INTEGRATION OF 21ST CENTURY SKILLS IN SINGLE NATIONAL CURRICULUM: A MIXED METHOD APPROACH

By

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NATIONAL UNIVERSITY OF MODERN LANGUAGES

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ABSTRACT

The increased globalization generated many new challenges and unprecedented demands for survival and success in 21st Century. There is a need to equip individuals with the competitive skills of 21st Century and for this, it is imperative to inculcate these skills at the very beginning, as students cannot be groomed miraculously at universities without a primary foundation. The study was carried out to analyze integration of 21st Century skills in Single National Curriculum (SNC) in subject of General Science at Primary level (class 5). The study investigated the document of Single National Curriculum (SNC) for Grade 5 and the subsequent Science textbook and their implication to explore the extent these curriculum reforms offer integration of selected 21st Century skills (creativity, critical thinking, collaboration, communication, and ICT). The study in hands adopted "interactive mixed method" approach and followed "multiphase sequential design". The research adopted purposive sampling techniques and employed self-developed instruments to collect the data. Moreover, the research pursued perspectives of relevant stake holders (04 curriculum developers, 02 textbook authors, 03 FDE academicians, and 10 science teachers) regarding inclusion of 21st Century skills, and their enactment in teachers' training and in classroom teaching-learning process along with availability of resources. Classroom practices at primary level were also observed to estimate the translation of skills in actual scenario. The content analysis was done quantitatively by calculating frequency and percentage while qualitative data from interviews were analyzed through thematic analysis by using deductive approach. The findings of the study revealed that the document of SNC gives sufficient provision for integration of selected 21st Century skills however, there is a considerable gap in its execution in real classroom. The main influencing factors that hindered implementation of these skills were lack of appropriate teachers' training, teachers' competence, and lack of facilities. The study recommends that there is an acute need to align teachers' professional development program in accordance with development of 21st Century skills.

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21CS	21st Century Skills
AEO	Area Education Officer
ATC21S	Assessment and Teaching of 21st Century Skills
ChatGPT	Chat Generative Pre-Trained Transformer
CIDA	Canadian International Development Agency
DCPs	Developing Country Partners
ERI-Net	Education Research Institutes Network
ESD	Education for Sustainable Development
FDE	Federal Directorate of Education
GPE	Global Partnership for Education
HOTs	Higher Order Thinking skills
ICT	Information and Communications Technology
JICA	Japan International Cooperation Agency
OECD	Organization for Economic Cooperation and Development
PBL	Problem-Based Learning
PBL	Project-Based Learning
P21	Partnership 21
MUVE	Multi-User Virtual Environment
NBF	National Book Foundation
NCC	National Curriculum Council

NCCS	National Curriculum Council Secretariat
NCP	National Curriculum of Pakistan
NEP	National Education Policy
SDGs	Sustainable Development Goals
SNC	Single National Curriculum
TLRM	Teaching Learning Resource Material
UNDP	United Nations Development Program
UNFPA	United Nations Funds for Population Activities
UNESCO	United Nations Educational, Scientific and Cultural Organization

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"May Allah expand my knowledge".

DEDICATION

To my Late Father who gave me wings to fly.

Who never told me that he loves me but always showed me.

His reminiscence would always stay with me.

CHAPTER 1

INTRODUCTION

1.1 Context of the Study

Pakistan being a developing country with limited resources and rapidly increasing population is in dire need of intellectual revolution to boost up its economy. In this context, flourishing knowledge economy is quite imperative. Knowledge economy refers to giving value to knowledge, novel ideas and encouraging creativity, talent, and innovation. Despite the fact that education is the spine of knowledge economy, situation of education is quite depressing in the country. Despite lower literacy rate and 22 million out of school children, there is rare evidence of quality education; an education that can compete with the global standards (Rehman, Jingdong & Hussain, 2015; Mughal, 2020; Badar & Mason, 2020).

Moreover, Pakistan's Vision 2030 recognizes the significant role of knowledge in economic growth. It mentions while describing the goal of transforming the country into a developed, equitable and prosperous Pakistan by 2030 by fixing knowledge inputs and through sustained development (Planning Commission, 2006). Knowledge economy is an economy in which services and productions are largely based upon knowledge-oriented activities rather than physical resources (Amjad, 2006). Knowledge serves as the main source of competitiveness in a rapidly advancing global economy. It is time to invest in intellectual capital with the help of information technology. Pakistan being 5th youthful country of the world is in drastic need to jump from labor intensive economy towards building a knowledge-based economy. For increased productivity and prosperity, there is a need to focus on fundamental human development areas like literacy, education, and skills of workers (Amjad, 2006). It is essential to generate the urge for life-long learning and in order to keep pace with the changing world.

21st century skills are the abilities, proficiencies and learning characteristics which are being acknowledged globally and are recognized as essential for success in modern societies and workplaces by educationalists, leaders, academics and governmental bodies. 21st century skills (21CS) provide an outline for effective and meaningful learning in classroom. These competencies warrant students' success in this rapidly changing with the slogan of "learning never stops" and change is the only constant. Almost every country in this rapidly changing globe is striving to warrant its education system to progress beyond the basic cognitive domain of knowledge that includes basic literacy (reading in addition to writing) and numeracy (mathematics). Aspiration is to equip children and young people with skills through which they become productive and useful members of society, country, and globalized world.

Richard Riley, U.S. Secretary of Education once quoted: "At present students are being prepared for the jobs that are not created yet; for utilizing those technologies which have not been invented yet and for solving the problems that are not being recognized as problems yet" (Hinton, 2020). Learning based upon rote memorization is completely outdated and obsolete in today's knowledge economy. Today, companies are seeking employees with technical and soft skills. Employers are interested in candidates who can solve problems creatively, innovate, communicate, and collaborate. There is a huge gap between what employers need and what schools are doing. Schools can utilize 21st century skills (21CS) for bridging this gap. Idea is to integrate these skills throughout their education system for enabling and supporting young students' survival and progress in the modern world of future (Hinton, 2020). For effective inclusion and integration of 21CS there should be alignment among all the components of learning system i.e curriculum, classroom pedagogies and assessment.

Likewise, the Sustainable Development Goal 4 relevant to quality education focuses on the skills necessary to acquire some decent work and also endorses sustainable development. Global initiatives like Assessment and Teaching of 21CS, Learning Metrics Task Force, Partnership for 21st century Learning and Research of Brooking Institute; Skills for Changing World" commenced significant work in the context of 21st century skills. For Pakistan specifically, different programs of UNESCO like UNICEF, UNDP, UNFPA took initiatives and are working on the system level approach regarding integration and inclusion of 21st century skills. Global Partnership for Education (GPE; 2020) suggests that "deficiency of knowledge and expertise of how to implement and integrate these skills holistically at entire sector level is being found, as we lack pragmatic frameworks and appropriate direction for inclusion and implementation". Global Partnership for Education (GPE) further reports that the Developing Country Partners of GPE included and prioritized 21st century skills in their education plans but they have noteworthy gaps regarding implementation in the whole system. Global Partner Education (GPE) suggests that in order to fully cultivate these skills in learners, there is a need to inculcate these skills at the very beginning as students cannot be groomed miraculously at universities without a primary foundation. Furthermore, GPE encourages exploration on "what is meant by translating policy ambitions with reference to 21st century skills in teaching and learning practices and how to embed and integrate 21st century skills all over the education system?" It advocates system level changes and alignments in all the components of teaching learning process to ensure the integration and implementation of these skills. Therefore, a system level analysis was required that could analyze the national curriculum, initiatives, classroom pedagogies and ways of assessment (GPE, 2020). These grounds necessitated the planning and conduct of the present study so that the enactment of 21st century skills at different levels can be scrutinized and publicized.

1.2 Rationale of the Study

Numerous influential agencies are endorsing development and inclusion of 21st century skills that can help in meeting the global challenges. In this context, efforts are being made by flourishing perspective, developing polices and frameworks for effectively addressing these skills. Various global initiatives like "enGuage 21st Century Skills (2003)", "OECD (2005) 21st Century Skills Framework", "Lisbon Council of the European Union (2007)", "Partnership for 21st Century Skills (P21, 2009)", "Learning Metrics Task Force (2012)", "Assessment and Teaching of 21st Century Skills (ATC21, 2013)", "Sustainable Development Goal 4 on education (SDG, 2015)" and most recently; "21st Century Skills: Global Partnership for Education (GPE, 2020)" has emphasized on significance of 21st century skills globally and call for serious attention towards inclusion and integration of this increasingly demanding area. SDG 4; more specifically, SDG target 4.4 (beyond work-specific skills, emphasises on nurturing higher order reasoning, cognition and transferrable skills, soft skills like critical thinking, innovation, problem solving and communication). Additionally, SDG 4.7 (skills to promote sustainable development and global citizenship) also focuses on incorporation and amalgamation of 21CS (GPE: 2020).Therefore, there is an immediate need for recognition of 21st century skills as a significant component of classroom teaching and a critical outcome of students' learning process.

Though the research in realm of 21st century skills is sought after as a global trend over the last decade, yet most of the studies are not inclusive and being conducted in bits and pieces/segmented. Lots of research is conducted to seek opinion, perception and awareness of in-service and prospective teachers regarding 21st century skills (Maqsood, Malik & Jumani, 2020; Pirzada, Muhammad & Anis, 2020). However, a few studies focus on the product of teaching-learning process; that how these skills can be developed in students. Some of the studies focus on the

development of one of these skills among students by using one kind of intervention (Talat & Chaudhary, 2014; Bashir, 2013). But there is a need to integrate these skills in the mainstream along with the core subjects and it requires alignment of all the components of education system. UNICEF's report suggests that "changes in classrooms in consonance to 21st century skills is grounded on changes that need to be done at system-level; that includes modifications in policies, curriculum, education plans and approaches, teachers' professional development, ways of assessment and many more" (GPE, 2020). It advocates a broader image of all the elements of education system to work together in alignment in order to guarantee that these competencies can be translated in classroom and can be developed among students. There is a need of the hour to conduct a coherent and well-connected investigation at system level considering all the components of education system. Therefore, the current study presented a holistic analysis of the whole system i.e national curriculum, textbook, classroom pedagogies and assessment methods. The study has sought out data from different stake holders and triangulated multiple kinds of data. It also suggested what kind of changes are required for integration of 21st century skills at primary level in Pakistan.

In Pakistan, very few research has been conducted in realm of 21st century skills at school level particularly targeting primary education, as explored by the researcher. Few researchers surveyed 21st century skills but at higher education institutions, seeking out opinions of students regarding their knowledge and perceptions about practices of 21st century skills at universities. Results of research studies publicized the insufficient development of 21st century skills among university students in Pakistan (Khan, Jumani & Gul, 2019). Current study concentrated on primary school level as these skills need to be inculcated from the beginning and cannot be developed miraculously in universities.

On the other hand, the current curricular reforms in the country naming Single National Curriculum (SNC: 2020) claim adhering to international commitments; counting and embracing SDGs and various UNESCO's initiatives, modern trends in education, addressing 21st century skills including Life Skill Based Education (LSBE), critical thinking, employment of information and Communication Technology (ICT) and project-based learning. Therefore, the existing study conducted a review of the SNC's prerogative about the above-mentioned claims in its content. It discovered the extent these 21st century skills are translated in science textbook and further in classroom teaching practices. It can help to establish the estimate gap between curriculum intentions and the ground realities about its implementation. For efficacious implementation of activity-based science curriculum, provision of relevant resources and facilities is quite imperative. In developing country like Pakistan, where government has many other issues and priorities, education sector always met the challenges of scarcity of funds. Researcher also looked upon the extent of availability and utilization of teaching learning resource materials in different public schools.

Furthermore, the researcher herself is working as headteacher in a public school since 2016. In this whole tenure she did not get a chance to see the curriculum document officially (by the school education department) nor any of her teachers. She and her schoolteachers know the curriculum document via textbooks. Copies of curriculum have never been provided in schools considering the assumption that only textbook is sufficient for the teaching-learning process. The need for and importance of curriculum is always underestimated by the educational managers, principals, and the teachers. Thus, there is a necessity to examine whether the textbook completely translates the spirit of curriculum and is suffice for the attaining the objectives of curriculum; including Student Learning Outcome (SLO) based teaching and assessment.

Additionally, in Pakistani research (Bhatti and Jumani, 2011) explored that the educational managers and head teachers have insufficient understanding about the curriculum. It seems quite obvious that without adequate understanding of the curriculum, the educational managers would be unable to make suitable measure to execute it. This became more crucial after the launch of new Single National Curriculum (2020). For effective implementation of the curricular reforms, more vigorous orientation training at all level was required; for administrators, for headteachers and for teachers. Unfortunately, only one batch of teachers (about 40) per subject are being trained in public sector so far. Less number of teachers being trained in short duration program raises apprehensions about the appropriate implementation of recent curricular reforms.

Considering all the above mentioned gaps, there is a need to conduct a baseline study to highlight the SNC aspiration regarding integration of 21st century skills and consequents measures/initiatives required for enclosure and incorporation of these skills in education mainstream. Therefore, current study directed a system level analysis; initially at micro level (General Science of class 5) covering public schools of Islamabad Capital Territory only.

1.3 Statement of the Problem

Current economic situation of Pakistan and the challenging global economy demand employment of 21st century skills that can alleviate youngsters' endurance in this demanding and competitive era. To be successful in life and participate in the knowledge based economy, individuals have to acquire 21st century competencies as these are also in high demands by todays' employers and companies. Research contemplated that the Pakistani university passed outs do not possess the desired 21st skills and competencies (Khan, Jumani & Gul, 2019). However, these skills cannot be developed miraculously at university level and there is a need to introduce and cultivate these skills in the early years of schooling.

Integration of 21st century skills was among one of the claims made by the government with the launch of Single National Curriculum (SNC). Therefore, keeping in view SNC's assertions, the study in hand was envisioned to analyze integration of 21st century skills in recent curriculum reforms in subject of General Science at Primary level (class 5). The study analysed the current situation, where we stand with reference to inclusion and integration of 21st century skills in school education sector; and what are the shortcomings in the prevailing education system that hinder the insertion and delivery of 21st century skills.

1.4 Research Objectives

1. To explore integration of 21st century skills in Single National Curriculum of General Science at Primary Level.

The research objective of the study was further split into following sub-objectives as:

1.1 To explore content of Single National Curriculum in subject of General Science at Primary Level with reference to 21st century skills.

1.2 To explore the content of General Science textbook (class 5) with reference to integration of 21st century skills at Primary Level.

1.3 To explore the role of teachers' training on Single National Curriculum in subject of General Science for integrating 21st century skills at Primary Level.

1.4 To explore the science classroom pedagogies adopted for integration of 21st century skills at Primary Level.

1.5 To explore the strategies for students' assessment adopted in science classroom for integration of 21st century skills at Primary Level.

1.6 To explore the availability of physical facilities in relation to integration of 21st century skills at Primary Level.

1.5 Research Questions

RQ1. In what ways Single National Curriculum (SNC) gives provision for integration of 21st century skills; (creativity, critical thinking, collaboration, communication, and ICT) in subject of General Science (Class 5) at Primary Level?

RQ2. In what ways General Science textbook of Class 5 translates and integrates 21st century skills (creativity, critical thinking, collaboration, communication, and ICT) at Primary Level?

RQ3. How teachers' training on Single National Curriculum (SNC) in subject of General Science (Class 5) is helpful for facilitating teachers in integrating 21st century skills; (creativity, critical thinking, collaboration, communication, and ICT) at Primary Level?

RQ4. In what ways are classroom pedagogies being utilized for integration of 21st century skills; (creativity, critical thinking, collaboration, communication, and ICT) in Science class at Primary Level?

RQ5. What strategies of students' assessments are being utilized in science classrooms which integrates 21st century skills (creativity, critical thinking, collaboration, communication, and ICT) at Primary Level?

RQ6. What kind of physical facilities (infrastructure and technology) are being available for integration of 21st century skills; (creativity, critical thinking, collaboration, communication, and ICT) in Primary Schools?

1.6 Conceptual Framework of the Study

Conceptual framework depicts logical orientation, plan, structure, practices, and execution of a research project (Kivunja, 2018). Likewise, Ravitch & Riggan (2017) asserted that conceptual framework is an umbrella term that includes all the details regarding your research

problem, theories applied, methodology followed, tools and procedures adopted for data collection, analysis, interpretations, and conclusion. In fact, conceptual framework portrays logical map of a research study that guides and directs the investigation.

The researcher developed conceptual framework of the study after extensive, yet systematic review of relevant literature which was inspired by philosophy of pragmatism focusing on "how things work in reality" (Jabareen, 2009). Pragmatism is considered as the enriched philosophy that allow mixing of paradigms, approaches and data collection and analysis methods (Creswell, 2014 & Johnson et al. 2017). The review of relevant literature for this research study established a relationship between 21st century skills and learning theories of "Social Constructivism" and "Connectivism". Both theories recommend students' learning in collaboration and endorse building knowledge and establishing connections in a continuously changing digital age. The study assumed following conceptual framework which was informed by the Constructivist Teaching Model (2015) presented by Kivunja, to analyze the integration of 21st century skills in subject of General Science at Primary Level (class 5).

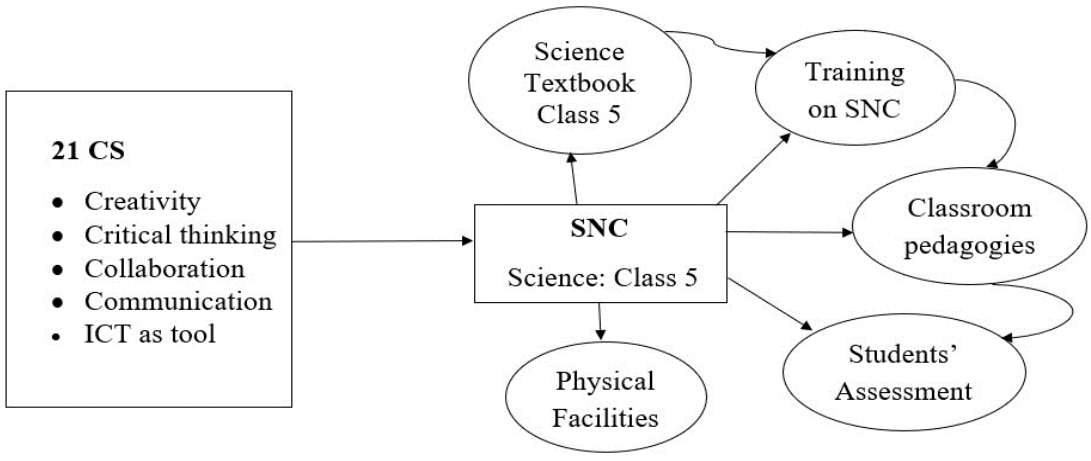

Figure 1.1 Conceptual Framework of the Study informed by Kivunja Constructivist Teaching Model (2015)

The study investigated the documents of Single National Curriculum (SNC) in subject of General Science for Grade 5 and the subsequent Science textbook to explore the extent these curriculum reforms offer integration of selected 21st century skills (creativity, critical thinking, collaboration, communication, and ICT). Moreover, the research followed to seek perspectives of relevant stake holders (curriculum developers, textbook authors, academicians, and science teachers) regarding inclusion of skills, and their enactment in teachers' training and in classroom teaching-learning process. The study also explored ways of students' assessment employed in science classroom that can integrate 21st century skills among students. The researcher also explored availability of facilities and resources necessary for the development of these skills. Likewise, the study probed the narratives of stakeholders regarding role of physical facilities and their utilization in improving skills among students at primary level.

Learning metrics (rubrics) were developed to make content analysis of SNC and science textbook quantitative. A code book was also developed to lead a focused, refined, and efficient data analysis. The perception and narratives of research participants were explored through semi-structured interview protocols. The classroom observations were made quantitatively through structured tally sheet. The data analysis was supplemented with enriched field notes and researchers' reflection.

The following figure 1.2 illustrated the aspect of investigations concentrated during the study in each component of the research framework.

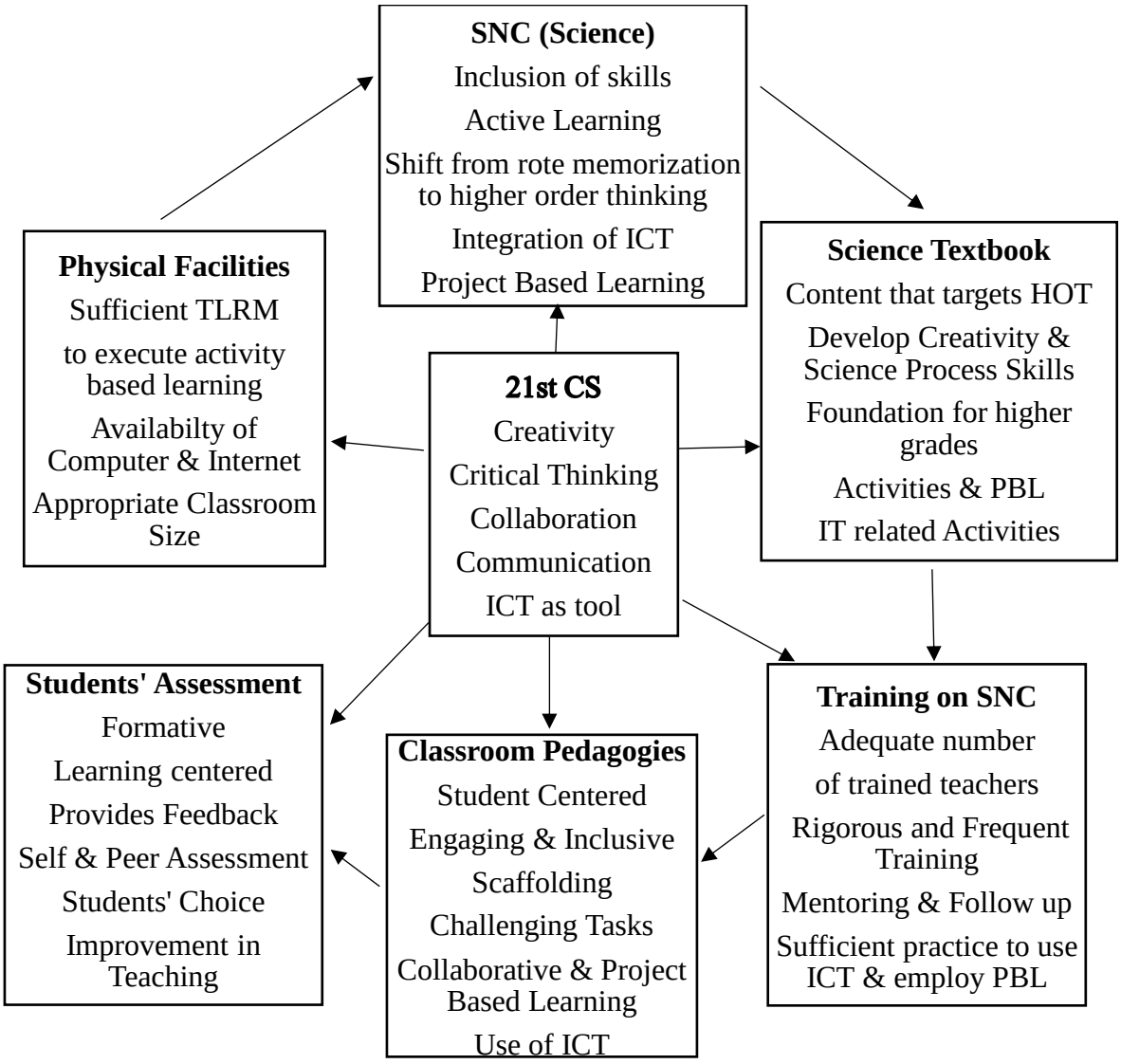

Figure 1.2 The Research Process Assumed to Investigate Integration of 21st Century Skills

The preceding figure. 1.2 displayed the research procedures followed to probe the integration of selected 21st century skills in Single National Curriculum (SNC) in subject of Science at Primary Level. The study conducted a micro-structural analysis to investigate skill integration at system level that initiated through curricular reforms in form of SNC. The researcher examined the content of SNC and subsequent Science textbook in order to verify the claimed skill integration. For the

execution and translation of SNC's spirit and particularly integration of skills, a system wide inquiry was obligatory. Related literature suggested that a review of key influencing factors like teachers' training, classroom practices, assessment strategies and provision of necessary facilities is quite momentous as only changing the curriculum content alone cannot bring revolution in the education system.

To start with, the investigation examined the document analysis of SNC (Class 5) in subject of General Science with reference to inclusion and integration of selected 21st century skills (creativity, critical thinking, collaboration, communication, and ICT). Literature suggested that for promotion of 21st century skills, the curriculum has to make a paradigm shift from traditional teacher-centered approach to learner-centered active learning approach. It should discourage rote learning and target the development of higher order thinking skills (HOTs). Furthermore, many researchers advocated that inclusion of project based learning and amalgamation of ICT in science content that is proven to promote development of 21st century skills. Secondly, to establish the enactment of 21st century skills in General Science textbook, the learning content should be flourishing higher order thinking skills (HOTs) and should introduce students with spirit of inquiry and science process skills. The science content in early classes should build a foundation for higher classes. It should be inquisitive; activity based and should give sufficient provision of collaboration and project based learning.

After the launch of Single National Curriculum (SNC), there was an immediate need of orientation training for the teachers, who have to execute these reforms and play the role of change agents. The effective teachers' training to implement the SNC particularly with reference to 21st century skills ought to be more practical, focusing hands on activities so that the teachers could be proficient in employing project-based, experiential, problem-based and cooperative learning that

can lead to enclosure and development of skills. As these concepts are relatively new for our conventional teachers, there should be rigorous and frequent training sessions specially regarding use of ICT and catering to a large number of in-service science teachers. Furthermore, the teachers need constant support and mentoring to implement these newly learned skills, so a follow-up mechanism was quite imperative.

The trained teachers were then supposed to implement the SNC in real field of classroom, to execute what they have learned and perceived in their training. Therefore, the study targeted only those science teachers who received training on SNC in subject of General Science. Literature revealed that development and integration of 21st century skills is possible in a classroom which is based on constructivism. The SNC content analysis also uncovered that the underlying foundation of curriculum reforms is also based on constructivism and student-centered approach. Kivunja (2015) alleged that a constructivist classroom is highly dynamic and engaging. Teacher gives equal learning opportunities to all learners; students are engaged, and active learning takes place. Students construct their own knowledge through scaffolding strategies and challenging tasks. The teaching-learning activities involve project-based learning and problem-based learning in collaboration with other students. The teacher employs ICT in the teaching to make learning more interesting and interactive. All the activities are learner-centered and goal oriented. Likewise, SNC also endorses active learning and Student Learning Outcome (SLO) based teaching and learning. Consequently, the classroom pedagogies were watched and analyzed with the lens of constructivism.

Furthermore, Single National Curriculum validates use of authentic formative assessment strategies which target higher order thinking skills. The assessment ought to be learner-centered and provide feedback for further improvement in both teaching methodology and students'

learning. SNC endorses student's self-assessment and peer assessment so that the students can also realize their learning progress. The assessment methods should be flexible, providing students opportunity to choose the task, time, and method of completion.

Last but not least, provision of necessary physical facilities is mandatory in order to provide students and teachers with enabling learning environment which is conducive for the integration of 21st century skills. Some of the basic facilities include provision of computer or LED in the science classrooms so that the teachers can integrate ICT in their teaching. The schools should have necessary teaching-learning resource materials for the employment of activity based and project based learning. The classroom should be well furnished and spacious in order to provide sufficient space for the students' group work and activities.

1.7 Significance of the Study

Every research has the major goal of contributing something new and expanding the existing area of knowledge or adding something in the related literature. The current study has brought out ground realities along with existing situation regarding integration of 21st century skills at primary level. It can be beneficial for all the educational stakeholders in meaningful employment of recent Single National Curriculum (SNC). The study conducted can sensitize policy makers, curriculum developers, teacher trainers, educational managers, and teachers to take appropriate steps in their capacity for inclusion of 21st century skills by presenting a system level analysis. It has highlighted the necessary modifications and alignments required at system level for integration and development of 21st century skills in school education. It can provide useful data for policy makers to re-think about the policy reforms; particularly with reference to grant allocations and subsequent strategies to analyse what can work well and what cannot in implementing 21st century skills as per agreement with international commitments. The study can be helpful regarding provision and

utilization of necessary resources and facilities in public sector specially at primary level in consequent with recent Single National Curriculum (SNC).

The study can facilitate the curriculum developers to appreciate the theory practice gap regarding implementation of Single National Curriculum (SNC). The findings of the study can enable curriculum reviewers to compare their curricular aspiration and intentions with the reality of the situation. The gaps explored can be utilized in making future curriculum revisions and incorporating changes which are doable and pragmatic in the field. That can be helpful in amending the prevailing strategies and adopting some realistic methods considering the ground realities.

It is anticipated that the study can provide helpful data to the textbook writers regarding inclusion and integration of 21st century skills as per aspirations of Single National Curriculum. The research has underscored the gaps between curriculum demands with reference to 21st century skills and the content of science textbook. The information can be utilized by textbook writers while revising their textbook manuscript for the next edition.

Capacity building of teachers in the realm of 21st century skills is the emerging area for teachers' professional development globally. The current research can give insight for teacher trainers to bring valuable modifications in teachers' professional development programs. There is a dire need to focus on how to develop and address 21st century skills among students instead of only propagating their significance.

The present study can provide useful evidence to the educational administrators; personnel of Federal Directorate of Education (FDE) regarding allocation of teaching learning resources that are necessary for integration of 21st century skills and the National Curriculum of the country. It can also be beneficial in planning and conducting co-curricular activities in public schools that can contribute to developing 21st century skills among students.

The prime intent of the educational research in realm of curriculum is to improve the teaching learning process and to devise effective teaching strategies. The study in hand can raise awareness about significance of higher order 21st century skills among science teachers. It can supply base-line information for primary science teachers in restructuring and reviewing their classroom practices particularly with reference to inclusion and integration of 21st century skills. The study can provide diagnostic information to the science teachers about the status of teaching learning process in consonance with the skill based SNC. The findings can be utilized in adopting effective strategies in congruence with the curriculum and SLO based assessment.

Finally, the ultimate beneficiary of the whole teaching-learning process is the student. The focus of all the efforts made in education sector is to improve students' accomplishment. The current study can also contribute to benefit students by suggesting measures for improving the teaching-learning process that can lead to effective schooling. It can help students in their preparation for life after school once these life skills start nurturing at the early blossoming age.

1.8 Research Design and Methodology

The study in hands adopted "interactive mixed methods" approach. The researcher followed "multiphase sequential design" (Schoonenboom & Johnson, 2017). Motive of the current study was to reconnoiter the integration of selected 21st century skills in the latest curriculum reforms made in the country at national level. The research objectives and the subsequent research questions called for assuming the mixed-methods research approach. Qualitative part aimed to explore in-depth information on perspectives of different stakeholders regarding integration of skills in Single National Curriculum. Quantitative part provided weightage and extent of inclusion of these selected skills in SNC, science textbook and in classroom pedagogies.

1.8.1 Research Data Sources and Research Participants

The research explored following documents for content analysis.

1. Single National Curriculum in subject of General Science (2020)
2. General Science Textbook (Class V: NBF, 2021)

Following research participants were included in the study.

1. Science Curriculum Reviewers/Members of Curriculum Development Committee
2. General Science Textbook Writers
3. General Science Textbook Reviewers
4. FDE Officials/Academicians/Educational Mangers
5. Primary science teachers who received training on Single National Curriculum

1.8.2 Research Setting

The study under contemplation, collected both the qualitative and quantitative data in the naturalistic setting of the research participants. The interviews were conducted in the offices of the personnel involved as per their convenience. For instance, most of the curriculum developers were interviewed in their offices at National Curriculum Council (NCC) and narratives of FDE academicians were sought out in their offices located in the headquarter, Federal Directorate of Education (FDE). Science teachers were being interviewed in their respective schools in accordance with their suitability and availability. Classroom observations were scheduled as per expediency of science teachers.

1.8.3 Research Population

Population and sample of a study may be comprised of persons, documents, objects, organization, or events, etc. (Boddy, 2016; Gay, Mills, & Airasian, 2019). The target population for this study were documents of General Science curriculum and subsequent textbook for grade 5. The science

curriculum experts and textbook authors who were involved in the development and review of these documents. The educational managers from FDE who are responsible to execute SNC in public schools of ICT. The science teachers who participated in the training organized to impart orientation about SNC.

1.8.4 Sampling Technique and Sampling Size

The current investigation employed multiple sampling strategy to get beneficial and relevant information from different data sources as single sampling strategy was inadequate to serve the purpose. The researcher deliberately employed purposive sampling combined with criterion sampling strategy to identify and choose the information-rich participants who can meaningfully contribute towards the objectives of the study (Cresswell & Plano Clark, 2011). The research pursued perspectives of relevant stake holders (04 science curriculum developers, 02 textbook authors, 03 FDE academicians, and 10 science teachers) regarding inclusion of 21st century skills in their respective domains. Sampling technique detail is being described in Chapter 3.

1.8.5 Research Instruments

Self-developed instruments were employed to collect data as labelled in the table below.

Table 1.1 Account of research instruments

Sr. No.	Instrument	Data Source
1	Learning Metrics for Document Analysis Rubrics for Quantitative Data Analysis	• Single National Curriculum 2020 (General Science, Class 5) • General Science Textbook (Class 5: NBF, 2021)

2	Interview Protocols For Semi-structured interviews	• Curriculum developers • Textbook writer and reviewer • FDE Officials • Science Teachers
3	Classroom observation checklist	• Science Classroom

1.8.6 Development of Research Instrument

Separate instruments were developed for each data source. Semi-structured interview protocols were also customized in accordance with the position and role of each participant in different strata. Learning metrics were developed for quantitative content analysis of documents. Structured checklist was used for quantitative classroom observation. It not only helped to validate the science teachers' interview information but also established the availability and employment of resources that could be utilized to integrate 21st century skills at Primary Level.

1.8.7 Validity and Reliability

Validity and reliability of research tools were safeguarded by adopting following measures as:

i. Experts' opinion

ii. Piloting of instruments

iii. Member Check

Both the above-mentioned procedures helped in improving the tool. Trustworthiness of research in term of its objectivity, credibility, reliability, and validity was ensured by researcher's detailed field notes, multiple meetings with research participants and taking each respondent's feedback through 'member check". The details are further explained in chapter 3.

1.8.8 Data Collection

Written consent of participation was taken from each research participant. Necessary departmental permissions were taken beforehand. Selected participants were visited multiple times to establish rapport and comfort. Science teachers were motivated and taken into confidence in order to make them agreed for their classroom observation. Data from schools were collected at the end of the academic year (2021-2022), after completion of one year of Single National Curriculum's implementation.

1.8.9 Data Analysis

The data obtained from different sources were organized. Quantitative content analysis was proceeded by adopting the stages described by Rose, Spinks & Canhoto (2014) and frequencies of 21st century skills in the documents of SNC and science textbook was calculated . Qualitative data obtained through interviews were analyzed by following thematic analysis as mentioned by Braun & Clarke (2006 & 2023) and Clarke & Braun (2013). Classroom observations were analyzed quantitatively by calculating the percentage of demonstrated 21st century skills in classroom pedagogies. After analyzing the data, researcher withdrew the conclusions and made recommendations.

1.9 Delimitations of the Study

Following described the delimitation of the present study along with the reasons.

Table 1.2 Portrayal of delimitation of the research study

Sr. No.	Delimitation	Justification
1	Primary Level	The recent curriculum reforms SNC (2020) were first implemented at primary level. One whole academic year of execution is being completed. It

		was spot on to explore the progress of transformation in teaching learning process in congruence with SNC and the mentioned 21st century skills.
2	Public Schools	The SNC was officially executed in true letter and spirit in public schools as part of Government policy at the start of academic year 2021. It was more auspicious for the researcher to pursue its implementation in very first year of its launch in the public sector schools. Many of the private schools refused to employ SNC at beginning of its roll-out.
3	Subject of Science	Researcher is a science graduate and worked as science teacher trainer in a teacher training institute (2007-2016). She got first-hand experience of conducting classroom observation of science teachers under different national level projects. Personal interest and relevant experience made the choice of research. It was also more appropriate to investigate the enactment of 21st century skills in subject of science rather than any other subject.
4	4Cs	4Cs (Creativity, Critical thinking, Collaboration & Communication) are most cited and well-established skills which are endorsed by all the 21st century frameworks since 2003. Partnership for 21st century (P21) identified these skills as deep learning competencies. They are recognized as "super skills" (Kivunja, 2015). 4 Cs are asserted as shorthand for the necessary skills desirable for success in school, profession, and life. Since the researcher has delimited the study to curriculum of science only and integration of these skills in particular is claimed in science curriculum document that's why the researcher has focused on these skills only. This domain is also most relevant to subject of science. Furthermore, 21st century skills is an umbrella terms

		that includes more than 25 skills and it's quite impossible to study all the skills in a single study. Additionally, the exempted skills comprise of social and personal skills which are less related to subject of science.
5	ICT	Information and Communication Technologies are recognized as Literacy skills in 21st century skills framework. The usage of these skills is endorsed in SNC; as tool for learning and trends of new era.

