighted to showcase effective strategies while also acknowledging the need to extend digital content reach to regions with varying Human Development Index (HDI) levels for a more comprehensive and inclusive educational framework.

6.3. SPECIFIC RECOMMENDATIONS FOR UZBEKISTAN

1.Enhancement of Internet Infrastructure and Affordability

Despite widespread internet access in Uzbekistan, the country faces challenges in providing high-quality and affordable BB internet, especially in remote regions. To ensure the smooth integration of BL and FCM, the government should focus on expanding BB access across the country, particularly in underdeveloped regions where MD is still dominant. Digitalization efforts are crucial, especially in rural areas where schools are among the first to receive BB internet connections, marking significant progress. Collaborating with telecom companies to offer subsidized internet bundles for students and schools can help reduce financial burdens on families, particularly those in rural areas. Improving internet speeds and bandwidth at both school and home levels will significantly enhance the quality of online education. Schools should be equipped with reliable, cost-effective internet solutions to support uninterrupted online learning, ensuring equal access to educational resources for all students.

2.Teacher and Student Digital Literacy Training

Digital literacy remains a significant barrier to implementing BL and FCM in Uzbekistan. While teachers have access to technology, many lack adequate training in using digital platforms for educational purposes. The government should prioritize the launch of nationwide professional development programs for teachers focused on enhancing their digital skills. These programs should be mandatory before implementing the FCM and should include regular refresher courses to stay updated on new technologies. Students should receive training on using educational platforms and digital tools to bridge the digital divide and ensure effective use of the technologies at their disposal. This approach will ensure that both teachers and students are well-equipped to engage with BL strategies and maximize the potential of FCM.

3.Localized Digital Curriculum Development

To foster greater engagement and success in FCM, it is essential to adapt digital educational content to the local context. The digital curriculum should be available in Uzbek and Russian to cater to the diverse linguistic needs of students. National education authorities should collaborate with content providers to either modify existing materials or develop new content tailored to Uzbekistan's curriculum and learning standards. In addition, it is crucial to incorporate a range of MM content—such as videos, interactive quizzes, and virtual labs—that align with students' learning preferences and the subjects they find challenging, such as mathematics, physics, and chemistry. Providing resources

in local languages will also enhance comprehension, making learning more accessible and engaging.

4.Creation of a Unified LMS

The fragmented use of multiple educational platforms in Uzbekistan can create confusion among both students and teachers. To streamline the FCM process, the government should develop or adapt a unified LMS that integrates various educational resources, tools, and assessments. This platform should support the local languages (Uzbek, Russian) and include key features like online quizzes, VLs, and assignment submission portals. By centralizing all educational content and activities in one user-friendly platform, students and teachers will have a more cohesive and organized learning experience, reducing the barriers associated with using multiple platforms. Maktab.uz is a significant digital education platform in Uzbekistan, providing essential resources and support for students and teachers. It enhances access to quality education and facilitates digital learning, as it represents a crucial step towards addressing educational challenges in the region. By showcasing such platforms, legislators can emphasize the importance of leveraging local initiatives to improve educational outcomes and promote BL effectively.

5.Improvement of IT Infrastructure and Technical Support

Although Uzbekistan's schools generally have good IT infrastructure, there are still areas that require significant investment to ensure equitable access to technology. A comprehensive needs assessment should be conducted to identify schools lacking sufficient IT devices, internet connectivity, and technical support. Efforts should be made to equip all schools with adequate resources, such as SB, MM devices, and backup power systems, ensuring that no student is left behind due to a lack of technology. Technical support should be improved by providing ongoing training for IT staff, ensuring they are well-versed in troubleshooting and maintaining equipment. This will enable the smooth functioning of digital tools and ensure that teachers and students can rely on technology without interruptions.

6.Development of Digital Libraries and Resource Centers

Access to a digital library is crucial for supporting students' independent learning and enabling them to access a wide range of educational resources. Uzbekistan should invest in the development of a national digital library that is accessible to all schools, providing textbooks, research papers, videos, and interactive learning tools. This library should be regularly updated with relevant materials and made available in multiple languages to accommodate the diverse linguistic preferences of students. By creating a centralized digital resource hub, students and teachers will have easy access to high-quality educational materials, further enhancing the implementation of FCM.

7.Teacher Incentives and Recognition for FCM Integration

For successful FCM implementation, teachers must be adequately motivated and supported. In Uzbekistan, teachers have expressed a need for recognition and financial incentives to encourage them to adopt new teaching models. The government should establish a framework for rewarding teachers who successfully integrate FCM into their classrooms, offering incentives such as performance-based bonuses, public recognition, and opportunities for career advancement. Furthermore, providing teachers with the opportunity to create their own VLs and share them with their students can enhance their engagement with the FCM. Schools should also allocate resources to help teachers collaborate in content creation, ensuring the materials are of high quality and tailored to students' needs.

8.Balanced Workload Management in BL

One of the key challenges with FCM is ensuring that students do not feel overwhelmed by the amount of online content and assignments. In Uzbekistan, students have expressed concerns about excessive workload, especially in subjects that already require significant effort, such as physics, chemistry, and mathematics. To address this, it is important to balance the online and in-person workload. The duration of VLs should be kept under 20 minutes to prevent student fatigue, and the frequency of online assignments and quizzes should be moderate to avoid overburdening students. By managing the workload effectively, students can benefit from the flexibility of FCM without feeling

stressed or disengaged. Teachers should be encouraged to provide feedback on VLs, facilitate discussions, and offer personalized support to help students manage their learning pace and workload.

6.4. SPECIFIC RECOMMENDATIONS FOR TAJIKISTAN

1.Expansion of Digital/IT Infrastructure in Schools

Tajikistan's educational system faces significant barriers to implementing BL effectively due to the limited accessibility of IT resources. While some schools have IT equipment, many students and teachers lack regular access to these resources, with CLs used sparingly. To address this, the government must prioritize the expansion of digital infrastructure in schools. A comprehensive needs assessment should be conducted to determine gaps in access to IT devices and MM tools, ensuring that all schools are equipped with sufficient computers, tablets, or laptops for students and teachers. Furthermore, resources should be optimized through strategies such as rotating schedules for sharing devices and establishing technology hubs in schools. Local and national education departments should also collaborate to provide schools with IT devices and MM equipment to ensure seamless BL adoption.

2.Providing Affordable and Reliable Internet Connectivity

Although schools in Tajikistan are equipped with BB internet, many students and teachers still face challenges with internet quality and affordability, particularly at home. The lack of sufficient internet access at the household level is a significant barrier to effective learning. To address this, the government should collaborate with telecom companies to offer subsidized internet plans for students and teachers. These bundles should prioritize educational needs and ensure that all students have access to a reliable and affordable internet connection. Additionally, funding for improving internet services in schools must be increased to mitigate the financial strain on school budgets, ensuring that the BB infrastructure is both reliable and sustainable.

3.Comprehensive Training for Teachers and Students

Digital literacy remains a critical issue in Tajikistan despite high device penetration rates. While most students are familiar with basic smart devices and platforms, they require more focused training to use these tools for educational purposes. Similarly, teachers need to be trained on the effective implementation of FCM and the effective use of digital platforms. The government should launch large-scale professional development programs for educators that include specialized training in digital pedagogy and BL methods. These programs should be mandatory and incorporated into teachers' annual professional development plans. Additionally, schools should offer students regular training sessions on using digital tools and LMS, ensuring that they can fully engage with the available online learning resources.