The study has focused on the followings:

- Single National Curriculum 2020 of Primary Level (Class 5, General Science) only.
- Interview with Science Curriculum Reviewers for their opinion and consideration during curriculum development.
- General Science Textbook of class 5 (NBF, 2021)
- Interview with Science Textbook Writer/National Curriculum Council (NCC) reviewer regarding inclusion and integration of 21st century skills (creativity, critical thinking, communication, collaboration, and ICT) in school education at primary level.
- Interviews with the FDE officials / academicians / educational managers
- Interviews with primary science teachers who received training on SNC.
- Exploration of classroom practices will be limited to grade 5 General Science classes: including both urban and rural sectors public schools along with model college institutions in Islamabad.

1.10 Operational Definitions

Integration

Integration means to incorporate, include, mix, or combine things so that they work together effectively.

21st Century Skills

21 CS are "competencies, attributes and dispositions that are necessary to learn for improving one's cognition, inter and intrapersonal skills with the help of technology and to complement living in the globalized world".

4Cs (Creativity, Critical thinking, Collaboration and Communication)

Creativity is a higher order cognition that enables students to generate novel and original ideas. It involves how students deal with complex tasks/problems and present their innovative solutions showing their new learning.

Critical thinking is higher order cognition that supports students in deep thinking process; enabling them to analyze, investigate, evaluate, and solve complex problems. It includes evaluating information and drawing conclusion-based evidence.

Collaboration is an interactive skill that includes working in groups/ teamwork in a cooperative and effective manner for a shared goal. It is a "social and cultural experience" for students to work respectfully in teams for a common goal with a shared responsibility of task completion.

Communication is social interaction that involves organizing and sharing of ideas, thoughts, feelings, questions, and solutions effectively via verbal and non-verbal means.

ICT (Information and Communication Technology) includes media technology concepts, tools, devices, and resources that help in enhancing students' communication skills and provide solutions through communication technology. ICT carries 03 placements in curriculum: "learning about ICT", "learning with ICT" and "learning through ICT". This study has concentrated on learning with ICT aspect; ICT as "tools for learning".

Single National Curriculum (2020) refers to recent curricular reforms induced under the vision to provide same quality of education to all the children of the country i.e public, private and

madrassah system; irrespective of their social and economic background. The intentions are to bridge the class disparity and to provide equal and fair opportunity for quality education to all the children of state.

CHAPTER 2

REVIEW OF THE RELATED LITERATURE

This section of literature is divided into three parts. First part will explain the nature, context, and importance of 21st century skills. Second part will discuss the organizations that promote 21st century skills along with their frameworks. Lastly, it will highlight the need and demand of these skills for education necessary for sustainable development and will quote reviews of some related previous studies. The investigation in the realm of 21st century skills reveal that ones' capability to innovate, self-regulate, collaborate, solve problems, communicate, and utilize digital literacy in combination with social skills are quite vital for accomplishment in life and career (Fisser et al., 2015). 21st century skills demand and urge pupils to be more interdependent with their peer and stimulate them to be interactive and pragmatic with the practical world. Interdependence and interactivity lead towards the transition from conventional pattern of individualistic and disconnected approach of traditional school systems. Glatthorn, Boschee, & Whitehead (2009 & 2018) asserted that the Linear Curriculum Theory is needed to be transformed into some "Holistic Theory of Curriculum" which can provide room for collaboration and integration which are important for effective and efficient implementation of 21st century skills. The present chapter tried to substantiate the rationale for teaching of 21st century skills by examining the relevant literature, underscoring new strategies needed for the modern century and as per teaching-learning requirements of 21st century learner.

Furthermore, the literature associated with integrated curriculum has also been explored. This chapter described definition and main characteristics of integrated curriculum along with some of the obstacles towards its implementation. Even though the integrated curriculum has remained quite a popular area since the 20th century (Drake & Reid, 2018). However, there is still a variance

and kind of disagreement in stating its practice and execution (Applebee et al., 2007; & Fraser, 2000). Hence, the research tried to oversee the barriers for implementing an integrated curriculum, role of classroom environment, misunderstanding regarding terminologies as well as perceptions and priorities of educators.

2.1 21st Century Skills: General Overview

Lot of countries across the globe took variety of reforms in area of curriculum, classroom instruction and methods of assessments with the aim of improving education standards and preparing their children to meet the demands and challenges of 21st century. By the start of new millennium, think tanks around the world started envisaging the skills necessary for young generation's success in this instantaneously changing world. Hence the educationist, policy makers, blue-ribbon committees and business leaders consented unanimously about the shift in learning paradigm; from rote memorization to nurturing higher order thinking skills which they referred to 21st century skills.

The dynamic members in any knowledge-based society have to adopt and grow in the area of 21st century skills so that they can contribute towards progressive, technology-oriented, and ceaselessly varying globalized cosmos (Fisser et al., 2015). Many organizations and companies around the globe are working on the promotion of these skills and have presented recommendations about defining and developing 21st century skills. Voogt and Roblin (2012) in a study swotted the relevant literature and concise their outcomes about 21st century proficiencies. They reviewed eight frameworks for 21st century skills in total that were presented by renowned organizations. These frameworks were supported by governments of different countries and celebrated corporations from all over the world so that the bias could be contended regarding priorities and dominance of any one organization or country. Furthermore, Fisser and Thijs (2015), extended their research

from the results of Voogt and Roblin (2010 & 2012) and asserted that among all the 21st century proficiencies, the skills of creativity and innovation, problem solving, critical thinking, collaboration and communication, digital literacy, self-regulation, and social-cultural skills are being reflected in most of the frameworks. These are not any new or radical skills in the field of education, instead these notions are considered as well-recognized component of numerous comprehensive curricula and educational theories for a good period of time. Nevertheless, many of the high school passed-out students are found lacking these substantially anticipated and desirable skills in universities and in practical life. Consequently, for successful induction in a knowledge-based economy, the re-investigation of these skills has become a hot topic for deliberation in educational circle. There is a dire need to sensitize the students about the requirements, challenges, and issues of a swiftly changing world so that they can embrace and look at these transformations in innovative and revolutionary ways and can adapt them successfully. Accordingly, the relevant literature has been explored in succeeding sections in order to establish a stipulation and rationale for the enclosure, expansion, and integration of 21st century skills in the education mainstream for the learners of futuristic world.

2.2 21st Century Skills – An Outlook of Definitions

Research literature is not very conclusive upon the definitions and classification of 21st century skills. There is no distinct or unique single definition which is universally adopted and followed. Because there is a wide series of skills and competencies that are attributed and categorized under the ambit of 21st century skills. Mostly "21st century skills" is taken as a broad and overarching concept that includes multiple categories of skills. 21st century skills are defined by Voogt & Roblin (2012) as "new competencies" which are increasingly demanding in youth for the jobs by society, employers, and industries. They affirm that "21st century skills are an all-embracing

concept that includes knowledge along with skills and disposition necessary for young people in order to empower them beneficial for society so that they can contribute to the knowledge economy (Voogt and Roblin, 2012). However, they mention that there is ambiguity in definition and terminologies employed for 21st century skills in all the 21st century frameworks, which is also a hinderance in the inclusion and development of these skills.

Scott (2015) states, "21st century skills include knowledge, abilities and attributes required to be successful in competitive 21st century workplace, for relevance in globalized society and cope up with the emerging challenges. These are the skills necessary to participate in uncertain and rapidly changing diverse societies. Furthermore, Chalkiadaki (2018) affirms that 21st century skills are wide-ranging skills and professional competencies that include creativity, critical thinking, developed cognition and metacognition, teamwork, national and global citizenship, collaboration, acceptance and adaptability, communication in native and foreign languages, digital and information literacy, leadership and accountability, cultural awareness, and physical well-being. Chalkiadaki quotes several frameworks for 21st century skills like EnGauge (2003), OECD (2005), P 21(2007), and ATC21 (2012).

The notion of 21st century skills is quite a popular idea in todays' world of competition and advancement. 21st century skills are referred to distinct core capabilities and proficiencies like digital literacy, collaboration, critical thinking, creativity and problem-solving. Rich (2010) described 21st century skills as the ultimate "learner-driven" education. He asserted that in 21st century education, the emphasis is not on the instruction of teachers but upon learning of students, taking responsibility of their learning through self-directed learning and steering it further. Under the umbrella of 21st century education, teachers act as facilitators of students' learning and assist them in their learning voyages. Furthermore, Vander Ark (2020) declared that it is quite censorious

and urgent issue of present time to assemble and call upon the originality of our young generation for meeting the growing challenges of modern societies". The proponent of 21st century skills believed that these competencies ought to be demonstrated in schools for helping students to be successful in today's world (Rich, 2010). The movement for 21st century skills is being initiated since more than two decades. Rich (2010) described that 21st century learning symbolizes a style of teaching and learning in which content knowledge tend to marry the skills". In this competitive era, it is not adequate for learners to merely "know the things." The students must require to stay peculiar in exploring and investigating things out (Rich, 2010). Furthermore, Vander (2020) declared that "21st century learning can be both individual and individualized. It is persistent, focused and credits individual variability of learners. Learning for 21st century ought to amalgamate skills with the unlimited challenges for learners". According to "OECD (2018), researchers for science learning discovered that there has been a set of significant conclusions that developed from their studies. The findings of those studies embraced the status deeper conceptual understanding in the students' learning, instead of learning apparent information and events. The research focused and highlighted the position of learning the articulated, comprehensible, and connected knowledge, rather than the superficial knowledge which is being compartmentalized in different courses and subjects. Acquisition of authentic knowledge with its background and contextual usage is far more important than decontextualized classroom practices. Similarly, collaborative learning is significant to a much greater degree than learning in isolation. Consequently, learning scientists are summoning for a shift in today's education sector.

2.3 Rationale for 21st Century Skills

In 21st century, increased globalization and modernization has initiated and imposed unprecedented challenges and demands for both the individuals and for the societies. The

advancements in technology have constructed a diversified and interconnected world which is loaded with information about every corner of the world. Hence a different kind of playing field is created for individuals, organizations, societies and countries for participation, competition, and innovation in the digitally connected global economy. The mixing of the global labor market led to create a competitive contest among most highly proficient personnels of advanced countries with the personnels of same competencies and qualifications in underdeveloped countries for the sake of employment. Contrarily twenty years ago, employment opportunities were localized, and only native people were included in the job competitions. In 21st century of today, organizations multinational companies, and states contest to recruit the most competent and skillful human resource that can contribute to the development and progression of knowledge (Friedman 2007; Wagner, 2010; Dede, Bellanca & Brandt, 2010; OECD, 2011). Hence, the teachers ought to amend the strategies they employ to train their students as future workforce. Educators needs to encourage and equip their students with necessary knowledge and 21st century skills to enable them in meeting the demands and challenges of higher education sector, employing companies, and the society. The duties and assignments expected by the employing companies have been modified due to the advancement in the realm of information and communication technologies (ICT). Now, many of the jobs demand highly educated and competent individuals who are proficient with 21st century skills and are capable of engaging in complicated tasks, solving complex problem, thinking rationally, and have excellent command over communications (Dede, 2007; Levy & Murnane, 2004; Friedman, 2007; Murnane & Friedman, 2012).

The succeeding segments of literature would further analyze and comprehend the present understanding about 21st century skills, elaborate the definitions, highlight the importance, and implications of 21st century competencies which also helped in developing the conceptual

framework of this thesis. The literature reviewed in this chapter first glanced on the worth and significance of 21st century skills and a short depiction about its worth in today's society and employment market. Then it examined the various renowned frameworks for 21st century skills and snapped a rationale for selecting and adopting the UNESCO's Framework for 21st century skills (UNESO, 2020) as an underpinning framework for this study. Additional sections of the chapter examined the curriculum reforms, teachers' professional competence and essential support systems required that are crucial for integration and inclusion of 21st century skills and relevant knowledge in the school education sector. The concluding part of the literature offered a justification of all the appropriate factors that can impact in preparing students with 21st century skills and competencies.

2.4 Importance of 21st Century Skills

Karoly & Panis, (2004) labelled that there is a noteworthy difference between the 20th century and the 21st century if we consider skills and necessary knowledge required for the United States to endure and sustain its competitive position at the international level. This is also true for the individual learners who wants to be successful and accomplished in their personal and economic lives, (Dede, 2010; P21, 2015). Furthermore, Friedman (2007) expounded that the emergence of ICT has created some novel set of pressures and challenges on teachers, learners, and employers. In today's 21st century, organizations, multi-national companies, societies, and individuals have shifted and modified the methods of working, collaboration, and contribution towards other individuals, towards the economy and towards the society. Now the whole world need to learn how to share knowledge and work in collaboration in real time so as to be more competent, operative, effective, and to sustain and survive the competition irrespective of their location. Lot of middle level positions that focused on specific tasks for instance, building line work, analyzing

the data, secretarial and accountancy are being substituted by technology driven tools or are being farmed out to some low-income country. The latest skills necessarily required for global economy are now not dedicated to some specialized assignments. Instead, new skills require people to be talented enough for making effective collaboration, for thinking critically and rationally, and for exhibiting good oral and written communication. The current workforce require its individual members to be well-versed with technology, to be able to incessantly modify and adapt themselves. Consequently, teachers, employers, and multi-national organizations have coincided that the 21st century proficiencies are significant and vibrant traits that are unavoidable and must be acquired to gratify demands of employability, and to contribute effectively to the welfare of the United States' economy and to participate successfully in today's competitive world, (OECD: Strong performers and successful reformers in education, 2011).

For preparing and ensuring students' success in higher education level and further at the workplace, the influential organizations, celebrated corporate leaders and teachers insist and motivate students for acquiring 21st century expertise. In recognizing the need and importance of these skills, several organizations have outlined frameworks to support teachers for the integration of 21st century skills within the core subjects of academia. Among these different 21st century frameworks, we would be analyzing framework given by Assessment and Teaching for 21st Century Skills (ATC21S, 2013), UNESCO (2015), Partnership for 21st Century Skills (P21, 2009), and Organization for Economic Cooperation and Development's (OECD, 2015).

Since the world is undergoing continuous modifications, the worth and implication of 21st century skills is also strengthening. Likewise, the job market is becoming more and more complicated due to competitive networking and globalization of today's realm. Now the technological tools have reinstated mundane and boring tasks at workplace. Unskilled and routine work are being

outsourced for less labor. In the progressive countries like United States, companies and firms demand such employees which are not only proficient in subject knowledge of a specific area but also acquire higher order cognitive skills that can assist them in resolving intricated yet complex problems. Such jobs also require basic background knowledge of subjects for instance science, mathematics, engineering, and technology (American Management Association, 2010). For future success and sustainability in competitive jobs, students ought to reinforce and foster their 21st century skills; like problem solving, creativity, critical thinking, communication, and collaboration, as well as the basics of technological literacy.

Nugent, Kunz, Rilett, & Jones (2010) asserted that with the growing demand for skilled workforce, unfortunately the United States is unable to produce students with essentially required credentials. They emphasized that when American students were compared with the students of similar advanced countries, the U.S students were ranked as 22nd in subject of science and 31st in subject of mathematics in the world (Burke & McNeill, 2011). Even though the other countries are continually improving the quality of their workforce for becoming more and more competitive economically, while the students in the United States of America are falling behind to a great extent. Moreover, lower-salary labor force throughout the globe is exclusively competing for employments within the United States. In addition, the scientific advancements and progressions are being carried out in many countries throughout the world other and now the United States is not the only solo spot for advancement and innovation (Committee on Science, Engineering, and Public Policy, 2007). For this reason, the schools must bring in prospects and opportunities for students so that they can hinge upon and become competent in 21st century skills in order to ensure the importance and competence of United States among other nations of the world.

There was formerly a time when society used to consider that a strong foundation of reading, writing, and numeracy are essential and sufficient for success in career and life. With this belief of solid footing of "three Rs," it was expected that all students have the potential and capacity to accomplish at the workplace. However, this is not the situation to any further extent. In addition to primary foundational competencies and skills, many of the upcoming careers expect employees to have background knowledge of math and science as well as awareness with the technology. Integration of technology can assist and help teaching and learning of all the subject areas. By employing technology in their classroom teaching, educators can not only increase students' conceptual understanding regarding content but also can deliver authentic and reliable information in an interesting manner. Davies & West (2014) reported that by integrating technology with the basic subjects, students become more stimulated and involved with the content that facilitates deeper understanding of the essential conceptual areas. Subject specially sciences demand students to have the competence of problem solving, lateral and critical thinking, creativity and innovation, collaborative skills, and technological literacy. Therefore, for success in basic subject areas of science, students have to improve and grow their proficiency in 21st century skills. Subjects of science, mathematics and technology are heavily dependent on expertise and competence regarding 21st century skills. Since subjects of science and mathematics are more dominant and advanced at secondary school level, it is necessary to prepare students on these lines at primary school so that these skills can be inculcated as foundation at the gross root level and students can have more time to practice and apply skills at elementary and secondary school level. Therefore, by nurturing and developing 21st century skills at a nascent age, students will get better chances of success in higher class and in universities, where they would need an advanced understanding and application of these skills for success along with plethora of subject matter.

2.5 Teaching 21st Century Learners

Greenlaw (2015) proclaimed that the learning of 21st century surrounds certain attitudes especially considering the increased utilization of technology in the recent times, the students can be self-adequate regarding managing their learning if the teachers become flexible and let them plan and organize their learning. Nevertheless, as described before, students lack essential skills that can successfully enable them to navigate, synthesize and analyze all the available information, that truly indicates that, "The need and significance of powerful teaching is ever more imperative and challenging in the current modern society" (Darling-Hammond, 2006). Teachers ought to be prepared and trained for developing necessary skills that further deliver and support students with some reliable and rich experiences in term of collaboration within the schools' students, with students from other schools, partnership with museums, universities, companies, community centers and other such organizations" (Umansky et al., 2015). However, as we have to develop and nurture 21st century skills of students in order to prepare them for the upcoming challenges, the teachers should not assume that the traditional best practices which are time-tested as well are no more relevant now and have no role in today's classroom. Contrarily, teachers need to acquire more and strategies so that they can shift and transform their method of direct instruction to design creative project-based learning assignments for the students and to make learning of 21st century skills possible for all students (Darling-Hammond, 2006). Though the instructional methods are time-tested and considered among best practices, still they need continuous refinement to meet the necessities and necessities of 21st century learners. Moreover, we need to focus on developing a curriculum design that can enable integration and provides teachers with a roadmap which is pragmatic to the real world situation. A curriculum that can make authentic and reliable connections and alignment within content areas and should be negotiable in term of transferring

content to students. The conventional, catalogued curriculum is rigid and inadequate in respect of providing teachers opportunities to create conducive learning environments that can enable inclusion and development of 21st century skills. Strict demarcation of disciplines hinders students' creativity, delimit their learning experience and chances to utilize concepts and content in a meaningful manner that leads to limitations in term of interconnectedness emphasized as features of 21st century skills. Additionally, with the continuous progression in field of technology, the world has become increasingly "interconnected and interdependent". Hence, it has become obligatory and unavoidable that the school should also present knowledge and skills to students in an interconnected and interdependent manner (Drake, 2018). Integrated curriculum is being encouraged in this scenario as it focuses on the real world examples and problems, present reliable connections within content areas, and is flexible in term of providing students with a pragmatic and realistic design that enables students to think and acquire a sense of ownership and accountability that will be essential in solving future life problems.

2.6 21st Century Skills and their Relevance

21st century skills have become area of great interest and discussion globally since the last decade. All the countries are striving to improve their education system beyond the basic standards of literacy and numeracy. Efforts are being made to bring educational reforms that can improve student learning outcomes as well as can prepare students for life after school. Rapidly changing globalization has created the need of preparation for the jobs that do not exist yet.

21st century skills are referred to group of skills essential to sustain in today's everchanging and unpredictable world. These skills are considered necessary particularly in field of education and employment for making students ready for the jobs that have not been created yet. Education

Ministers of OECD (2004) embraced the term "lifelong learning" for all these meaningful learning skills in the life of an individual.

2.7 Why 21st Century Skills?

Many frameworks on 21st century skills attribute need of these skills with the rapidly changing society and technological advancements. Progression in Information, Communication and Technology has transformed our society from industrial society to knowledge society which focuses on conceptual information and Metacognition. Furthermore, globalization is also an important driving agent that urged the need of changes in employability and labor market. There is a need of flexible "mind workers" who can understand and interpret information, adapt themselves and work collaboratively in team. Voogt & Roblin (2012) concluded societal and economic advancements driven by recent technology reshaped our home environment and features of employments which are the key impetus that call for acquisition of 21st century skills. All the frameworks for 21st century skills strongly endorse social and economic needs. Moreover, EnGuage and P21 mention need for acquisition of 21st century skills as a powerful mean for improvement in teaching and learning. Similarly, various researches in pedagogical sciences endorse effectiveness of learner-centered learning in which students are actively engaged in their learning activities. This learner-centered learning is in consistent with the notion of "lifelong learning" as mentioned in EnGuage framework for 21st century skills. Lastly, the urge of perpetual improvement in term of quality education is also an important driving factor for inclusion of 21st century skills in the curricula of schools.

2.8 Merits for 21st Century Skills

In 2012, Binkley et al., defined 21CS as: "The competencies and attributes which one can learn or acquire for enhancing his intellect and thoughts, his learning style, ways of working and style of

living in the world. The skills embrace innovation and creativity, problem solving, critical thinking, metacognition (learning to learn), working in collaboration (teamwork), communication, media and ICT literacy, information literacy, both local and global citizenship, career skills, individual and social responsibility (that includes cultural awareness and intercultural competence)".

These are the skills that our progenies and young people need to master so that they can participate constructively and progressively in their future life as a global citizen. These skills are necessary for their engagement as active and prolific counterparts of their societies, states and globally, if we look into bigger picture. In order to embrace globalization, it is very essential for us to bring valuable reforms in our education system that can make our youth lifelong learner and ready to accept the trials and challenges of life after school. 21CS are the set of competencies required for a person to face the upcoming challenges of the future (Graczyk-Kucharska, Özmen, Szafrański, Weber, Goliński, & Spychała (2020).

2.9 Alternative Terms Used For 21st Century Skills

Different terms are used by different countries to describe the skills or competencies that are essential for the learners other than academic content, these are often named as "non-cognitive skills", "non-disciplinary skills", "transversal skills", "transferable skills", "digital skills", "critical skills", "soft skills", or "social-emotional skills" or competencies etc.

2.10 Approaches Adopted for the Categorization of 21st Century Skills

Various sources classify a wide number of skills and dispositions, along with many attempts to synthesize and categorize them by using different analytical frameworks. For example, Partnership for 21st Century Learning (P21) initiated "4Cs" (creativity, critical thinking, collaboration, and communication). Sternberg & Subotnik (2006) and Wagner et al. (2006), highlighted the term

"3Rs (reading, writing, and arithmetic)", while ATC21S promoted "3Ps ("Passion" that embraces character; "Problem solving" for communication and "Producing" - what is required with creativity and skill", are all good examples (Scott, 2015). However, despite of the diversity in use of different terminologies, majority of literature in this area demonstrate some common set of skills and competencies along with certain dispositions to be classified as 21st century skills (Voogt &Roblin 2012; Scott, 2015, Lewin & McNicol, 2015; Chalkiadaki, 2018). The three major areas are classified as:

1. **Personal learning, life and career skills** that includes critical thinking, innovation and creativity, metacognition, ability to learn new skills, adaptability, self-direction, and flexibility.
2. **Social Skills** comprise of clear communication and collaboration. Cultural and global awareness.
3. **ICT and digital literacy** that includes efficient and effective use of technology as a tool for learning, Information literacy, information management, and use of information.

Additionally, personal attributes are also considered as main anchors for the life in 21st century like:

- Personal health, physical well-being, and self-control
- Emotional and societal skills
- Local and global citizenship, environmental literacy
- Creativity and cultural in expression

There are many other kinds of classification for 21st century skills which are being given in different frameworks presented by influential organizations and global agencies and are listed as:

Table 2.1 Referential Frameworks for 21st century skills

Organization	Typology/Categories	21CS
P21 (US; 2009)	Skills for life and career	Initiative, adaptability and flexibility, self-regulation, cross-cultural and social skills, leadership, and responsibility
	Innovation and learning	Originality and creativity, critical thinking and problem solving, collaboration and communication; also known as 4Cs.
	Information and communication technologies	Information and media literacy, ICT literacy
ATC21S, (Australia; 2013)	Ways of thinking	Creative thinking, meta cognition, and critical thinking.
	Ways required for working	Collaboration and communication.
	Tools required for working	Information and ICT literacy.
	Living in the world	Domestic and global citizenship, personal, life, social and career accountability
OECD	Categories of knowledges	Subject knowledge, interdisciplinary knowledge, knowledge of epistemology and procedures.

(France; 2015)	Cognitive, metacognitive, emotional, social and Physical skills	Creativity, Critical thinking for self-learning and self-regulation, self-efficacy, collaboration empathy and effective use of technology.
	Individual, social, local, and global values and dispositions	Respect for one's own self and for others, respect for the environment, human diversity and for animals' rights, confidence, trust and empathy.
	Transformational skills and competences	Novelty and originality, resolution skills To counter tensions and crisis and sharing responsibility.
UNESCO (US; 2016)	Learning of knowledge in 21st century	Global awareness, literacy (health, financial, economic, civil, enterprising, and physical well-being.
	Learning to work in 21st century	Innovation and creativity, problem solving and critical thinking, communication and collaboration, ICT literacy.
	Learning to be in 21st century	Initiative, self-sufficiency, and autonomy, interculturality, responsibility, socialization, cognition and meta cognition, entrepreneurship and learning to learn in 21st century.

Learning to live together in 21st century	Respect for diversity, capability to manage teamwork, civic and global citizenship, digital and cross-cultural competence.

- (Adapted from Garay & Quintana (2019) "21st Century Skills: An Analysis of The Theoretical Frameworks to Guide Educational Innovation Processes").

2.11 4Cs (Creativity, Critical thinking, Collaboration, and Communication)

The P21 framework for 21st century identified and highlighted the 4Cs: Creativity, critical thinking, collaboration, and communication that includes a range of skills that they propose to develop along with the core subjects. These skills are stressed, elevated, and epitomized as "super skills" and are considered as necessary for success in school, career and in practical life (Saxena,2015). The assertion for 4Cs model claims that the acquisition of these skills stimulates individual's capabilities in core subjects and can provide better students' learning outcomes (P21, 2015b).

The proclamation of '4Cs' model is founded on the aspirations to prepare individuals for embracing the challenges of 21st century by emphasizing their competencies not only in core content, but also by stimulating their social and cross-cultural skills, refining their language proficiency, and developing an understanding of political and economic forces that shape societies. P21 stated in its mission statement as, "All United States' children require 21st century knowledge, skills, and competencies in order to be successful as beneficial citizens, as an employee and as a leader. This can be successfully achieved by blending the 4Cs with 3Rs. It stated that the schools in United states must align their classroom environments with real life situations for success in higher education, at their workplace and in the competitive global world. The 3Rs comprised of core subjects that include reading, writing and arithmetic that broadly cover local and foreign

languages, mathematics; arts and science; history and geography; government and economics. Whereas 4Cs include creativity and critical thinking, collaboration, and communication. P21 asserted that the 3Rs serve as an umbrella for the core subjects and the 4Cs reflect all the necessary skills required for success. Hence, the aspiration is to offer students a blend of subject knowledge, skills, and literacies. (P21, 2015a)".

Gerald (2015) mentioned the notion of 4Cs as the central part of teaching and learning process in the current era of 21st century. He stated that the "4Cs are reshaping teaching by transforming learning opportunities for the children at school. Acquisition of these skills is imperative as it not only provides a strong base for higher education but also facilitates in admission to a reputable university, helps in promising career and challenging job assignments and for overall success in the contemporary world". Lin (2014) also asserted that "It has become necessary to embrace and underscore the significance of 4Cs in 21st century education". Likewise, Caroline Lippl in 2013 presented 4Cs as important and foundational 21st century skills. She articulated that the "It was time when Education used to revolve around mastery of 3Rs, but now in this competitive world; Reading, writing, and arithmetic are not the sufficient skills for students to be successful. Now students should be able to demonstrate that they can communicate and collaborate effectively. They need to show that they are critical thinkers and can complete their task innovatively. These 4Cs are the skills that make 21st century learning. The Partnership for 21st Century Skills (P21, 2015b) interprets 4Cs as interdependent and interconnected skills and hence categorized them as "the super skills" for the 21st century. They are presented as "the shorthand for all the skills required for success in school, career and life after school" (P21, 2015c). Let's discuss each of these skills, 4Cs along with ICT, one by one.

2.11.1 Creativity

Creativity is mostly mentioned in all the prominent frameworks for 21st century skills. Creativity is the ability to initiate novel ideas from the already existing concepts. Creativity or innovation depends upon one's imagination, inspiration, and the process of creative thinking to generate new ideas that can lead to new discoveries and inventions. Creativity is the mindful exploitation of "innovative ideas, or unique and novel use of ideas that can add to social or economic value" (IBSA, 2009). It is being quoted by The Partnership for 21st Century (P21, 2007) that "in today's competitive world of task automation, creativity and innovative capability are becoming essential requirements for success at both personal and professional level". P21 further states that today economies are driven by digital technologies in which innovation and creativity are the key players. Without creativity there will be no progression, no invention, no advancements, and we will be reiterating the same patterns over and over. Creativity has important role in success of human race. Karlyn Adams in 2006 articulated that the creativity counts how different individuals approach certain problems and find their solutions. It also depends upon the personality of individual, his thinking and working style. Creativity is considered as the most important human resource, essence of human survival. Creativity includes development, application, and presentation of new and unique ideas. Creative people tend to be open, flexible, and responsive in observing new and dissimilar views. They tend to think out of the box for finding smart solution to complicated tasks. Creativity is among the 4Cs "super skills" that ought to be taught in schools (Adams, 2006). Creativity encompasses five complex processes that includes ability to disagree with others in a sensible way without feeling discomfort, seek and try solutions to problem; find out of the box explanation which are dissimilar from current practices, integrating and synthesizing knowledge obtained from different fields, managing, and solving difficult problems, and the ability

to recognize a problematic situation and critically think over a problem for an unconventional solution. In today's contemporary world use of technology in making decisions, solving difficult problems, and generating innovative ideas is quite common. Therefore, integrating creativity with ICT in classroom teaching practices is fairly relevant.

2.11.2 Critical thinking

Critical thinking is "thinking with a purpose". It involves probing appropriate and meaningful questions, assembling, and sorting pertinent information creatively, making connection of new evidence with the existing body of knowledge, re-examining ideas, beliefs, and assumptions, thinking rationally, and deducing reliable and truthful conclusions. Critical thinking demands conscious and determined efforts for applying theoretical concepts in order to fully understand and comprehend the problem, sorting relevant evidence, and evaluating techniques or methods in approaching an appropriate judgement. It involves high order thinking skills of cognition that include analysis, explanation, interpretation, extrapolation, and evaluation. Continuous monitoring and modifying one's own bias and reasoning are the main spirit of critical thinking. Curiosity, flexibility, and a quest mind are the dispositions closely linked with critical thinking.

Critical thinking is the capability of understanding and comprehending a complex problem. It involves creating connection of one source of information with the other in such a way that eventually develop various solutions to the problem. Critical thinking skills is the most sought out skills required students in present world. Students who have the able of critical thinking can resolve the issues effectively in their educational, social, and practical life which are necessary in making decisions. Many critics quoted critical skills as the essential skills in the context of 21st century skills.

Karadağ & Demirtaş (2018) recognized five sub-skills and desired behaviors as part of critical thinking skills that can upsurge and stimulate success of individuals. These includes social skills, communication, and higher-order thinking skills. Scott (2015) emphasized the importance of critical thinking skills and asserts that seven skills are prerequisite for survival and preparedness for life in 21st century which are problem-solving and critical thinking, effective written and oral communication, and collaboration; leadership, adaptability, and agility; Initiative and entrepreneurialism; accessing, analyzing, and interpreting information.

2.11.3 Collaboration

Collaboration is a 21st century trend that is widely categorized under the umbrella of 4Cs. In today's democratic world societies need people thinking and working together on critical concerns to find mutual solutions. Handsley (2011) defined collaboration as "skills of working in team, managing group work, and working supportively with others". Collaboration is a shift from individual work to group efforts. It is the process of working together in teams for a common cause and the achievement of common goals. Davies, Brady & Hobday (2006) presented collaboration as sharing of "social and cultural experiences" among the team members. P21 (2010) defined collaboration as working effectively in diverse teams. It further illustrates that collaboration is not merely a group activity for students, but it is also an ability and opportunity to socialize and to control one's ego, bias, and emotions. Collaboration tends to create togetherness and care along with shared responsibility as a team and individual contribution as a member. It demonstrates ability to show willingness and flexibility in making compromises for the achievement of a shared common goal. Because of its strong rationale in enhancing students' learning and increasing productivity, collaboration has been grouped under 4Cs by The Partnership for 21st Century Skills (P21, 2015a).

In collaboration learners tend to work together in teams towards a shared goal. Collaboration follows a student-centered approach adopted from social learning theories with socio-constructive perspective. Collaboration nurture positive interdependence among learners that helps in fostering individual accountability and interpersonal skills. For making collaboration effective, teacher should act as a facilitator in enhancing students' capability to work and learn within group. This process involves creating, providing, and managing learning opportunities that can inspire students' thinking and they can relate classroom learning to the real-life problems (Raphael, 2015). Raphael (2015) reported that both teachers and students achieve impressive performance results when students were organized to work collaboratively in groups. Kivunja (2015) asserted that the collaboration has the power to improve classroom pedagogy and students' management. Johnson and Johnson (2009) strongly recommended the influence of collaboration in improving effectiveness of both teaching and students' learning and also endorsed its efficiency in all fields of practical life after school.

In today's competitive world, complexity and intricacy of complicated tasks require workers to collaborate in diverse teams to get maximum benefits out of their expertise. Consequently, tasks are usually performed in teams with complementary skills, roles, and expertise. The employees tend to work interdependently, understanding their own roles and contribution as a member in collaboration. Employees are expected to engage in digitally networked distant collaborations to share information resources. Therefore, it is mandatory for workers to have strong and effective communication skills supplemented by efficient use of digital technologies in order to make collaboration meaningful and operative (Dede, 2010; Fraser & Hvolby, 2010).

2.11.4 Communication

Lippl (2013) stated that communication is about comprehending and sharing information and ideas. It is the individual's ability to interconnect clearly and meaningfully through oral, written, and non-verbal language in variety of contexts. Piascik (2015) added that communication is "sharing of thoughts, ideas, questions and their solutions." Effective communication is always being considered as an essential skill for success at workplace, in business, in family relationships, in fact in all walks of life. However, due to 21st century globalization, there is a rapid and instantaneous mixing of individuals of different ethnicity and diverse culture that has made effective communication more visible and more important. The Partnership for 21st Century (P21, 2015) described that, "Though communication skills have always been remained important and being valued at workplace and in social life but 21st century has transformed communication skills even more, making it in central and more important".

Research-based evidence (Coulson, 2006; Muijs & Reynolds, 2011) indicated that both transactional and interactional communication skills are vital for success of students even after their school life in the practical world which is beyond their classroom. Gerald (2015) proclaimed that communication is undoubtedly among the super skills as all the thoughts, ideas, questions, and their solutions are shared through communication. Trilling and Fadel (2009) described that effective communication is an essential skill in the 21st century. They asserted that the graduates should be capable of articulating their ideas and thoughts effectively in verbal, nonverbal and written communication. They should be good listener so that they can decipher meaning, knowledge, attitudes, and intentions along with values. They should be efficient in communication so that they can inform, instruct, inspire, and persuade, and can utilize digital media and technologies in diverse environments using multilingual medium. (Trilling & Fadel, 2009). These

necessities for communication endorse why communication skills are categorized as super skills and put among 4Cs.

2.11.5 ICT as a tool for learning

Employing Information and Communication Technology (ICT) as a tool for learning touch on the capability and competence to utilize and choose appropriate technology for learning both content and skills, to retrieve relevant information, to examine and evaluate, and to relate with the accurate source of information (Prensky, 2012; Wilcox, Liu, Thall, & Howley, 2017). ICT can influence and improve students' learning to a great extent if the teachers are technologically literate and can proficiently use and integrate it in their teaching. Voogt et.al, (2012) labeled students of contemporary era as "digital natives" who consumed their lifetime in tapping and accessing various kind of technologies for living, learning, and working better. He further added that in future, professional careers will emphasis less on manual, mundane job assignments but focus much on accessing, retrieving, and extracting meaning out of abstract data and manipulating the information. Tyner (1998) asserted that many of the students have sufficient knowledge and skills to manage and employ digital technology. However, appropriate, and responsible usage of technology tools in quest of knowledge and information for better learning demands a more sophisticated and refined approach. The utilization of technology tools should consider and account for the purposefulness, nature and provisions of technology employed. It should also take into consideration the strength and flexibility required to deal with technical glitches and malfunction associated with the technological tools and equipment. Moreover, the most important part is the competence to recognize the origin and authenticity of information retrieved through digital platforms.

Binkley (2012) affirmed while defining and describing the 21st century skills that learning with the help of digital technology and through utilizing technology tools is fundamental and imperative to work and survive in 21st century. ICT inclusion and integration can even profit development and nurturing of other 21st century skills like communication, creativity, problem solving and critical thinking. ICT applications can build virtual communities of learning among different students, teachers, and institutions.

2.12 Alignment of 4Cs with 21st Century Skills-A Novel Learning Paradigm

Kivunja (2014) asserted the move the 21st century skills as a shift in learning paradigm which he connotes as, "vision for the success of students in emerging global economy". He proclaims that the prime purpose of education is to yield such citizens who can work productively in the dynamic and challenging societies. For this purpose, curricula, teaching-learning, and assessment are required to equip students with necessary skills that can empower them to contribute to 21st century economies. Many educationists and bloggers endorsed the significance of 4Cs. Gerald (2015) explains 4Cs as essentials of 21st century teaching and learning. He asserted that the school is the central stage where we can transform our children's potential by exposing them with meaningful learning opportunities that can provide a base for their admission in a good university, induction into a decent career and future success in the competitive world.

2.13 Integrating Technology and 21st Century Skills

In order to prepare students of today to meet the challenges of tomorrow in their later years, at university and at workplace, the schools are required to include and promote 21st century skills. In this context, technology can be utilized as an efficient aid to teach and strengthen 21st century skills. Inclusion and amalgamation of technology with 21st century skills will not only enhance effectiveness of teaching but will also appear as a time efficient technique of incorporating both

the subjects. It will help students with practical lessons that would be beneficial and representative in real-life jobs. For integrating 21st century skills, technology can be employed by adopting several different teaching methods. Some of these teaching methods that involve technology and 21st century skills are based on previous teaching strategies, or some updated methods that incorporate technology usage, like problem-based learning (PBL) or using interactive whiteboard (IWB) with students working in small groups. Additional methods include new practices that can be exclusively employed in combination with technology. Multi-user virtual environments (MUVEs) are the methods that solely utilize technology and mixed reality experiences like Twitter and web blogging. Though lot of practices of integrating technology with 21st century skills have been employed, but still the impact of technology application on elementary classes is not well recognized. Many researches have focused on adopting and integrating technology based method at higher school classrooms and in universities but the appropriateness and practicability of these methods on the primary classroom is still undocumented. Recently, problem-based learning is one popular method of teaching that is being adapted successfully in some of the primary classes to incorporate and amalgamate technology with the teaching 21st century skills. The problem-based learning (PBL) involves students to work with an ill-structured problem. Students make assumptions, hypothesize, gather, and analyze appropriate evidence, and work together with other students to discuss and solve the problem. Sungur & Tekkaya (2006) asserted that PBL urges students to utilize and incorporate use of critical thinking, metacognition, self-regulation, and cooperation among peers. Permana (2018) also supported the idea that PBL empowers learners to develop information and enable assimilation of genuine elements of learning, for instance strong critical thinking aptitude, inspiration, and creativity; and flexibility to collaborate. Through PBL method, students try to investigate real life problems, facilitate, and apply the relevant information

and skills that they learned in school to the practical world (Pedaste, 2015). Furthermore, Amir & Jumani (2018) stressed that for effective and efficient employment of PBL to K-12 students, it is obligatory that both the prospective and in-service teachers should be involved and trained as how to utilize and assess relevant learning resources and educational modules that can lead to operative implementation of PBL in classroom. Suwastini, et al ., (2021) also found that PBL is undoubtedly a suitable teaching-learning approach to cater the needs of 21st century learners provided the problems chosen should be based on real-life scenarios and teachers are equipped with good problem-solving skills.

However, problem-based learning is a pedagogical approach that can be employed in classroom with or without integrating technology. Conventionally, it was employed without technology, however, combining technology with PBL can enhance the effectiveness of the method, and can help in preparing students better for technology usage educationally. While integrating technology in PBL, students can generate ideas by utilizing different kinds of technology, for instance they can assemble and examine the evidence, and can refine and filter their ideas as they follow these steps systematically for finding solution of their problem. Technology enables students to be flexible and active learners, while the teacher act as facilitator and a guide, helping students during the process. Technology empowers all students to contribute and participate, supporting all the students to succeed which might not be possible in a conventional classroom (Swartz, Balkin & Phillips, 2003). In board meetings of big companies many of the deliberation and problem solving happen virtually utilizing technology like Microsoft Teams, e-mail, Skype and Zoom meetings etc. without involving face to face meeting. Likewise, many secondary schools and universities are expanding the level of virtual learning through utilizing educational technology and this has become a new normal after Covid-19 periodic lockdowns.

Recently, in an attempt to adapt to this ever-developing digital world, an innovative application of artificial intelligence has been launched which is called “ChatGPT” that has revolutionized conversation (Azharuddin, 2023). It enables the users to communicate, find information and get answers of their inquiries in a very small fraction of time. It is multi-lingual and user-friendly, has the ability to recognize the mistakes and helps in getting correct information. However, like other artificial intelligence applications, ChatGPT also has some limitations. For instance, it can generate offensive, inaccurate or biased responses. The content may lack quality and here applies the critical thinking and decision making power of the user to evaluate the generated text. Therefore, besides the effectiveness of this powerful tool, the learners of 21st century must realize that it has some constraints that should be smartly handled through human intelligence.

In this context it is imperative that the students at the primary school level should also be at least introduced to such advancements so that they can be well prepared to cope with the challenges of 21st century job market and practical life (Dede, 2007). The content mostly taught through textbooks lacks real-world relevance and significance. Hence, the problems given in textbooks that students try to solve are not authentic or genuine. Such problems lack context from the real world that makes them difficult to understand and connect with the actual scenarios. Students engaging in such activities are not true representative of conditions which they will actually experience in their life after school or at their future jobs (Dede, 2007). Consequently, technology amalgamated PBL carries the prospects to improve students’ capability to utilize technology and master the subject matter in an interesting and innovative way in addition to preparing students for higher education and job market. Additionally, Multi-User Virtual Environment (MUVE) is another method which is popularly employed in combination with PBL for integrating technology in classrooms. MUVE works on the pattern of a video game, but the content is purely built on

educational requirements (Dede, 2007). Curriculum for MUVE is acquired through inquiry practices, covering national standards for that particular content (Ketelhut, Nelson, Clarke, & Dede, 2010). The learner discovers a setting with the help of an avatar and then examines and solves a problem which is based on the particular MUVE (Dede, 2007). Multiple participants can contest in a MUVE representing different avatars, and can enter a simulated virtual world, where they can network and collaborate with digital artefacts, and can communicate with other avatars. During collaborative learning activities with other avatars, each student trails the inquiry process and tries to solve the encountered virtual problem. The students as avatars can utilize e-mails, skype, instant messaging, social media and blogging to interact with other learners (Warren, Barab & Dondlinger, 2008). These activities engage and connect students in different perspectives of inquiry like making observations, formulating hypothesis, scanning evidence, planning, and conducting investigations, testing hypothesis, and making inference along with findings. Multi-User Virtual Environment are devised to particularly simulate realistic and valid scientific inquiry through letting students employ the relevant technology and operate like scientists (Ketelhut, Clarke, Nelson & Dede, 2010).

2.14 Single National Curriculum (SNC)

The recent curriculum reforms were launched under the political vision of “One Nation-One Curriculum”. The intention propagated was to overhaul and restructure the education system by implementing uniform education system and promoting social equality throughout the country. It advocated to implement same curriculum, uniform medium of instruction and assessment in an attempt to provide equal learning opportunities to all the children hailing from different socio-economic background (Henna, 2021; Abbas, Basit, Akhtar, Mehmood & Nazim, 2022; Malik, Batool & Mahmood, 2023). Single National Curriculum established minimum standards and

benchmarks for learning that each student must accomplish in a specific subject at a particular grade. SNC was declared as a “living document” which is open to revisions and is accessible on the official website of “Ministry of Federal Education and Professional Training (MOFEPT)” along with its vision, key considerations, standards and benchmarks, development process, stakeholders involved and content of the curriculum. The stated goals in SNC for science education reflect a comprehensive and forward-looking approach that can foster scientific literacy among primary level students. Each goal features a particular aspect of science education that contributes to the holistic development of students as life-long learner and nurtures their ability to engage in scientific and technological literacy. It is also available in subject-wise format coupled with the guidelines for the users and expectations to be covered.

2.14.1 The Process of Single National Curriculum (SNC)

One of the main considerations while formulating the SNC was development and nurture of a 21st century learner that should be knowledgeable, creative, critical thinker, balanced yet reflective, globally aware, and digitally literate. In this context, the National Curriculum Council (NCC) of Pakistan involved more than seventy subject experts from across the country for the preparation of the National Curriculum (SNC). Those experts made suggestions regarding the basic structure of the National Curriculum and its implementation through consultative processes and conferences at the provincial and federal level. The curriculum outline developed was approved in consultation and consensus with all the provinces/stakeholders. In the preparation of the national curriculum, the curriculum of international educational institutions has also been compared and evaluated that include curriculum of Singapore, Malaysia, Indonesia, and Cambridge.

In April 2021, with the start of new academic year, the first phase of the nationwide implementation of the uniform national curriculum was announced, i.e., a curriculum for "Class

Pre-I to 5th class". In the second phase, curriculum for elementary classes (grade 6-8) was developed and implemented in 2022. The third and final phase of the national curriculum, the curriculum for grade 9^{th} -12^{th} is being implemented in the country from the academic year 2023. General science curriculum and later a model textbook as per curriculum guidelines was prepared by the Federal Government of Pakistan to teach General Science. Key considerations in developing the curriculum and textbook content were needs and requirements to equate the world views and according to the demands of our culture and social set up. The curriculum and the subsequent textbook were provided to provinces, private schools and madrasas and they were given autonomy to add or change the subject matter while remaining within the periphery of the national curriculum. The idea of this uniform National Curriculum was that all children living in any region of the country and studying in any school set-up whether public or private, even those studying in madrasas, will get the same quality of education through same curriculum content. The government's philosophy under the slogan of "One Nation-One Curriculum" was to end the social division and class disparity created particularly with reference to education, so that our children should be able to get the same quality education and adopt the same mindset.

2.14.2 Single National Curriculum in Subject of General Science

The key contemplations stated in the preface of general science curriculum were highlighted as international commitments, global trends, adherence to Sustainable Development Goals (SDGs), shift from rote learning to activity based learning, life-skill based education, project based learning, use of information and communication technology and inclusion of 21^{st} century skills together with evolving challenges of modern era (MOFEPT, 2020). The content of science focused on creative and critical thinking of students through student-centered and activity based teaching methodology (Abbas, Basit, Akhtar, Mehmood & Nazim, 2022). Inclusion of constructed response

questions, weblinks and projects leads to target student' critical thinking and nurture their creative thinking abilities. Waheed, Gilani and Rabia (2022) compared the contents of general science curriculum 2006 and 2022 and found a considerable gap in terms of concepts regarding scientific knowledge, methodology and particularly in terms of integration of technology in each chapter of science. However, almost every research conducted on SNC recommended that these curriculum reforms alone are insufficient to bring fruit instead demand serious shifts in teaching methodologies and call for subsequent alignment in teachers' training coupled with appropriate placement of necessary resources (Henna, 2021; Abbas, Basit, Akhtar, Mehmood & Nazim, 2022; Malik, Batool & Mahmood, 2023; Waheed, Gilani & Rabia ; 2022).

2.14.3 Goals of Single National Curriculum

The Single National Curriculum (SNC) places a distinct emphasis on fostering scientific thinking and nurturing science processes among young students. The most pivotal theme described in these newly induced educational reforms is the promotion of scientific literacy and endorsing active learning spirit . The curriculum explicitly underscores the inclusion and integration of "Life Skills Based Education (LSBE)," drawing inspiration from the curriculum model being followed in Malaysia. SNC prioritizes and line up the cultivation of imaginative and critical thinking skills, aligning it with the principles of Life Skills Based Education. LSBE approach seek out to support students' creativity and innovative skills by providing them with the intellectual tools needed to navigate the challenges of rapidly changing contemporary world. Learning from the curriculum of Malaysia, United Kingdom and Singapore, Single National Curriculum endeavors to deliver a well-rounded and globally informed learning experience for our students, fostering the young generation to adept the scientific knowledge and the essential life skills which crucial for their holistic development.

2.14.4 Strands, Standard and Benchmarks of Single National Curriculum

The introductory pages of Single National Curriculum (SNC) features its commitment to address the needs and necessities of 21st century, with particular emphasis on higher order thinking skills and international educational trends. The preamble stresses the inclusion of Information and Communication Technology (ICT) as one of the paramount considerations during the development of SNC. Likewise, it explicitly references the enclosure and integration of "Life Process skills" within the wider framework of 21st century skills. The inclusive vision of SNC extends beyond national boundaries, aligning Pakistan's recent international commitment to the Global Partnership for Education (GPE, 2020) and the execution of Sustainable Development Goals (particularly SDG 4.4 and 4.7, emphasizing on quality education and skill-based education). In essence, SNC echoes a national enthusiasm and dedication to international standards and emerging advanced educational paradigms.

An overarching objective of SNC is to empower young learners with the necessary skills and values to navigate the progressing challenges of 21st century. The genesis of SNC involved a sequence of workshops and conferences at the national level, with an exclusive thematic focus on Sustainable Development Goals (SDGs), creative and critical thinking, and Life Skill-Based Education (LSBE). Additionally, specialized attention was given to the General Science Curriculum by aligning it with international standards of 21st century. The goal of upgrading the General Science Curriculum was explicitly asserted as the cultivation and promotion of higher-order thinking skills among young students, emphasizing traits such as imagination and curiosity, inquiry, problem-solving and critical thinking. Fostering curiosity along with sense of wonder is fundamental to engaging students in scientific exploration. Likewise, Inquiry-based learning encourages active participation of students and fosters deeper understanding of scientific concepts.

SNC advocates that empowering students with the capability to employ scientific knowledge and technological tools in real-world scenario tends to enhance not only their problem-solving skills but also supports the practical implication of science in daily life.

The document of SNC recognizes the fundamental and crucial role of scientific method and inquiry in science education. Furthermore, SNC acknowledges that these science processes skills are not only significant to science education only but are inherent in almost every decision-making aspect of our lives. SNC in subject of General Science emphasizes that the innate human curiosity leads to applicability of these processes and skills in solving everyday problems. The prominence of problem-solving, innovative and critical thinking in SNC and a particular emphasis to cultivate higher-order thinking among students reflects a forward-looking approach to 21st century education. SNC contemplates a progressive approach that recognizes and endorses the significance of preparing students with futuristic plan to utilize the opportunities and face the challenges of rapidly changing world.

2.15 Integrated Curriculum

Integrated curriculum can be considered as the best approach encompassing range of diverse practices, that falls somehow amid the traditional distinctive content areas and the skills. The National Council for Teachers of English (1935) as quoted by Drake & Reid (2018) defined integrated curriculum as: “The amalgamation and merger of all the content areas and the relevant experiences”. The consideration of integrated curriculum as a continuum, and as diverse segments of curriculum mixing is being illustrated by various researchers (Applebee et al., 2007; Drake & Reid, 2018; Mohr & Welker, 2017). They described the characteristics of such curriculum as where subjects transform from being separate and dissimilar, to become blended and mingled with some boundaries, the discipline combine and amalgamate in a way that their disciplinary discrepancies

are not very unique or evident. Nevertheless, with all these diversity, research has gleaned three distinct mutual features of integrated curriculum which are: Importance of the 'realistic world,' authenticated linking among the subject areas, and mediation of subject matter with the students. However, some researchers pronounced and related curriculum integration to the 'factual-realistic world' in footings of serious scrutiny of societal problems that include actively preparing the individuals to take part and contribute in the democracy (Applebee et al., 2007). Furthermore, some curriculum experts considered integrated curriculum as an instrument to employ the classroom practice to 'real world' and purely reproduce it as it is. Drake & Reid (2018) supported and expressed that: "Our world is constantly transforming so the education system must be modified in response to these changes. As we are living in an interdependent and interrelated global village, the knowledge must be presented as intersected and inter-reliant, and this leads to authenticated and reliable ties among the content areas. The literature described integrated curriculum as the most distinct fiber woven throughout and has the opportunities to narrate, correlate or blend the subject matter of one field with the other one. In actual fact, this is the essential and recognized key for the curriculum approaches that come under the umbrella and continuum of integrated curriculum. Three overarching classifications have been identified through literature that are normally referred in describing and making genuine links within content areas, for instance, interdisciplinary, multidisciplinary, and transdisciplinary. The difference between characteristics of multidisciplinary and interdisciplinary integrated curriculum methods is of deep connections and links, developed among their content areas, in addition to intentional insertion of 'real world' problems. The issues are kept intrinsically multifaceted so that the interdisciplinary approach appreciates the prerequisite to embrace multiple kind of knowledge and skills which are then "presented by various discipline areas, and among them strong and inter-

related connections are made" (Draghicescu et al., 2013). On the other hand, multidisciplinary integrated curriculum commonly retains the demarcation among various disciplines. The interdisciplinary methods may initiate to obscure the separating boundaries that conventionally detach one subject area with the other (Drake & Reid, 2018). In actual fact, an interdisciplinary emphasis of curriculum may result in the expansion of a new subject discipline via curriculum reorganization. Multidisciplinary approach generally tend to build thematic associations among traditionally split subject areas (Drake & Reid, 2018). Through the multidisciplinary approach, a subject theme is counted from the perception of multiple fields, thus offering more clearness and the prospects for in depth understanding of subject by the students (Draghicescu et al., 2013). Such thematic organization are identified as "correlation" that can be trivial and of casual consideration as compared to related subject materials in other disciplinary areas" (Drake & Reid 2018). However, some researchers argued that the plotting and organization of thematic sections among these disciplines and the curriculum integration are different things. Still, multidisciplinary planning in the literature often discovers its place within the integrated curriculum. All these three approaches developed for integrated curriculum may appear at the extreme of the continuum, closer to the conventional subject-wise arrangements. However, the literature labeling multidisciplinary approach does not incorporate compromise on reality nor does it openly express the concern for the pragmatic world. Yet, school can take multidisciplinary approach as an initial step towards adoption and implementation of integrated curriculum. (Draghicescu et al., 2013). The transdisciplinary approach to curriculum is among the most closely connected with the real life practices, appear at the other end of the integrated curriculum continuum, farthest from conventional discipline-oriented demarcation of the curriculum. Drake and Reid (2018) highlighted that "Teachers are supposed to manage and consolidate the curriculum around

concerns and questions of students ". The transdisciplinary curriculum is also labelled as "unstructured core" (Mohr & Welker, 2017). It is the curriculum in which both students and teachers are made to work jointly for constructing curriculum units that are extracted from different disciplines. However, Draghicescu et al., (2013) concerned that this approach of developing the curriculum should not be completely student-driven, and in this regard the knowledge, expertise and skills of teachers cannot be challenged. Employment of transdisciplinary approach to the curriculum development involves lot of flexibility and the method can be exhausting for the teachers as curriculum integration of this kind implicates careful planning well before execution time. Furthermore, the operation and implementation of integrated curriculum in the classroom may encounter certain challenges that can be exhausting and troublesome for the teachers (Drake & Reid, 2018). Irrespective of the approach adopted for curriculum integration, it is very crucial to consider that curriculum should encompass valid and authentic connection to the actual world that should be meaningful for the students instead of tying superficial connections and overlap This tend to allow students to create and develop eloquent connections between the actual world and the subject areas as per their own interests and developmental needs. One of the main flaw of the traditional curricula is that they do not train students as effective decision makers as far as their learning is concerned and students do not feel any ownership and association with the traditional curriculum. Indeed, there is a lot of role and responsibility on part of talented and devoted teachers that make exertions to generate opportunities and occasions for students' participation so that they can feel ownership . It also give a good voice to the thought of students as they utter what they need and what is suitable and fitted for the young people, instead of mere assumptions and speculations. This is the essential element of the integrated curriculum that it recognizes and establishes the role and place of students as active participants. The ownership offered by the

integrated curriculum also expands students' commitment towards their own learning. Integrated curriculum clearly proposes the inclusion of students' voice which is needed for the holistic development of 21st century skills.

2.16 Integration of Technology in 21st Century

The technology advancement has opened various possibilities and also enhanced and generated lot of changes and modifications in the society and employment market. Now the moderately stable industrial society is converted into a dynamic and vibrant knowledge based society as now focus is on the knowledge creation and exchange of information instead of yielding typical products. The job opportunities with mundane production work are reducing now. On the other hand, the jobs that demand decision making, flexibility, critical thinking and problem-solving abilities are quite sought after. Trilling and Fadel (2009) named this shift as the innovation economy. The innovation economy drive to breed and create new ideas via collaboration, technological application, exchange of information, and entrepreneurship. This is not only applicable at the individual worker level, but in the same way true for the companies and businesses. Thriving corporations and firms can be described and exemplified by their prompt response towards new advancement and progress, their flexibility, intensive cooperation and collaboration, innovation, and adaptability, both within and outside their organization. The expanding possibilities of technology has a radical impact on our daily lives. Todays' society is saturated with technology, besieged by abundance of technological media that can provide us various opportunities to communicate and exchange different information. At this moment, the old media of information like newspapers and television have become relatively obsolete and newer media such as Internet and supplementary Apps and opportunities like social media are taking leads. This is because these new-fangled media are easy to access and user friendly. Here, the media operators can also become

media creator and designers, which is why the count of new web logs, posts and reels, videos, tweets, and information shared through Twitter, Facebook, Instagram, Linked-In, and WhatsApp persistently expand. Furthermore, in addition to technology, globalization also playing a key role in our world. Technology has helped and facilitated the communication beyond the borders and now people collaborate with friends and colleagues outside their frontier. World is moving and shrinking towards global market, which is making us largely dependent on expansions beyond the borders. This also enables employees and citizens to discuss and share their opinion and narratives on complex social issues, for instance related to climate change, and deliberate for their innovative solutions. This provide individuals with opportunities to contribute in international associations and deal with cultural diversity. Increasing individualization also influences the social and personal lives of people.

2.17 Organizations that Endorse 21st Century Skills

Various significantly influential leading international organizations promote inclusion and integration of 21CS in the education mainstream. Among most notables is the "Partnership for 21st Century Skills (P21)" that proposed to help educationist and practitioners to amalgamate skills in traditional teaching learning process by integrating with core subjects. P21 presented a comprehensive yet holistic framework for learning in 21st century by blending content knowledge of core subjects with skills, literacies, and expertise (P21, 2013).

Then University of Australia, Melbourne in collaboration with Intel, Microsoft and Ciso launched a project; "Assessment and Teaching of 21st Century Skills (ATC21S)" that aimed to focus on describing and categorizing sought after skills for 21st century and to device ways/tools to measure those skills. It advocated integration of 21st century skills in classrooms by inducing collaboration, problem solving, critical thinking and ICT (ATC21S, 2013). The main purpose was to support

development of cognitive and social skills of students which are necessary for a collaborative problem solver.

Likewise, Organization for Economic Cooperation and Development (OECD) that launched, "Education 2030: The future of Education and Skill", a program to facilitate partner countries in developing these skills and competencies that would be required in 2030. Skills, values, and attitudes are considered as main pillars of OECD learning. It aims to facilitate student to navigate their potential and shape their future with dignity and respect (OECD: Education 2030;2018).

2.18 Theoretical Background of 21st Century Skills

UNESCO identified learning as a vital factor to counter the current and future challenges of 21st century. The commission under supervision of Jacques Delor in 2013 emphasized the needs of youth and individuals for acquisition of necessary skills and competencies under "lifelong learning" (Delor, 2013). It presented a framework for lifelong learning which was based on four pillars. These four pillars of skills and competencies comprise of cognitive and psychomotor competencies, socio emotional competencies and behavioral competencies. Cognitive skills are based on knowledge and understanding that includes awareness of local, communal, national, and international issues. Socio emotional skills includes self-regulation, empathy, relationship skills, respect for diversity, maintaining good relationships, sharing values, responsible decision making and emotional regulation. Behavioral skills include conflict resolution, responsible and effective response required for promotion of peace in region and at national and international level (NEQMAP, 2018).

2.19 UNESCO's Pillars of Life-Long Learning

First pillar of lifelong learning framework presented by UNESCO is "learning to know or learning to learn". Rapid scientific inventions, excessive use of information and advanced technology made

the world pretty dynamic. It is quite imperative now to have up to date information and understanding about the new paradigms of the constantly changing world. For educating young children it is essential to raise their interests in new inventions, discoveries, developments and instrumentalizations. Only a person with latest knowledge can foresee upcoming future and prepare himself for the related challenges. Such attitude and information can support him to understand the complexities of life and sustain in competitive world.

UNESCO's second pillar is "learning to do". It stresses the acquisition of work specific skills and competencies necessary for employment and decent work in the competitive world. Now, it has become very important to be innovative and creative for doing smart work in collaboration with work group. It encourages empowering a person for global opportunities to contribute and become productive worldwide. Third pillar of learning is "learning to live together or learn to live with other". It is the learning about human rights, cultural and ethnic diversity, democratic participation, excluding bullying, intercultural and intracultural respect, celebrating achievements, principals of global citizenship, ethical understanding, dealing with diverse environment, openness to accept others, etc.

UNESCO fourth pillar is about "learning to be" which endorses holistic development of a person. It includes nurturing skills of logical reasoning, self-analytical and self-awareness of a person. It is learning about the strengths and weaknesses of a person, community, or a system. Learning to be includes preparation of individuals throughout their life journey to nourish and supplement "learning to learn", "learning to do" and "learning to live in the world", keeping potential of all individuals along. UNESCO pillars of education are presented to reshape the system and coping with the futuristic challenges. These pillars demand reforms in educational policies, curricula,

pedagogies, teacher trainings, teaching strategies and assessment tools/methods keeping in mind notion of social dimensions and co-existence (Hamid & Mehmood, 2020).

2.20 Additional Frameworks for 21st Century Skills

Salas-Pilco (2013) arranged different frameworks for 21st century skills in a chronological order to present emergence and evolution of these skills.

- Jacques Delors (1996) highlighted the significance of humanistic approach to reshape education. His report established the "four pillars of learning" and presented the idea of lifelong learning.
- Organization for Economic Cooperation and Development (OECD) established Definition and Selection of Competencies DeSeCo in the era of 1992 to 2003. This effort described skills and competencies for youth and adults necessary for 21st century.
- In the period of 1998-2002, The International Society for Technology (ISTE) constituted National Education Technology Standards for Students (NETS.S). It presented a list of indicators that includes what kind of information youth and children should know, what students should be capable of doing to live in a productive manner in this rapidly changing world. The drive was to present guidelines for the students about the necessary skills required to face upcoming challenges of life.
- In 2002, Lisbon Council of European Union presented key competencies essential for lifelong learning in 21st century.
- In 2003, enGuage, a web-based framework advocated the prominence of 21st century skills by using digital technology effectively to enhance the learning of students and for their future workplace readiness. It was developed by Metiri Group in collaboration with

Learning Point Associates for fostering 21st century skills among students, teachers, and managers.

- In 2005, Organization for Economic Cooperation and Development (OECD) published its findings on governance in 21st century highlighting what kind of decision-making will be required in the emerging global society. It underscored the issues of classroom teaching-learning and ways of assessment in context of 21CS in OECD countries.
- In 2009, "Partnership for 21st century skills (P21)" were offered by United State department of education alliance with renowned business organizations that endorsed inclusion 21st century skills in students' learning by amalgamating them with the 3Rs of core subjects (reading, writing and arithmetic) in K 12 education. P21 is a national organization that work in collaboration with various private sector companies like Apple, Dell, Microsoft corporation and National Education Association (NEA).
- In 2010, a framework of necessary competencies for the young learners was defined by Ministry of Education, Singapore.
- Learning Metric Task Force (2012) highlighted the need of quality education to meet the ambitions of SDG 4. They underscored the significance and worth of learning 21st century skills that may accelerate progress of quality education.
- In 2013, Binkley et al. presented a framework of competencies and skills with name "Assessment and Teaching of 21st Century Skills (ATC21S)" at Melbourne University, Australia. It was an international project sponsored by Intel, Microsoft, and Cisco. The aim was to state explicitly clear definitions of 21st century skills for the purpose of designing relevant and novel assessment methods of students' assessment.

- Care (2016) presented set of skills which are considered as essential for survival in a swiftly changing digital world in a comparative study. In that study, different frameworks of 21st century skills were compared. Most prominent frameworks were "ATC21 (Assessment and teaching of 21st century skills)" initiated by Binkley et al., "UNESCO's four pillars of education" by Delors, "P21 (partnership for 21st century learning)" for identification and definition of twenty first century skills or competencies by USA, "Lisbon European Union Commission reference framework" for defining 21st century competencies presented by Gordon et al., and then OECD countries gave a set of skills as "DeSeCo (Definition and Selection of Competencies)" for learners of new millennium (Hamid & Mehmood, 2020).

Almost all the 21st century skills framework are consistent in term of mentioning the skills that should be made part of curriculum. These frameworks differ only in their focus, categorization of skills within the main competencies/skills and importance given to any set of skills (Dede, 2010). For instance, P21 and OECD are broader frameworks that offer conceptualization of 21st century skills in key categories and groups in which further skills can be placed. The ATCS framework focusses on assessment while EnGuage and UNESCO emphasis more digital literacy and inclusion of technology in teaching learning process.

2.21 UNESCO's E2030 Agenda

Furthermore, United Nations' Educational, Scientific and Cultural Organization (UNESCO); presented a UN resolution with name; "E2030 agenda: Education and skills for the 21st century". The consensus was made to ensure quality education that can empower youth with knowledge, necessary skills, and values to enable them to live a dignified life and empower them to contribute to their society. Most recently, United Nations' initiative Global Partnership for Education (GPE, 2020) emphasized the significance and relevance of 21st century skills for young people for success

in this rapidly changing global economy. The partnership decided to play its part in patronizing developing country partners (DCPs) to induce 21CS into their education system. It aspired that the young people ought to be prepared and furnished with these necessary skills in order to become productive members of their societies, countries and ultimately globally (GPE;2020).

In 2009, UNESCO established Education Research Institute Network (ERI- Net) with the aim to enhance collaboration among research institutes, in order to deal with education policy related issues. ERI- Net deals with the education sectors from kindergarten education up to the higher education level. It takes interest in technical and vocational education as well. It is working in collaboration with UNESCO Bangkok. Till now, it has highlighted a lot of educational issues. In 2010, it has explored the financial crisis on higher education. From 2013 to 2015, it has done researches to integrate 21CS in education sector policies and practices in the constituent territories of the Asia Pacific region (Asia Pacific ERI-Net, 2018).

In 2012, ERI-Net named these skills as "Transversal Competencies" and defined these skills as the set of skills, values and attitudes required for the learner development and makes him capable to adopt change. ERI-Net drafted a framework for defining these competencies. It described these in six broad domains. These domains are described in the table below.

Table 2.2 UNESCO's framework of 21st Century Skills

Domains/Area	Significant skills, dispositions, competencies, attributes, and values
Innovation and critical thinking	Originality and creativity, reflective thinking, entrepreneurship, applications skills, resourcefulness, reasoned decision making
Social/interpersonal skills	Organizational and management skills, communication skills, collaboration and teamwork, affability, empathy, and kindness

Self-management/ Intrapersonal skills	Self-awareness, self-discipline, self-motivation, productivity, ability to learn independently, self-respect, adaptability and flexibility, resilience, perseverance, determination, integrity
Global citizenship	Global awareness, proactive in interaction within their community, acceptance, sincerity towards peace and harmony, social responsibility, respect for miscellany, ethical understanding of diversity, conflict management and resolution, democratic participation, respect for the environment, sense of belonging towards the globalized world.
Information and media literacy	Capability to gather and analyze information to make informal judgements with the support of ICT (Information and Communication Technology), competence to evaluate the obtained information critically. appraise media content and righteous usage of ICT.
Physical health, religious values	Gratitude for healthy living, reverence for religious values of all.

(Adopted from Kellaghan & Greaney, 2001)

2.22 21st Century Skills and Sustainable Development Goal 4

Education 2030 agenda on sustainable development has been put forward to safeguard the effective implementation of Education 2030. The agenda for sustainable development emphases education as an important mean to accomplish the targets of other SDGs. Education is considered as a significant key that can reinforce the growth and economic sustainability of any country. SDGs are the global goals to ensure sustainable development in consensus to meet global challenges.

Sustainable development Goal (SDG) 4 on education comprises targets on skill development for a decent job through inclusive, equitable and quality education. SDGs target 4.4 and 4.2 emphasis on attainment of skills for sustainability. SDGs target 4.4 states: “Till approaching 2030, considerably increases the figure of youth and adult population with appropriate related skills that includes both vocational and technical skills for employment, reasonable and decent occupations, and entrepreneurship.”

One of the proposed targets to ensure quality of education mentioned in SDGs target 4.2 is: “Till approaching 2030, countries should safeguard that all their learners must gain the necessary knowledge and skills required for endorsement of sustainable development, that includes, education for sustainable development along with supportable living and lifestyles, civil rights, gender parity, flourishing an ethos of harmony and nonviolence, global citizenship along with respect towards diversity and cultural multiplicity and contribution towards sustainable development.”

In 2012, third Asia Pacific Meeting on Education 2030 (APMED, 2030) was being conducted in Bangkok that presented regional recommendation for achieving Sustainable Development Goal 4.2. The four prominent action areas emphasized in the meeting were implementation of SDG 4.2 through education sector reforms. The highlighted areas were classroom teaching-learning, teacher training and development, curriculum, supervision and accountability, provision of learning resources and learning enhancement through modifying assessment. (3rd Asia- Pacific Meeting on Education 2030, 2012).

2.23 Contribution of UNESCO for Inclusion of 21st Century Skills

From 2013 to 2015, three studies were made by UNESCO under initiative of Educational Research Institutes Network (ERI-Net) in the Asia Pacific region. These researches were conducted to

evaluate the extent 21st century skills are focused in the educational policies of partner countries. These researches also focused to appraise how these countries are working to teach, learn and assess these skills (Hamid & Mehmmood, 2020).

First study (Phase 1) was done by ERI-Net on TVCs in 2013- 2014. The study defined 21st century skills under six domains in a comprehensive framework. This study was carried out in ten countries of the Asia Pacific region to underscore the implementation and growing interest of countries towards 21st century skills. It presented three ways to integrate 21CS in the regular curriculum. It was being suggested that the 21CS can be presented as specific subject with specific goals and learning outcomes. Second method was to introduce 21CS in the conventional education mainstream across the prime/core subjects as traditional school subjects. Third way was to make inclusion of 21st century skills a part of school environment; as extracurricular/cocurricular activities. The conclusions of the study exposed that many of these countries are emphasizing on 21CS in their national policy for education, curriculum, and classroom practices but there is no financial provision in their education sector plans that can flourish 21st century skills (UNESCO, 2013).

Second study (Phase II) was conducted as supplementary study to phase I. Phase I study was being carried out at macro level i.e., at national level while phase II study was carried out at micro level i.e., at school level. Th study pointed out that a change is desired for inclusion and implementation of 21st century skills in education. For this change, teacher must be prepared and proficient with new skills and teaching strategies for inclusion of these skills in the classroom. Here, the role of teacher is considered very significant to implement educational reforms along with these new skills. Furthermore, the study opened the door for the future research that can explore what type

of competencies can assist a teacher to exhibit and translate 21st century skills in his classroom practices (UNESCO, 2015).

Third study (Phase III) explored what kind of reforms in professional development of teachers can be helpful in making them competent enough to demonstrate and transmit 21st century skills to the learners of twenty first century. This study exposed that teachers were sufficiently informed about the significance of 21CS. They were completely convinced and in support to make-shift in their conventional teaching and learning strategies that can reinforce integration of these skills in the classroom practices. However, there are a lot of challenges that a teacher is facing to employ 21CS in his teaching tutorials. This study exposed that many countries have 21st century skills as the part of national education policy and curriculum but a lot of challenges are there to implement the policy aspirations and the curriculum. These challenges include lack of clear knowledge and guidance to teach 21st century skills as mentioned in curriculum, lack of professional competence of teachers, lack of system support to teachers to teach and practice these skills, etc. (UNESCO, 2015).