4.Development and Localization of Digital Curriculum

Tajikistan must ensure that digital content for FCM is available in both Tajik and Russian languages to make learning accessible to all students. While some local platforms, such as eDonish, already provide digital content in Tajik, there is a need for more widespread development of educational materials in these languages. The government should collaborate with educational content providers to either develop new digital curricula or adapt existing resources to suit local languages and cultural contexts. These resources should include videos, quizzes, and interactive exercises that are easy to understand, especially for challenging subjects like chemistry, mathematics, and physics. The digital content should be designed to support various learning styles, with a focus on visual, aural, and text-based resources.

5.Adoption of a National LMS

Tajikistan currently lacks a unified digital platform for managing learning resources, assessments, and student progress, which hampers the full adoption of FCM. While platforms like eDonish are in use, they do not provide comprehensive support for all aspects of BL. The government should invest in developing a national LMS that is compatible with local languages, is user-friendly, and can integrate content management, assessments, and real-time tracking of student progress. This platform should be accessible to all schools, offering features such as interactive quizzes, grading, feedback tools, and communication channels for teachers, students, and parents. The LMS should also be scalable and flexible to meet the diverse needs of different regions and educational institutions.

6.Enhancement of Technical Support and IT Staff Availability

To ensure the smooth operation of digital learning tools, every school in Tajikistan should be equipped with dedicated IT staff capable of handling technical issues and maintaining digital infrastructure. Currently, only half of the schools have access to IT experts, which is insufficient given the increasing reliance on technology in classrooms. The government must prioritize the hiring of qualified IT professionals for every school, providing them with adequate training and resources. These experts should be responsible for maintaining hardware and software, troubleshooting technical issues, and ensuring that digital platforms function seamlessly. By investing in technical support, Tajikistan can reduce disruptions to learning and ensure that both students and teachers can fully benefit from digital resources.

7.Financial Investment in Education Technology

Although the initial setup costs for FCM in Tajikistan may not be prohibitive, ongoing funding for the maintenance and expansion of IT infrastructure is essential for sustaining digital learning initiatives. The government should increase its financial support to schools to cover the costs of equipment upgrades, software licenses, and the development of digital content. Schools should be provided with a dedicated budget for IT-related expenses, ensuring that resources are regularly updated and maintained. Financial incentives for teachers who successfully implement FCM can further motivate educators to adopt digital learning tools. These funds should also support professional development programs for teachers to help them integrate technology into their classrooms effectively.

8.Support for Creating Engaging and Relevant Learning Materials

To effectively implement FCM, Tajikistan must create high-quality, engaging, and locally relevant learning materials. Students, particularly in challenging subjects, expressed a preference for visual learning content, such as videos and interactive materials. Teachers should be encouraged to create their video lessons or adapt existing materials to suit the local context and learning preferences better. To support this, schools should provide teachers with the necessary resources and time to develop these materials. Furthermore, a centralized online repository for educational videos, worksheets, and problem-solving resources should be established, allowing teachers to share and access content. The government can incentivize teachers to create and share educational materials by offering professional recognition or additional support in their work.

6.5. COMMON RECOMMENDATIONS

1. Minimum ICT investments needed for BL to take place

Some countries may be more ready than others, but minimum investments are needed to ensure technology-enabled classrooms. IT equipment such as a computer/ laptop with a display screen or TV is needed to display digital content such as videos in classrooms. While electricity is not a major concern for the countries that have been surveyed, some schools may still have unreliable electricity and hence, an uninterruptible power supply may be required. Similarly, internet connection is not universal, although

major strides have been undertaken in the four countries. To prevent overreliance on internet connection, educational content materials of the LMS should be available on the local server, which may sync for updates from the main education server. This study advocates a phased and localized implementation of FCM, exploring offline solutions like prerecorded videos or radio-based instruction. In the context of this study, while FCM may offer benefits in more connected areas, it is essential to recognize that alternative, lower-tech solutions like IVR (interactive voice recordings) and voice technology could better serve populations with limited digital access. The goal should be to adapt educational interventions to the specific technological realities of each region, ensuring inclusivity and accessibility. In addition, in areas where internet access and smartphones are scarce, prioritizing lower-tech, cost-effective solutions can have a more immediate and meaningful impact on learning outcomes.

To address the concern that video-based learning in a blended model can exacerbate inequalities owing to varying access to resources at home, we propose a policy that focuses on delivering BL in controlled environments, such as schools, to ensure equal access. Schools should be equipped with infrastructure like internet access, MM equipment, and LMS to provide equal access to BL resources. This will help students who lack adequate resources at home benefit from video-based and digital learning content. Schools can also offer after-school learning sessions for students with limited access to technology. Private schools have better financial access and can more easily acquire laptops and tablets. In contrast, public schools need financial constraints,

making it more difficult to integrate technology. There should also be distinct strategies for implementing FCM in public and private schools, with a more targeted approach to meet their specific needs and capabilities. Governments can collaborate with private sector companies to provide schools with digital infrastructure, such as computers, SBs, and reliable internet connectivity. Community learning centers should be established in underserved areas to bridge resource access gaps. By shifting the focus of video-based BL from home environments to schools or community spaces, we can mitigate the risk of exacerbating inequalities and ensure that all students benefit from these innovative teaching models.

2. FCM integration into the course plan

Without proper planning, the success of the teaching practices or FCM may not be guaranteed. It is crucial to redesign CPs for subjects that include BL techniques by incorporating online and offline academic activities. Digital content, such as VLs (with all ideal features), assessments, and practical sessions, must be decided upon and planned in the CP. It is ideal to share the CP in advance with students to lend flexibility and time for preparation. Furthermore, a well-thought-out CP ahead of time provides the necessary time for instructors to balance the frequency of students' workload. Hence, if FCM is to be implemented, guidelines/training for preparing CPs must be provided to teachers by school administration or education ministries for a comprehensive and uniform implementation of the model. Furthermore, students and teachers should be given access to digital content and platforms for the smooth implementation of the model. Ensuring that the FCM approach aligns with the current national educational framework is also crucial.

3. Time management, teacher assistance, and incentives for workload management[21]

Time management in the BL method is essential for students and teachers. Teachers must monitor and guide students on how to manage their time both inside and outside class activities. LMS solutions should be user-friendly and easy to use. The content found in these LMS solutions should support teachers instead of creating a burden for them. Implementing FCM, which requires teachers to enhance their planning and workload, may cause a significant barrier to adoption. Concerning time issues, teacher feedback delays may create consequences for students. Thus, teachers must focus on providing consistent and timely feedback for student guidance. If the CP integrates FCM, the teacher's workload is expected to rise because the teacher has a crucial role in effectively implementing the FCM and realizing the model's real potential. The administration must assist teachers and keep the workload manageable even under FCM.

The workload will be manageable if the school management grants access to digital content and platforms, and the teachers must incorporate it into their CPs. However, if teachers have to create digital content alone, it will create time management and workload issues. If this is the case, some initial financial incentives or promotions may be granted to keep them motivated if the budgetary constraint allows it. We recommend securing centralized digital content and platforms to avoid this cost. The centralized access acquired by the ministries of education will not only lift the burden on teachers

[21] Time management is discussed separately in the case of Pakistan because teachers there are overburdened by the highest pupil-teacher ratio in the region, dissatisfied with the salary structure, and need incentives to take on more workload.

but also reduce the cost of financial incentives and harmonize educational practices at the national level.