2.24 UNESCO' Initiative for Assessment of 21st Century Skills

In 2013, UNESCO launched "Network on Education Quality Monitoring in the Asia Pacific" (NEQMAP) to refurbish education system and to it more robust and powerful. NEQMAP focuses on student learning assessment to improve quality of education. Assessment can be used as a mean to monitor the quality of learning and to guide the student learning outcomes. The network covered the learning assessment of the countries in the Asia Pacific region by providing support in research, capacity development and related activities (Hamid & Mehmmood, 2020). During its 6th annual meeting that was held in 2018 with the aim to promote inclusion and equity through quality teaching and assessment. The two main concerns associated to teaching and practices of the 21st

century skills which were common among countries, were described. The first issue stated that there is a need to redefine the competencies as mentioned in SDG 4.2. Further, there is a need to orient these skills through curriculum, teaching strategies and assessment at national level. Second issue state that there is misalignment and a very feeble nexus among curriculum, teaching, and assessment (NEQMAP, 2018).

2.25 Reforms required for 21st Century Skills

Scott (2015) conducted a study with UNESCO to reconnoiter, "Why 21st-century learning must change"? He emphasized that there is a wide gap between what schools are doing and what employers want. Unfortunately, schools are unable to cater the needs of the stakeholders. They are preparing children to face upcoming complex challenges of the real world. Schools are not well equipped with necessary knowledge, competence, and services to fulfil the stresses and challenges of the labor market. The industry complained that their workers lack skills which are expected from them and there is the need for training or guidance to work appropriately. The shift in the employment market along with shortage of skills demand a change in learning. A significant gap is predicted in demand and supply of skilled workforce in near the future. Changing global market, advancement in technologies, globalization, international competition, online banking, online marketing and environmental changes, natural disasters, unexpected weather changes, political and economic challenges are all the aspects of this century. A person who is able to face these challenges can survive in this world. The ability to move in this dynamic century demands the acquisition of necessary skills along with knowledge. It is being suggested by Scott (2015) that teachers can assess the skills of their pupils and can use that information as prime data to identify and address their shortcoming and learning difficulties. Teachers can design need-based learning activities that can target the deficiencies of students and can benefit them to attain a deeper and

clearer understanding of concepts. Ongoing and continuous and formative assessment is considered as the most efficient and effective approach for the purpose as it enables teachers to refine their methodologies and teaching strategies within same lessons for optimum welfare and development of students (Hamid & Mahmood, 2020).

2.26 21st Century Skills and Education for Sustainable Development

In 2002, UNESCO Bangkok, presented guiding rules for the development of "Education for Sustainable Development (ESD)" that can help implementation of ESD at the national level focusing on the Asia Pacific region. Every country can make goals for ESD by keeping in mind its own national goals and priorities. On the bases of these priorities, changes can be made in national and regional policies that lead to the implementation of these policies. In order to re-orient the education according to changing world, in United Nations General Assembly (2002) the era of 2005- 2014 was declared as a "Decade of Education for Sustainable Development" (DESD). ESD was also linked with "Education for All (EFA)" and MDGs as all are the programs under DESD. EFA is broader in scope than ESD. EFA emphasized equality in education that has a world-wide concern for all the developing and underdeveloped nations in term of access (Hamid & Mahmood, 2020). On the other hand, ESD give provision to set goals and priorities as per national interests of every partner country. In 2005, UNESCO Bangkok chapter for Asia Pacific region directed a situational analysis to know the current situation and the extent to which policies of countries integrated with ESD. It was explored that the countries like Philippine, Vietnam, Malaysia, Palau, Australia, China, Indonesia, Iran have developed their goals and priorities for ESD. This report also highlighted the monitoring and assessment of the progress of implementation of skills that can lead to implementation of ESD. Furthermore in 2009, another conference was held in Germany

in which action plan for execution of ESD was put forward. The plan described steps to implement Education for Sustainable Development (ESD) in partner countries.

2.7 21st Century Skills and Global Partnership for Education

United Nations' recent initiative: "Global Partnership for Education (GPE, 2020)" is a multilateral enterprise that funds entirely for the development of education in the world's most deprived and under privileged countries. The partnership intensifies the skills and musters the resources of many countries for supporting developing and disadvantageous countries to meet challenges and produce results within their systems. 21st century skills also denoted as "soft", "non-cognitive", "transversal", "whole child development", social-emotional" or "transferable" competencies or dispositions in education. GPE is helping and assisting developing country partners (DCPs) in implanting 21CS in their education mainstream and now these skills are an area of increased focus in the international education discussions. GPE emphasizes enhancing learning outcomes of students and on learning assessment reforms in its Developing Country Partners in their current strategic plans (GPE, 2020). The stock takes of GPE suggest that there are gaps in implementation of 21st century skills at the system level. GPE suggests that there is a gap and disconnection between countries' education plans, where 21st century skills are featured at stronger position; and less progress is seen in systemwide implementation. The misalignment may be caused due to different perceptions in context of 21st century skills in developing countries about lacking knowledge of how these skills can actually be developed. Therefore, there is a need to conduct a holistic study covering all the components of education system in order to identify the loopholes and further opportunities for the integration.

21st century skills hold a strong rationale in various studies regarding their knowledge and perception of stakeholders, their assessment and development of one or more skills mostly by

employing project-based learning. Most of the frameworks on 21st century skills describe definitions and needs for these skills. But very few deals with the practical implementation, integration, and assessment of these skills. Most of the studies in the realm of 21st century skills are being conducted in chunks, focusing on any one aspect. Literature reveals that the implementation and development of these skills has three crucial challenges: integration of 21st century skills through curriculum, prerequisite for professional development of teachers and involvement of education stakeholders (Voogt & Roblin, 2010). Hence, there emerged a need to conduct an all-inclusive investigation that can cover all the components of education system to provide a holistic view of the entire system including recent curriculum reforms along with teachers' pedagogical and assessment practices. The study can help to highlight the gaps in implementation and misalignment among the elements of our education system.

Voogt & Roblin (2010) concluded that all the frameworks on 21st century skills converge on certain common skills that include originality and creativity, collaboration, problem solving and critical thinking, ICT literacy, communication, citizenship, and globalization. However, the grouping/categorization of these skills along with different terminologies make it quite vague. It creates confusion and hinders integration and development of these skills. However, leaving this debate aside, 4Cs (creativity, critical thinking, collaboration, and communication) are among the most cited and well-established skills which are endorsed by all the 21st century frameworks since 2003. Partnership for 21st century (P21) conducted research and identified these skills as deep learning competencies and named them as 4 Cs for 21st century learning. They are recognized as "super skills" (Kivunja, 2015). 4Cs are renowned as learning skills essential for any career. These are the foundational skills that are advocated to be immersed with the common core standards (P

21, 2009). 4 Cs are asserted as shorthand for all the skills needed for success in school, career, and life.

Secondly, Information, Communication and Technology (ICT) is also being acknowledged as core 21st century skill by various frameworks. In the second place, ICT is also considered as a support for the acquisition, development, and assessment of 21st century skills (Voogt & Roblin, 2010). Therefore, the study has delimited its investigation to integration of 4Cs (creativity, critical thinking, communication, collaboration) along with ICT as a tool for learning only.

2.28 Challenges for Integration of 21st Century Skills

Literature highlights that the integration and execution of 21st century skills have three main issues as mentioned in various frameworks:

I. Curriculum and classroom instruction

II. Professional development of teachers

III. Conditions and strategies for integration at school and national level

2.28.1 Curriculum and Classroom Instruction

Defining the role and placement of 21st century skills within the curriculum is the foremost controversy in the integration of these skills. The most important debate in this context includes their emphasis as core students learning outcomes and how to address these skills explicitly and directly in the curriculum (Dede, 2010). Many frameworks suggest that we can either add these skills directly to the prevailing curriculum as a novel separate subject (ATCS,2013) or these can be amalgamated as new content inside the conventional subjects (P21, 2009). However, European Union (Gordon et al., 2009) suggest that the 21st century skills should be integrated as cross disciplinary competencies within the curriculum to support the subject taught in school and also underpin acquisition and development of these skills. It is also being recommended that the schools

as learning organizations can transform the structure of conventional subjects for the acquisition of these skills (UNESCO, 2015). Though different approaches were recommended in different frameworks, yet almost all the frameworks acknowledge integration of 21st century skills across the school curriculum. Even these competencies are found to be integrated in the national policies of participating countries of European Union (Gordon et al., 2009) and OECD (Ananiadou & Claro, 2009). The main difference lies on the emphasis given to specific set of skills. Finally, it can be summarized that the 21st century skills should be stressed and embedded within the core subjects of curriculum and their cross disciplinary linkage should also be mentioned explicitly.

However, irrespective of different approaches recommended for integration, all the frameworks endorse that the inclusion of 21st century skills call for substantial and major reforms in curriculum. These modifications are not merely limited to structural changes that can make room for 21st century skills but include innovative methods of classroom instruction and assessment. European Union and P21 frameworks recommend that the integration of 21st century skills is best reinforced by certain pedagogical techniques that include problem-based learning, experiential learning collaborative learning, project-based learning, and most importantly formative assessment. Besides these innovative pedagogical approaches, many frameworks stress the powerful use of technology that can support students' learning and help them in acquisition of 21st century skills. In this context, Anderson (2008) quoted specific examples like use of videos/animations to understand a complicated concept, simulation to help students in critical thinking and problem solving and using technology to facilitate students' collaboration.

2.28.2 Professional Development of Teachers

The vital role of teachers as an executing agent of curriculum reforms is being acknowledged widely. The belief and attitude of teachers along with their competence and teaching practices are

the key determinants in the successful implementation of any innovations and reforms made across the curriculum (Dede, 2010). All the frameworks for 21st century skills recognized the key role and support of teachers required for integrating these competencies in schools. Furthermore, it is also anticipated that the teachers should not only facilitate students in the acquisition and development of these skills but should also possess and exhibit these skills (Gordon et al., 2009). Therefore, it is strongly recommended that the teachers professional development programs should be modified to address and develop the desired competencies in order to support effective and efficient execution of 21st century skills. In this respect two mutual recommendations are mentioned by many frameworks i.e., European Union, P21 and UNESO.

I- There is a need to nurture and develop teacher's competence and command on variety of innovative teaching methods.

II- There is a need to empower teachers for effective use of ICT that can assist students' learning.

Moreover, P21 emphasis the need of awareness being raised among teachers to comprehend the importance and significance of 21st century skills, how to cultivate and integrate them in their classroom pedagogies. For this purpose, teachers should be given the opportunity to witness the example, experience the activities, share their knowledge with the peer to find out the ways for the meaningful learning of these skills. UNESCO along with European Union recommends that the continuous professional development of teachers ought to be a continuous and enduring process that should also consider teachers' prestige and need for acknowledgement and recognition.

Despite of the fact that the teachers' professional competence and provision of sufficient support system, are considered as main challenges for integration and implementation of 21st century skills, still there is insufficient information regarding clear description of type of support required and

how it can be provided. Secondly, more emphasis is being placed on the development and refinement of teachers' knowledge of pedagogy and technology. But there is also a need to nurture teachers' subject knowledge and their abilities to teach from perspective of inter-disciplinary approach. Additionally, teachers should also be able to assess student's previous knowledge, diagnose their learning difficulties and shortcomings, and can identify their learning styles in context of 21st century skills. Lastly, the importance of formative assessment with respect to 21st century skills cannot be ignored. All these aspects put lot of expectations and pose many challenges for the teachers. In order to cope up with these challenges and to meet the expectations, teachers need academic knowledgeable and emotional support which is ignored in these frameworks.

2.28.3 Conditions and Strategies for Integration at School and National Level

Among all the frameworks, only P21 and European Union mention the conditions and strategies that can support and facilitate integration of 21st century skills. These frameworks have identified the main stakeholders and their desired role in executing these skills. Among these stakeholders are policy makers both at federal and state level, School leaders and administrators and the researchers. P21 also call for the public-private partnership while European Union stresses the active role and participation of teachers and international organizations. They further state that the implementation and integration of 21st century skills must consider the responsibilities and implication of these stakeholders. In this context, school leadership is considered as the significant factor that can support successful integration. Conclusively, all the frameworks agree that the effective integration of 21st century skills require multiple strategies at every level i.e., at national policy level, school level and in classroom practices along with active involvement of all the educational, public, and private stake holder. For this purpose, we need to sensitize the stake holders and should create awareness regarding importance and need of 21st century skills. There

is a need to stimulate and encourage collaboration among public-private partnerships in education sector. This can be done by organizing symposium and conferences to raise awareness among teachers and students.

2.29 21st Century Skills and Shift in Learning Paradigm

Care (2016) stated that education system which includes 21st century skills demand a shift in teaching learning process. There is a need to think out of the box about how student with different learning styles learns and how teacher teaches. There is need to introduce skill development programs for the professional growth of teachers and for the reformulation of curriculum. It is important to change the learning paradigm of traditional classroom environment; from teacher centered to student centered (Hamid & Mehmmood, 2020). Professional development of teachers can bring reforms in their teaching strategies, ways of demonstration and appreciation towards student participation. GPE (2020) is of the view that there are system level gaps for the inclusion and integration of these skills in developing countries partners (DCPs) that require system level reforms in curriculum, classroom pedagogies and assessment. Teaching 21st century skills is different from traditional teaching-learning as it is based on developmental pattern; where students and teachers mostly focus on memorization of facts and figures and to recall the subject matter. GPE further suggests that there is lack of understanding and knowledge among the developing countries partners regarding implementation and integration of these skills at system level. Countries need to include relevant activities in their education plans that can flourish 21CS along with implementation grants. It has been implied by the GPE report that though the developing countries partners (DCPs) along with international organizations like UNICEF, UNESCO and World Bank have undertaken substantial work to bring valuable reforms in their teaching learning system yet there are gaps for research particularly in the realm of school education for the

integration of these skills. There are gaps in term of translating and implementing curriculum reforms in the classroom. There is a dire need of effective and efficient use of resources/learning materials provided to include these skills in education mainstream. Restructuring in the professional development programs of teachers as a change agent is also a pre-requisite to assimilate and transfer these skills among students. It is also established by the GPE that despite all the initiatives and efforts made, there is a little research about how to incorporate and integrate 21CS in the mainstream; and how to promote their implementation at whole sector level.

2.30 Assessment for 21st Century Skills

All the frameworks for 21st century skills considered assessment as a critical component in context of their implementation. ATCS, European Union and P21 have recommended and mentioned some ways for assessing these skills. There are three mutual themes which are common in these frameworks:

i. Need for innovative assessment models and tools
ii. Types of assessment (how to assess these skills)
iii. Technology and assessment

Both ATCS and P21 acknowledged that the prevailing assessment models and tools failed to evaluate complex 21st century skills as they merely focus on measuring students' knowledge rather than their abilities to understand real life situations critical thinking and problem solving (Dede, 2010). Both the frameworks uphold that the current assessment system needs a shift. ATCS asserted that the important characteristic of assessment should be, "What and how to assess" and that should be linked to what students should know and what they should be able to do after their school. It further proclaimed that the assessment should be in alignment with the goals of 21st century skills. It should be responsive and adjustable to the new advancements. Assessment should

be based on performance and should be able to provide useful information and feedback for future improvement both for the students and teachers. Assessment should focus on cross disciplinary content and not on simple subject-based knowledge. Assessment should specify students clearly about the expectations made in term of achievement, not only in knowledge but in skills, values, and dispositions. Here, more focus is being given on formative assessment in order to improve classroom practices and also to provide feedback for refinement in both students and teachers. Second important component is diagnostic assessment that can help teachers in determining succeeding steps for students' advancement in learning. The purpose is to make sure that every student is progressing and learning need of every student are catered relative to curriculum outcomes. However, the most crucial and practical issue is to answer that, "Are our school-teachers prepare to carry out formative and diagnostic assessment?", "What are the demands of formative assessment?", "What sort of support system is required to adopt formative assessment in schools?", "Do teachers have sufficient professional competence to implement and assess 21st century skills?".

For the above-mentioned questions, first of all the type of need schools require for implementation of 21st century skills ought to be recognized. On the basis of these need, clear strategies should be adopted for the provision of required assistance and support. The assessment should be aligned with the level of students. It is recommended that the students should be implicated in the assessment process, for making self-assessment, and in peer assessment so that they can evaluate the quality and worth of their own tasks. Similarly, previous "good practices" should be used as starting point and shared with other teachers. Furthermore, support of technology can be utilized in constructing innovative assessment tasks along with measuring students' efficiency in using technology applications.

2.31 Issues to the Implementation of 21st Century Skills

To prepare and accouter our young generation for success in the new millennium of 21st century, transfiguration of the whole prevailing education system is required. There are several barriers and obstacles to the accomplishment of 21st century skills in our educational institutes. This segment tends to review the issues and hurdles that our educational institutes face regarding implementation of 21st century skills. These issues and barriers can be encompassed as (i) curriculum and instruction (ii) Professional development and (iii) Strategies and conditions for the enactment of 21st century skills in educational institutes.

2.31.1 Curriculum and Instruction

Curriculum and instructional pedagogies tend to offer students both knowledge and necessary skills and are considered as among the most substantial columns of any education system. Curriculum and the subscribed pedagogies also supplies students with a consolidative approach towards success. Dede (2010) endorsed the significance of both curriculum and instruction and further persuaded them as one of the most debatable concern as far as role and placement of 21st century skills in considered within the curriculum. Furthermore, Trier (2002) implied that the dialogue regarding placement of 21st century skills may be convinced by encompassing them explicitly and directly within the curriculum during the curriculum development process. Similarly, Voogt and Roblin (2010) detailed that there could be several numbers of methods and approaches as given by various renowned frameworks for integration of 21st century skills through curriculum reforms. Yet, all these frameworks for 21st century skills suggested that the 21st century skills demand substantial and significant alterations within the curriculum. Among these crucial modifications, the most significant are concerned with the restructuring of the prevailing curriculum. Hence, the curriculum for 21st century must deliberate and focus on knowledge

construction and motivating the 21st century learners to create new information that has value, meaning and potential to build and nurture these novel skills. There is an urgent need to connect the curriculum with the real-world problems in order to prepare students for mature adult life.

Common Core State Standards Initiative (CCSSI, 2010) were framed and enclosed as vigorous and related to the factual pragmatic world, that endorsed accumulation of 21st century skills and the relevant knowledge as compulsory for the young generation, for their accomplishment in educational institutes, in professional careers and to contest efficaciously in the global technologically driven economy (National Governors Association, 2010). The curriculum developers in Partnership for 21st century asserted that the intended curriculum for 21st century should acknowledge and permit learners to comprehend and have mastery over the necessary academic knowledge. The curriculum should offer students prospects and opportunities to explore, learn and develop several kind of literacies such as health literacy, financial literacy, environmentally friendly literacy, and global awareness literacy. Research scholars scrutinized and endorsed that "multiliteracy" can empower the individuals in making date judgments that support them in their preparation for the global demands and challenges and assist them to be more effective and productive at their workplace (Wiggins & McTighe, 2011). Contemporary curriculum and educational decisions regarding implementation and integration of 21st century skills ought to be amended and restructured completely to adapt these skills. For the reason that the 21st century skills has the potential to increase the students' accomplishment level, to upgrade their reasoning processes and to assist them in constructing new knowledge and making them skillful in their potential future careers. Instructional pedagogies are the next issue forth regarding implementation of 21st century skills in the educational institutes. To deal with this problem, teachers must try to employ multiple teaching methodologies and techniques for inculcating and

nurturing these skills as there is no single distinct strategy or module to accomplish the attainment of these skills. Consequently, it is essential to utilize new teaching and assessment methods in order to supply and train the learners with 21st century skills.

Related to this context, teachers need to play an influential role in facilitating the learners for acquiring and developing new skills through employing instructional methods and practices that has the potential to increase their capabilities. The selected teaching strategies and learning tools must be innovative to link cognitive and social skills together with the subject knowledge. These innovative teaching methods should enhance students' participation in learning activities to nurture their collaboration that can uphold these future skills. These teaching approaches can enhance and upgrade students' content and skills and can involve and link learners with the real practical life. Partnership for 21st century (P21, 2009) first ranked and prioritized these teaching strategies and mentioned them as outcome oriented pedagogical methods, and they include problem-based and project-based learning (PBL), experiential learning, game based learning, cooperative learning etc. that has the potential for attainment and development of 21st century. Furthermore, the employment of technological tools in teaching, learning and assessment process can also enhance learning of students and assist in their mastery over 21st century skills. For instance, in problem-based learning the students can be engaged in discussion and exploration of multiple problems and issues. The method of problem-based learning enables the learners to examine and analyze the real life problems, scrutinize data, evaluate, and make decisions that are best fitted to the problems. Research studies have demonstrated that problem-based learning is an effective strategy to improves student's involvement and engagement in routine classroom activities and tend to nurture critical thinking among students (Joyce et al., 2009). Similarly, Suwastini, et al., (2021) acknowledged that a significant relationship exists between the problem-based learning activities

and development of higher order thinking skills. The PBL method facilitates the individuals to utilize their creative thinking and to learn and break the thinking hurdles for attainment of 21st century learning skills. By applying the strategies of PBL, teachers can provide students with opportunities to improve their critical thinking abilities and enhance social interaction.

Another pedagogical strategy for developing and inculcating 21st century skills is cooperative learning. The strategy of cooperative learning involves learners to work in different diverse groups of varying interests and capabilities that has magnificently positive effect on learning of student with optimum outcomes. Group work appeared to be more creative and interesting than individual work as students tend to benefit of each other's strengths and talents while striving for a common goal or target. Knowlton (2003) asserted that the diversity in capabilities and versatilities of students may promote and improve their creativity where "each and every student is supposed to bring something to the table and contribute". Similarly, Trilling and Fadel (2009 and 2017) reasoned that performing and contributing in groups of various abilities is quite valuable for students as it may develop multiple learning aspects among students for instance, mutual respect among all team followers, tolerance and acceptance, and mandatory teamwork required to complete a joint venture. Additionally, method of cooperative learning also grounds collaborative learning that has a satisfying effect on students' capabilities. It can enhance pursuit and performance of students along with nurturing and fostering social collaboration among them (Joyce et al., 2009).

Furthermore, Jacobsen (2001) asserted that the amalgamation of modern teaching technologies with the modern up-to date method of instruction may play a significant role in fostering 21st century skills. In this context he argued the notion that the usage of technological tools in classroom teaching and learning may offer students with the prospect and experiences to

encompass the real-world problems. Technology integration may improve students' understanding and comprehension along with nurturing their creativity and innovation. Use of multimedia is one of the best example to increase students' attention and motivation for learning. Amalgamating technology in classroom learning encourage problem solving abilities of students, improve their collaboration, innovation, can stimulate their cognitive processes and help in creating new knowledge.

The above discussion can reach us on conclusion that the 21st century curriculum and instructional strategies can supply a consolidative approach for accomplishment of students in 21st century. Rotherham and Willingham (2009) reasoned that the enactment of 21st century curriculum and aligned instructional strategies help in preparing our students for the challenges and competition of the modern global world. Correspondingly, the forthcoming future research studies may focus on the professional development of educators as how to empower them in implanting and translating 21st century skills in their classroom teaching strategies while employing modern technological tools. Furthermore, future research may discover the influences of 21st century curriculum and instructional strategies on both students' academic abilities and their social capabilities. Wiggins and McTighe (2011) explored that with acquiring both the important academic content along with necessary 21st century skills, individuals can secure an optimistic and bright future. Likewise, implementation of 21st century curriculum and subsequent instructional strategies is very vital in training todays' learners that would support individuals in fulfilling and satisfying their objective to be successful in their future life.

2.31.2 Professional Development

Professionally qualified and well-trained teachers are the most essential pre-requisites for the development of 21st century skills. Teachers' professional attitude, proficiencies and practices are

among the steering influences that impact the most on teaching-learning process and in nurturing 21st century skills and education. These elements can be acquired by teachers through specialized and repeated professional training courses. The Partnership for 21st century skills recognizes the imperative role teachers can play in nurturing these skills and highly endorsed the need for continuous professional development of teachers for effective implementation of these skills. P21 also highlighted that the teachers ought to appreciate the importance and need of 21st century skills and learn how to include these skills in their teaching curriculum. However, in order to develop these skills among students the teachers must be assisted and supported with appropriate, advanced and result oriented training programs that can aware them about the importance of these skills and orient them with the techniques as how to develop them in students.

In the same scenario, Voogt & Roblin (2010) accredited that the professional development of teachers along with sufficient support system play the most pivotal role in the accomplishment of 21st century skills. Nevertheless, it is worth mentioning that teachers' training programs ought to be well planned in a way that can fully assist in the achieving 21st century skills and should have the ability to improve technical and pedagogical knowledge of teachers. Teachers' professional training programs should help in training the teachers for first acquiring and developing 21st century skills by themselves and then to translate and practice these skills in their classroom teaching for their development in students.

However, it is pertinent to mention that the professional development for teacher ought to be assumed at the pre-service level and should be a continuous part during their service. The teachers should be sensitized to think and to undertake development of these 21st century skills as their prime responsibility and their mission should be how to practice and translate these skills in their

classroom. But there is a dire need to strengthen the support structures and the provision of resources to assist teachers in developing 21st century skills.

Conversely, the National Education Census (2005) of Pakistan along with other studies disclosed that domain of teachers training in the country is not based on acceptable appropriate professional standards. Since the past three decades, the teachers' training programs organized for their professional development is facing many problems and issues, and that the existing condition of teacher education in the country is not up to scratch. Most of the modules being taught in these professional development training programs are outdated and mere relics of 19th century's "normal school model". These obsolete teachers' training programs cannot build capacity of teachers and make them skillful to nurture and forward the future skills of critical thinking or communication. The knowledge and pedagogical skills demonstrated at the teachers' training institutes are mostly of inactive nature for the reason the teachers are incapable of developing and fostering 21st century skills among students. (Govt of Pakistan, 2009).

In this context, The Policy and Planning Wing under Ministry of Education, Pakistan appreciated the worth and significance of in-service teachers' continuous professional development and pre-service teacher education of prospective teachers. The said wing apprised the importance of teacher education and decided to align with the demands and necessities of 21st century. In partnership with UNESO and USAID, National Professional Standards for Teachers (NPSTs) were formulated and specifically inked down. These standards proposed to enhance and boost quality and merits of education by concentrating specifically on the excellence and superiority of teacher education. The ten standards for teachers firmly uphold that a professional teacher ought to possess sufficient knowledge of his subject content in addition to relevant instructional pedagogies. The teacher ought to be well informed about the theories and phases of human cognitive growth and

development. He ought to be skilled in employing relevant information and communication technologies. The teacher ought to be familiar with the implication of conducive and enabling learning environment and must strive to construct and provide to his students. He ought to be prepared for collaboration with the other teachers and should be readily prepared and available for developing his professional competencies.

2.31.3 Insufficient Assessments

Place and prominence of assessment in education system cannot be denied, whether it is conducted for decision making purpose through standardized tests or for formative purpose through classroom tests. In both circumstances, assessment is counted as a foundation stone for successful teaching and learning. Effective assessments provide reliable and pragmatic evidence for student's learning along with supporting and directing both teachers and students regarding progress of teaching learning process (P21, 2009). Standardized tests are administered to gauge and evaluate the fundamental knowledge of the individuals but are not meant to assess the aptitude of learners, and their tendency to analyze, apply, and create new knowledge. Contrarily, the standardized tests has created certain kind of high risk testing conditions that led to teaching of essential content knowledge which is supposed to be tested (Silva, 2010).

Though the notion of 21st century skills is being popular since the past two decades, the idea needs ample consideration for implementation in education sector. Different factors can be quoted as reason for lack execution of 21st century skills, for instance, differential conviction of teachers regarding learning that leads to erratic assessment practices in classroom scenario (Swaffield, 2008). This is because of the reason that most of our teachers are of behavioristic viewpoint regarding curriculum, classroom instruction and assessment and still tend to assume that summative assessments are the solitary methods to measure students' learning outcomes.

Conversely, 21st century skills, for instance skills of collaboration and communication cannot be measured effectively using conventional assessment methods. The traditional assessment methods, for example, paper-pen examination is a distinct individualistic endeavor that is incapable of assessing collaboration and communication skills as they are meant to be part of teamwork. Such skills can be measured only when individuals are supposed to engage in group work and learning occurs mutually as a team in classroom scenario. Hence, it is important to mention and realize that the 21st century skills cannot be assessed through traditional testing but mostly can be assessed in groups when students tend to work together. Consequently, classroom assessment methods ought to be amended accordingly as per changing demands of 21st century education (Black & Wiliam, 1998).

Formative assessment is employed to measure the progress and process of students' learning whereas summative assessment is operated to establish students' achievement and focus on product part of learning. It is worth mentioning that for successful integration and execution of 21st century skills, teachers' convictions and beliefs regarding students' learning and assessment needs to be changed as these differential views influence students' learning to a great extent. The prevailing assessment practices in schools tend to assess students' content knowledge in subjects like science, languages, mathematics, and arts, etc. There is a wide gap consistent in assessment of students` knowledge and skills as far as 21st century skills are concerned. "These existing assessment practices of schools are insufficient to analyze and assess reliable evidence for 21st century skills. This is because of the fact that the existing are not intended to assess the extent students can apply their learning to some new situation or to evaluate how students might utilize necessary educational technologies and tools for their learning and to handle their daily life difficulties." (P21, 2009).

However, it is quite challenging for the teachers to modify and adopt their existing assessment procedures to an extent that can support the 21st century education and can assess these skills. In this context, both formative and summative assessments can be utilized and can be combined with the cognition and thinking skills of primary subjects along with ICT literacy. However, a profound commitment would be required on part of teaching community that can acknowledge and devote to the process of execution of skills that is anticipated to be slow and relentless and will demand several challenges. In order to align the existing assessment practices with the 21st century education and skills, following initiatives can be taken: (1) creation of some obligatory standards: the state should take the responsibility of providing essential guidelines, procedures, and standards for teachers to prompt the assessment process. (2) Revamp, evaluate, execute, upgrade, and evolve assessment strategies: All-inclusive plan should be made that can implement and monitor classroom assessment strategies and can review their practicality and effectiveness in achieving 21st century skills. Furthermore, the assessment strategies should be examined regarding their efficiency in improving teaching and learning, and their utility in the classroom. However, all these aspects would demand constant adjustment, alteration, and improvement before proper, efficient and effective assessment strategies can be recognized and actualized. Additionally, continuous research, structured meetings with assessment specialists, and steady multidisciplinary deliberations among diverse stakeholders would provide a robust preliminary step for the implementation of 21st century assessment strategies. 3) Align both formative and summative assessments with 21st century curriculum and teaching instruction. In Pakistan particularly, assessment drives what should be taught, and consequently schools direct all the resources and time on that particular academic content. (4) Evolve teachers' professional development strategy. An effective and continuous professional development can enable and empower teachers in

assessing 21st century skills skillfully, particularly if we consider formative assessment. Professional development programs should focus on improving several assessment strategies of teachers, should assist in developing various new abilities, for instance, assessment framework development, analysis, instructional strategy adjustment, modification, and effective execution. Uniform curriculum seemed to deliver same text and thoughts to a child studying in an elite school in Islamabad and a child studying in any remote rural school of country. It was claimed that this uniformity will tend to eliminate the discrimination and disparity in the country's education system to a large extent. A zero-draft for SNC was reviewed and shared with public and private educational institutions of federal and all provinces, madrasas, and Cambridge. It was asserted that the SNC implementation would highlight the thinking and reasoning abilities of the children and introduce unity and uniformity in the educational process.

2.32 Theoretical Framework for Integration of 21st Century Skills

Kivunja (2018) extracted that theoretical framework includes theories of authorities in your area of research. It gives you a scholarly foundation and direction for analysis of data and interpreting your results. Swanson (2013) proclaimed that theoretical framework can support or hold a theory for your research. Theoretical framework is the synthesis of works of specialists and experts in your research zone, that help you to solve your identified problem, to analyze your data and to extract meaning out of it.

The notion of 21st century skills has been defined in the previous pages in detail along with different frameworks presented by various influential organizations. The current study focused on the 02 main domains which are “Learning and Innovation Skills” that includes creativity, critical thinking, collaboration, and communication and “Digital Literacy Skills” that covers ICT as a tool for learning (Trilling & Fadel, 2009; Hixson, et.al, 2012 and Kivunja, 2014).

The theoretical literature reviewed for this research established a relationship between 21st century skills and learning theories of "Social Constructivism" and "Connectivism". Social constructivist theory suggests that the learners construct new knowledge in collaboration, via interacting with others in a particular context (Schunk, 2012). Problem based learning, cooperative learning, collaborative learning, and project based learning are based on theory of social constructivism that involve students working in classroom environment and sharing their background knowledge, discussing, and participating towards solution of a problem or to a constructed meaning. Theory of social constructivism provides students with freedom to discover and put new ideas into practice through collaborative activities and assignments.

As the current study was contextualized with selected 21st century skills (creativity, critical thinking, collaboration, communication) that endorse active learning along with ICT as a tool for learning, therefore its theoretical framework is correspondingly linked with the theory of connectivism. Siemens (2005) affirmed that connectivism tries to support learning by sharing information to people through making connections in a digital age. The proponents of connectivism suggest that learning takes place via connection of information through digital nodes and connections are maintained to build knowledge in a continuously changing world. Connectivism endorses student-centered pedagogy and believes that students can learn best when they are taught through technology. It validates that learning is promoted in variety of opinions and thoughts, trailing recent trends, urge to learn more, maintaining the links and connections and most importantly the competence to choose what and how to learn. Alam (2023) asserted that connectivism can enable the learners in acquiring knowledge and skills that are essential for navigating in the contemporary rapidly changing world. Connectivism supports discussions and collaborations in groups, allows different perspectives and opinions, openness, and autonomy of

students in decision-making and extracting meaning out of information. Connectivism believes that mutual collaboration of students and teachers contribute towards creating, understanding and enabling the knowledge (Dacholfany, Saifi & Sulaiman, 2022).

Since the time when the internet was initiated, there has been a diversity of prerequisite skills to meet the challenges and work processes of constantly changing technological era. Kivunja (2014) asserted that our students are required to be prepared for this digital world so that they can be empowered to navigate successfully through this information loaded realm. Hence the relevant literature explored for this study established a significant connection among 21st century skills, philosophy of Single National Curriculum (SNC) and underpinning theories of "Social Constructivism", and "Connectivism." Social constructivism, as bounded by Schunk (2012), speculates that the learners actively construct new knowledge through collaborative peer interactions in a specific perspective. Social constructivists view learning as an interactive social process wherein individuals engage with others to co-create understanding. Whereas connectivism as posited by Siemens (2005) facilitates knowledge acquisition by leveraging information-sharing via interconnected digital nodes in the current age of technology. Connectivism contends that the collaborative work of both students and teachers significantly influences to create, understand, and disseminate knowledge. In essence, connectivism supports a holistic approach towards students' learning that incorporates technological connectivity, sovereignty, and collaborative involvement as prime elements of knowledge acquisition process. Inclusion of terms like collaborative learning, problem-based learning, cooperative learning, experiential learning and utilization of ICT in the document of SNC to employ active learning also endorse its roots with the theories of constructivism and connectivism.

As the study revolved around investigating integration of learning and innovation skills (4Cs; creativity, critical thinking, collaboration, and communication) and ICT as a tool for learning in SNC which have their roots grounded in theories of social constructivism and connectivism, so these two learning theories together provide theoretical foundation of this research. Furthermore, the theoretical framework considered for integration of 21st century skills is also inspired by the "Constructivist Teaching Model" by Kivunja (2015). Kivunja in this model presented a holistic picture of the teaching-learning system based on constructivism. This model appeared a perfect fit as it provided underpinning for active learning which is the foundation of SNC and ought to be reflected in the consequent textbook, teachers' training, classroom teaching and assessment practices for effective execution of curriculum reforms. The model also gives due consideration on value of dynamic classroom environment that covered investigating provision of physical facilities in the current study. The Constructivist Teaching Model also helped in building interview protocols that were employed to explore research questions of the study, for instance nature of active learning strategies employed in the classroom, students' participation, and peer-assessment, etc. These dynamics of teaching learning process were asked by all the strata of research participant to explore their perceptions in their particular domain and supported in extracting meaning out of research data collected.

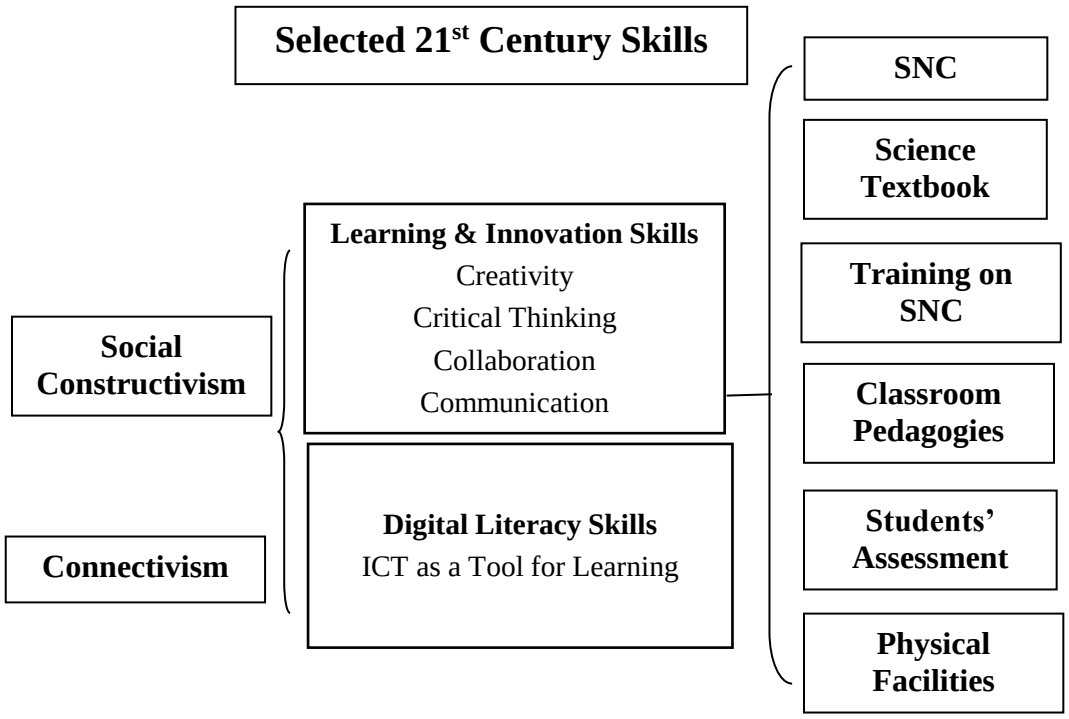

Figure 2.1 Theoretical Framework for Integration of 21st Century Skills inspired by the "Constructivist Teaching Model" by Kivunja (2015).

2.33 Previous Related Researches: Global Overview

Education required for future is the focus of educational debates since the start of new millennium. The deliberations involve what kind of knowledge and skills will remain relevant in coming days that can help our youth for this everchanging world. Many of the renowned organizations highlighted these competencies as 21st century skills; desired to be developed among youth for their success. As per opinion of Care, Vista & Kim (2019), "Education must support individuals in understanding their society and the changing environment. Changing environment requires acceptance of change that can be initiated by change in curriculum, in ways of teaching and in classroom pedagogies". Now, there is a global consensus that there is dire need of skills,

competencies, attributes, and values, much more than knowledge. Hence, there is a need to cultivate these skills among students to be successful in practical life (Care, Vista & Kim, 2019).

A research study was conducted on the topic “Integration of 21st century skills into the curriculum of primary and secondary education” by Petra Fisser and Thijs Annette (2015). The research asserted that Education for the future has become one of the dominant themes of todays’ debates and discussions. The deliberations aim on answering the question as what kind of knowledge and expertise are most significant for preparing our youth to survive in a swiftly modifying society. In such deliberations, many of the skills identified are labelled as "21st century skills". The research paper also developed a conceptual framework comprising of eight skills namely, creativity, critical thinking, collaboration, communication, digital literacy, problem solving, social and cultural skills, and self-regulation (Fisser & Thijs, 2015). It can be presumed from the literature that the importance of these mentioned skills is agreed upon internationally however, there is inadequate knowledge about the operational execution practices that can accomplish learning outcomes at primary and secondary level education. The study concluded that the curriculum reforms extend the prospects and possibilities of integrating these skills in education, if clear direction, resources, and incentives are supplied to the teachers and the schools. The study employed a questionnaire for teachers to seek their opinion regarding implemented curriculum. The research exhibited that primary and elementary school teachers are acquainted with the idea of 21st century skills and accept their importance as significant foci of attention. Conversely, the case studies demonstrated that the teachers’ intentions require focus, and their teaching practices are not enacted and structural. In fact, practicing and translating skills is often more complicated as compared to the expectations and developing classroom activities that can nurture and develop 21st century skills effectively.

Kimberly Mohr and Robert Welker (2017) completed a research with title "The Role of Integrated Curriculum in the 21st Century School". The study described that many of the schools in Columbia are showing increased interest and focus on development of 21st century skills. The literature review of the study also spotted eight generic skills which were mutually shared and widely accepted in many of the frameworks presented by influential organizations. These common skills include creativity, critical thinking, collaboration, communication, digital literacy, problem-solving, social, and cultural skills, along with self-regulation (Mohr & Welker, 2017). The study adopted mixed-methods research to interview school-teachers in order to recognize their attitude and classroom practices. providing data for analysis. The study detected an interrelationship between the skill-integrated curriculum and teachings of 21st century skills with some obstructions that hinder best teaching practices.

A doctoral thesis labelling "How Omani teachers perceive the process of integrating 21st century competencies and skills into the EFL curriculum: A step forward" was accomplished by Atoom Mohamed Al Khatri in 2019. The study uncovered that the global demands due to rapid technological advancements are stepping towards integration of 21st century skills and proficiencies in the education mainstream and the education system in Oman is not excluded to this revolution. The knowledge explosion due to globalization and brisk changes in the economy and labor market has imposed these challenges to the nations (Al Khatri, 2019). Consequently, the countries including Sultanate of Oman is assuming plenty of reforms, both implicitly and explicitly, for the inclusion and integration of 21st century competencies and proficiencies in their education system Al Khatri (2019). The study also identified creativity, critical thinking, problem solving, collaboration, communication, information, media, and technology skills as the main competencies and skills. The study mentioned improvements in the curriculum of "English as a

Foreign Language (EFL)" reforms in its course subject matter, teaching methods and assessment strategies for pitching towards the inclusion and integration of 21st century skills and competencies. The study focused on the notion of "Teachers as Change Agent" and examined Omani EFL teachers' narratives and teaching practices for the skills' integration process. The research was guided by the interpretive paradigm and employed an explanatory sequential mixed-methods research design. The researcher utilized EFL teachers' questionnaire, semi-structured interview protocols and classroom observations for collecting quantitative and qualitative data accordingly. The outcomes of the study discovered that some of the respondent teachers positively recognized the integration of the skills within the EFL curriculum; yet they were unhappy with the exclusion of skills from the teaching-learning process. Additionally, teachers highlighted the discrepancy between curriculum and strategies of assessment and believed it as one of the major challenges they encountered during employment and development of skills. Additionally, the teachers faced challenges of shorter time span, textbooks, and the students' lack of competences in English as a foreign language that hindered successful implementation of 21st century skills. Furthermore, the respondents of the study also furnished few suggestions to strengthen curriculum policy and English language teaching practices for adequate inclusion and employment of 21st century competencies.

Likewise, Susan M. Drake and Reid (2018) completed a research "Integrated Curriculum as an Effective Way to Teach 21st Century Capabilities" in Canada. The study elaborated that the significance of developing 21st century skills is a promising global agreement that is anticipated to be made as part of curricula at all levels. However, the educationalists are still not very sure about the descriptions of these skills and are uncertain as to how to teach and evaluate them. The research offered integrated curriculum as a successful mode to overcome some of the challenges allied with

the development of 21st century capabilities (Drake & Reid, 2018). The study presented a holistic and predominant curriculum framework with the name "the Know-Do-Be". After identifying and describing the 21st century capabilities in various categories, the study offered a planning process that sanctions and supports creative and rational curriculum design. The study also presented models of integrated curriculum that allow effective integration of skills. Lastly, the research brought 21st century competencies and integrated curriculum together to design a rich teaching learning situation. The study recommended curriculum integration as a foregrounding for fostering and nurturing 21st century capabilities.

Alismail and McGuireon (2015) conducted a research naming "21st Century Standards and Curriculum: Current Research and Practice" at University of Colorado, United States. The study illustrated that the assimilation of 21st century skills along Common Core State Standards (CCSS) within the curriculum is valuable for both teachers and students and also required to groom and train our students for their future occupations. In this modern age, where scores of standardized tests regulate the achievement of schools, it is quite significant to encourage students in developing creativity and employing the technology powers in order to strengthen essential skills and to learn in exceptionally unique ways (Alismail & McGuireon, 2015). The study endorsed that through utilizing a portfolio-based system we can enable students to think creatively and evaluate content standards. In this way, students can demonstrate their concept understanding and retention along with producing visible and significant outcomes. The study contemplated that the future of our students rely on their flexibility and originality and not on scoring well on certain tests. We needs to make an instructional shift in our education system that can warrant success of our students as the pioneers and creators of the future. The article also explored some of the methods that can enable students to improve and nurture 21st century skills. It underlined how teachers can connect

students' existing knowledge with some authentic experiences that not only motivate them but also empower them to innovate and collaborate through latest technologies. The research concluded that by fitting in multimedia in the classroom can provide students the opportunities and prospects to improve their academic and societal skills. Through technology integration, the students can organize their ideas, communicate, and share information, and can utter their ideas and opinions while working on a project or handling an online research.

Christian Glinel (2020) completed a research titling "Teaching 21st Century Skills: An Integrative Literature Review" to reconnoiter the relevant literature on 21st century skills. The review of literature analyzed the prevalent patterns and trends regarding traits of 21st century skills. The study persisted in examining the 21st century proficiencies and competencies and analyzed which of them are primarily dominant. The purpose of the study was to portray the origin and emergence of 21st century skills and to detect the gaps it reflects (Glinel, 2020). Preliminarily the study examined the leading and renowned international frameworks that promotes 21st century skills, published by public and non-profit organizations. The study then followed the realistic literature on the domain of skills, involving two comparative analyses for comparing frameworks for 21st century skills. Glinel additionally proposed the strategies and technologies that can support and reinforce development and nurturing of 21st century skills.

Barbara Ann Boutwell Jansen (2014) accomplished a research. "New Media's Support of Knowledge Building and 21st Century Skills Development in High School Curricula" for her doctoral degree. The study detailed that there persist a growing consensus that the classroom pedagogies ought to be shifted from teacher-centered and textbook-directed instruction towards student-centered learning. This changeover is originated from the desire to retain the United States' dominance and competitive approach in the global world market and to ready the young generation

for a socially active, economically vigilant, and politically complex society (Jansen, 2104). The research study investigated how employment of new media can sustain and help in building subject knowledge as well as assist in development of 21st century skills as experimented in 09 classrooms of a private high school. The inferences of the study informed the classroom practices of teachers requesting to amalgamate 21st century skills in their classrooms. The study identified educational technology tools from the review of literature that may enable teachers to centralize their efforts in integrating and nurturing the groups of 21st century abilities, teaching strategies. Additionally, the study also recognized priorities for future researches to operationalize and invoke the major concepts, strategies, and tools essential for 21st century skills and that can actually contribute to the accumulation of pragmatic knowledge for their integration. Furthermore, the study suggested that the researchers should pursue to construct operational definitions of individual skills and to recommend best examples as how to develop them in the students.

2.34 Researches in Pakistani Context

A doctoral level research titling "Implementation of 21st Century Skills in Higher Education of Pakistan" was proceeded by Hayat Khan in 2019. Khan (2019) argued that with the advent of global economy, the demands and challenges of employment and success in life has evolved to another level in this new technological age. The entire world is modifying towards knowledge-based economy from industrial and labor driven economy. Viewing these challenges in context, today's modern society and employment sector entail workforce which is well-equipped with 21st century skills. The study investigated the accomplishment and inclusion of 21st century skills in Pakistani universities. The study observed the current academic programs and teaching practices at the higher education level and explored their relationship with the domains of 21st century skills.

The findings of the research uncovered that the 21st century skills were not enacted or fully inculcated in the education mainstream and among most of the university students.

Likewise, Farkhunda R. Choudhary, Ahmad, Sultan and Khushnood conducted a research with title "Comparative study of 21st Century Skills of Science Teachers and Students of Formal and Non-Formal Educational Institutes" in 2021. Choudhary contended that the 21st century teaching and learning skills are very necessary for the teachers to follow and translate in their teaching along with their development among 21st century learners. The prime focus of her research was to investigate the 21st century skills among in-service science teachers and science students. She conducted an online survey for assessing these skills in her population of science teachers and university students (Choudhary, Ahmad, Sultan & Khushnood, 2021). The survey was delimited to 4Cs and comprised of creativity and critical thinking, collaboration, and communication skills. The findings of the study surprisingly exposed that the science students at higher education institutes acquire more 21st century skills than the science teachers working at those institutes. The study suggested that the university science teachers should try to practice 21st century teaching and learning skills more frequently to develop and inculcate these skills among students. The study also endorsed that the university science teachers should try to improve their critical thinking and must strengthen their collaboration with students. The research was quite substantial as it disclosed the current status of skills among formal education set-up science teachers that is envisioned to be taught and transmitted to the 21st century students.

Furthermore, Amina Talat conducted a study with title "The Effect of PBL and 21st Century Skills on Students' Creativity and Competitiveness in Private Schools" in 2014. She initiated with the deliberation that the private sector education business has done quite well despite slow economic growth of the country and where lots of businesses failed to make up. The study analyzed the

influence of project-based learning (PBL) and nurturing 21st century skills on enhancing creativeness and competitiveness of students in private schools of Lahore (Talat, 2014). The study argued that by developing 21st century skills among students, they become more viable and competitive in the challenging environment. The framework of project-based learning also advocates social and personal development of students. The study utilized survey as primary research method to reach substantial number of private schools teachers. The outcomes of the study reflected that the 21st century skills inserted through PBL framework, have a significant and positive influence on creativeness and competitiveness of students. Social development also impacts creativeness and competitiveness of most of the students whereas personal development remained the least significant factor.

Additionally, a research was accomplished by Samina Ali, Qutoshi and Jabeen (2021) with the title "The Perceptions and Practices of Secondary School Teachers for Developing Critical Thinking Skills in Students". The researchers asserted that the critical thinking is a complicated and multi-layered process that demands higher level cognition. Perceptions and teaching practices of teachers to foster critical thinking skills in their students inspire their classroom behaviors. The study explored the opinions, beliefs, and practices of teachers teaching at secondary school level in extending the skills of critical thinking skills among their students. For this purpose, the research selected four secondary teachers to conduct their semi-structured interviews which were followed by their classroom observation and lesson plan document analysis (Ali, Qutoshi & Jabeen, 2021). The study data were being analyzed by adopting thematic data analysis approach. The research concluded that some secondary school teachers do not even possess core knowledge about the critical thinking skill; consequently, they were incapable to define and comprehend the notion of critical thinking and were just ignorant to translate and foster it in the students. However, 66.6%

of the teachers were familiar about the importance of developing critical thinking skills among students but remained incapable to offer any evidence of using effective and efficient classroom tactics that can develop critical thinking skills in secondary school students. Furthermore, it was also examined by the study that students were not capable of analyzing and applying their classroom learning in new situations or in real life scenario. The study proposed that schools are in dire need of trained teachers that should be equipped with modern pedagogies and can create interactive and engaging classrooms in which students can think critically and rationally.

2.35 Critical Summary

This review of relevant literature articulated the attributes and significance of 21st century skills along with reforms and challenges for integration of 21st century skills. The research detected that the notion of 21st skills is certainly not a novel thought, however novelty lies in their innovative implications and integration in the area of education and technology that demands educators to reflect on a new paradigm of teaching and learning. The research explored and portrayed features of integrated curriculum, instruction and assessment that can help in establishing some methods to plan and accelerate the teaching and learning of 21st century skills. The literature also investigated some obstacles and challenges for the promotion and integration of 21st century skills in the education mainstream as discovered through the findings of relevant studies to stipulate background knowledge.

The literature review also revealed connectivism as learning theory of 21st century which relies on theoretical perspective of social constructivism. Both of these learning theories have their roots in pragmatism. These theories recognize the active role of students in constructing and managing their knowledge. Both theories emphasize the significance of self-directed and life-long learning. However, both theories put responsibility on the teachers as how they facilitate their students and

providing them opportunities to build their learning through social and digital networks. Teachers ought to be prepared in supporting their students to adapt to changing situations and technological transformations. In this context, literature suggests that the students should be encouraged to think critically, to work in collaboration in order to create and share new knowledge. For this purpose, the teachers should be digitally literate so that they can utilize, demonstrate, and transfer skills effectively. Similarly, there is a need to transform assessment strategies from individualistic approach to collaborative performance.

The literature projected and pronounced that any solo modification would not adequately develop and integrate 21st century skills lest we empower and enable our teacher professionally as a change agent. A competent teacher well equipped with these competences in a favorable, conducive, and well-furnished environment can only deliver these skills among students. Serious efforts are required to think how to increase students' engagement that can improve quality of education and help in achieving these beneficial interpersonal skills of competitive world. There is a dire need to make necessary reforms and modifications in teachers' professional development programs, in shifting their teaching instructions and practicums, subsequent classroom practices, in aligning the assessment practices with the modified curriculum and in accordance with the 21st century skills. It is worth mentioning that all these reforms would still necessitate the provision of facilities and resources to translate and integrate these skills in the classroom scenario. On the basis of groundwork and subsequent investigation, the researcher anticipated and found that the conceptual framework developed from literature, has helped and facilitated in the forthcoming steps of data collection and analysis, inferring the findings, drawing conclusions, and sketching future implications which are being explained in the succeeding chapters.

CHAPTER 3

RESEARCH METHODOLOGY

The present research study examined integration of 21st century skills in the latest curriculum reforms i.e., Single National Curriculum (SNC) along with subsequent developments made in the teaching-learning process for the execution of these reforms at primary level in the Federal Government schools of Islamabad Capital Territory. The current chapter outlines the research approach, method and procedures assumed to accomplish the objectives of the study. It includes description of the research participants, sampling strategy and size, an account of research instrument, methods of data collection and data analysis along with integration of different types of data. The chapter also incorporates validity of the research protocols and tools in addition to piloting of the instrument.

3.1 Research Paradigm

Mitchell (2018) and Denscombe (2008) contended that pragmatism in term of philosophy is regarded as best partner for mixed-methods research approach. Johnson et, al. (2007) also asserted that pragmatism is the expanded philosophy that offers both the logical and epistemological foundation for blending the qualitative and quantitative methods and approaches. Furthermore, Creswell (2014) affirmed that the viewpoint of pragmatism allows combining paradigms, approaches, assumptions, and methods for research . The idea of pragmatism revolves around "what works" and often referred to as "theory of truth". Shannon-Baker (2016) and Hall (2013) asserted that instead of merely building assumptions regarding nature of knowledge, pragmatism is directed to find solutions to everyday problems of real world. This notion of pragmatism makes it suitable for "action oriented" research problems (Creswell, 2014 & Cameron, 2011). The idea of "what works" can also be associated with the selection of research methods or which research

method can “work” most appropriately to answer your research questions or what serves best as per research purposes (Creswell, 2014).

Since the research in hand focused on investigating the integration of selected 21st century skills in Single National Curriculum (SNC) at Primary Level, pragmatism was found to be the most appropriate philosophy to direct the study in the realistic field. Figure 3.1 depicts philosophical paradigm of the study. Pragmatism was underlying philosophy of the study, in which researcher adopted mixed-methods approach and employed three-phase multi-sequential design.

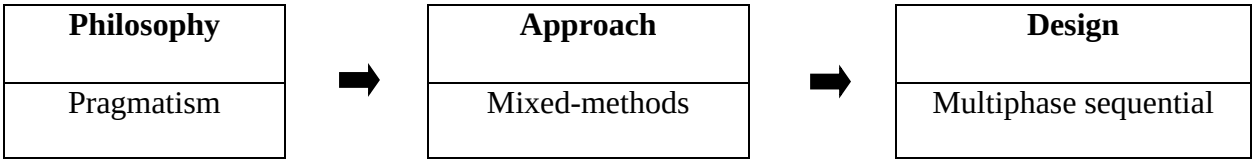

Figure 3.1 Research Paradigm of the Study

3.2 Research Approach

The current study was intended to be mixed methods in its investigation and utilized “multiphase sequential design” (Schoonenboom & Johnson, 2017) constructed on the footing of basic embedded designs (Creswell & Plano Clark, 2011; Creswell, 2014) . More than two phases were involved within the study and mixing/integration took place at multiple levels of tool development, sample selection, data collection and data analysis (Maarouf, 2019). The researcher interconnected the different phases of the study in order to address the interrelated research questions (Creswell, 2014). Triangulation tends to strengthen and enrich the findings of results obtained from different data sources or using different data collection methods to investigate the same phenomenon, integration of 21st century skills in Single National Curriculum (SNC) in this case. As the present study was a base-line study in congruence with the newly launched curriculum reforms (SNC) ; tool development for interviews (qualitative method) was informed by the result of preliminary document analysis (quantitative method). Furthermore, the discoveries from the teachers’ semi-

structured interviews (qualitative method) helped in making sampling decisions for conducting classroom observations (quantitative method) as described by (Creswell, 2014; Maarouf, 2019; Branes, 2019). Combining quantitative and qualitative components together helped in strengthening the study's inferences and answering the research questions. Mixed methods "embedded or integrated design" expanded the breadth and depth of the investigation by employing different methods appropriate to different component of research. Mixed methods approach also provided contextual understanding of the research problem along with generalizable findings. The following figure 3.2 illustrates the different phases of multi-phase sequential design adopted by the researcher to perform the whole research process. After formulating the research questions, the document analysis was carried out quantitative. The findings of the quantitative analysis informed and guided the researcher in modifying the interview protocols employed for conducting semi-structured interviews. The information gathered during the interviews assisted the researcher in selecting the appropriate participants for classroom observations. The findings from different data sources were then integrated to answer the research questions.

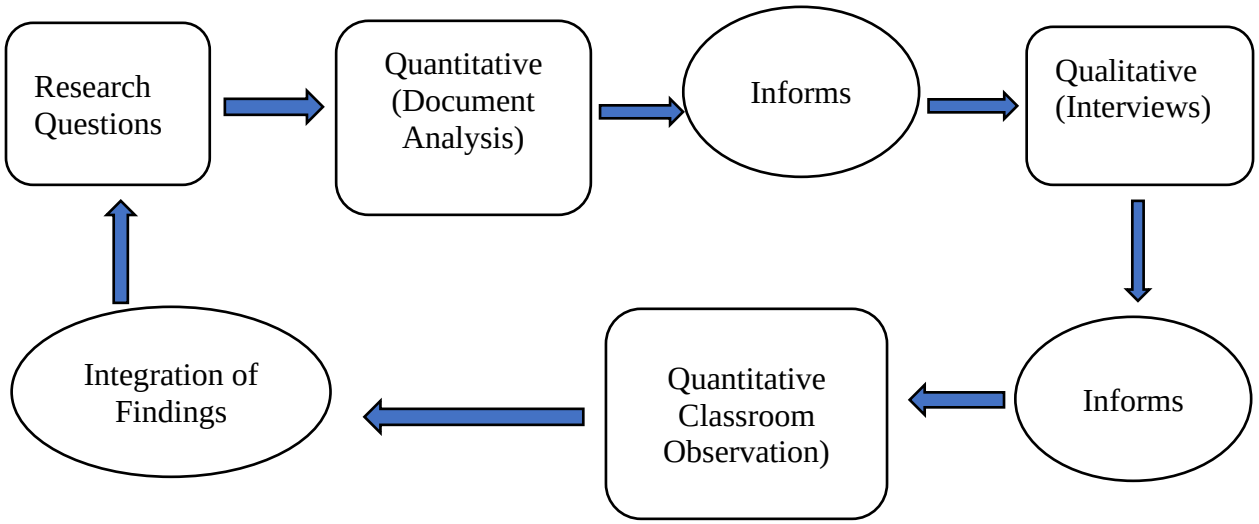

Figure 3.2 Multiphase Sequential Design adopted in Research

3.3 Research Design

The study in hand followed a "three stage" QUAN→QUAL→QUAN sequential design (Johnson & Christensen, 2017) built on basic "embedded research design" as directed by its research questions. The research steps were interactive "sequential dependent" as development of one component was built on the findings of preceding component (Johnson & Christensen, 2017). The outcomes of document analysis informed the development of semi-structured interviews and data from interviews facilitated in sampling of teachers for classroom observation and development of structured observation tool. Hence, the study has multiple points of integration i.e., tool development and sampling, besides the analytical point of integration and results point of integration (Schoonenboom & Johnson, 2017).

The researcher contemplated research design as flexible and interactive process. The investigation aimed to analyse and review the policy documents (Single National Curriculum, 2020) and General Science textbook of class 5 (NBF, 2021) with reference to provision of 21st century skills (creativity, critical thinking, collaboration, communication along with Information and Communication Technology). Semi-structured interviews with curriculum developers and academicians from Federal Directorate of Education (FDE) pursued information about their perspective and initiatives taken regarding inclusion and integration of these skills in primary education. Teachers who attended training on SNC under FDE; were interviewed to sought out their perspective on integration of 21st century skills in their classes. Utilization of physical facilities (infrastructure and technology), science classroom pedagogies and students' formative assessment were observed (through an observation sheet). In order to fully grasp the enactment of curriculum implementation, the researcher revisited the participants multiple times specially after classroom observations, to discuss the ground realities and their possible solution. During the

study, the researcher maintained a reflective journal, along with audio recording of all the interviews and documented all the decisions made regarding research observations and findings.

3.4 Research Methodology

The study was "interactive mixed methods" research. It adopted multiphase sequential design to explore system level integration of 21st century skills (creativity, critical thinking, collaboration, communication, and ICT) in subject of General Science at Primary Level as per recent curriculum reforms (SNC). The research questions of the research were interrelated and evolved during the study. The objectives and subsequent research questions of the study demanded the selection of mixed methods research in which qualitative component dominated due to exploratory nature of the research problem. The quantitative part tends to enumerate the degree of inclusion of selected skills in single national curriculum (SNC) and the subsequent textbook. However, the quantitative content analysis was supplemented with qualitative description with the intention to add meaning and context to the numbers. The qualitative method was chosen to collect detailed and in-depth information regarding perception and interpretation of stakeholders about 21st century skills and their integration in single national curriculum. The enactment of claims regarding integration of 21st century skills as made in semi-structured interviews was verified through classroom observation as an evidence. The underneath table 3.1 demonstrates 03 interactive phases of this mixed methods study as.

Table 3.1 Phases of Mixed-Methods Approach

Sr#	Quantitative Part	Qualitative part
	Document Analysis • SNC (General Science; class 5)	Semi- structured interviews • Curriculum developers • Textbook writers

- General Science Textbook (NBF, 2021)
- Classroom observation
- General Science Teachers
- FDE Officials

The research questions were interconnected; for instance, the provision for integration of integration of 21st century skills was first examined in the document of Single National Curriculum, then its understanding and insight was sought out in perception of different stakeholders i.e curriculum developers, FDE officials and science teachers and lastly its implication and executions was analyzed in the pragmatic scenario of science classroom through observation.

The researcher used following mixed methods paradigm which suits the study and also clarified the major methodologies adopted to illustrate the entire process. The underneath figure 3.3 explains the entire research methodology; showing the underlying philosophy (pragmatism); which provided the prime lens to orchestrate the whole research including its subsequent methodologies, data sources and collection, data analysis alongside the recommendations. It shows the instruments employed to collect data from different data sources, data collection methods and the methods utilized to analyse and represent data.

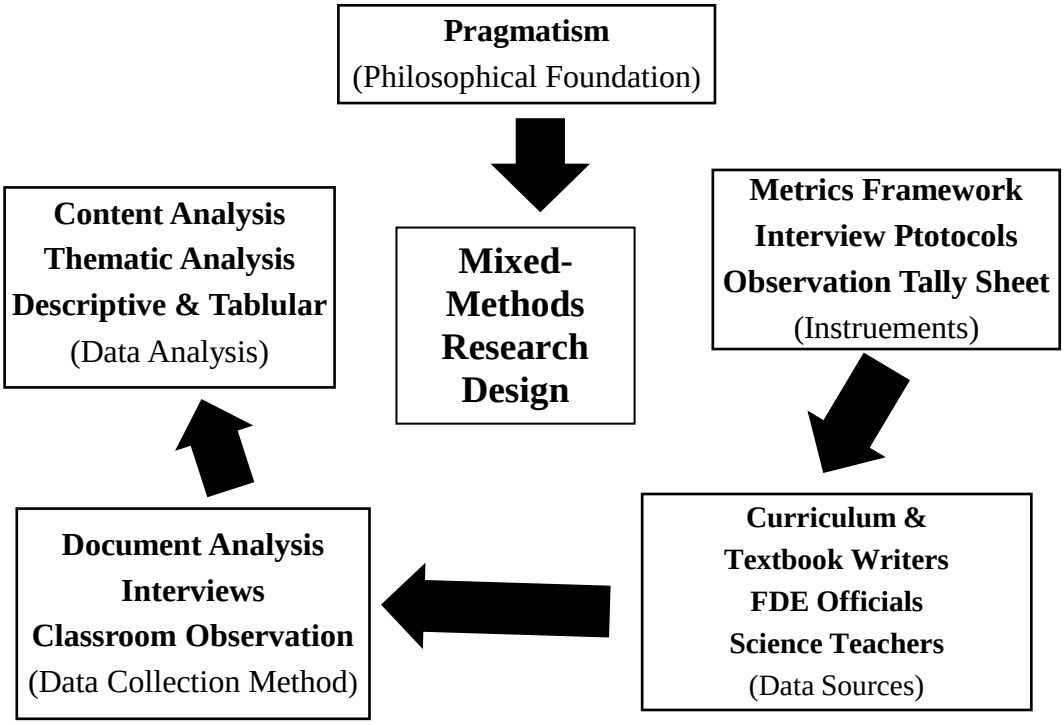

Figure 3.3 Research Methodology Framework

The study under consideration reconnoitered with document analysis of Single National Curriculum (SNC) in subject of General Science particularly focusing content of Garde 5 and the subsequent General Science Textbook. It interviewed government personnel; curriculum experts involved in development of Single National Curriculum. The researcher tried to explore the alignment and cohesion between Single National Curriculum (SNC, 2020) and the subsequent General Science textbook of class 5 (NBF, 2021) along with investigating the evidence regarding vision of curriculum developers for integration of 21st century skills at primary level.

The investigation started with documents analysis (SNC and General Science Textbook). Quantitative content analysis was employed for the purpose. Then qualitative method was utilized for collecting data from semi-structured interviews with curriculum developers. The researcher

constructed instruments (interviews and structured observation sheet) after reviewing the relevant literature and the results of document analysis. The self-developed instruments were validated through 05 experts, who had relevant research experience and working in eminent organizations. The researcher also conducted 02 pilot interviews to rehearse the systematic procedure of interviewing and observation. Piloting also ensured the usefulness, time required, reliability and validity of interview questions. It helped to revisit, rephrase, and modify the interview questions in order to collect more meaningful information. Furthermore, the data gained from qualitative data sources helped in selecting the participants for classroom observation and improving the quantitative instruments (structured classroom observation tally sheet).

The researcher then interviewed FDE authorities to pursue information about initiatives taken along with subsequent physical facilities (infrastructure and technology), teachers' training and co-curricular activities; provided for integration and promotion of these skills. The scholar also approached primary school teachers, who received training on SNC. Interviews with these teachers provided useful and deep insight regarding effectiveness of the SNC training programs. It also helped in getting the information about teachers' knowledge and competence for integration of these skills in classrooms along with their problems and shortcomings. The researcher then observed classroom practices of selected science teachers, methods of formative assessment employed in classroom, utilization of provided resources and opportunities for co-curricular activities. Science lessons' SLOs was used to select relevant lessons/classes for making classroom observation. Teachers' input/consensus was also taken into consideration. Classroom observations helped in understanding the ground realities regarding prevailing teaching methodology/strategies in different science lessons. It helped to understand the reasons why things are like the way they are.

The document analysis and classroom observation were analysed quantitatively, while interviews were analysed qualitatively. Integration of both the quantitative and qualitative findings is being made with an integrative statement in the "results point of integration" (Morse & Niehaus, 2009). Moreover, the researcher used data of document analysis for developing interview questions and tally sheet for teachers' observation (tool development). Furthermore, selection of participants (sample development) for classroom observation was made based on the information gathered from the interviews of science teachers; that also indicate points of integration in mixed-methods research (Teddlie & Tashakkori, 2009). Convergence and corroboration of multiple data obtained from different sources and methods helped in triangulation and addressing the research question (Bhandari, 2023).

3.5 Research Participants and Research Setting

As per opinion of Gay, Mills, & Airasian (2019), population and sample of a study may be comprised of persons, documents, objects, organization, or events, etc. The objectives and research questions of the study under discussion demanded for employment of purposive sampling to collect data from the following data sources as:

a. Single National Curriculum in subject of General Science (2020)
b. Science Curriculum experts/Members of Curriculum Development Committee
c. General Science Textbook of class V (NBF, 2021)
d. General Science Textbook Writers and Reviewers
e. FDE officials/Academicians/Educational Mangers
f. Primary science teachers who received training on Single National Curriculum

The study collected both the quantitative and qualitative data in the natural setting of the research participants. The interviews were conducted mostly in the offices of the personnel involved as per

their convenience. All the interviews were conducted in private, one-on-one mostly in some noiseless and comfortable environment. Most of the interviews proceeded smoothly, without any interruption. The participants were informed and coordinated well before time and informed consent of participation was taken before hand. Purpose of study, procedure and confidentiality of participation was ensured to keep participants at ease and to get all the interviews recorded. Classroom observations were being made in the routine classes as it was more conducive and convenient for the teachers as well as for the students. Researcher observed the classrooms in a "complete observer" style.

3.6 Sampling Technique

The sample size in qualitative investigations is contextual (Boddy, 2016). It depends less on the research paradigm but more on the point of data saturation. In order to make the study meaningful and beneficial, the researcher employed multiple sampling strategies to get in depth and relevant information from different data sources. The purposive sampling along with criterion technique was adopted to interview knowledgeable and information rich participants from different strata (Cresswell & Plano Clark, 2011). Relevant documents (SNC and subsequent science textbook) were selected and analyzed as driven by research purpose. Sample of the study included curriculum developers, textbook writer, and reviewer, FDE academicians and general science teachers. The research pursued perspectives of relevant stake holders (04 curriculum developers, 02 textbook authors, 03 FDE academicians, and 10 science teachers) regarding inclusion of skills, and their enactment in teachers' training and in classroom teaching-learning process along with availability of resources. The researcher collected the data till the saturation as per norms of qualitative data collection.

The purposive sampling technique was adopted to interview science curriculum experts who were being involved in curriculum development and review. Intentions were to get detailed, relevant, and in-depth information regarding integration of 21st century skills (creativity, critical thinking, collaboration, communication, and ICT) in Pakistani context as consequence of newly executed Single National Curriculum at primary level. National General Science Curriculum Review committee was constituted of 28 members (N=28). The study interviewed 04 curriculum experts (n=4, 15% of 28) who were involved in the curriculum development and review process in subject of General Science. Two authors wrote the textbook which is being taught in federal government schools. Initially the study planned and approached one of the two textbook authors (n=1, N=2). But later, the researcher also contacted and interviewed 01 textbook reviewer from National Review Committee who analyzed and endorsed its authenticity before implementation in public schools at primary level.

The study under discussion contacted all the 03 relevant FDE academicians (Academics and Quality Assurance Department) for their input regarding provision of facilities; infrastructure and technology and initiatives taken that can help in integration of 21st century skills in public sector schools at primary level. Furthermore, to interview the primary school teachers; researcher followed stratified criterion sampling technique to have a representation of male and female teachers in both rural and urban sectors of Islamabad along with including teachers from Model Colleges set-up. Till now, a total of 240 teachers were given training on Single National Curriculum (SNC); that included 38 teachers (N=38) in subject of General Science. The researcher interviewed 10 teachers (n=10, 26% of 38) who received training on Single National Curriculum in subject of General Science. According to Boddy (2016), 10-12 cases selected from a fairly homogenous population are ample to get saturated information. Moreover, the researcher selected

03 participants each from urban, rural, and model colleges set-up and planned to observe 05 science lessons of each science teacher for at least 25 minutes each. However, the researcher observed 03 classes of each participant as there was no change in their lessons or methodology and research got the same information every time.