4. Communication tools

Students and teachers prefer communication tools like WhatsApp, WeChat, Telegram, and so on for VL sharing and collaboration. These cost-efficient and user-friendly communication methods make them highly successful in implementing BL teaching and learning. Low-cost and subsidized internet bundles may be provided for students and teachers to use these tools for educational purposes. Education authorities may choose any of the above platforms to communicate and share VLs and assessment tools; there is no need to proceed with every one of them. The choice of tool, however, depends upon the cost, ease of use, and priority of the stakeholders.

5. Difficulties keeping up with rapid technological change and student motivation

Students voiced their frustration with the rapid pace at which technology advances, posing a challenge to stay abreast of upgrades and novel features. The FCM should strive for flexibility and prioritize fundamental technology abilities that can be applied across various platforms; it must avoid frequent program modifications. The extensive material and lengthy nature of questions in certain instructional technology platforms might result in weariness and diminished involvement, especially for students. Some students expressed that they felt inundated by the vast amount of IT deliveries and the possibility of experiencing eye strain owing to prolonged screen usage.

The model could include intervals and tactics to mitigate information overload and encourage balanced screen usage habits. It might be difficult to stimulate pupils' engagement with technology, especially if they lack inherent motivation or have motivational difficulties. The FCM design must be diverse and flexible to keep all students motivated and engaged in the learning process. Further, implementing a trial period for the BL model can help gauge student responsiveness. Gathering feedback from students will allow for continuous improvement of the program and help tailor it to their needs.

6. Power backup

Providing power backup systems in Pakistan and Tajikistan is crucial, as both countries frequently experience power rationing. The power outages in Tajikistan worsen during winters and in Pakistan during summers. An uninterrupted power supply is essential to ensure a seamless, tranquil, and conducive learning environment.

7. Risk assessment of using publicly available platforms

Most students and teachers use YouTube and other openly available apps and platforms for educational purposes. We suggest including thorough rules for the responsible and secure use of openly accessible platforms in educational contexts, such as YouTube, in future recommendations. Reducing hazards involves educating teachers about data security, privacy issues, and content protection. Furthermore, we advise putting procedures in place to guarantee adherence to data protection laws and instructing educators on the best ways to protect sensitive data when utilizing these platforms.

8. Role of stakeholders

Meticulous planning and the active participation of all relevant stakeholders in the educational community are essential for producing online educational resources and content.

School administration: School administration is the key player in implementing FCM. The administration should effectively manage available resources for the smooth implementation of FCM, inform higher authorities about deficient resources, and put effort into acquiring them. Further, they must vigilantly monitor the process of FCM integration by the teachers and get frequent feedback on constraints and challenges faced to overcome those challenges. Frequent feedback and performance evaluation of both teachers and students may help revise and improve FCM design over time.

Governments/education authorities/ministries: The government should prioritize reforming national education policy by incorporating BL techniques in the development of course content. The government should provide schools with financial, technical, and human resources to facilitate the implementation of these techniques. Education ministries and authorities should guide the government policy-making process based on ground realities and effectively participate in and implement policy initiatives launched by the government to revolutionize the educational landscape by integrating modern BL technologies. Further, carefully monitoring and evaluating FCM implementation and upgradation is a crucial part of the program that the authorities must carry out to realize the intended benefits of the model.

Parents: Parents should be involved before using BL teaching strategies since their support and provision of IT gadgets and internet facilities at home are crucial for the intended success of FCM. Although most respondents in the study have reported that their parents will support them with the provision of IT devices and the internet, there is still a need to actively involve parents by arranging parent-teacher meetings where they are informed regarding the adoption of FCM, its impact on their children's performance, and their role in its effective implementation.

6.6. SPECIFIC RECOMMENDATIONS FOR IsDB

1. Promote context-specific BL models

IsDB should prioritize supporting pilot projects to adapt and implement BL models in Kazakhstan, Pakistan, Tajikistan, and Uzbekistan, ensuring these models are tailored to address the unique challenges, cultural nuances, linguistic diversity, and educational contexts of each country. These pilot projects should engage local stakeholders, including educators, policymakers, and community leaders, to ensure relevance and acceptance. They should leverage existing digital infrastructure while identifying and addressing gaps, incorporating localized content and teaching strategies that resonate with diverse student populations. Through these efforts, IsDB can facilitate equitable access to quality education, enhance learning outcomes, and empower these nations to build resilient, future-ready education systems.

2. Support the strengthening of digital infrastructure in schools

IsDB should prioritize investments to strengthen digital infrastructure in schools across member countries, focusing on ensuring reliable internet connectivity, robust power backup systems, and access to essential digital tools such as computers, tablets, and SBs. These foundational improvements are critical for fostering digital inclusivity and enabling the effective implementation of technology-driven education solutions. Targeted funding is required for the development and deployment of advanced LMS,

digital libraries, and school websites to streamline course delivery, foster communication, and enhance access to educational resources. Priority should be given to Pakistan and Tajikistan, where digital gaps are most pronounced, to bridge the divide and ensure equitable access to quality education. By addressing these infrastructural deficiencies, IsDB can empower schools to embrace modern teaching methodologies, support blended and remote learning initiatives, and build resilient education systems that prepare students for the challenges of a digital future.

3. Develop Sustainable Financing Mechanisms for Long-Term Implementation

To ensure the scalability and sustainability of BL implementation, IsDB should actively establish strategic partnerships with other donor organizations, the private sector, and non-governmental organizations (NGOs) to mobilize resources, expertise, and innovative approaches. Collaboration with donor organizations can enhance funding pools and align global educational development efforts, while partnerships with private sector entities, such as technology providers and content developers, can offer cutting-edge solutions and technical support. Engagement with NGOs can bring grassroots insights and ensure the initiatives are inclusive, addressing the needs of marginalized and underserved communities. By fostering these partnerships, IsDB can create a synergistic framework that maximizes impact, drives innovation, and ensures that BL models are both effective and sustainable across diverse educational contexts.

4. Support the Development of Edutech Solutions and Partnerships

To ensure the effective implementation of the BL model, IsDB should focus on identifying and collaborating with technology partners and systems that align with the specific educational and technological needs of target countries. There are many fragmented education technologies, and IsDB should develop a suite of suitable and affordable technologies as a comprehensive solution that would enable BL to enhance the quality of classroom education. Besides the deployment of technology, IsDB may create awareness of the availability and uses of the technology solution. Selected technology partners should be well-versed in addressing critical challenges such as limited digital infrastructure, low connectivity, and diverse linguistic and cultural contexts. Furthermore, these partners must integrate the valuable lessons and insights outlined in this report, tailoring their solutions to meet the unique demands of each region.