Table 3.2 Research Sample for Document Analysis

Sr#	Document for Analysis
01	Single National Curriculum 2020 (Primary: General Science)
02	General Science Textbook (Class 5: NBF, 2021)

Table 3.3 Research Participants/Informants

Sr#	Research Participant Category	Population (N)	n (%)	Sample (n)
01	Curriculum developer (General Science)	28	14.8%	04
02	Textbook authors and reviewers	02	50%	01+01
03	FDE Officials	03	100%	03
04	Primary Science Teachers (Interviews)	38	26.3%	10
05	Primary Science Teachers (Observations)	10	30%	03

Selection of participants for classroom observation was made upon the usefulness of information collected from the interviews of general science teachers. That information was utilized in making decisions to select participants for effective classroom observations as well as consideration to

cover all the three mainstreams of Federal Directorate of Education (FDE); rural, urban, and model colleges. The researcher made observation of those science teachers who can provide more relevant, credible, and in-depth information. The specific classes/lessons observed were selected after reviewing the content of General Science Textbook (including SLOs) and teachers' consensus; in order to select the concepts that demand employment of 21CS in classroom teaching. For classroom observation, the study engaged 03 participants as 01 male and 02 females. It also assisted in making gender wise comparison along with sector wise analysis. Moreover, the study made 03 classroom observations in Model Colleges of urban areas (institutes with full fledge resources) 03 in Federal Government school of urban area (school with basic facilities) and 03 in Federal Government school of rural area (school with very less facilities). It helped to make a comparison whether integration of 21st century skills depend on the availability of resources or not. The researcher observed the classroom as a "complete observer/non-participant observer". Each classroom observation was made for at least 30 minutes. As practiced in qualitative studies, researcher kept on collecting the data till saturation.

3.7 Sample Size

As directed by research questions, the study under-discussion employed purposive sampling technique in the following categories:

1. Documents for Analysis
    a. Single National Curriculum at Primary Level (SNC: 2020)
    b. General Science Textbook of Grade 5 (NBF: 2021)
2. Research Participants
    a. Science curriculum experts/ Curriculum developers and reviewers (04)
    b. Textbook Writer (01)

c. Textbook Reviewer (01)

d. FDE officials / Academicians / Educational Managers (03)

e. Primary teachers who attended training on SNC in subject of General Science (10)

No hard and fast rules can specify the appropriate number of participants/sample size in collecting qualitative data. Therefore, the researcher collected the data up to the saturation level in each category of participants, though faced some difficulties regarding willingness of some of the research participants. Few participants were reluctant and declined to take part in the research process. Many of the science teachers who took training on Single National Curriculum in the subject of general science were teaching in secondary and higher secondary schools and not to primary classes. Hence, they could not be chosen as subjects for classroom observation. Additionally, the researcher also devised a criterion for including the participants; that the science teachers must hold a master's degree along with professional degree and should have at least 10 years of teaching experience at primary level. Consequently, the sample size for classroom observation was delimited to 03 participants. However, the researcher chosen the most relevant, competent, and knowledgeable science teachers who could provide valuable insight of the ground realities; on the basis of information retrieved from their interviews. Furthermore, the representation of all the three existing strata in Federal Directorate of Education (FDE); rural, urban, and model colleges along with male and female participants were taken into consideration. However, the researcher conducted 03 classroom observation of each science teacher as information were found to be same in all the 03 observed lessons and it was somewhat useless to conduct more observation.

3.8 Instrumentation

The current research was a descriptive study that combined components of quantitative and qualitative methods for data collection that includes document analysis, semi-structured interviews, and classroom observations. The research purpose and consequent research questions of the study called for employment of mixed methods. Self-developed instruments were employed to collect data for the study. A code book was also developed in the light of UNESO Framework (2020) for 21st century skills to understand the description of selected 21st skills and to identify them in the documents selected for analysis. Rubric frameworks were constructed to conduct document analysis of Single National Curriculum (SNC) and General Science Textbook. The semi-structured interview protocols along with their frameworks were made to collect truthful qualitative data based on facts. The research aimed at analyzing integration of selected 21st century skills in the Single National Curriculum (SNC) and its consequent teaching-learning process including textbook and classroom pedagogies. The interview protocols inclined to collect information regarding understanding of respondents about the importance of 21st century skills' integration in teaching-learning process. The instruments tend to focus on the knowledge and understanding of the respondents rather than asking memory-based details. All the interview protocols, metrics frameworks and classroom observation checklist followed themes of SNC, as it served as the foundation for all other investigation steps of the study. Rubric frameworks were developed for document analysis of Single National Curriculum and General Science Textbook. The frameworks included provision of selected 21st century skills in all the 05 themes of Single National Curriculum (SNC) document and all the units of general science textbook (Grade 5). The rubrics in these frameworks were constituted in two categories of "Yes" (1) for presence, and "No" (0) for absence of selected skills. Separate interview protocols were employed to interview

different categories of research participants. The questionnaire includes open ended questions regarding SNC provision for integration of selected skills (creativity, critical thinking, collaboration, communication, and ICT). It also tends to explore the connection of SNC implementation and integration of these skills along with barriers and challenges faced in the execution. Structured observation sheet was utilized to make classroom observation quantitatively. The observation checklist included indicators regarding inclusion and integration of selected skills in the daily classroom practices. The coding of selected 21st century skills was developed using UNESCO framework (2020). The details of instruments employed to collect data from different strata of respondents are given in the table underneath.

Table 3.4 Account of Research Instruments

Sr#	Instrument	Data Source
1	Metrics framework for document analysis	• Single National Curriculum (SNC; 2020) • General Science Textbook (Grade 5: NBF, 2021)
2	Semi-structured interview protocols	• Curriculum Experts • Textbook Authors • FDE Academicians/officials • General science teachers
3	Observation Checklist	• Observation of primary science classroom

To begin with, the tools were developed/adapted from the review of literature and further refined by information received after document analysis of SNC and science textbook. The interview questions were then validated by experts' opinion. The instruments were employed for interviewing curriculum developers, textbook author and reviewer, Federal Directorate of

Education (FDE) officials/educational managers, interviewing primary science teachers, for observing classroom pedagogies. A fact sheet/ observation sheet was constructed to examine the employment of facilities, classroom practices and students' assessment that can integrate 21st century skills (creativity, critical thinking, collaboration, communication along with Information, Communication and Technology) in primary science classes. Moreover, the information obtained from qualitative data of interviews particularly with the general science teachers, was also utilized to refine structured tally sheet employed in classroom observation. All the constructs were re-visited several times for modification and to safeguard their validity and reliability.

3.9 Validity of Research Instruments

The face validity of the instruments was ensured by a team of specialists, 06 eminent experts working in prominent organizations. The experts were experienced educationists and were totally independent and objective in their opinion. Besides the research instruments, whole research plan along with research questions and methodology was discussed to make the experts familiarize and understand the whole investigation process. The details of professionals consulted for the expert opinion are mentioned at "Appendix k".

Multiple meetings and deliberations were conducted to thoroughly discuss the interview protocols along with research questions. After taking input from the experts, the researcher revisited the instruments for modification. Most of the experts emphasized to include conceptual questions checking understanding of the respondents regarding inclusion of skills rather than focusing memory-based questions. Secondly, the experts opined to reduce the number of major questions and advised to stress more on the subsequent probing questions to extract in-depth information on a particular facet of research questions. For instance, in the very first draft of interview protocol with curriculum developers, there were 15 major questions, and each question has 2-3 probing

questions. These major questions were then reduced to 13 questions. Similarly, in the interview protocol with general science teachers, at initial stage there were 20 major questions which were lesson to 16 after consultation with the experts. The less relevant and insignificant questions in context of research informants were removed. Furthermore, the statements of questions were modified and accepted by the research experts with little alterations. Extensive deliberation was made to make interview questions' statements more expressive and explicit for the respondents. Moreover, initially the classroom observation tally sheet was constructed on 03 point Likert Scale (0,1,2) which after discussion with the experts was modified to 02 pint Likert Scale (0,1).

3.10 Pilot Testing of Instruments

Finally, the instruments were piloted to ensure their validity in actual field. Piloting helped in further fine tuning and rephrasing of interview questions in order to get maximum useful information from the participants. Interview protocol was piloted with a curriculum expert who had a research background as well (a PhD in education) and that facilitated the researcher more. Pilot-testing helped in making amendments regarding language and sentence structure to give clear thoughts/understanding to the participants. The questions which appeared less meaningful in context of participants were removed. The sequence of few interview questions was also modified. Pilot testing also helped the researcher in rehearsing the interview protocol, to improve the interview methodology and to estimate the time consumed in commencing one complete interview. After conducting piloting of interview protocols, some less necessary questions were eliminated, instead few more probes were added to sought out in-depth details. As researcher is also working as head teacher, the observation sheet was piloted in her own school to check its validity in science classroom. The alterations made after piloting the interview protocol were again shared and discussed with the experts and the supervisor.

3.11 Trustworthiness of the Research

According to Lincoln and Guba (1985), trustworthiness of a qualitative research is naturalist's equivalent of internal and external validity, objectivity, and reliability. Researcher's prolonged engagement in the research field and multiple meetings with the informants and triangulation led to determine credibility of the study. Furthermore, the credibility of the research was affirmed by the step of "member check" that ensured that the transcribed data is the exact interpretation of informants' meaning and perspectives (Stahl & King, 2020). Similarly, data triangulation was carried out to analyze document of Single National Curriculum (SNC) and subsequent Science textbook both quantitatively (content analysis) and qualitatively (thematic analysis) to further promote credibility of the research. An effort was made to safeguard the authenticity of the study as the researcher approached diverse level of stakeholders in multiple strata to hear voices and narratives of all the patrons. The transferability of the research was also enacted as the classroom observation was made in 03 different set-ups of FDE schools i.e., urban, rural, and model set up. Therefore, transferring results of one's finding, for instance classroom observation of one school of rural area to another school in the similar locality and with similar context.

The reliability of the research was ensured by "thick description" of data with the intention that the transcribed text appeared rich in details and a thick description was made closer to perceptible (Stahl & King, 2020). The reliability of the study was further supplemented by recording the interviews and through detailed and comprehensive field notes by the researcher. Thick description of field notes during interviews and classroom observation, and explanation of teachers' attributes supplemented in transferability of the study. Moreover, the dependability of the research was built by establishing rapport with the research contributors in multiples meetings to establish trust in order to seek their truthful responses.

3.12 Data Collection

Study started with document analysis that yield quantitative data from rubric frameworks constructed for content analysis of Single National Curriculum (SNC) and subsequent General Science Textbook. Quantitative document analysis proceeded towards generation of qualitative statements to give insightful and contextual meaning of the curriculum reforms and the science textbook. Quantitative data alone was found insufficient to securitize the whole background and philosophy of Single National Curriculum in context of selected 21st century skills. Therefore, in order to make the research more meaningful, qualitative data were collected through semi-structured interviews. Science curriculum experts who were involved in developing and reviewing SNC (2020) in subject of General Science and the subsequent science textbook author and reviewer were approached in this context. The researcher personally visited and interviewed all the participants. Senior officials/ academicians from Federal Directorate of Education (FDE) were interviewed regarding their insight on provision/availability of physical facilities; infrastructure and technology that can flourish and integrate 21st century skills (creativity, critical thinking, communication, collaboration, and ICT) at primary level. The researcher made multiple visits to the offices of concerned participants to confirm and verify certain information.

Public school primary science teachers who received training on SNC were interviewed to examine their understanding on integration of 21st century skills in primary education through newly adopted curriculum. Necessary permissions were taken from the concerned quarters in writing particularly to make field visits to the schools and to observe the classroom practices. Participants' written consents, from each target group, were taken for their willingness to contribute to the study. The researcher made more than one sitting with each participant in order to establish rapport with them so that they can feel relaxed, and the investigator can get truthful response from the

participants. It was also considered significant to make them at ease particularly for classroom observation. All the interviews and classroom observation were scheduled as per convenience of the research participants, and they were informed beforehand. Almost all the interviews were conducted in private, one-on-one as per convenience of participants. The interview protocols were followed to proceed sequentially, and probing technique was used in order to get maximum information. Participants' anonymity was assured by assigning them pseudonyms and codes. All the interviews were audio recorded and rich verbatim was used in transcribing the data. On interview closure, the researcher summarized the session and ask for suggestions or comments, if any from the interviewee. The researcher then expressed her gratitude to the participants for their time and ask permission for follow up interviews, if required.

Classroom observations of 03 primary teachers were done three times for at least 30 minutes each. The classroom observations were made to appreciate the theory-practice gap and to see the enactment of 21st century skills in real classroom scenario. The intention was to see the employment and utility of Single National Curriculum, impact of training on SNC, utilization of physical facilities; infrastructure and technologies, pedagogies and assessment methods employed in the classroom that can incorporate 21st century skills in the teaching learning process. It was anticipated that analyzing the policy documents and seeking perspectives of stakeholders through interviews is not sufficient and cannot ensure the pragmatic integration of skills in school education sector. Enactment can be testified by observation only and not on the opinion and perception.

To counter the researchers' bias in context of observing teachers' lessons, followings measures were taken in account as: the researcher has worked as science teacher trainer in a teacher training institute (2007-2016). She got first-hand experience of conducting classroom observation of

science teachers under different national level projects of JICA, CIDA and FDE. Secondly, the classroom observations were made structured (Appendix-I) and objective in the form of checklist (yes/no) to control researcher's bias. The structured observations tend to be systematic and support the researcher to draw numerical yet objective data out of observation. The use of structured tally sheet helped in minimizing the researcher's subjectivity and ensured consistency in the classroom observation process (Cohen, Manion and Morrison, 2007). It is also pertinent to mention that the classroom observation sheet was validated by 06 experts (Appendix-K & L) and then was piloted and amended. Furthermore, the researcher utilized code book (Appendix-J) approach to make the classroom observation focused and free from researcher's bias. The development of code book helps and directs the data collection and analysis procedure. Code book approach tends to define and describe the categories by elaborating on "what need to be included" within a specific activity (Susan & Isabel, 2015) which in this particular research were selected 21st century skills. The utilization of code book approach is deemed suitable for interpretation of data and demonstration of rigour in the research (Roberts, Dowell & Nie, 2019). It is worth mentioning that a metrics framework was also designed and validated by experts to account for the occurrence and frequency of 21st century skills (4Cs and ICT) during classroom observation. The classroom observation was planned to be quantitative so that it can be objective and for that the observation tally sheet was constructed on 2-point Likert scale (0= not observed/absence and 1= observed/presence). The reason was to keep the categories discrete so that there may not be any overlapping or confusion regarding judgement about presence or absence of selected 21st century skills. The philosophy of using only 02 categories was to just count the evidence for appearance or non-appearance of a skill as defined in the code book. Additionally, the lessons were selected after discussion with the science teachers considering the content as if it may give provision of integration of selected skills.

Thereby, the researcher also conducted post lesson discussions with the observed science teachers to review the observation process regarding enactment of skills and findings of classroom observation were also triangulated by the information extracted from the interviews of same science teachers.

It is also worth mentioning that the classroom observation was made limited to examining classroom practices of 03 science teachers only as the suitable sample (science teachers) for classroom observation was found very limited. It was due to inappropriate/irrelevant training nomination of science teachers and unwillingness of science teachers for classroom observation. Furthermore, mostly trained teachers were not teaching general science at primary level, so it was not possible to make their classroom observations. The classroom observation was made in March 2022, at the end of the academic year. It was presumed that the curriculum has been completely implemented and one academic year is sufficient for the teachers to understand and execute the spirit of SNC. Researcher maintained her journal and kept record of field notes during interviews and classroom observation.

3.13 Member Check

The interviews were voice recorded. The researcher also maintained a diary to ink down certain gestures and necessary information. After completion of all the interviews, the voice notes were decoded verbatim. The researcher listened to the audio tape multiple times to get familiarize with the data. The interview transcripts were then sent to the concerned interviewee to confirm whether the said information is same as he/she intended to and there is no difference of perception. Almost all the participants agreed with the contents of the interview transcripts. Only one curriculum expert made minor modifications which were incorporated by the researcher. This step also ensured reliability and truthfulness of the study.

3.14 Data Analysis

The data analysis started quantitatively by employing content analysis for document analysis of Single National Curriculum (2020) and General Science Textbook (grade 5). Susan and Isabel (2015) asserted that the content analysis of a text or documents can be carried out both quantitatively and qualitatively. The quantitative document analysis determined if and how the 21st century skills were being mentioned and incorporated in these documents along with their frequency and intensity of provision. Content analysis is used to ascertain the occurrence of certain words, phrases, concepts, or themes within a given text or document. Content analysis is also found useful in examining the trends and reforms in education (Fraenkel, Wallen & Hyun, 2011). The study applied content analysis to quantify (in term of frequency), the extent of presence or absence of selected 21st century skills (creativity, critical thinking, communication, collaboration along with Information and Communication Technologies) in above mentioned documents at primary level. According to Rose, Spinks and Canhoto (2015) and further employed by Ashraf and Huma (2021) numbers are the outcome of quantitative content analysis that can be manipulated and interpreted using different statistical methods. The quantitative content analysis was carried out by using stages as mentioned by Rose, Spinks and Canhoto (2015) and Ashraf & Huma (2021).

The content analysis was made by applying deductive approach to thematic analysis. A code book was developed after reviewing the literature and particularly focusing the framework given by UNESCO (2020) to define the selected 21st century skills. The development of code book helps and directs the analysis procedure. Code book tends to define and describe codes and themes by elaborating on what is “codable” and need to be included within a specific code. Coding unit should be taken in account considering your research questions and including concepts one want to analyze (Susan & Isabel, 2015) which in this particular research were selected 21st century skills.

The utilization of code book approach is deemed suitable for interpretation of data and demonstration of rigour in the research (Roberts, Dowell & Nie, 2019). A metrics framework was then designed and validated by experts to account for the occurrence and frequency of 21st century skills (4Cs and ICT). The rubrics utilized for the quantitative content analysis of documents were in the categories of "yes/1" and "No/0". Every sentence of the two documents was unit of analysis and frequency of each of the selected 21st century skills was then measured. The 21st century skills were then identified, underlined, and tabulated to determine the frequency (Ashraf & Huma, 2021).The inter-rated reliability was also determined to verify and establish the consistency of human coding of content analysis. The content of Single National Curriculum was analyzed along with a curriculum officer working at National Curriculum Council Secretariat (NCCS). The sub-sample was selected randomly for this purpose, and it was Chapter 4 and 5 of SNC document. Content analysis was further validated by two experts at NCCS. Afterwards in order to add value and meanings to the numerical data, contextual description was also added in the content analysis, both for SNC document and science textbook.

The study then proceeded towards the second phase which was qualitative analysis of semi-structure interviews with different strata of relevant stakeholders. Qualitative data extrapolated from semi-structured interviews were analyzed using deductive approach to thematic analysis. Thematic analysis includes coding of data and then segregating and putting the codes under similar themes. The researcher watched for patterns in order to extract meaning out of the data for further placing it into pre-determined themes that can interpret and describe the data (Braun & Clarke, 2023). The code book developed as per UNESCO framework for 21st century skills was also utilized to analyze the real-world data. Employment of code book also assisted in conducting a focused, refined, and effective analysis of interview data. Furthermore, the code book approach

tends to ensure coding reliability in thematic analysis through lens of pragmatism (King & Brooks, 2018; Roberts, Dowell & Nie, 2019). It also ensured objectivity and accuracy of coding as well as kept a check on "researchers' bias". A set of rules was formulated for "coding the text". The text was coded as per developed rules for checking both the existence, frequency, and intensity of 21st century skills (creativity, critical thinking, collaboration, communication along with Information and Communication Technologies).

Furthermore, the classroom observation was made quantitatively with the help of a structured tally sheet to account for the frequency of utilization of 21st century skills in classroom pedagogies. Here, again the rubrics employed in the two categories i.e., "Yes" and "No". "1" point given to the observation of an indicator and "0" point counted for the absence of an indicator during classroom reflection as per tally sheet. After analyzing the data from multiple sources, interpretations and subsequent findings were compared and converged to reach final corroboration.

The study adopted six-step qualitative data analysis model presented by Cresswell (2009) as given in the following figure 3.4.

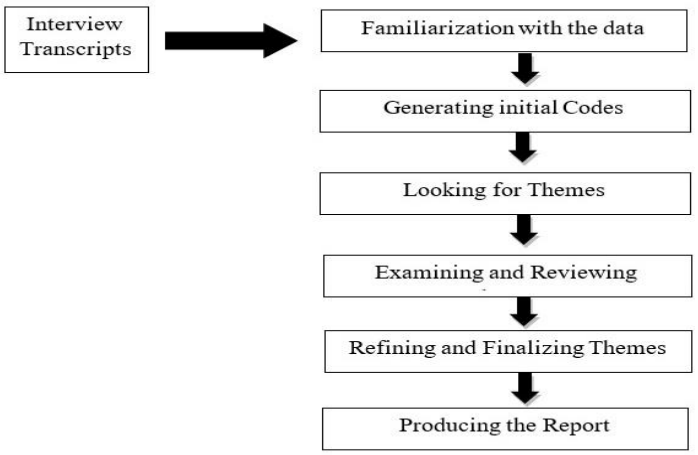

Figure 3.4 Data Analysis Process for Qualitative Data assumed from Creswell (2009).

The data analysis steps are followed as:

Step-1: Familiarization with the data

First of all, all the audio recorded data of individual interviews were transcribed and jotted down on a word file in computer. Qualitative data corpus in form of verbatim transcript from semi-structure interviews were scrutinized as some of the information was not related with the study. The researcher also created separate word file to jot down her observations, body language and facial expression of the research participants and contradiction of any views/ facts or documentary paradox, in case, under heading of "researcher's reflections". In this step, the researcher became very closely familiarized with the data and developed a very deep sense of whatever was exchanged between her and the research participants. The transcribed data were then sent back to corresponding research participant for the "member check". The researcher went through the data many a times and reflected on the responses of the research participants to deduce meaning and sense out of the data.

Step-2: Generating Initial Codes

Data corpus were transcribed verbatim to be fitted in the pre-determined codes and subsequent pre-conceived themes. The researcher adopted deductive, theory-driven approach to thematic analysis to develop code book that helped in identifying the emerging codes within the data. Coding process also involved re-considering the research questions in mind while assigning codes to the data. The researcher adopted both "sematic" and "latent" coding focusing on information related to research questions. Semantic coding includes analyzing the literal and explicit meaning of the data while latent coding approach implies analyzing and extracting in depth meaning, ideas and underlying assumptions of the data set. The researcher ensured to remain unbiased while coding the transcripts. The researcher utilized manual/hand approach to analyze the data and opted

color coding scheme to highlight relevant text/codes and then putting them on stick notes of different colors. Hand analysis approach can be preferred in case of small database that can be tracked easily, for instance less than 500 transcript pages and field notes (Creswell, 2009).

Step-3: Looking for themes

After coding all the transcripts, researcher made lists of all the extracted codes. Similar codes were grouped together on different colored cards and redundant/less relevant codes were scrutinized again. The researcher then applied open, axial, and selective coding scheme to generate themes. Similar codes were aggregated along to form broader themes that were relevant to research questions and discussed most by the research participants. The themes were identified by adopting the "top down" approach. Less number of themes are considered more appropriate as they can offer detailed information under a certain idea (Creswell, 2009).

Step-4: Examining and reviewing themes

The developed themes were scrutinized and reviewed again. Some of the codes were re-arranged and shuffled. The researcher tried to ensure that the finalized themes captivated the essence of relevant codes in connection with the research questions of the study (Clarke & Braun, 2014).

Step-5: Refining and finalizing themes

The themes were then filtered and finalized by inferring meaning out of the patterns and to make sense of data set deduced from different strata of research participants. The researcher also added thick descriptions from the field notes that included body language of research participants, their gestures, contradiction in answering certain questions or any of researchers' observation.

Step-6: Producing the report

Finally, the data was examined and interpreted to report the findings and make certain conclusions.

The report was descriptive to narrate perspectives, stories, experiences, and reflection of stake holders that participated in the research.

Table 3.5 Summary of Analysis Plan for the Research

Research Questions	**Unit of Analysis**	**Tools**	**Method of Analysis**
1. In what ways Single National Curriculum (SNC) gives provision for integration of 21st century skills; (creativity, critical thinking, collaboration, communication, and ICT) in subject of General Science (class 5)?	SNC document analysis	Learning Metrics framework for SNC Analysis	Quantitative Content Analysis
	Interviews with curriculum developers	Semi-structured interview Protocols	Qualitative Thematic analysis for interviews with curriculum Developers
2. In what ways General Science textbook of class 5 translates 21st century skills (creativity, critical thinking, collaboration, communication, and ICT)?	General Science Textbook Analysis	Learning metrics for General Science textbook Analysis	Quantitative Content Analysis for General Science textbook
	Interview with textbook writer	Semi-structured	Qualitative Thematic analysis for interviews

	and General Science teachers	interview Protocols	with textbook writer, reviewer, and teachers
3. How teachers' training on Single National Curriculum (SNC) in subject of General Science (class 5) is helpful for facilitating teachers in integrating 21st century skills (creativity, critical thinking, collaboration, communication, and ICT) at primary level?	Interviews with FDE officials and General Science teachers	Semi-structured interview Protocols	Qualitative Thematic analysis for interviews with FDE officials and teachers
4. In what ways are pedagogies being utilized for integration of 21st century skills; (creativity, critical thinking, collaboration, communication, and ICT) in science class at primary level?	Interviews with General Science teachers and their classroom observation	Observation Tally sheet	Scoring Rubrics for classroom observation
5. What strategies of students' assessments are being utilized in grade 5 science classroom that can integrate 21st century skills (creativity, critical thinking, collaboration, communication, and ICT) at primary level?			
6. In what ways are physical facilities (infrastructure and technology) being			

available and utilized for integration of 21st century skills; (creativity, critical thinking, collaboration, communication, and ICT) in primary schools?	

The above table 3.4 described the whole analysis, framework of the study including research question, unit of analysis, tools employed and methods of analysis.

3.15 Ethical Consideration of the study

The study was conducted in the naturalistic settings of the respondents. Field work in real-world settings may raise some ethical challenges. Following ethical concerns were taken into consideration from the very beginning.

1. Necessary permissions were taken before starting the data collection procedure. A reference letter from National University of Modern Languages (NUML) was utilized for the purpose.
2. Written informed consents were taken from the research participants. No participant was compelled to contribute to the study if they were unwilling to do so. Though prior permission for cooperation was taken from their directorate, participants' free will was respected and none of the respondent was pestered to take part in the study. That's why the sample size for classroom observation and the number of observations made could not be extended.
3. Participants' privacy of opinion and confidentiality was ensured. They were not forced to mention their names or professional affiliation. The participants were coded instead of writing their names in the database.

4. The researcher developed rapport with the participants through multiple meetings. This made them relaxed, and they were not anxious while describing their perspectives and interpretations.
5. The contributions made by other researchers included in this study are appropriately cited and referenced.

CHAPTER 4

DATA ANALYSIS AND INTERPRETATION

Chapter 4 deals with the extensive analysis and comprehensive interpretation of the data collected in the research journey. The study was meant to investigate integration of 21st century skills in the Single National Curriculum (SNC) at Primary Level. To accomplish the objectives of the research, self-developed instruments employed to collect data are as follows:

1. Metrics framework for quantitative content analysis of SNC.
2. Metrics framework for quantitative content analysis of General Science Textbook.
3. Separate interview protocols for different strata of participants i.e curriculum developers, textbook writers, and reviewer, FDE officials, science teachers.
4. Checklist/tally sheet to make quantitative classroom observation.

The data gathered by employing these tools from the stakeholders were arranged, analyzed and consequent results were shown in the form of tables and description. The analyzed data in this section is presented as per research design of the study i.e multiphase-sequential design (QUAN→QUAL→QUAN). The analysis is presented in three sections as:

I. Quantitative data analysis (document analysis of SNC and General Science Textbook)

II. Qualitative data analysis (semi-structured interviews with research participants)

III. Quantitative data analysis (classroom observation)

The researcher's role in this chapter is to evaluate the opinions stated by the persons who were included in the research and shared their individual experiences about the desired topic. The data analysis is objective in its orientation and includes plaintiff estimation about the issue prevailing in the education set up. This is so because the participants included are part of it and they know about the pros and cons of the education system in which they are dwelling and dealing. In this

regard present part of research is quite essential and sensitive in dealing with. It is researcher's duty to deliver all the assessments with honesty and complete confidentiality. So, keeping in mind the research ethics the researcher tried to incorporate all the estimation as per stated by the respondents of the study with true and vivid explanation. Only art and artifice included is lingual as most of the respondents stated it in national language "Urdu" while the research work to be presented was in English language. While transcribing the data into second language, the researcher was conscious of the fact that the idea and philosophy of the opinion may not be changed, and it might reach the readers clearly and explicitly as per intents of the respondents. Secondly, after transcribing the data all the interview transcripts were sent back to the corresponding participants for "member check" in order to safeguard if there is any difference of perception while recording/translating the interviews. This step ensured the validity of the research. Moreover, personal opinions, biased ideas and prejudice of the writer may be reduced to null. All the opinions included or interpreted are original and free from writer's intent. The analysis presented here deals with the nationwide legislation and execution of SNC, textbook, teacher training and observation of teaching learning strategies perceived in the Single National Curriculum (SNC) of Pakistan.

The study concentrated on investigating integration of selected 21st century skills in Single National Curriculum at primary level. Since the inception and launch of the curriculum, the contents of general science textbook of the grade 5 went through reforms. As the curriculum document claims to adhere to global trends and international commitments, the study focused on investigation whether the globally sought out concept of 21st century skills is being considered in the latest curriculum reforms or not. Subsequently, the study led to scrutinize whether the consequent general science textbook gave provision of incorporation and integration of these skills

(creativity, critical thinking, collaboration, communication, and ICT). As per these aforementioned reforms, the teaching strategies should also be renewed as the teachers teaching at primary level were given orientation trainings as refresher in service training so that the academicians might be able to align their teaching methodologies in order to obtain desired outcomes. The teacher trainings were designed to provide sufficient orientation to the primary teachers about the standards, benchmarks, content, teaching strategies and assessment of the Single National Curriculum (SNC). Some sessions were designed on classroom pedagogies and assessment strategies like problem-based and project-based learning and experiential learning to be adopted for the learners that can address these skills in science classrooms. The table underneath shows brief scheme for analyzing relevant documents of SNC and subsequent science textbook. Separate frameworks were developed to inquire in interviews with the curriculum developers, textbook writers, and reviewers, FDE managers and science teachers who got the orientation training on SNC and now are executing it in the science classroom.

The table 4.1 below shows the entire scheme for unit of analysis.

Table 4.1 Description of Unit of Analysis for the mixed-methods research

Unit of analysis (UA)	**Subject**	**Data**	**Analysis**	**Subjects**	**Research Question (RQ)**
UA 1	General Science Class 5	Document Analysis	Quantitative	Document of Single National Curriculum (SNC) and subsequent G.Sc. Textbook	RQ1 RQ2
UA2		Interviews	Qualitative	Semi-structured Interviews	RQ3 RQ4 RQ5
UA3		Classroom Observation	Quantitative Descriptive and Tabular	Classroom observation	RQ6

The researcher devised research objectives of the study with the notion to identify the contents of Single National Curriculum (SNC) that give provision for integration of skills. The intention was to observe how SNC was constituted in relation with the selected 21st century skills (creativity, critical thinking, collaboration, communication, and ICT) in subject of General Science (class 5). The data collected from different data sources via different tools were analyzed separately.

The data analysis is also being presented in this chapter with reference to the research design of the study i.e QUAN→QUAL→QUAN. The study initiated by the quantitative document analysis of SNC and General Science Textbook. To explore and examine document of Single National Curriculum (SNC) and subsequent General Science Textbook with reference to integration of selected 21st century skills, the researcher developed metric frameworks to do quantitative content analysis of the said documents. The table 4.2 underneath depicts metrics framework for analysis of SNC document.

Table 4.2 Metrics Framework for Document Analysis of SNC

	Selected 21st century skills				
Themes of SNC	**Concept of 21st century skills**	**Creativity**	**Critical Thinking**	**Collaboration**	**Communication**	**ICT as a tool for learning**

The skills mentioned in the above table number 4.2 are popularly known as the 4C's. These are the four influential and repeatedly quoted 21st century skills which are endorsed by different celebrated and leading organization around the globe. The modern world is trying to integrate these skills into the new generation so that they may be able to cope with the contemporary standards and challenges of education. The researcher delimited her study to these established skills (4Cs) along with "ICT as a tool for learning".

4.1 Quantitative Data Analysis (Document Analysis of Single National Curriculum and General Science Textbook)

The two major documents of the study i.e Single National Curriculum (SNC) and subsequent General Science Textbook were analyzed quantitatively. The quantitative analysis of both the documents is displayed in the following section.

4.1.1 Content Analysis of Single National Curriculum (SNC) in subject of General Science (Grade 5)

The very first research question of the current study was:

RQ.1 In what ways Single National Curriculum (SNC) gives provision for integration of 21st century skills; (creativity, critical thinking, collaboration, communication, and ICT) in subject of General Science (Class 5) at Primary Level?

For seeking answer to this research question, the document of SNC was analyzed quantitatively which is illustrated in the following table 4.3.

Table 4.3 Quantitative Tabulation of 21st century skills Curriculum Document (General Science)

Areas	**Selected 21st century skills**						
Themes of SNC	**Concept of 21st century skills**	**Creativity**	**Critical Thinking**	**Collaboration**	**Communication**	**ICT as a tool for learning**	**F**
Goals, Strands, Standards & Benchmarks	03	02	02	01	05	17	30
Learning Contents & SLOs	00	01	00	00	02	03	06

Teaching & Learning	00	06	01	07	02	03	19
Assessment & Evaluation	00	03	01	02	07	05	18
Guidelines to the Textbook Authors	00	07	02	00	02	01	12
F	03	19	06	10	18	29	85

Table 4.3 illustrates the frequency (number of recurrence) of selected 21st century skills (creativity, critical thinking, collaboration, communication and Information and Communication Technology) along with total frequency in all the themes/chapters of Single National Curriculum (SNC). It was found that the frequency of 21st century skills is 03, creativity is 19, critical thinking is 06, collaboration is 10, communication is 18 and ICT is 29 in the different chapters of Single National Curriculum in subject of General Science at Primary Level .

4.1.2 Content Analysis of General Science Textbook (Grade 5)

The second research question of the current study was:

RQ.2 In what ways content of General Science textbook of Class 5 translates and integrates 21st century skills (creativity, critical thinking, collaboration, communication, and ICT) at Primary Level?

The quantitative content analysis of document of General Science Textbook (Class 5: NBF, 2021) was conducted to explore the second research question which is illustrated in the following table 4.4.

Table 4.4 Quantitative Tabulation of 21st century skills Textbook Analysis (General Science)

Sr#	**G.Sc. Content Class V**	**Selected 21st century skills**					
Unit No.	Unit Title	Creativity	Critical Thinking	Collaboration	Communication	ICT as a tool for learning	F
01	Classification of Organisms	01	08	02	00	04	15
02	Microscopic Organisms	00	07	05	07	01	20
03	Flowers and Seeds	01	03	02	03	01	10
04	Environmental Pollution	00	06	03	03	02	14
05	Physical & Chemical Changes in Matter	00	03	04	05	01	13
06	Light and sound	01	17	09	10	02	39
07	Electricity and Magnetism	02	23	13	13	02	53
08	Earth's Structure	01	06	05	05	01	18
09	Space and Satellites	00	03	00	00	04	07
10	Technology in Daily Life	00	03	14	13	01	31
F		06	79	57	59	19	220

The aforementioned table 4.4 illustrates the frequency (occurrence and repetition) of selected 21st century skills i.e., creativity, critical thinking, collaboration, communication, and ICT in each unit of General Science Textbook of Grade 5. It was found that the frequency of these skills is creativity 06,critical thinking 79, collaboration 57, communication 59 and ICT 19 in the different chapters of General Science textbook (Class 5: NBF, 2021).

4.2 Qualitative Document Analysis (SNC and General Science Textbook)

In order to add depth and contextual meaning, the researcher also conducted document analysis of both the Single National Curriculum (SNC) and subsequent General Science Textbook qualitatively which is as follows.

4.2.1 Descriptive Analysis of SNC with reference to 21st Century Skills (4Cs and ICT) in subject of General Science (Grade 5)

National Curriculum (2006) of General Science aimed primarily on student-centered and inquiry-based approach. The curriculum publicized to be outcome focused. The targeted learning strands include knowledge in addition to skills, attitude and STSE (science, technology, society, and environment). However, the National Curriculum (2020) particularly stressed upon the development of science skills and processes among students. Here, the slogan was promotion of scientific literacy and active learning. It specifically mentioned the notion of "Life Skills Based Education (LSBE)" with focus on creative and critical thinking skills that were being adopted from the curriculum of Malaysia. Following is the account of status selected 21st century skills acquire in Single National Curriculum (2020).