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APPENDICES

Table I : Summary of socio-economic profiles

Dimension	Male (%)	Female (%)	Pak	Kazak	Uzbek	Tajik	Total	Percent
Locality								
Rural	20.00	5.13	2	0	0	4	6	10.00
Urban	80.00	92.31	21	11	12	8	52	88.00
Semi-urban	0.00	2.56	1	0	0	0	1	2.00
Residential status								
Own	45.00	79.49	19	9	9	3	40	67.80
Rented	25.00	10.26	2	1	3	3	9	15.25
Sharing	30.00	10.26	3	1	0	6	10	16.95
Disability								
No	75.00	89.74	19	10	10	11	50	84.75
Yes	25.00	5.13	4	1	1	1	7	11.86
Not disclosed	0.00	5.13	1	0	1	0	2	3.39
Qualification								
Undergrad	0.00	2.56	0	1	0	0	1	1.69
Bachelor	25.00	48.72	1	6	7	10	24	40.68
Master	25.00	33.33	13	4	5	2	24	40.68
MPhil	15.00	15.38	9	0	0	0	9	15.25
PhD	5.00	0.00	1	0	0	0	1	1.69
Vocational/technical/computer diploma								
Yes	65.00	38.46	12	2	7	7	31	52.54
No	35.00	61.54	12	9	5	5	28	47.46
Type of diploma								
Pedagogical	7.69	7.14	1	0	7	1	9	33.33
Computer	7.69	7.14	5	0	0	3	8	29.63
Others	0.00	0.00	5	2	0	3	10	30.00
Job type								
Full-time	95.00	92.31	23	10	10	12	55	93.22
Contract	5.00	7.69	1	1	2	0	4	6.78
Alternative income source								
Yes	45.00	25.64	3	2	4	10	19	32.20
No	55.00	74.36	21	9	8	2	40	67.80
Satisfaction with salary structure								
Yes	50.00	56.41	10	10	7	5	32	54.24
No	30.00	7.69	5	1	2	1	9	15.25
To some extent	20.00	35.90	9	0	3	6	18	30.51

Table II : Summary of administrator profiles

Dimension	Pakistan	Kazakhstan	Uzbekistan	Tajikistan	Total
Administrator qualification					
BA/BSc	0.00	75.00	60.00	50.00	38.10
Master	12.50	25.00	20.00	50.00	23.81
M Phil	75.00	0.00	0.00	0.00	28.57
PhD	12.50	0.00	20.00	0.00	9.52
Training (vocational/technical/computer diploma)					
Yes	62.50	0.00	60.00	100.00	57.14
No	37.50	100.00	40.00	0.00	42.86
Language spoken at school					
Urdu	62.50	0.00	0.00	0.00	23.81
Punjabi	25.00	0.00	0.00	0.00	9.52
PASHTO	0.00	0.00	0.00	0.00	0.00
English	62.50	0.00	0.00	0.00	23.81
Russian	0.00	50.00	80.00	75.00	42.86
KAZAKH	0.00	100.00	0.00	0.00	19.05
TAJIK	0.00	0.00	0.00	50.00	9.52
UZBEK	0.00	0.00	80.00	0.00	19.05
Other	12.50	0.00	0.00	0.00	4.76

Table III: Type, quality, and cost of the internet at home (teachers)

Type	Male (%)	Female (%)	Pak	Kazak	Uzbek	Tajik	Total	Percent
MD	61.11	28.95	9	4	1	8	22	39.29
MDBB	16.67	13.16	0	4	2	2	8	14.29
BB	16.67	42.11	6	3	8	2	19	33.93
BBOT	5.56	0.00	1	0	0	0	1	1.79
OT	0.00	15.79	5	0	1	0	6	10.71
No internet	0.00	0.00	3	0	0	0	3	5.08
Quality of internet (teachers)								
Excellent	11.11	5.26	2	1	1	0	4	7.14
Good	50.00	55.26	10	7	8	5	30	53.57
Average	22.22	34.21	7	3	3	4	17	30.36
Poor	50.56	5.26	1	0	0	2	3	5.36
Bad	11.11	0.00	1	0	0	1	2	3.57

Table III: Type, quality, and cost of the internet at home (teachers) - continued

Type	Male (%)	Female (%)	Pak	Kazak	Uzbek	Tajik	Total	Percent
Internet speed: Does your internet allow you to watch YouTube/educational videos satisfactorily?								
Always	27.78	34.21	5	6	6	1	18	32.14
Frequently	44.44	42.11	11	4	4	5	24	42.86
Less frequently	22.22	23.68	5	1	2	5	13	23.21
Never	5.56	0.00	0	0	0	1	1	1.79
Internet consistency: Does your internet allow you to watch YouTube/educational videos without interruption?								
Always	27.78	36.84	6	5	7	1	19	33.93
Frequently	44.44	42.11	9	6	3	6	24	42.86
Less frequently	11.11	18.42	4	0	2	3	9	16.07
Never	16.67	2.63	2	0	0	2	4	7.14
Internet reliability: Does your internet allow you to watch YouTube/educational videos without interruption daily?								
Always	27.78	47.37	5	7	10	1	23	41.07
Frequently	38.89	36.84	12	4	0	5	21	35.50
Less frequently	22.22	15.79	3	0	2	5	10	17.86
Never	11.11	0.00	1	0	0	1	2	24.57
Does your family feel financial strain to cover internet costs?								
Always	27.78	10.53	4	1	1	3	9	16.07
Frequently	16.67	21.05	9	2	0	0	11	19.64
Less frequently	27.78	18.42	5	1	3	3	12	21.43
Never	27.78	50.00	3	7	8	6	24	42.86
The family has difficulty meeting educational expenses								
Always	30.00	48.72	4	8	8	5	25	42.37
Frequently	46.00	43.59	14	3	4	4	25	42.37
Less frequently	30.00	7.69	6	0	0	3	9	15.25

Note: MD = mobile data, BB = broadband, O = other

Table IV: Type, quality, and cost of school internet

Type	Pakistan	Kazakhstan	Uzbekistan	Tajikistan	Total
Administrator qualification					
MD	50.00	25.00	0.00	0.00	38.10
BB	50.00	100.00	100.00	100.00	61.90
OT	0.00	0.00	0.00	0.00	0.00
Quality of school internet					
Excellent	25.00	50.00	20.00	0.00	31.58
Good	50.00	25.00	60.00	100.00	47.37
Average	25.00	25.00	20.00	0.00	21.05
Internet speed: Does your internet allow you to watch YouTube/educational videos satisfactorily?					
Always	12.50	75.00	20.00	20.00	31.58
Frequently	87.50	25.00	60.00	60.00	63.16
Less frequently	0.00	0.00	20.00	20.00	5.26
Internet consistency: Does your internet allow you to watch YouTube/educational videos without interruption?					
Always	25.00	50.00	20.00	50.00	31.58
Frequently	75.00	25.00	60.00	50.00	57.89
Less frequently	0.00	25.00	20.00	0.00	10.53
Internet reliability: Does your internet allow you to watch YouTube/educational videos without interruption daily?					
Always	25.00	50.00	0.00	50.00	21.05
Frequently	75.00	25.00	80.00	50.00	68.42
Less frequently	0.00	25.00	20.00	0.00	10.53
Does your school feel financial strain to cover internet costs?					
No	25.00	75.00	20.00	25.00	14.29
Yes	50.00	25.00	40.00	0.00	33.33
Sometimes	25.00	0.00	40.00	25.00	23.81
Not applicable	0.00	0.00	0.00	25.00	23.81
Other	0.00	0.00	0.00	25.00	4.76

Note: MD = mobile data, BB = broadband, OT = other

Table V: Teacher satisfaction with school facilities

Facility	Satisfied (%)						Needs improvement (%)					
	Male (%)	Female (%)	Pak	Kazakh	Uzbek	Tajik	Male	Female	Pak	Kazakh	Uzbek	Tajik
Digital library	0.30	0.13	0.16	0.45	0.08	0.08	0.25	0.25	0.20	0.18	0.16	0.50
Library	0.35	0.41	0.37	0.63	0.25	0.33	0.25	0.15	0.33	0.18	0.00	0.08
Standard of education	0.45	0.33	0.25	0.72	0.25	0.41	0.25	0.12	0.29	0.09	0.08	0.08
Use of IT gadgets	0.35	0.48	0.29	0.72	0.41	0.50	0.35	0.23	0.29	0.27	0.16	0.33
Basic facilities	0.40	0.46	0.25	0.81	0.50	0.41	0.20	0.12	0.12	0.09	0.08	0.33
Power supply	0.25	0.07	0.16	0.18	0.00	0.16	0.30	0.10	0.20	0.00	0.16	0.25
Internet	0.35	0.28	0.16	0.81	0.33	0.08	0.30	0.25	0.20	0.00	0.16	0.75
Healthy environment	0.35	0.35	0.12	0.36	0.58	0.58	0.15	0.05	0.16	0.00	0.00	0.08
Sports/ playgrounds	0.30	0.30	0.16	0.45	0.25	0.50	0.25	0.07	0.16	0.09	0.00	0.25
Transport	0.10	0.02	0.08	0.09	0.00	0.00	0.25	0.12	0.12	0.09	0.25	0.25
Dispensary	0.20	0.07	0.16	0.09	0.00	0.16	0.20	0.00	0.08	0.00	0.00	0.16
Building	0.50	0.35	0.29	0.54	0.25	0.66	0.15	0.02	0.12	0.00	0.00	0.08
Proximity	0.30	0.23	0.12	0.27	0.16	0.58	0.05	0.05	0.04	0.00	0.16	0.00
Other	0.00	0.12	0.00	0.00	0.25	0.16	0.00	0.23	0.00	0.00	0.50	0.25

Table VI: Effective learning styles and preferences

Mode	Student Perception (%)		Teacher Perception (%)	
	Female	Std. dev.	Female	Uzbek
What is the most effective learning/teaching style for you?				
Visuals	0.24	0.43	0.50	0.50
Auditory	0.28	0.45	0.28	0.45
Kinesthetic	0.19	0.39	0.33	0.48
Read/Write	0.31	0.46	0.18	0.39
Multimodal	0.29	0.46	0.32	0.47
Other	0.02	0.15	0.00	0.00
Which mode most aligns with your Learning/teaching Preferences?				
Engaging Videos	0.63	0.48	0.87	0.34
Audios	0.26	0.44	0.20	0.40
Text Base	0.35	0.48	0.35	0.48
Other	0.03	0.16	0.03	0.18

Table VII:Familiarity, skills, and training of FCM (%)

	Pak	Kazak	Uzbek	Tajik	Total	Percent
Teacher familiarity with the concept of FCR						
Yes	13	9	7	9	38	64.41
No	11	2	5	3	21	35.39
Necessary skill (pedagogical/IT skills - teachers)						
Yes	15	9	10	10	44	74.58
No	9	2	2	2	15	25.42
How many FCR-related sessions (pedagogical/IT skills) are held in school annually? (chi2=38.04*)**						
0	15	0	3	2	20	33.90
1-2	6	1	5	9	21	35.59
3-5	2	9	4	1	16	27.12
More than 5	1	1	0	0	2	3.39
Preferred mode of training (chi2 = 55.02)**						
Seminar	4	0	0	5	9	16.07
Workshop	9	1	3	0	13	23.21
Short Course	4	1	1	1	7	12.50
Online Course	1	1	3	2	7	12.50
Seminar/Workshop	3	1	2	0	6	10.71
Seminar/Short Course	1	0	0	1	2	3.57
Workshop/Short Course	0	0	1	0	1	1.79
Workshop/Online Course	0	1	0	0	1	1.79
Short Course/Online Course	0	1	0	1	2	3.57
Seminar/Workshop/Short Course	0	1	1	0	2	3.57
Seminar/Workshop/Online Course	0	2	1	0	3	5.36
Seminar/Workshop/Short Course/Online Course	0	2	0	0	2	3.57
Other	0	0	0	1	1	1.79

Table VIII: School facilities and IT infrastructure

	Pak	Kazak	Uzbek	Tajik	Total
Buildings	100.00	100.00	80.00	95.00	95.24
Boundary Wall	87.50	100.00	100.00	100.00	95.24
School Gate	75.00	100.00	100.00	100.00	90.48
Play Ground	37.50	100.00	100.00	50.00	66.67
Examination Hall	87.50	100.00	100.00	75.00	90.48
Conference Room	25.00	75.00	40.00	25.00	38.10
Faculty Lounge	50.00	100.00	40.00	75.00	61.90
Library	50.00	50.00	0.00	100.00	47.62
Electricity	87.50	100.00	80.00	100.00	90.48
Electricity Backup	75.00	25.00	0.00	50.00	42.86
Water tank	87.50	50.00	0.00	75.00	57.14
Filtration	37.50	75.00	0.00	25.00	33.33
Water Cooler	87.50	25.00	20.00	100.00	61.90
Mosque	25.00	0.00	0.00	0.00	9.52
IT Infrastructure					
Internet	100.00	100.00	100.00	50.00	90.48
CL	87.50	100.00	80.00	100.00	90.48
Server Sys	25.00	75.00	20.00	75.00	42.86
LMS	0.00	0.00	0.00	0.00	0.00
MM	75.00	100.00	60.00	75.00	776.19
SB	37.50	100.00	80.00	75.00	66.67
E-Library	25.00	100.00	0.00	25.00	33.33
School YouTube Channel	0.00	100.00	20.00	0.00	23.81
School Website	37.50	100.00	60.00	25.00	52.38
Other	0.00	0.00	0.00	25.00	4.76

Table IX: Details of students, teachers, classes, books, computers

	Total	Pakistan	Kazakh	Uzbek	Tajik
Teacher familiarity with the concept of FCR					
Observations	21	8	4	5	4
Students	1,281.67	958.87	1,163	1,352.8	1,957
Classes	36.86	18.5	51.5	41	53.75
Teachers	58.38	34.37	100.5	62.4	59.25
ST ratio	28.14	46	11	13.8	27.5
MA teachers	17.04	21.06	9.25	11	22.75
MPhil teachers	1.72	3.63	5	1	0.0
PhD teachers	0.58	1.0	0.00	0.2	0.75
Teachers with a diploma or specialization in IT /digital skills	3.86	3.86	4.25	3	4.5
Classrooms	29.81	17.25	37.75	38.8	35.5
Books	8,516.76	1,437.625	34,144.5	1,344	6,013.25
Computers	74.81	14.88	256.5	24.4	76
SB	7.095	0.5	13.5	7.4	13.5
MM	5.86	1.5	7.5	5	14