4.2.1.1 Concept of 21st century skills

The preliminary pages of Single National Curriculum (SNC) mention that the 21st century skills including Information and Communication Technology (ICT) were among the key consideration during SNC development. The preface also refers to inclusion of Life Skill-Based Education (LSBE) which comes under the ambit of 21st century skills. The Single National Curriculum contemplation embraces adhering to international commitments and modern trends in education that can be related to Pakistan's recent pledge to Global Partnership for Education (GPE,2020) and execution of Sustainable Development Goals (SDG 4.7 for quality education). Furthermore, SNC

aims at developing skills and values among young students to cope with the evolving challenges of 21st century. SNC was being developed after a series of conferences and workshops at national level on themes of Sustainable Development Goals (SDGs), Critical Thinking and Life Skill-Based Education (LSBE) in particular. The purpose of reviewing the General Science Curriculum in particular highlighted its alignment with the international standards of 21st century. The goal of General Science Curriculum aspires to develop higher order thinking skills among students by mentioning curiosity, imagination, and critical thinking specifically.

4.2.1.2 Creativity

The Single National Curriculum (SNC) determines foremost goal of developing curiosity and wonder about ventures of science and technology. It inspires students to utilize science and technology for creating new opportunities of solving problems. SNC encourages students to explore their talent, passion and creativity in variety of careers in order to survive in this era of technological innovation.

In particular, the strand 03 of "Earth and Space Sciences" mentions about the curious nature of children and explains that their inquisitive nature inclines them to observe, gather and record the information about different phenomenon relating to universe. Furthermore, the 5th strand sets expectations of developing curiosity and interest regarding objects and events in the surroundings of the students. The objective of writing measures and suggestions for securing endangered species in unit, "Classification of Living Things" and scripting measures to protect yourself from infections in unit "Microorganisms" also aim to raise creativity among students. Students are asked to maintain a "scrap book" with preserved flowering and non-flowering plants and pictures of vertebrates and invertebrates also tend to nurture their creativity. Similarly, the activities of planning an awareness raising campaign about environmental pollution and devising measures to

lessen non-biodegradable materials in unit of “Environmental Pollution” addresses students’ creative thinking skills. The activity of designing symbols and creating signs to control noise pollution and appreciate human’s role in minimizing noise pollution in unit “Light and Sound” tend to nurture creative writing skills of students. Likewise, activity of designing a cardboard satellite model in unit “Space and Satellite” also targets students’ imagination and creativity. Similarly, activities of making simple technical models and devices out of easily available low-cost materials in unit “Technology in everyday life” also foster students’ creativity and innovation. Single National Curriculum (SNC) also talks about the opportunities for exploring and creating scientific knowledge. Active learning based on the theory of constructivism is the desired pedagogical approach advocated in SNC. The proposed teaching and learning strategies for active learning demand that the task designed for students should be creative, investigative, and challenging. The anticipated attitudes and values to be flourished in science classroom includes taking initiatives, inventiveness, and creativity. The examples mentioned for active classroom learning include “Flipped classroom” and “Problem-based learning” for enhancing creative capacity of students.

The assessment described in Single National Curriculum endorses divergent thinking by encouraging different and novel ideas for solving a problem and promoting the concept of no “single right answer”. SNC also directs that the test items should be constructed to measure achievement of students in area of creative and analytical thinking of students. SNC further explains that the scientific attitude of curiosity is an ongoing process that should be embedded in science lessons and can be flourished through individual and group projects. The reporting of project work enhances students’ creative writing skills that further lead to nurture scientific communication among them.

In delineating recommendations for the textbook authors, Single National Curriculum prescribe a textbook that can involve students in higher order thinking and can offer a strong underpinning for quality learning. For this, an important salient feature of textbook is to comprise review questions that should be engaging and can nurture creativity among students. The open-ended questions in section of “Investigate” and “Think-Tank” are to be included for provoking creativity and investigation skills of students. Furthermore, the criteria for reviewing the science textbook also states that the exercises at the end of chapters should encourage students to think, to be creative and to satisfy their inquisitiveness. SNC opted the idea of developing creative and critical thinking skills from Malaysian curriculum. It describes creative skills as generating ideas, relating connections, predicting, making generalizations, visualizing, synthesizing, formulating hypothesis, establishing analogies and inventing or adapting something.

4.2.1.3 Critical Thinking

Critical thinking is considered as one of the foundational stones of SNC as a series of workshops were being organized at national level on the critical thinking. In the introduction part, the SNC states the prime purpose of science as to teach students how to make observation, think critically, analyze, solve problems, and then make informed decisions. One of the goals set for science education is to enable students in critically addressing science related social, environmental, economic, and ethical issues. SNC emphasis that the critical thinking and problem-solving are two most important and desirous skills that students should learn in school. It claims that the new curricular reforms are designed to advance these higher order skills among students.

The strand 1 on “Life Sciences” in chapter on “Strands, Standards and Benchmarks”, provides students with opportunity to investigate the life diversities and examine how different living beings intermingle with each other and with the environment. The “Physical Sciences” strand 2 also urges

students to reflect upon the investigations about different concepts of electric current and sound. Furthermore, the standard 4 on “skills” categorically references development of students’ critical thinking skills regarding science concepts. It clearly mentions that the students should be encouraged to predict and re-design their investigation. They should be able to find multiple solutions to the problems, identify difficulties and propose improvement plans.

In chapter on content “Progression Grid” students are being asked to analyze factors which are upsetting Biodiversity, hence providing them with the opportunity to think critically about their natural environment and find solutions. Furthermore, in the next chapter students are required to think and deduce about useful and harmful effects of microorganisms by quoting examples from daily life. Students brainstorm on different activities and discuss which of these are caused by bacteria, viruses and fungi and how can we prevent them. The chapter on “Environmental Pollution” urges students to investigate possibilities and propose measures to lessen the non-biodegradable materials. Activity of designing an experiment for monitoring the changes during seed germination and a model of greenhouse effect also tend to nurture students’ critical thinking skills. Similarly, performing different experiments and making students observe and then draw the whole process along with findings also foster their higher order thinking skills.

SNC strongly endorses promotion of scientific literacy through age-appropriate critical thinking which are provided in SLOs of each chapter. Students are anticipated to utilize the opportunity of in-depth investigation and to understand the connections among science, technology, society, and environment (STSE). It encourages that students should take responsibility of their own learning and should be inquirers in the classroom. SNC advocates provision of Problem-Based Learning in order to foster their critical thinking skills.

SNC suggests that the assessment should be a comprehensive process of analysis and reflection that summarize assessment and make informed decisions. It envisions that after taking ownership of their learning the students should be empowered to be the critical and predictor of their learning too. Students should adopt the role of a transparent researcher and should utilize their critical thinking skills to find facts and making inferences. SNC stimulates students to re-think, reflect and articulate their learning in order to learn science processes and skills. The assessment described in SNC gives sufficient weightage (20%) to the reasoning and critical reflection.

SNC instructs textbook authors to include the concepts that can foster higher order thinking of students. The science textbook should contain sufficient range of engaging activities that nurture students' thinking. The students should be able to draw their own inquiries and construct their understanding from lower to higher investigation skills. The critical thinking skills that are being categorically mentioned and emphasized in SNC includes attributing, comparing, and contrasting, grouping, and classifying, sequencing, prioritizing, analyzing, detecting bias, evaluating, and making conclusions.

4.2.1.4 Collaboration

The development of scientific literacy is based upon the acquisition of certain skills that are commonly labelled as higher order thinking skills. However, realizing the importance of global interdependence and consummating ones' role for a sustainable future is another important aspect of scientific literacy which is being considered in curricular reforms. Single National Curriculum (SNC) offers sufficient opportunities for the students to work in collaboration, share and discuss in groups. It urges students to work in teams and make informed decisions. SNC aims at developing essential habits of mind for the purposeful study of science and its relevance to the society. This results in a disposition to understand the universe and the ways in which one can contribute

positively towards it. It includes reverence, concern, sensitivity, and apprehension for well-being of peers. SNC has incorporated these attitudes in the SLOs so that the students can learn responsible behaviors. Various activities that involve brainstorming, planning, designing, conducting, and compiling are suggested to be performed in groups that involve closed collaboration among students. Projects assigned at the end of each unit are also group activities in which students have to fabricate or make different models. The motive is that the students should take responsibility of their individual role in a group assignment and should contribute their part towards accomplishment of the project activity. In this way students can take maximum benefits out of their talents and abilities, work towards achievement of a common goal and can learn according to their preferred learning styles.

Single National Curriculum promotes active learning which has its roots in constructivism and social constructivism. Social constructivism advocates "social interaction with teacher and peers" as being the catalyst for learning. Thus, the teacher being the more "knowledgeable other" and the peer learners together work in collaboration to build community of active learning. SNC specifically mentions notions of "collaborative learning", "cooperative learning" and "problem-based learning" while explaining the features of active learning. It encourages collaboration among learners and promotes peer assessment. Active learning in every unit in SNC is supplemented with the activities of dialogues, paired/group discussions, role plays and group work.

SNC promotes to embed assessment within the teaching learning process by promoting team efforts and collaboration among students. It also includes and stresses assessment of individual contribution in team/group work, in class discussions and in projects. The assessment suggests that the written test items should also be constructed in a way to assess students' capability to work in a team with peers.

4.2.1.5 Communication

Single National Curriculum aims to introduce and converse students with appropriate scientific and technical vocabulary necessary for communicating the concepts of physical world. The cross-cutting themes of SNC include discussing and communicating scientific concepts. Almost every concept includes students' involvement in variety of ways of communication like written and oral presentations, graphs, labelled diagrams. Furthermore, students are expected to plan and conduct campaign regarding awareness raising on different environmental and climatic issues. Many of the student learning outcomes include students designing and demonstrating different models that nurture their communication skills.

The prime purpose of scientific literacy stated in Single National Curriculum embraces students to not only obtain scientific knowledge but also learn how to communicate their findings and conclude their inquires in front of others. Role-play, debates, discussions, and oral presentations are kept as integral part of learning strategies suggested in SNC. Teachers are anticipated to encourage students for explaining and communicating their learning concepts and key ideas in their own words. SNC also endorses students' self-assessment that allows the learners to communicate their scientific learning and then the effective communication link of teachers with the parents in reporting progress of students' learning. Scientific communication is considered as key part of scientific learning and its assessment is recommended through oral presentation, drawing labelled diagrams, practical reports, role-plays and performances, exhibitions, peer assessment and research projects and their reports. Communication has been put as a central science process skill that present all the learning content, its delivery in classroom and the assessment. SNC recommends that the students should learn to organize, process and interpret their learning.

4.2.1.6 ICT as a Tool for Learning

Single National Curriculum (2020) ingeniously introduced and amalgamated ICT (Information and communication technology) as a tool for learning. As adhering to modern trends in education was one of the key considerations of National Curriculum, so inclusion and integration of ICT; being the most popular teaching learning tool in contemporary world was inevitable. The cross-cutting elements of curriculum included STEM that involve students' understanding of concept that how technology affect and improves our lives. There is a complete separate chapter with name "Technology in Everyday Life" that involves development and management of technical skills among students. The highlight of curriculum in area of computer technology is that it has embedded relevant weblinks in every chapter of general science. Therefore, both the teacher and the students can visit and utilize the suggested weblink to grasp the concept. It can make the lessons interesting, and students can easily visualize the abstract models and notions that cannot be performed in classrooms due to lack of resources or some other reasons. Secondly, active learning is the catchphrase of national curriculum which furthermore mentions provision of "flipped classroom". The pedagogical model of flipped classroom can be employed successfully through utilizing ICT as a tool for learning. ICT enables both the teachers and students to access teaching-learning material, for instance instructional videos, quizzes, innovative projects, online tests and other so many av aids. The classroom assessment strategies mentioned in the curriculum also encourage technology usage for alternative modes of students' appraisal other than conventional paper-pencil test. In the chapter of "guidelines for the textbook authors", the writers are suggested to incorporate IT related activities for encouraging students to make effective use of internet.

4.3.2 Descriptive Analysis of General Science Textbook (Grade 5) with reference to 21st Century Skills (4Cs and ICT)

In Pakistan, textbook is the most substantively utilized teaching-learning resource material to lead students' learning in classroom. Most of the time textbook is the only guiding tool to direct students' learning, especially in public sector schools. The general science textbook presently employed in federal government schools is published by National Book Foundation and written by Prof. Jawaid Mohsin Malik and Prof. Muhammad Ali Shahid. The said textbook translated the learning outcomes of science curriculum as per cognitive level of primary students. A detailed account of guidelines has been provided in the curriculum document along with the criteria for the evaluation of that textbook. The thematic analysis of general science textbook with reference to selected 21st century skills is delineated as follows.

4.3.2.1 Creativity

The recently developed and implemented general science textbook is designed to be student-centered by incorporating lots of activities. The component of "project" included at the end of general science chapter is an effective break-through towards cultivation of creativity among students along with other 21st century skills. However, the component of creativity was not very much addressed as compared to other skills. The element of creativity could be enhanced by providing open-ended, unstructured pursuits and students had to think on their own about the materials and procedures to complete the project. Likewise, students could be asked to think about the various ways to solve a given problem and to perform a certain activity.

4.3.2.2 Critical Thinking

Critical thinking is the most frequently addressed skill in the general science textbook. Almost all the units of the general science textbook aim for developing critical thinking of students. Most of

the units starts with the introductory questions that instigate and stimulate students' thought process. Insertion of dialogue boxes with the heading "investigate", "points to ponder" and "constructed response questions" in the exercise of each chapter particularly earmark and nurture student's critical thinking skills. There are lot of activities that require students to observe and think. Similarly, the dialogue boxes of "point to ponder" and "quick quiz" also excite students' high order thinking skills.

4.3.2.3 Collaboration

Almost all the activities prescribed in general science textbook urge students to work in collaboration as a team. Group work is very much encouraged that can enhance cooperation among students. Students gathering material for different activities and performing them in groups is an effective option to develop collaboration. Besides various activities "projects" given in each unit are another way to enhance collaboration among students. Similarly, conducting class quiz in form of teams also urges students to be responsible, accountable of their learning, to cooperate and support each other.

4.3.2.4 Communication

The activities and projects performed in groups with collaboration lead to the presentations which could be individual or group presentation. Students discuss the activities and assignments in groups that improve their communication skills. Similarly, explaining and presenting their projects in front of whole class not only raises their confidence but also leads to enhanced communication skills.

4.3.2.5 ICT as a Tool for Learning

For enhancing students' knowledge and understanding, 2-3 weblinks are offered at the end of each general science unit. The provision of these links also urges students to make effective and

responsible use of internet. Likewise, the inclusion of "open ended questions", "points to ponder" and "constructed response question" require and pushes both students and the teachers towards web surfing.

4.4 Qualitative Data Analysis (Semi-structured Interviews with Research Participants)

The succeeding research questions of the study were as:

RQ3. How teachers' training on Single National Curriculum (SNC) in subject of General Science (Class 5) is helpful for facilitating teachers in integrating 21st century skills; (creativity, critical thinking, collaboration, communication, and ICT) at Primary Level?

RQ4. In what ways are pedagogies being utilized for integration of 21st century skills; (creativity, critical thinking, collaboration, communication, and ICT) in Science class at Primary Level?

RQ5. What strategies of students' assessments are being utilized in science classrooms which integrates 21st century skills (creativity, critical thinking, collaboration, communication, and ICT) at Primary Level?

RQ6. What kind of physical facilities (infrastructure and technology) are being available and utilized for integration of 21st century skills; (creativity, critical thinking, collaboration, communication, and ICT) in Primary Schools?

These research questions were interrelated, and researcher tried to reach out the most information rich cases to explore the closest and relevant information. In order to seek out perspectives and narratives of stakeholders regarding integration of 21st century skills in SNC, the research adopted qualitative method of conducting interviews in order to get in depth and meaningful information from the most relevant research participants. The literature review generated following themes for

integration of 21st century skills in Single National Curriculum. The deduced themes directed the construction of semi-structured interviews with the research participants.

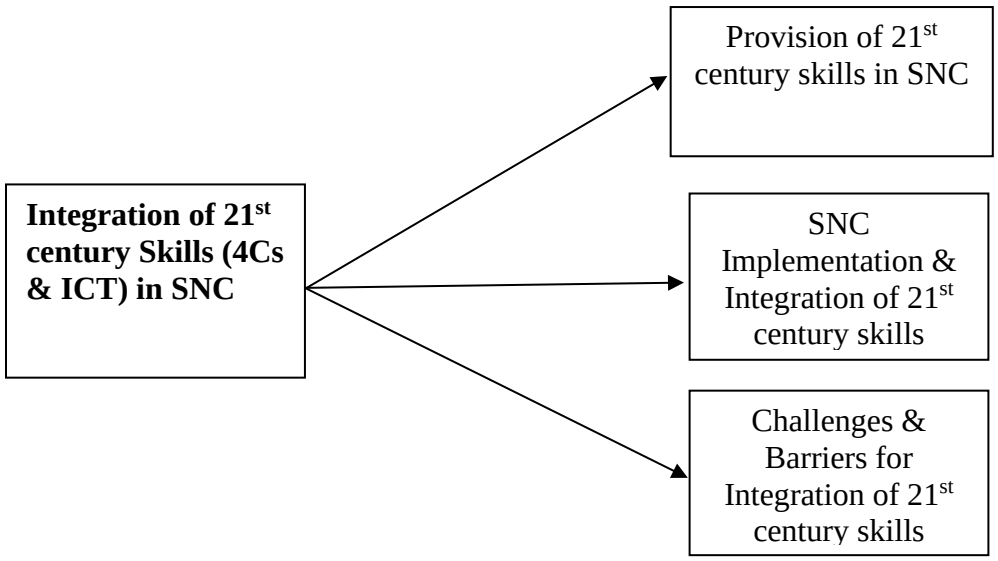

Figure 4.1 Themes for Integration of 21st Century Skills in SNC

The researcher based the interviews on these four selected skills (creativity, critical thinking, collaboration, and communication) along with "ICT as a tool for learning". The stakeholders selected were directly or indirectly involved in the procedure of initiation, development, and execution of SNC at primary level education.

Table 4.5 Framework for semi structured interview with stakeholders (Curriculum Developers, Textbook Writers and Authors, FDE Officials and General Science Teachers)

Sr.	Construct/ Themes	Interview Questions	Probes
1		Q.1 Does SNC address 21st century skills?	(i) Can you explain with some examples… how?

	Provision of 21st century skills (4Cs and ICT) in SNC	Q.2 How do you perceive the idea for inclusion and integration of 21st century skills in SNC?	
		Q.3 Does SNC address 4Cs? How and in what ways?	(ii)What kind of classroom pedagogies and assessment strategies are directed in SNC that can integrate 4Cs at primary level? Can you specify some methods or activities?
		Q.4 Does SNC address ICT as a tool for learning? How and in what ways?	(iii) What kind of classroom pedagogies and assessment strategies are directed in SNC that can integrate employment of ICT at primary level? Can you specify some methods or activities?
2	SNC Implementation and Integration of 21st century skills (4Cs & ICT)	Q.5 In your opinion, how can we develop 21st century skills among students?	(iv) What kind of benchmarks/standards you design to enhance 21st century skills in students?

		Q.6 Do you think that the SNC curriculum reforms can be helpful in integration of 21st century skills (4Cs and ICT)?	
		Q.7 Mostly our examination system targets recall and understanding level, as an educationist what do you suggest for implementing of SLO based assessment focusing higher order thinking skills?	(v) How and in what ways? Whether there should be shifts in teacher development? Or in provision of facilities/ resources?
		Q.8 What do you suggest for teachers regarding implementation of SNC and development of 21st century skills among students?	
3	Challenges/Barriers for integration of 21st century skills	Q.9 In your opinion, what are the main hindrances/ challenges for integrating 21st century skills in our education system?	(vi) Can it be lack of facilities and resources, training deficit, teachers' competence….?
		Q.10 Do you think that our public-school teachers have the potential to translate and integrate 21st century skills (4Cs & ICT) in their classrooms?	(vii) If yes, please specify some indicators or quote reference? If no, what can be the possible solution?

Q.11 Do you think that the training on SNC was sufficient to empower teachers for translating and integrating 4 Cs & ICT in their classrooms?

Some of the "code-able" text from the research participants are quoted below as an example.

Table 4.6 An Example of Thematic Map associated with the deduced Themes

Codes	Themes
"SNC is a blend of STEM and STEAM that focuses on critical thinking, creativity, hands on activities and teamwork." "We have included textboxes like "Interesting information", "Do you know", "Projects" and "Points to ponder" that instigate students' thinking and curiosity. "Provision of web-links in each science unit is an attempt to integrate technology". "The purpose of including STEM in curriculum reforms was to introduce and address 21st century skills".	Provision of 21st century skills (4Cs and ICT) in SNC
"We ask our students to collect resource material for class activities in form of teams". "Classroom activities are conducted in pairs or in groups which is a step towards inclusion of skills".	SNC Implementation and Integration of

"Students share not only the materials but also the knowledge and the skills".	21st century skills (4Cs & ICT)
"We endorse role of teacher as a facilitator and not as a dictator".	
" We tried to lessen teacher-centered approach and focused more on student-centered approach".	
"We have no mechanism for quality assurance of teachers' training at federal level".	Challenges/Barriers for integration of 21st century skills
" We cannot take our students to computer lab, nor do we have internet in our school".	
" Teacher lack skills and will to improve their professional competence".	
"It is difficult to conduct activities in our classroom as we have above 50 students in our class".	
"We arranged the material required for activities by our own selves".	
"Our students have language barrier; they feel difficulty in understanding concepts described in English language".	

4.5 Provision of 21st century skills (4Cs and ICT) in Single National Curriculum (Theme 1)

The declaration of research participants regarding inclusion and integration of 21st century skills in the recent curriculum reforms in form of Single National Curriculum (SNC) was asked through semi-structured interviews which is described category wise in the upcoming pages. Theme I of the semi-structured interviews consisted of probing questions regarding perception and ideology of the stakeholders including curriculum developers, textbook writers, and authors, FDE officials

and general science teachers regarding enclosure and integration of 21st century skills. In the first place, the depiction inscribed from the respondents who were involved in the curriculum policy design, its development and implementation is given as.

4.5.1 Curriculum Developers' Assertions regarding Provision of 21st Century Skills in SNC

One of the curriculum developers shared that the 4Cs have been particularly addressed and targeted in Single National Curriculum. Technically, SNC is a blend of STEM and STEAM that focuses on critical thinking, creativity, hands on activities and teamwork. Therefore, we can say that the 21st century skills are deeply addressed both by the curriculum writers/developers and the reviewers. However, the issues come in the implementation phase of curriculum. The curriculum specialist claimed that she has also reviewed the curriculum documents in her PhD study and found that we have developed very good curriculum documents in the past as well, but the main problem is the implementation, as these documents do not reach our teachers and principals so could not be executed in true spirit.

The research participant no.2 opined that in any curriculum reforms made, the most important factor that should be considered is that the modifications must be in accordance with the latest trends as you have to apprise the students about the modern trends and global advancements and for that curriculum is the key. So, the basic reason of this curriculum revision was that the last curriculum was made in 2006 and after that a lot has been changed. Thus, we conducted comparative studies with the curriculum of different countries. We found that our previous 2006 curriculum was also quite good, and it also addressed 21st century skills to some extent and it mentioned critical thinking, inquiry, and problem-solving skills. But in order to align these skills with today's latest trends like when we were developing 2006 curriculum; we were talking about

MDGs and now we are talking about SDGs. Now a days we are making special reference to SDG 4 on quality education, that stresses critical thinking, global citizenship, and creativity. Therefore, we organized conferences in collaboration with UNESCO to make comparative analysis and to see the extent SDG 4.7 has been catered in old curriculum. Then after identifying the gaps in 2006 curriculum, we made sure that these gaps should be addressed in new curriculum. In order to do this, one way was to introduce a separate subject; but another better way is that such things should be brought as cross cutting theme. Therefore, what we have done is that we have included these themes as a cross-cutting themes in our curriculum. Now, if you see our curriculum or pick our textbooks or the teachers training modules which we have developed and even in assessment frameworks, we have somewhere tried to ensure this thing that the skills of critical thinking, creative thinking, collaboration and specially citizenship skills should be included. Similarly, the awareness about some common societal issues like cyber-crimes or traffic sense should be included from the very basic level and progress gradually towards higher order cognition like environmental and climate changes and a lot of other things are being included in curriculum, in our textbooks and in the teacher training modules. The respondent advocated the dire need of thinking skills' development and considered it utmost for the development in the national curriculum. The participant stressed mainly on the development of positive thinking from the beginning to make children good citizen, problem solver, good leader of the humanity and a person who takes right decision at the right time for the betterment of the society and humanity.

One of the research participants explained that inclusion of collaborative, cooperative learning, problem-solving and experiential learning in SNC seemed to put more stress on the skill development among the learners. As education deliverance was thoroughly committed to achieve the Sustainable Developmental Goals (SDGs) in Pakistan so keeping its relevance to 21st century

skills, components of SDGs were also in our mind. Like we inculcated content about how to take care of environmental pollution or work in collaboration with reference to the particular topics.

Another curriculum developers further delineated that the situational teaching adds to another modern activity being envisaged in the minds of the learners from the beginning and that are skills of collaboration and communication which are being considered as the focal one while developing curriculum. The skills of collaboration and communication were also our parallel focusing part while developing curriculum. We fixed our science content writers that there must be some hands-on activities or some project with every science unit. These skills can be fostered and developed in students by engaging them in various projects activities. These activities can be in pair or in groups. Group activities involve children of different abilities. During these activities, the students share not only the materials but also the knowledge and the skills. The communication of children can be improved by involving them in various practical situations. They learn from each other. They respect each other's point of view and can make their point of view understandable to others. Their presentation and confidence level also increases as they are being provided with the opportunity.

ICT is one of the major sources of learning now a day. SNC, brought a major paradigm shift in the form of ICT. The development of SNC was made after reviewing curriculum of various advanced as well as developing countries. It was noticed that the content in these curricula is very less, but the more focus is on skills. The main emphasis is on the information that what type of technology you should have and particularly provision of a web link that can take the students directly to some authentic web pages or site of that concept for more clarification and deep understanding. Accordingly, we have included reliable web links and online resources in our curriculum through facilitation of various reputed organization. We have added separate chapter on technology so that

the students can have practical first-hand knowledge of some common household devices like usage of thermometer, and they should have an idea how to apply their skills in daily life. Hence, we have added a separate skill-based chapter that includes activities relevant to content but also have practical applications. For instance, how to prepare face mask using low-cost and no-cost material as a safety measure in emergency like COVID-19. Children should be made to learn how to work in collaboration and present their work effectively.

The fourth research participant responded regarding provision of 21st century skills in SNC as these higher order skills are always being addressed in curriculum and particularly with reference to the subject of science. There has always been the need to stress and develop skills like creativity and curiosity among children through motivating and promoting hands-on activities. Hence, development of skills with reference to science and to make science class interactive is always being considered as very necessary.

One of the research respondents expressed that the development of SNC was related more to the science process skills. Therefore, the key consideration necessary for the students while SNC development was that their observation skills must be sharpened. The children must be able to predict. Thus, we motivated the teachers that their classroom teachings should be started with prediction. The main purpose of curriculum was that the observation skill must be improved in children. So, that when they go and experience things by themselves; they make analogy and connect their classroom learning with the daily life, and they would be able to draw their conclusion. Therefore, such type of activities and skills are being tried to promote in curriculum which increases curiosity and creativity of children. There has been an attempt to enforce communication skills among students as well. Consequently, the students not only do work with their hands, but they should also be able to present it. The activities and methods employed to

enhance these skills should be more attractive and engaging so that they can improvise curiosity and creativity among students. Secondly, it should also be considered what sort of assessment should be adopted in the classroom so that these skills, if developed in the students, can be judged. Involvement of the students in each and every activity in class is ensured at all grounds as without students' engagement nothing can be achieved. These activities are illustrated in the science textbook. Information and Communication Technology (ICT) is being addressed in SNC to supplement and support classroom teaching. When the curriculum was being developed, one of the main considerations was to what extent we could facilitate the teachers. Through deliberations, the idea pop up that there are so many websites available on the internet which provide learning resource material like worksheets and quizzes to the teachers; and everything available there is free of cost. Therefore, according to different topics in the curriculum; the web links to these sites have been given. So, the teacher which ever concept he/she wants to teach can consult the material accordingly. Some material is just for the teachers but some material like worksheet is useful for the students as well. If only a single teacher makes a worksheet or if student consults one worksheet which is in the book, then it is a limited resource, it doesn't create or develop much curiosity or depth in understanding. But if you have multiple worksheets from different sources available for children then s/he will take that concept from different angles and in that case more development of skills will take place.

4.5.2 Textbook Writers' Assertions regarding Provision of 21st Century Skills in SNC

The researcher approached and took interviews from the stake holders who were the part of developing textbooks of general science for the primary level learners. The researcher identified the authors who have written and reviewed the general science textbook. They were also being

involved in developing science content from the very beginning. They were the supervisors of science textbook development process as well.

The experts selected hold multidimensional experienced regarding textbook content development and its review. The experts were of the view that while designing the contents of the general science textbook the consideration of 21st century skills were kept in mind as per needs and requirement of the learners. They affirmed that textbook authors and reviewers were given necessary orientation about the inclusion of SDGs. After the training and rigorous meetings with focal committee on SDGs under Ministry of Federal Education and Professional Training, the authors started textbook development under the SDGs domain which included 21st century skills as one of the focal parts for consideration. A conscious effort was made to incorporate 21st century skills in the textbooks. The curriculum mapping was done to target these 4Cs and digital literacy in particular. When the experts had planned the roadmap, they designed the science content and classroom pedagogies for the science textbook so that they might be able to address 21st century skills. Former science curriculum of 2006 was revisited and many of the major activities were constructed keeping in mind the previous curriculum and endpoint was to make it more student centered, and activity based targeting higher order thinking.

The outcome of this entire rigorous activity was inquiry-based curriculum along with STEM integration. The textbook authors were completely sensitized and focused regarding inclusion of SDGs and 21st century skills. They made it completely activity and inquiry based and integrated STEM along with components of technology. Hence, textbook writers incorporated activities with reference to skills, added triggering and brainstorming questions, points to ponder, interesting information so that the child can explore by him/herself. Addition of group activities to foster and develop collaboration among all students was yet another uphill task as this curriculum was aimed

to be “Single National Curriculum” so learning needs and learning styles of all kinds of children, like students with higher learning abilities, and students with some learning difficulties were considered.

The textbook author asserted that the next phase was the assessment of the pedagogical skill acquisition through these inductive inferences which the learners were supposed to take up while learning through these books. Assessment is an important domain. A formative assessment technique was preferred and suggested for the grade 1-5 learners’ assessment. This was made possible through the inclusion of questioning & answering technique, brainstorming, worksheets, and including different projects within the textbook. In order to elaborate the concept and for future investigations the component of ICT was incorporated in the form of web links which were added in each unit for students to explore and learn more. Secondly, the addition of textbox with the captions of “interesting information” and “points to ponder” that mostly instigate students’ thinking and curiosity.

The science textbooks in the market were declared as the instrument for inclusion and integration of 21st century skills. The general science books were found quite interesting and meaningful. But now the main thing is its implementation and transmission in true spirit. A conscious approach is required for the execution of higher order skills and activities included in science textbook. Structured Teacher training is very necessary to sensitize teachers about transferring these skills in students. But it’s a big challenge and conscious efforts are required for effective implementation.

The respondents were asked a core question about the design and effectiveness of the textbook in complementing SLO based assessment as the textbook is based on student learning outcomes (SLOs) taken from the SNC. The research participant explained that now the teachers, textbook publishers and the examination boards are quite aware and sensitized about the importance of

SLOs in teaching learning process. Punjab Examination System has started "school-based assessment" which is totally SLO based. So, gradually assessment is being moved towards SLO based. The teacher's role is highly crucial in this regard. The Teachers should be given proper awareness and training. If they are not aware about these reforms, how can we expect them for its implementation? Secondly, there is lack of motivation. Because of regular jobs and job security, government sector teachers are not taking any pain to work hard. On the other hand, as private sector teachers do not have job security so in order to show performance, they are implementing these reforms in a better way. Teachers 'motivation, availability of resources and follow-up are the main things for proper implementation. Additionally, the respondent added that we have piloted all the activities in our classroom before their inclusion in the textbook. We have particularly considered that all the activities should be doable and easy for students. Resource materials should be low cost and easily available.

The general science textbook enclosed creativity and self-learning prospects in the form of projects. The directions are also given for the facilitation of both the teachers and the taught. Such aforementioned structured activities and guided projects seemed to diminish students' creativity and novelty. In response to this inquiry the textbook author affirmed that we has a detailed deliberation and brainstorming on this part during textbook development. The textbook designers might work out to resolve problems/issues which a learner at the primary level might face as they are open ended, and inquiry based. Many of the learners at initial level are not used to internet surfing or utilizing web links. Majority of the teachers do not have the science background or competence to guide students. As we were doing it for the very first time so many experts opined that without instruction and guidance our teachers would not be able to do the needful. At present, the teacher does not have the potential to explore and guide students, so we have limited activities

and projects to instruction and demonstration as a starting point. Moreover, curriculum of class 5 is considered heavy curriculum because of its alignment with the Trends in International Mathematics and Science Study (TIMMS). Consequently, if we have kept the activities and projects open ended, teachers might just skip it because of lack of knowledge, guidance, and interest. Therefore, to start with; the intention was to just initiate the process. Constructed response questions and mini projects given in science textbook can also inculcate creativity in students. I think our students are more motivated than our conventional teachers.

One of the textbook developers acknowledged that the 21st century skills have been addressed in primary general science textbook. She declared that during the textbook development process, all the textbook authors and reviewers have been given orientation about the inclusion of SDGs. We had regular meetings with focal committee on SDGs under Ministry of Federal Education and Professional Training. The SDGs domain also includes and promotes 21st century skills. Therefore, a conscious effort was made to incorporate 21st century skills in the textbooks. We did curriculum mapping to target these 4Cs and digital literacy in particular.

The textbook author further affirmed that though our former curriculum 2006 was also activity based and student centered. It was inquiry-based curriculum along with STEM integration. But unfortunately, that spirit of curriculum was not being reflected and implemented in the previous textbooks. There was a gap. But now this time, we were completely sensitized and focused regarding inclusion of SDGs and 21st century skills. We made it completely activity and inquiry based and integrated STEM along with component of technology. Hence as far as selection of science content and classroom pedagogies are concerned, we incorporated activities with reference to skills, added triggering and brainstorming questions, points to ponder, interesting information so that the child can explore by himself. We have added group activities to develop collaboration

among students. As this curriculum was aimed to be "Single National Curriculum" so we considered all kind of children like students with higher learning abilities students and students with some learning difficulties. We suggested formative assessment technique for students' assessment. We included questioning, brainstorming, worksheets, and different projects for this purpose.

For the assessment part, we have incorporated understanding based MCQs and short question answers. Then we have added "constructed response questions" whose answers are not typically provided in the book. To answer those questions, students have to brainstorm and think critically about the concepts. Students have to dig up the solutions to such questions. Moreover, we have added "projects" that can nurture observation, creativity, and collaboration among students.

4.5.3 FDE Officials' Assertions regarding Provision of 21st century skills in SNC

In response to discourse the need for and importance of 21st century skills, director academics of Federal Directorate of Education (FDE) rejoined that there is a dire need of developing these 21st century skills among students. This can be done by revising the curriculum, through implementation of the teaching practices and through capacity building of the teachers. It cannot be denied that our curriculum was in dire need of revision and upgradation as per global requirements, after 2006 curriculum. The conventional teaching methods and learning acquisition required drastic change to meet the demands of current era. The essentialities were required not only to meet the current demands of time but also to fulfill the competitive job market hassles. If we don't develop these skills among students from the beginning, we will not be able to get the desired output in higher education. If a child is not able to communicate well and he is not confident, then how he would be successful in future life? So, it is very important to develop these skills among students.

The research participant stated that developing skills among students will generally improve quality of education. The skills will tend to improve the academic abilities of students; whether they are prone to take science or any other subjects as majors in their higher education. Because when we talk about creativity, critical thinking, and collaboration, these are basically life skills and whatever profession or higher qualification they are aspiring for; these skills would be beneficial for the students. The academic output of students can be improved through fostering these skills and these skills can help students in competing positively with each other. We cannot restrict our students to opt for science education only; yes, science education has more scope, but they will also contribute in a better way to the other areas of education as many of us are doing. All areas of education can be improved through employing these skills.

Another educational manager highlighted that inclusion of 21st century skills is very necessary not only to meet the current demands of time but also to fulfil the competitive job market. If we don't inculcate and develop these skills among students from the beginning, we will not get the desired output in higher education. If a child is not able to communicate well and he is not confident, then how he would be successful in future life? So, it is very important to develop and nurture these skills among students. The respondent further added that in order to excel in science, we need improvement in field of research as we are lagging behind in it. If a child has acquired these 21st century skills he would have multidimensional thoughts and he will excel in the field of research. He will try to explore more and more and will present his ideas in a better manner. In this way, his skills will complement and support science teaching and learning.