Table X: Frequency of usage of IT gadgets at schools

	Pakistan	Kazakhstan	Uzbekistan	Tajikistan	Total
SB (chi^2 = 13.06)					
Daily	0.00	100.00	100.00	66.67	71.43
Weekly	33.33	0.00	0.00	0.00	7.14
Occasionally	33.33	0.00	0.00	25.00	14.29
Never	33.33	0.00	0.00	0.00	7.14
MM/projector (chi^2 = 3.75)					
Daily	33.33	50.00	40.00	66.67	44.44
Weekly	33.33	50.00	20.00	0.00	27.78
Occasionally	33.33	0.00	40.00	33.33	27.78
Any other online learning tool/digital resources? (chi^2 = 18.45)					
Daily	12.50	100.00	40.00	0.00	33.33
Weekly	12.50	0.00	20.00	0.00	9.52
Occasionally	25.00	0.00	0.00	50.00	19.05
Never	37.50	0.00	0.00	25.00	19.05
Not available	12.50	0.00	40.00	25.00	19.05

Table X: Frequency of usage of IT gadgets at schools (continued)

	Pakistan	Kazakhstan	Uzbekistan	Tajikistan	Total
Personalized recorded VLs (chi² = 24.17*)**					
Daily	42.86	0.00	0.00	0.00	15.79
Weekly	0.00	0.00	0.00	66.67	10.53
Occasional	0.00	50.00	80.00	0.00	31.58
Never	50.00	50.00	20.00	33.33	42.11
Relevant online lecture (chi2 = 7.14)					
Daily	42.86	25.00	40.00	33.33	36.84
Weekly	25.00	50.00	25.00	0.00	36.84
Occasional	14.29	25.00	0.00	33.33	15.79
Never	28.57	0.00	0.00	0.00	10.53
Refer online source (chi² = 17.64)**					
Daily	14.29	25.00	60.00	33.33	31.58
Weekly	14.29	75.00	20.00	0.00	26.32
Occasional	57.14	0.00	20.00	0.00	26.32
Never	14.29	0.00	0.00	66.67	15.79

Table XI: Skills, training, technology, and government support for FCM (%)

	Pak	Kazakh	Uzbek	Tajik	Total
For Which Class do you use Technology Aids (chi² = 8.12)					
Grade 5	12.50	0.00	0.00	0.00	4.76
Grade 9	50.00	0.00	20.00	0.00	23.81
For all	37.50	100.00	80.00	100.00	71.43
Does your school have the IT infrastructure to implement the FCM (chi² = 2.11)					
Yes	87.50	75.00	80.00	50.00	76.19
No	12.50	25.00	20.00	50.00	23.81
Does your school have an IT expert to deal with IT-related matters? (chi² = 3.65)					
Yes	87.50	100.00	80.00	50.00	80.57
No	12.50	0.00	20.00	50.00	19.05

Table XI: Skills, training, technology, and government support for FCM (%) (continued)

	Pak	Kazakh	Uzbek	Tajik	Total
Do teachers acquire Pedagogical Training or IT skills to implement FCM (chi² = 13.00)**					
Yes	37.50	25.00	0.00	50.00	28.57
No	62.50	0.00	20.00	25.00	33.33
Some of Them	0.00	75.00	80.00	25.00	38.10
Would subject-related videos be helpful for students' learning (chi² = 4.46)					
Yes	100.00	75.00	100.00	100.00	95.24
No	0.00	25.00	0.00	0.00	4.76
Does the school provide Specialized Training to Students for FCM (chi² = 0.05)					
Yes	25.00	25.00	25.00	25.00	23.81
No	75.00	75.00	80.00	75.00	76.19
Does the Government Provide Funding to enhance the IT Capabilities of schools (chi² = 8.92)					
Yes	37.50	50.00	40.00	0.00	33.33
No	62.50	0.00	20.00	50.00	38.10
To Some Extent	0.00	50.00	40.00	50.00	28.57
Does the Government supply IT infrastructure to support the use of educational technologies? (chi² = 7.15)					
Yes	37.50	75.00	60.00	0.00	42.86
No	12.50	0.00	0.00	0.00	4.76
To Some Extent	50.00	25.00	40.00	100.00	52.38
Has the government initiated any recent projects to improve IT infrastructure? (chi² = 2.65)					
Yes	37.50	75.00	40.00	75.00	52.38
No	62.50	25.00	60.00	25.00	47.62

Table XII: Device ownership by students

	Male (%)	Female (%)	Pak	Kazak	Uzbek	Tajik	Total
TV	21.14	21.93	31.54	23.19	6.94	13.89	21.55
Laptop	27.43	31.55	18.12	39.13	43.06	30.56	29.56
PC	17.14	10.16	11.41	13.04	15.28	16.67	13.54
Tab/iPad	10.86	13.9	8.05	20.29	11.11	15.28	12.43
Smart Phone	68	62.03	30.2	100	98.61	69.44	64.92
Basic Phone	13.71	9.63	16.11	10.14	5.56	9.72	11.6
Game Player	13.71	2.67	4.7	7.25	13.89	9.72	8.01
Other	4.00	1.07	0.67	0.00	5.56	5.56	2.49

Table XIII: Device use for educational purposes by students

Device	Male (%)	Female (%)	Pak	Kazak	Uzbek	Tajik	Total
TV	88.57	88.24	36.24	10.14	77.78	33.33	38.95
Laptop	47.43	47.59	34.23	69.57	87.5	50	54.7
PC	30.86	31.55	24.83	27.54	83.33	38.89	39.78
Tab/iPad	29.14	27.81	18.79	11.59	61.11	26.39	27.35
Smart Phone	80.57	70.01	42.95	88.41	94.44	76.39	68.51
Basic Phone	49.71	48.13	11.41	0.00	6.94	2.78	6.63
Game Player	21.14	14.44	5.37	0.00	4.17	1.39	3.31
Other	8.57	4.28	2.01	0.00	12.5	2.78	3.87

Table XIV: Student time spent on devices

	No of Days per Week					Hours per Day			Time Allocation for Education					
	Daily	Twice	Three	More	Once	N/A	Less	1-2 hour	More	30min	60min	90min	120min	0
TV	42.27	16.3	11.33	7.18	13.26	9.67	42.48	43.14	14.38	33.43	33.43	8.56	12.15	12.43
Laptop/PC	27.9	16.3	8.84	7.18	16.57	23.2	31.68	45.54	22.77	21.27	31.49	19.89	22.38	4.97
Tab/iPad/ Smart Phone	68.78	11.88	4.42	4.42	3.59	6.91	15.26	30.52	54.22	23.48	26.52	20.17	23.48	6.35
Game player/ other	10.5	12.15	4.7	6.08	8.01	58.56	44.74	42.11	13.16	27.07	28.18	11.6	11.88	21.27

Note: If you are given access to devices for two hours daily, how much time will you allocate for educational purposes under the FCM model?

Table XV: Need for device training by students

Type	Male (%)	Female (%)	Pak	Kazak	Uzbek	Tajik	Total
TV	18.86	20.86	31.76	2.86	4.17	27.78	19.89
Laptop	37.14	43.85	45.27	45.71	18.06	48.61	40.61
PC	34.86	34.22	33.11	28.57	22.22	55.56	34.53
Tab/iPad	24.00	17.11	25.00	5.71	13.89	31.94	20.44
Smartphone	26.29	17.11	20.95	22.86	12.50	30.56	21.55
Basic Phone	12.00	10.16	18.24	5.71	5.56	6.94	11.05
Game Player	16.00	16.58	20.95	0.00	27.78	11.11	16.30
Other	24.57	20.86	5.41	25.71	61.11	16.67	22.65

Table XVI: Device ownership by teachers

	Male (%)	Female (%)	Pak	Kazak	Uzbek	Tajik	Total
TV	55.00	53.85	70.83	54.55	41.67	33.33	54.24
Laptop	60.00	82.05	62.50	90.91	100.00	58.33	74.58
PC	20.00	23.08	16.67	18.18	41.67	16.67	22.03
Tab/iPad	20.00	12.82	8.33	27.27	16.67	16.67	15.25
Smartphone	65.00	89.74	62.50	100.00	91.67	91.67	81.36
Basic Phone	20.00	12.82	20.83	9.09	8.33	16.67	15.25
Game Player	0.00	2.56	4.17	0.00	0.00	0.00	1.69
Other	5.00	2.56	4.17	9.09	0.00	0.00	3.39

Table XVII: Device use for educational purpose by teachers

Device	Male (%)	Female (%)	Pak	Kazak	Uzbek	Tajik	Total
TV	15.00	48.72	29.17	27.27	91.67	8.33	37.29
Laptop	65.00	82.05	66.67	90.91	100.00	58.33	76.27
PC	45.00	61.54	25.00	54.55	100.00	75.00	55.93
Tab/iPad	30.00	43.59	20.83	36.36	83.33	33.33	38.98
Smartphone	50.00	76.92	29.17	90.91	100.00	91.67	67.80
Basic Phone	0.00	10.26	8.33	0.00	16.67	0.00	6.78
Game Player	0.00	0.00	4.17	0.00	0.00	0.00	1.69
Other	5.00	12.82	4.17	18.18	25.00	0.00	10.17

Table XVIII: Teacher time spent on devices

	No of Days per Week					Hours per Day			Time Allocation for Education				
	Daily	Twice	Three	More	Once	N/A	Less	1-2 hour	More	30min	60min	90min	120min	0
TV	45.76	13.56	13.56	3.39	13.56	10.17	48.15	29.63	22.22	5.08	37.29	35.59	11.86	10.17
Laptop/PC	59.32	11.86	3.39	3.39	13.56	8.47	20.00	28.57	51.43	16.95	25.42	30.51	23.73	3.39
Tab/iPad/SP	84.75	1.69	0.00	1.69	10.17	1.69	12.00	28.00	60.00	18.64	42.37	20.34	13.56	5.08
GP/other	6.78	3.39	5.08	3.39	6.78	74.58	75.00	25.00	0.00	25.42	1.69	33.90	18.64	20.34

Note: Time Allocation by Teachers. If given access to devices for two hours daily, how much time will you allocate for educational purposes? GP = game player, SP = smartphone

Table XIX: Device training needed by teachers

Type	Male (%)	Female (%)	Pak	Kazak	Uzbek	Tajik	Total	Across
TV	23.00	12.82	20.83	18.18	8.33	25.00	18.64	1.23
Laptop	50.00	44.03	50.00	54.55	16.67	50.00	44.07	4.65
PC	45.00	28.21	29.17	36.36	25.00	50.00	33.90	2.08
Tab/iPad	40.00	12.82	16.67	18.18	8.33	50.00	22.03	7.27*
Smartphone	30.00	23.08	12.50	45.45	16.67	41.67	25.42	6.59*
Basic phone	5.00	2.56	4.17	0.00	8.33	0.00	3.39	1.74
Game player	0.00	7.69	0.00	9.09	8.33	8.33	5.08	2.17
Other	20.00	14.00	8.33	45.45	66.67	41.67	33.90	13.72***

Note: Do you need training to use these devices for educational purposes?

Table XX: Need for training of platforms (students)

Platforms	Male (%)	Female (%)	Pak	Kazak	Uzbek	Tajik	Total
Internet browser	36.00	33.69	53.69	10.14	9.72	44.44	34.81
YouTube	24.00	25.67	32.89	0.00	12.5	44.44	24.86
Chat/WhatsApp	21.14	23.53	38.26	0.00	8.33	25	22.38
MS Office	56.57	55.08	53.69	47.83	51.39	72.22	55.8
Google Classroom	38.29	30.48	43.62	10.14	58.33	13.89	34.25
Daryn Online	18.29	15.51	38.93	4.35	0.00	0.00	16.85
Kitobkhona.tj	25.14	20.32	35.57	1.45	23.61	15.28	22.65
Talim.uz	18.86	15.51	38.93	5.8	0.00	0.00	17.13
Edu-portal	22.86	15.51	37.58	1.45	16.67	0.00	19.06
Edu-market	22.86	14.97	35.57	4.35	16.67	0.00	18.78
E-Maktab	21.71	13.9	35.57	0.00	15.28	0.00	17.68

Table XXI:Training to use educational platforms (teachers)

	Male (%)	Female (%)	Pak	Kazak	Uzbek	Tajik	Total
MS Office	30	33.33	12.50	27.27	50.00	58.33	32.2
Internet browser	25	25.64	41.67	9.09	0.00	33.33	25.42
LMS	15	25.64	29.17	9.09	33.33	8.33	22.03
Google Classroom	15	25.64	25.00	18.18	41.67	0.00	22.03
TedEd	15	23.08	25.00	36.36	16.67	0.00	20.34
Ilm ke Dunya	20	20.51	25.00	27.27	25.00	0.00	20.34
Youtube	15	20.51	25.00	9.09	8.33	25.00	18.64
Vimeo	15	20.51	25.00	27.27	16.67	0.00	18.64
TeleSchool	20	17.95	25.00	27.27	16.67	0.00	18.64
Other	5	25.64	0.00	9.09	66.67	16.67	18.64
Khan Academy	15	17.95	25.00	36.36	0.00	0.00	16.95
Edu-portal	20	12.82	20.83	27.27	8.33	0.00	15.25
E-Donish	15	15.38	20.83	9.09	25.00	0.00	15.25
Kitobkhona.tj	10	17.95	20.83	18.18	16.67	0.00	15.25
Bilim Media Group	15	12.82	20.83	27.27	0.00	0.00	13.56
Daryn Online	15	12.82	25.00	9.09	8.33	0.00	13.56
Edu-market	15	12.82	20.83	18.18	8.33	0.00	13.56
Tedtalk	10	12.82	20.83	0.00	0.00	16.67	11.86
Kundelik	20	7.69	25.00	9.09	0.00	0.00	11.86
Talim.uz	15	10.26	25.00	9.09	0.00	0.00	11.86
Kitob.uz	15	10.26	25.00	9.09	0.00	0.00	11.86
Chat/WhatsApp	5	12.82	12.50	9.09	8.33	8.33	10.17
E-Maktab	10	10.26	20.83	0.00	8.33	0.00	10.17
Kitobdust	10	10.26	20.83	9.09	0.00	0.00	10.17

Table XXII: FCM features teacher perception (%) (part A)

	Male	Female	Pak	Kazakh	Uzbek	Tajik	Total
1. VL delivery time (Do you prefer a FCM in which teachers share VLs?)							
Before Class	30	28.21	33.33	36.36	41.67	0	28.81
During Class	20	28.21	16.67	18.18	50	25	25.42
After Class	55.25	64.1	45.83	45.45	66.67	100	61.02
2. VL sharing tool							
Messenger	50	90.91	91.67	75	65	74.36	71.11
Email	29.17	45.45	41.67	16.67	40	28.11	32.2
USB	37.5	27.27	58.33	33.33	30	43.59	38.98
Bluetooth	12.5	0	0	0	15	0	5.08
Other	8.33	9.09	0	0	10	2.56	5.08
3. VL availability forum							
School Website	50	81.82	91.67	66.67	65	69.27	67.8
LMS	45.83	54.55	58.33	8.33	45	41.03	42.37
YouTube Channel	45.83	90.91	41.67	33.33	50	51.28	50.85
Online other than school resources	20.83	54.55	83.33	50	55	41.03	45.76
4. VL and other materials							
VL with Study Material	79.17	81.82	66.67	58.33	75	71.79	72.88
Short VL and Related Homework	62.5	81.82	50	33.33	60	56.41	57.63
Only VL as Homework	16.67	27.27	33.33	0	15	20.51	18.64
Only VL and no in-person class	12.5	27.27	25	0	15	15.38	15.25
Lecture-related short text	41.67	45.45	50	33.33	35	46.15	42.37
Problem-Solving VL	45.83	72.73	83.33	25	40	61.54	54.24
Audio Lecture	41.67	63.64	58.33	66.67	60	51.28	54.24
Animated VL	33.33	54.55	75	33.33	40	48.72	45.76
VL Includes activities of student's Interest	25	63.64	91.67	66.67	45	58.97	54.24

Table XXII: FCM features teacher perception (%) (part A)(continued)

	Male	Female	Pak	Kazakh	Uzbek	Tajik	Total
5. VLs or FCM integration in CP to increase students' interest and engagement							
CP, including FCM material, be shared in advance	75	66.67	66.67	63.64	83.33	66.67	69.49
CP should be equally divided into online and in-person content	70	61.54	66.67	72.73	75	41.67	64.41
Students' opinions should be considered in the CP	55	46.15	41.67	72.73	33.33	58.33	49.15
Students' attitudes should be considered in the CP	45	51.28	33.33	63.64	100	16.67	49.15
6. Ideal VLs watching location							
Home - Less Distraction	55	58.97	54.17	63.64	91.67	25	57.63
Lab more comfortable	60	35.9	58.33	27.27	50	25	44.07
MMwith Teacher assistance	45	25.64	50	18.18	25	16.67	32.2
CL less distraction	55	69.23	33.33	100	66.67	91.67	64.41
Anywhere during free time	25	15.38	25	18.18	16.67	8.33	18.64
7. VL resource person							
Teacher Privately	54.17	63.67	83.33	83.33	80	61.54	67.8
Teacher During Class	50	45.45	50	0	40	38.46	38.98
Students During Group Discussion	37.5	54.55	16.67	33.33	45	30.77	35.59
Students Globally and Available Online	29.17	81.82	25	25	40	35.9	37.29
Best Tutors Globally and Available Online	29.17	81.82	83.33	58.33	45	61.54	55.93
8. VLs content coverage							
All Subjects	62.5	54.55	75	83.33	80	61.54	67.8
Specific Subjects	50	36.36	25	16.67	30	38.46	35.59
All Contents of the subjects	45.83	18.18	66.67	33.33	60	33.33	42.37
Specific topics	29.17	9.09	41.67	33.33	30	28.21	28.21
Other	4.17	9.09	0	0	5	2.56	3.39
9. Ideal length of VLs to avoid overburden and keep students motivated							
More than 30 min	87.5	90.91	91.67	100	90	92.31	91.53
15-20 min	25	0	16.67	33.33	30	15.38	20.34
5-10 min	16.67	0	16.67	8.33	15	15.31	15.25
Under 5 min	12.5	0	0	0	8.33	16.67	12.5

Table XXIII: FCM features teacher perception (%) (part B)

	Male	Female	Pak	Kazakh	Uzbek	Tajik	Total
10. Ideal frequency of VLs, online quizzes, and assignments							
If shared daily	70	51.28	50	81.82	41.67	66.67	57.63
If shared weekly	25	25.64	41.67	18.18	16.67	8.33	25.42
If shared for every subject	45	23.08	20.83	45.47	8.33	58.33	30.51
If shared specific subject	15	10.26	12.5	9.09	25	0	11.86
If frequent quizzes are uploaded	40	33.33	16.67	54.55	75	16.67	35.59
If frequent assignments are uploaded	25	30.77	12.5	27.27	83.33	8.33	28.81
If quizzes and assignments are uploaded occasionally	20	17.95	20.83	0	41.67	8.33	18.64
11. VLs impact on student performance							
Because they can watch VLs at anytime	70	69.23	66.67	72.73	100	41.67	69.49
They may revise concepts	90	79.49	66.67	100	91.67	91.67	83.05
They may learn at their own pace	50	51.28	58.33	54.55	50	33.33	50.85
They can replay VLs for a precise understanding	55	61.54	33.33	81.82	100	50	59.32
Other	35	30.77	29.17	36.36	50	16.67	32.2
12. Role of teacher feedback, grading and tracking progress on student performance							
Provide frequent feedback	60	84.62	79.17	90.91	91.67	41.67	76.27
Rate quiz based on a mark	45	23.08	41.67	45.45	25	0	30.51
Rate quiz based on learning attitude	35	20.51	33.33	45.45	16.67	0	25.42
Help track out-of-class activities	60	46.15	33.33	54.55	75	58.33	50.85
Help track in-class activities	50	43.59	41.67	63.64	33.33	50	45.76
Help workload management	35	56.41	37.5	45.45	100	25	49.15

Table XXIII: FCM features teacher perception (%) (part B)(continued)

	Male	Female	Pak	Kazakh	Uzbek	Tajik	Total
13. Ideal features of the online platform							
A platform that is accessible and easy to use	80	71.79	58.33	100	91.67	66.67	75.58
A platform that organizes course content well	75	74.36	58.33	81.82	100	75	74.58
A platform that facilitates communication with teachers	60	66.67	45.83	81.82	91.67	58.33	64.41
An interactive platform	50	53.85	41.67	63.63	75	41.67	52.54
Simplifies quiz attempts and grading	50	48.72	29.17	54.55	75	58.33	49.15
A platform that secures privacy	55	46.15	29.17	54.55	91.67	41.67	49.15
A platform that tracks progress frequently	60	38.46	29.17	63.64	50	58.33	45.76
Streamline feedback process	60	35.9	33.33	45.45	58.33	50	44.07
Adjust to my needs	50	51.28	29.17	54.55	100	41.67	50.85
Provide technical support	50	33.33	29.17	45.45	50	41.67	38.98
Peer collaboration among students	55	46.15	29.17	45.45	83.33	58.33	49.15
Students collaborate with their peer	40	41.03	29.17	45.45	75	25	40.68
14. Factors to motivate teachers for implementing FCM							
If VL resources are available online globally	55	64.1	45.83	18.18	25	58.33	38.98
If VL resources are available on the National website	75	41.03	58.33	72.73	33.33	41.67	52.54
If the Teacher prepares VLs himself	55	38.46	37.5	63.64	33.33	50	44.07
If the school shares the burden of preparing VLs	55	30.77	37.5	63.64	16.67	41.67	38.98
If teachers are provided financial incentives to implement FCM	60	66.67	33.33	81.82	100	75	64.41
If teachers are provided training to implement FCM	60	56.41	33.33	81.82	75	66.67	57.63
If the performance evaluation of teachers includes appreciation for VLs	50	43.59	29.17	54.55	75	41.67	45.76


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