Contrarily, another participant from management of FDE though admitted the importance of 21st century skills but added that unfortunately education is not our priority and has never been. Our

only priority is just to get some share out of the foreign funding, under-cover of some educational projects. There are lots of funds available but unfortunately these are not being used effectively.

4.5.4 General Science Teachers' Assertions Provision of 21st century skills in SNC

During the interviews with general science teachers the researcher discovered that public school science teachers were not very much conversant with the 21st century skills. Though in category of science teachers, the study sampled only those participants who received training on Single National Curriculum (SNC). The teachers were familiar with the notion of 21st century skills to some extent particularly the ones who were master trainer and got 01-week training, but they were totally clueless as to how to address and develop these skills. One of the teachers opined that the 21st century skills are useful and important tools that can be applied to teach science and technology. These skills can be utilized to enhance the ways of thinking and creativity of student. These are the life-skills which students in contemporary times must utilize to live a successful life. She added that science starts from critical thinking and creativity and all these 4 skills are important. One more teacher added that we need to develop creativity in our students so that we can have innovations and creative scientists in future.

Another teacher pronounced 21st century skills as technology/computer related proficiencies. She focused on conceptual understanding and connected skills with the internet searching. Although the teachers were not sufficiently clear about the concept of 21st century skills yet they were aware that these skills are very much required for success in the contemporary era. One of the research participants stated that the 21st century skills enhance potential, capability and cognitive flexibility of students which encourage them to learn new ideas and develop their social and emotional capabilities. She added that these skills will expose students to the real-world data and tools by

emphasizing deep understanding rather than shallow knowledge. These skills also help to develop self-regulation.

In response to the question about her perception on 21st century skills, one of the teachers stated that I believe that our student of class 4 or 5 should be at the same level as that of some other students of the world. He should be cooperative and learn in cooperation with other students. He should be an active learner and not a passive one. He should be able to present his work and findings in front of his class. He should be an eager learner and create something from his classroom learning instead of rote memorization. We want learning of our students in accordance with the global concept of 4Cs. The research participant added that 4Cs tells us clearly about inclusion of collaboration and communication. For instance, we want all the students to actively participate in group activities. So, in group work students should involve their critical thinking in solving a problem, they should observe, cooperate, collaborate, and communicate their work. Another science teacher analogies 21st century skills with the activity-based learning. She stated that if we teach any topic through activities, children will take interest and will master and hence skills would be developed among students.

To conclude with and taking account of narratives of all the stake holders, it is determined that all the relevant strata of education stream were well aware of the notion of 21st century skills. Most of them recognized the need for and significance of these skills and endorsed their inclusion and integration in the teaching learning process. The curriculum developers and textbook authors strongly authorized the enclosure and amalgamation of these skills in Single National Curriculum (SNC) and subsequent science textbook. The representative of Federal Directorate of Education (FDE) also affirmed the importance of these skills but at the same time they confessed that no specific project is being initiated after the launch of SNC at primary level that can promote and

integrate skills among students. Similarly, no specific learning resource is provided to schools for addressing and developing these skills. Furthermore, the general science teachers who received orientation training on SNC were though acquainted with the names and idea of 21st century skills but were not clear about what are these skills actually. Most of them often confused and limited 21st century skills merely with the use of technology and activity-based learning.

4.6 SNC Implementation and Integration of 21st century skills (4Cs & ICT) (Theme 2)

The proclamation of research participants on integration of 21st century skills with reference to Single National Curriculum's execution is as follows.

4.6.1 Curriculum Developers' Assertions regarding SNC Implementation and Integration of 21st century skills

One of the curriculum developers proclaimed that for the first time in Pakistan, national curriculum has been aligned with the global trends and international commitments that led to inculcation of 21st century skills in SNC. These skills are being addressed in SLOs as well as in teaching strategies. The curriculum developer asserted that for creativity, we have given concept of STEM and STEAM in science curriculum. We can develop creativity in children by indulging them in various projects. For instance, if we are teaching force and motion; in that topic besides the content, I would provide students with a challenging environment so that they can think critically. For instance, using concept of force, how can they create some device that put less effort and lift more weight or by applying certain concept how can they make their life easy. In this way, we have inculcated creativity and critical thinking in science curriculum. The students can work on their own by using the low-cost material provided. In our previous curriculum, focus was on cognitive thinking but now by connecting cognition with the affective and psycho motor domain; we can

inculcate creativity in students. We can measure their psychomotor domain by project-based learning.

Another research participant quoted that any simple example can be taken, for instance if a teacher is teaching a lesson on plants, conventionally that teacher opens the book and start reading from the book that these are the parts of plants, etc. Instead, if the teacher asks children to collect and bring plants for themselves. Afterwards, the teacher can ask the students to compare and relate the pictures given in the book with the plant they brought. Help them in making comparison like: "Which parts are there in your plant and what parts are there in the picture of plant given in the book". The students themselves can identify easily, whether this is stem, root or leaves of a flower. Thus, a lot of such sorts of activities have been included in curriculum and in classroom pedagogies, and for them children can collect material from their home or from their school and can present in their class. The information given in the book should be compared and relate with the daily life. We have also tried to promote the role of teacher as a facilitator and not as a dictator. We have lessened teacher-centered approach and put forth the student-centered approach.

One more curriculum developer retorted that the beauty of this single national curriculum is the induction of all skills in the classroom instructive outfit and assessment stratagem. Separate chapter based on teaching learning strategies are provided for the guidance of a novice teacher. We have focused on active learning which has its roots in constructivism. It promotes connecting and building students' new learning with their prior knowledge. Then along with active learning we have associated the notion of cooperative learning, problem solving, activity-based learning, experiential learning, collaborative learning, and project-based learning. To inculcate all these activities, teachers are advised to either involve students in group work or urge students to ask inquiry-based questions from teacher. The teacher can also adopt whole classroom instruction or

demonstration method depending on the classroom environment and availability of resources and can ask the students to practice it later. These skills can be developed in students by actively involving them in classroom activities. Techniques like debates, role playing, group discussion and presentation; all these are included in the activities part, and they can play a significant role. We have kept teacher bit flexible in choosing the activities and strategies as per his classroom situation. A teacher can adopt any of these strategies according to his classroom environment and available resources.

One of the research respondents affirmed that overviewing the challenges raising in the implementation of these innovative science texts, a major paradigm shift is required so that the science content may integrate skill acquaint among the taught. This can be jotted down as first of all, activity-based teaching with STEM and STEAM integration should be started. Projects should be given to students. Our teacher has to think, plan and work hard to design the classroom teaching. School leadership should monitor the classroom teaching practices. Effective and change oriented training of SNC is required to achieve the desired goals. These trainings should not only be for the sake of training but rather a discursive design of trainings are required to take things in consonance. The training purpose should be inducted unless the trainees understand the basic concepts regarding STEM, problem-based learning, and project work. There should be a series of trainings arranged for the teachers periodically so that the teachers might address all the difficulties coming in their path. This would help the effective implementation of the SNC.

Face-to-face trainings must be arranged instead of online training because of its more effectiveness and the training should be based upon hands-on activities. The online training conducted in provinces provided teachers only with the orientation and they just had an idea what SNC is about. But to have good understanding and to fully implement it we need more comprehensive trainings.

The textbook author asserted that this point should be included in the recommendations of current research study that both the science teachers and school leadership should be given training on SNC. One must be given responsibility of teacher training as lot of new areas and dimensions have been emerged in domain of teacher training. But unfortunately, our change agent, our teacher is not fully equipped to implement these reforms.

The examples regarding classroom pedagogies and assessment quoted for further illustration in this regard can be activity-based learning which is the main key towards inclusion of skills. In SNC also, activity-based learning is recommended. Students should be involved in various hands-on activities. For instance, students can be asked to collect data in the form of teamwork. After data collection, presentations can be given regarding a particular topic. For example, one activity that I proposed, and which is also being included in science textbook, curriculum developer asserted, is about collecting data regarding diabetic/BP patients, which are quite common diseases in our country. Students can be asked to do some research about the history of such patients, like their eating habits and lifestyle; in order to explore the reasons behind these diseases. Here, "Why" form of questions can be asked by the teacher as well. Hence, the higher order thinking skills of students can be addressed in such activities. In progression, the use of instruments and making measurements will come in higher grades. Such activities are very useful for the students to familiarize them with scientific way of research. All the 4Cs are addressed in such activity-based learning.

Another curriculum developers added that while designing the SNC, the focus of academician was to improve thinking of students rather than merely improving the content. Thinking can be improved only by developing the skills. While developing the curriculum, we reviewed many international curricula of different countries (Malaysia, Singapore, Australia, UK, and USA) and

explored how they teach science. We frequently found the notion of 21st century skills in these curricula. Then we decided whatever content we include in our science curriculum; component of thinking skills should be the primary focus. Both our classroom pedagogies and assessment strategies should be based on the thinking skills. Thus 21st century skills were the basic component of primary science curriculum, and these are integrated through concepts of STEM and STEAM. Keeping in mind the global demands, we intend to include content and activities in the curriculum that can make a collaborative class, can foster cooperative learning, problem-solving and experiential learning in science classroom. The commitment interpolated was to achieve the Sustainable Developmental Goals (SDGs). In this pursuance inculcation of how to take care of environmental pollution or work in collaboration with reference to the particular topics were also assorted. Specifically, the issue that were being brought to concerns were the inculcation of creativity or critical thinking for the learners at beginners' level. These skills are being addressed in SLOs as well as in teaching strategies. For creativity, we have given concept of STEM and STEAM in science curriculum. We can develop creativity in children by indulging them in various projects. For instance, if force and motion is being taught in the class then in that topic besides the content, teacher would provide students with a challenging environment so that they can think critically. Likewise, using concept of force how can they create some device or by applying certain concept how can they make their life easy. In this way, we have tried to inculcate creativity and critical thinking in science curriculum. The students can work on their own by using the low-cost material provided. Similarly, another activity of mounting a flag in the playground with the help of pulley and hoisting that flag. In the general science textbook teachers are advised to just provide students the names of materials required which are easily available like a rope, bamboo, and a hanger. The students would then use their critical thinking and creativity to assemble all the

materials to make that flag hoisting functional. In this way, their concepts will be cleared, and their imagination and thinking skills will be developed. They would think analytically and apply their concept in the practical life. In our previous curriculum, focus was on cognitive thinking but now by connecting cognition with the affective and psycho motor domain; we can inculcate creativity in students. We can measure their psychomotor domain by project-based learning.

One other research participant affirmed that as far as ICT is concerned it is being submerged and integrated with other thinking skills. The teacher in a class can integrate ICT in his lesson by using internet research as web based activities are included in curriculum. It is very necessary that students indulge in internet research work. The students can be asked to use computer in making power point presentation. Here, children can work in collaboration. First, they will collect data individually and then will compile data in group and make presentation on a given topic. But I am talking about the ideal situation while ground realities are different. The teacher should also have computer literacy to make students work like this, it is absolutely essential. In Pakistan unfortunately, teachers do not want to learn new things and they do not have these 21st century skills. The same group work activities can be performed by the students at home. This approach is mainly called “remote collaboration” and for this the knowledge of computer is necessary. Documents can be shared through Google drive. I create documents and PowerPoint presentations and share them via Google drive. It is free of cost. There is collaborative chat as well. In this way, technology can facilitate and ease work of teachers.

4.6.2 Textbook Writer Assertions regarding SNC Implementation and Integration of 21st century skills

One of the research respondents added that the mentioned skills are stressed a lot in the classroom while teaching science subject. The benchmarks and standards of curriculum were designed to

develop or enhance 21st century skills among students. The curriculum standard and SLOs are basically the means to improvise skills among the learners. He further indicated that we initiated with bringing skills into the curriculum in different subjects. For example, the authors who were writing textbooks, they kept content more or less the same but the teaching learning activities and how you assess that content, that creates the difference. Consequently, while designing some activities or while designing some guidelines for the teachers or while designing your assessments, the textbook authors ensured that these things are inculcated. You should ensure that students are tested the way they should be tested, for example, keeping in mind the critical thinking skills, if you are just focusing on lower order thinking and you keep making your questions on basis of knowledge and forgetting about affective domain, that would never help. Therefore, it is important that you assess how much understanding of a certain thing has been developed in a student. Then you judge whether it is being adopted according to latest modern-world trends and that the students are now capable enough to find solutions to their problems. Because we are living in the century where changes are coming so rapidly that it is very difficult and challenging to keep up with that pace. So, if you cannot update yourself, you will be irrelevant in coming years. Like today's child in 2022 would come into job market after 16 years; probably in 2038 or 2040. If we are not ready to solve the problems of today, then we don't even know about the nature of problems which are coming ahead. Therefore, in that sense it is very important that we talk about problem solving skills. Consequently, somewhere in curriculum we have talked about life-skill based education, critical thinking in different subjects and in teacher trainings as well. Still, we have a lot of things in pipelines upon which we are planning to do a lot of work.

In this general science textbook, we have tried to start all the SLOs with the activities and mostly we have not shared results in the textbook. The intention was to discourage rote learning so that

the students may not memorize the results/answers of an activity. Students should try to find out the results by themselves. For example, in an activity of dissolving sugar in two glasses of warm and cold water, we have not mentioned the result. The reason was that the students themselves should perform the experiment and explore by themselves that the sugar would be dissolved more easily in warm water. Similarly, the effect of stirring the water on dissolution of sugar is also not revealed with the intention that the students should perform and observe by themselves. Teachers mostly try to spoon feed the children so that they can get more and more marks which in turn reduces their creativity. Teachers should try to make student creative writers from the very beginning. The philosophy of Single National Curriculum is that all the different streams of education in Pakistan; for example, English medium, Urdu medium, and Madrassah system should deliver same kind of education in whatever medium they are using. All the students should get equal learning opportunities to excel in the world. Throughout my professional career, I gave admission to every student in my college. Instead of marks, aptitude test should be the criteria for admission.

4.6.3 FDE Officials' Assertions regarding SNC Implementation and Integration of 21st century skills

The provision of physical facilities/infrastructure or technology must be provided to the schools especially for the teaching of science subject so that the schools could integrate 21st century skill among students. The rapid provision of these resources is required as nothing has been provided particularly in context of implementing 21st century skills or SNC execution. But many schools already have lots of resources like they have USF computer labs which are utilized by students. Many schools like my previous school have an activity room which has lot of resource material provided through different projects i.e., Children Resources International (CRI) project. The room

also has a LED; if a teacher brings some videos in her USB, she can use that facility to show it to the students. Furthermore, the activity room has some reading material other than textbooks that the teacher can also use. In some schools, even multimedia and projectors are also available which are being given through different projects. But FDE has not provided any material particularly with reference to implementation of SNC or 21st century skills; all available resources are project based. Secondly, it also depends upon the school management how they manage their resources within their provided budget, but we specifically don't have any provision for the availability and utilization of these resources.

Orientation training on SNC is essentially required to empower teachers so that they can translate these skills in their classroom practices. So far, the trainings conducted by National Curriculum Council (NCC) or by Federal Directorate of Education (FDE); were merely an orientation of SNC's philosophy and teaching methodology being. It was merely an introduction and not sufficient in terms of length, in terms of content and in term of expertise as how to incorporate spirit of Single National Curriculum (SNC) in their teaching practices. There must be more intensive and more comprehensive capacity building programs for the teachers and there has to be continuity in such programs in order to inculcate these skills into teaching practices, happening in the classrooms.

For the sustainability and effectiveness of the training programs follow up mechanism with particular reference to inclusion and integration of skills might be scheduled. The visit of master trainers should be arranged to check the implementation of the training in the real classroom scenario particularly focusing on the teachers who received SNC training. One of the FDE official proclaimed that there was once a follow-up initiative, adopted and governed by this office of (academic section) but that does not exist anymore. The teachers were asked to conduct/

disseminate the training to their colleagues at school level and send us the feedback report. But there was no specific and structured mechanism that can monitor the progress of trained teachers or effectiveness of any training program.

The respondent on the question of provision of some physical facilities regarding infrastructure, ICT tools or any resource material to empower and facilitate teachers so that they can implement these skills in their classes. The research participant was clear in stating that they have provided a comprehensive document of "instructional guides" in schools. This document can be used as a good resource. It is a planner of "SLO based teaching" from grade (Prep to V). Instead of focusing on the textbook content, the focus must be shifted to skills. That document is one good resource and if teachers can utilize this document, it can change and improve their teaching practices.

In this context, one of the FDE academicians (Director) declared that initiatives are being taken by FDE and Ministry of Federal Education and Profession Training (MOFEPT) to facilitate teachers and schools regarding implementation of SNC. But all these things are happening in pockets. We cannot say that there is some consolidated policy that says that we have to implement 21st century skills in our classroom practices or in our schools and for that we have to take measures. It is the other way round. Things are happening, but in chunks. She stated some initiatives are as:

One scheme is in the area of human resource; that is to recruit competent science graduates. Fresh science graduates will be hired through vigorous competitive process, solely for primary schools. 500 Elementary Science Teachers (EST) will also be entering into the public education system shortly. In addition to these 500 ESTs, subject specialists would be appointed through competitive exam of Federal Public Service Commission (FPSC). Consequently, by the end of this year, almost 1000 new fresh blood will be well received in the system that can bring change in the system. But change, especially in education sector is not something that happens overnight or in weeks or

months. For people of education, we may say that it takes thousands of years to boil the ocean. So, you have to wait and put so much of energy to see any change.

4.6.4 General Science Teachers' Assertions regarding SNC Implementation and Integration of 21st century skills

The interviews with the public-school teacher were arranged as the teachers are the main stakeholder/implementer of this curriculum. They are the change agents who are supposed to execute the policies. The teacher is the main pillar, and their role is instrumental in the policy implementation. The question was asked about the perception of a teacher about the role SNC execution can play in integrating 21st century skills. Teachers were asked as to what extent the curriculum standards are followed in actual classroom and how much facilitation had been given to the teachers for this implementation.

Another teacher responded that the 21st century skills are quite important. Not only for Pakistani students but as to live and compete in this whole global world. These skills are very important to work in competitive jobs. Like as now we have started teaching instructions in English, it would be helpful for our children in their future life if they go abroad for further study or for work. I perform practical activities in classroom, relate the concept with daily life, and quote examples from real environment. I try to address these skills within the provided facilities. The teacher affirmed that I use different kind of assessment strategies like questioning, assessment through experiment and through paper-pen test. The inclusion of ICTs is also linked with 21st century skills to a great extent. The teaching aids available in schools are white board, charts, models, and some audio-visual aids. I teach and make them understand practically. Then I quote suitable and relevant examples.

One of the general science teachers asserted that there is a lot of group work in science. Resultantly all these skills like critical thinking, communication, collaboration, creativity and inquiry which are being developed in children as they are actively involved in the teaching learning process. Children' critical thinking is being developed in group work in which they discuss the problems with each other in given projects and make joint presentations.

The data educed from the research participants found out that the 21st century skills are important to improve the quality of education at primary level especially in science education. It is so because due to these activities and skills the new and relatively different concepts get imprints into minds of students forever. These skills of creativity, critical thinking or communication in teaching tend to improvise "learning by doing" in understanding scientific concepts rather than merely reading the content of book. One of the science teachers clarified that through implementation of SNC, the teachers are bound to first make the concept understandable by describing the concepts on whiteboard secondly, then they try to perform certain activities in classroom. Sometimes teachers take students out of the classroom like in playground while teaching them about flowers and plants. Science is a subject of understanding; it is not about rote memorization. The General Science Teachers (GSTs) try their best to make students understand the concepts.

One general science teacher illustrated that primary level education is the perfect level to develop and implant the seeds of these skills in mind of young children. The role of teacher is quite crucial in this regard as s/he is to work out substantially towards their development. The modern world's challenges have become vaster and if we try to develop these skills at an early age among students; for instance, at primary level, it will help them in making observation, in analyzing the situations, in thinking critically and in solving problems in their later years. These 4Cs and ICTs seemed more helpful to improve the quality of science education. Science is a subject which is related directly

to practical activities. Quality of science education can be improved only if we teach students through scientific way of observation and experimentation that can be done only by employing these 4Cs and ICT.

Another science teacher asserted that these 4Cs (critical thinking, collaboration, collaboration, communication) and ICT can address and bring innovation in learning. After introducing or presenting a new topic/concept in my class, I asked my students to think critically and asked questions whatever comes into their mind. In this way they can develop habit of inquiry in them. Then, I perform the activity given in the science textbook. I involve my students in groups or in pairs. Then students solve problems given in the book. This illustration helped learners to develop critical thinking and problem solving in their daily routines as well in the classroom learning. Almost all the content given in SNC of grade 5 can utilize ICT. We have LED screens in our classrooms, but we do not have the internet facility in our schools. Thus, maximum we can do is that we can download videos from our own mobile data and show them to children. It can help students in picking and grasping new concepts. Secondly, we can also ask students to watch the video links given in the textbook at their home.

The general science teachers (GSTs) also perceived 21st century skills as the life and career skills which included habits and traits that are critically important to students for success in today's world. They alleged that 4Cs are always essentials for a science classroom teaching. These skills are strongly recommended because if students would not adopt these skills they would be left behind in the whole world. Therefore, in order to compete with the world and to progress, the learners should be given proper training in these skills. The learners at grade 5 need to develop these skills. These skills will expose students to the real-world data and tools by emphasizing deep understanding rather than shallow knowledge.

The GSTs uttered that the 21st century skills are essential as they focus on deep understanding and help the learner to solve daily life problems. The 21st century skills enhance working and cognitive flexibility which encourage students to learn new ideas and develop their social and emotional capabilities. On answering the questions about the incorporation. The general science teachers were of the opinion that first of all, they set their targets and objectives of classroom teaching that what they were going to achieve in a particular lesson. After introducing a new concept, students are made to think critically and answer the questions asked by the teacher. Many students are quite creative, and they give novel and multiple ideas about the concepts, which are beneficial for the other students as well. Activities are performed in collaboration within groups, students help and support each other. Then students infer and express their findings which improve their communication. For instance, in unit "Conversation of Endangered Species", students can think critically and analyze factors that can cause extinction of endangered animals. Furthermore, thinking about the measures that can save the endangered animals can develop critical thinking among students. Similarly, the Unit "Biodegradable and Non-biodegradable materials" also involve generation of scientific ideas and problem-solving approach among learners.

The data retrieved in the form of interviews from general science teachers indicated that most of the male and female teachers who have got training on SNC, have developed some perception of the 21st century skills and their incorporation in science classrooms. It may be generalized that the students of class 4 or 5 are treated equally as the learners around the globe are being taught the subject of science. One of the general science teachers affirmed that one of the major reformations of SNC is that the learners are becoming more cooperative and learn rules of collaboration and teamwork with other students. They have become active learners by the introduction of SNC. Now they try to present their work and findings in front of their class. They are in a habit to work in

collaboration and cooperation in classroom with their classmates. This procedure empowers them to learn and create something through classroom learning instead of rote memorization. This revolution happened because of shifting the teaching paradigm in accordance with the globally set concepts.

One of the FDE officials affirmed that during the visits and observation of the schools, they observed that the students were working in pair share technique, students being divided into small groups to meet the needs of their curriculum and to learn and compete in a positive way. As per concept of 4Cs all the students were actively participating in the group activities. All the individuals have defined roles and responsibilities. Even in group presentations, thinking and working of all the students were reflected. Like in group work, students were seen showing their involvement in critical thinking while solving a problem, they cooperate, collaborate, and communicate their work. These modern and innovative skills of 21st century can make Pakistani students to equate with the world and can create a global sense of competition among them. The youngsters are future of this world, and they have the equal rights to up bring their faculties like the other students of the world. The knowledge of scientific concepts and contents are almost the same throughout the world, but the difference lies in their teaching methodology only. As the world has become a global village now, our students should not be deficient in any aspect. These skills are extemporizing the subject of science as active learning, and ICT are just in consonance with the concepts of science teaching. The teachers in Pakistan should try to induct such classroom pedagogies in their teaching instructions that can develop 4Cs among students. As far as classroom pedagogies are concerned, it depends on topic and varies from topic to topic. For instance, in some topics, they divide the class in groups and assign them tasks. Students perform the assigned task or activity or solve any problem. Here, we observe the performance of group as well as the

individual's role and participation. An observation can also be made on how they present and communicate their topic. Accordingly, the teaching tactics varies from topic to topic. First, selection of activities is made as per topic to be taught and then decision is made about the teaching methodology.

One of the science teachers claimed that among various 21st century skills, technology dominates in almost every renowned framework. Technology is everywhere and use of computers has changed everything. Teaching methods have evolved. Curriculum and the teaching contents have transformed. Everything is based on technology now as it is an era of information technology. If we consider the COVID time, it has altogether changed our teaching methodology and strategies. Previously in science textbook, the questions were given in exercise; at the end of each chapter and they were related to the content of that chapter. But now only 1-2 questions are directly linked with the contents of the chapter while for other questions/answers, the child must explore and search for himself. It means that the emphasis is on developing the critical thinking of students through internet surfing. Now the course pattern and methodology has changed. In addition to short questions answers, there are constructed response questions whose conceptual idea is given in the chapter. To find the answer to the constructed response questions, the children must clear their concepts and think critically about the questions. There are investigatory questions at the end of each chapter in which the child must search and investigate by himself. He ought to search the internet or ask for help with teacher or some elderly person. Role of teacher is only of a facilitator and a coach. There are projects in which teacher can only provide guidance, but students have to complete it by themselves. New curriculum has made role of children quite active and responsible for their learning. The children are involved in various activities and their horizons of learning are being expanded related to the given topic.

One more general science teacher proclaimed that science starts from critical thinking and creativity and all these 4 skills are important to support and develop critical and creative approach. Now the teaching approach has changed altogether as we are trying to move from teacher centered approach to student centered. Now, children are being involved in group work and teachers give them projects. There's a lot of group work in science. Resultantly all these skills like critical thinking, communication, collaboration, creativity; are being developed in children as they are actively involved in the teaching learning process. Children' critical thinking is being developed in group work in which they discuss the problems with each other in various projects and make joint presentations. There are a lot of constructed response questions which can be given as home task. The teacher monitor and facilitate classroom discussion and after that they come up with a concrete group answer. Besides that, there are lots of small thought provoking questions at the beginning of each lesson. Before a lesson is started, teacher ask these questions in the class so that the students think; in this way the previous knowledge is also being linked to new lesson. There are stimulating questions in between the lessons as well; within the small paragraphs in form of small boxes. The activities given in the textbook also constantly engage students' thinking. There is a lot of material in the science book that can enhance and develop these skills in students. Utilization of ICT in classroom teaching is an effort to include ICT in the home task given to children. A matter of exploration and investigation is aroused among students not only in the classwork but also in the home tasks to complete it on the internet by themselves. As these A.V. Aids Like projector or LEDs are not available in schools so computer labs can be utilized as audio visual labs. In some cases, employment of ICT is quite imperative like when we are teaching them concepts related to Earth Sciences or space science, then students do not have any visuals for it. Such concepts are quite abstract for them. For concept like structure of flower or leaf we have

models, or the students have some idea or visual concepts about them but now by addition of ICT, such new concepts can be taught effectively, and students' concepts can be clarified easily.

The narratives of stakeholders regarding SNC implementation and integration of 21st century skills can be summarized as almost all the research participants agreed to the notion that SNC implementation can lead to integration of 21st century skills in education mainstream at primary level. The curriculum developers and textbook authors proclaimed that the SNC is aligned with international standards and global trends and has the potential to target and integrate skills among students if executed in a desired manner. They declared curriculum and subsequent textbook is SLO based and can lead to development of higher order thinking skills among students. The items described under caption of "constructed-response questions", "point to ponder", "investigate", "projects" and "weblinks" have sufficient probability of stimulating and instigating students' learning abilities. However, now it all depends on the teacher and his/her teaching methodologies as how s/he implement it in the real classroom scenario.

The FDE managers also advocated the suitability and relevance of SNC in developing 21st century skills however, they confessed that no specifical measures in term of providing physical facilities, resource material or teachers' training was initiated at Federal Directorate of Education (FDE) level. The 38 science teachers who received orientation training on SNC were trained by National Curriculum Council (NCC) but afterwards no initiative was taken by FDE to further cascade this training and train more teachers. Moreover, there is no monitoring mechanism to follow up the effectiveness and utilization of these trainings. Additionally, inappropriate teachers' nomination was done at FDE level that led to training of irrelevant teachers.

All the other stakeholders (curriculum developers, textbook authors, and reviewer, and FDE officials) held teacher as responsible for execution of SNC or integration of 21st century skills.

However, nothing has been done extraordinarily to empower teachers for implementing SNC in true spirit or to develop 21st century skills. The teachers though were acquainted with the notion and significance of 21st century skills but were absolutely clueless as how to develop an integrate these skills in their classroom practices. Most of the science teachers confused 21st century skills merely with activity-based learning and group work. Though these strategies if executed properly can play role in skills' development but these two strategies are not the only tactics to address and integrate skills. The SLO based assessment is possible only if we make SLO based teaching.

4.7 Challenges/Barriers for Integration of 21st century skills (Theme 3)

On the theme regarding challenges and barriers in incorporating and integrating 21st century skills in the education mainstream at primary level, all the strata included in the research study shared their opinion as follows.

4.7.1 Curriculum Developers' Assertions regarding Challenges/Barriers for Integration of 21st century skills

One of the curriculum experts proclaimed that after the 18th constitutional amendment unfortunately, no organization is held responsible for teachers' training in ICT institutes and no proper mechanism was established for training till now. There are many training organizations like Academy of Educational Planning and Management (AEPAM), Federal College of Education (FCE) or National Curriculum Council (NCC) etc. which are arranging different training sessions for the stake holders, but no one is responsible or accountable for teachers' training of Federal Government teachers and there is no quality assurance of teachers' trainings. This flaw should be attended, and the Federal Government should establish an independent training department that would conduct regular teachers' training and refresher courses for capacity building of teachers as no such section or training wing is established till now.

There are so many challenges in the implementation process. The major challenge is of time. To overcome this challenge, teachers are advised to plan these activities in groups. It would be very beneficial if the activities are well designed, planned and structured according to the classroom strength and availability of time and resources. Low-cost materials should be used that are readily available for teachers and students. Implementing and executing these activities is more important and challenging than planning these activities. Hence, every school should plan the implementation as per their convenience.

One of the research participants quoted that in meeting the challenges one of the examples witnessed is the formative assessment which is very significant and beneficial in improving thinking skills, communication, and collaboration among children. Formative assessment is also helpful in developing problem-solving ability in children. The teacher can make a check list of these skills to determine which skills have been addressed by the students and to what extent. The teacher can make a list of problems or difficulties faced by students. Then they come to know how to do proper planning and revisit their teaching strategies to solve students' difficulties and can address and develop these skills among students in a better way. The teacher can make heterogeneous groups of students with different abilities so that they can learn and help each other in overcoming their weaknesses. To conclude it can be inferred that all the suggestive formative assessment are in terms monitoring teaching-learning progress.

4.7.2 Textbook Writers' Assertions regarding Challenges/Barriers for Integration of 21st century skills

In pursuance of the researcher's question, one of the textbook writers proclaimed that the medium of education - the shortcomings in English language is the main barrier in executing SNC or integration of 21st century skills. He further asserted that students' home environment and

upbringing also play a significant part in children education. The textbook writer proposed that before teaching this science textbook to the students, I suggest that this book should be taught to the teachers so that they may learn how to teach it. Whatever good content we include in textbooks, basically it is the teaching methodology that makes the difference. If the teacher does not have the required skills how he can translate and develop these skills among students.

The textbook reviewer emphasized that the main challenges/barriers in the execution and integration of 21st century skills seemed to be teachers' least motivation and lack of resources. Head teachers should also facilitate teachers in term of provision of resources and motivating students. Orientation training of head teachers should also be conducted to raise awareness and to prepare them for implementation of these reforms.

The second textbook writer expressed that in our country the problem is not the textbook but the medium of instruction - the language. Education is not completed from books or schools; the actual education is from home and home environment and upbringing play an important role in children's education. The language taught in school is different than the language spoken at homes which turns out to be a main barrier. The textbook author quoted that when we started writing general science textbook in Urdu as per instructions of Ministry of Education and worked for six months on its draft. Afterwards government immediately changed its policy and within 12 days we translated and compiled the whole book in English hurriedly. Though we tried our level best to compile it up to the mark, I believe it still may have some shortcomings. I have also given the suggestion that the science textbook should be first written in English then its translation should be done in Urdu and other local languages. But that could not happen. So, before teaching this science textbook to the students, I suggest that this book should be taught to the teachers so that they may learn how to teach it. Whatever good content we include in textbooks, basically it is the

teaching methodology that makes the difference. While writing a textbook about 12 years ago, I surveyed a primary school and asked teachers there how they teach general science. Both male and female teachers replied that they make students learn about 50-60 questions/answers and the students just cram them, which is very wrong. The right thing is that the child should be able to think and answer on his own; no matter the answer is right or wrong. The teacher should also not scold the students on wrong answers. The right answer to a certain question is not the only criteria for learning. Many of the scientific invention are based on the mistakes. Therefore, we need to make our student think and to create. Furthermore, our primary schools do not have laboratories; even in the secondary schools, teachers used to finish all the practicals in the last 10-15 days of the academic session. Science is all about practical work and without going into the laboratory students will learn science in pattern of history or any other non-science subject.

The textbook reviewer endorsed that as far as content is concerned, the science textbook book is mostly activity based which are supposed to be done by students. The main problem is that our students have language barrier; they feel difficulty in basic literacy skills both in writing and reading English language. The students understand science through activities, but they feel difficulty in elaborating and explaining it in English. Hence, the main point is to improve their skills of basic English and Urdu language. The main reason for this is the lack of support from the students' home. For this reason, school has to pay more attention and focus on teachers' training and improving classroom instructional practices. Textbook authors affirmed that they have tried to keep language of science textbook simple so that students can understand it easily.

4.7.3 FDE Officials' Assertions regarding Challenges/Barriers for Integration of 21st Century Skills

A probing question was asked from the head of training section in Federal Directorate of Education (FDE) about the teachers' training segments. Purpose of asking this question was to evaluate effectiveness of teachers' trainings and schedule of further trainings. The researcher further inquired about the Master Trainers trained by NCC who were supposed to further disseminate and cascade the training to more FDE science teachers. Replying about this question, the respondent said that it is a dilemma that whoever gets any training from any organization does not disseminate the training information nor changes his teaching instructions after joining back to the school. His learning remains limited to the training center only. Major purpose of these training is to replicate and practice what they have learnt and then to disseminate it to other teachers. He affirmed that FDE has no training mechanisms nor the resources to organize trainings on our own. Ministry of Education has all the powers and the funding to initiate and conduct trainings. We are bound to obey the discretion of Ministry of Education and just conform to the Ministry's design whatever reform or initiative they bring to us for implementation.

4.7.4 General Science Teachers' Assertions regarding Challenges/Barriers for Integration of 21st Century Skills

Almost all the teachers agreed that 21st century skills must be integrated but they have lack of resources to employ activity-based learning or to plan and perform activities in groups. Computers or LEDs are not available for teachers and students and if available the schools do not have internet access to integrate ICT in classroom teaching. However, most of the teachers opined that the new syllabus is too lengthy, and the academic year was made shortened due to pandemic, therefore the teachers were very much under pressure to cover the lengthy content in a shorter period. As the

curriculum is heavy in respect of content, it is very difficult to cover and perform all the activities in class. They further discoursed that the activity-based learning is very time consuming, and it takes lot of efforts in planning and collecting material for the activities. One of the teachers added that they also face discipline problems during activity-based learning as students become out of control when they work in groups or left independent. Unfortunately, most of the science teachers who got trained on SNC were not teaching science to primary classes. They were either teaching in secondary schools or were not science teachers at all. That also made significant reduction in the already smaller population of science teachers who received training on SNC.

One of the general science teachers beliefs that all the stakeholders need training on SNC for instance, the parents and head teachers should also be given training to empower system so they can transfer these assistances among students. No such training program had been launched solely till now due to which integration problems are being encountered in its practical implementation in the classroom teaching practices. All the stake holders need to be on same page for the implementation of curriculum and subsequent segment of skill development.

One of the general science teachers who was a subject specialist of mathematics and was teaching science due to shortage of teachers in the school was questioned. The respondent was of the opinion that 21st century skills include that the syllabus should be in accordance with the level of students so that they can get maximum benefits out of it. We offer knowledge to the students so that they can use it. But it depends upon the environment as well. This new syllabus is very good, and I liked it very much. But in my opinion, this syllabus is for the students of urban areas where parents give proper attention to the studies of their children; and schools are also well equipped to facilitate and provide conducive learning environment to the students. For students of rural areas this syllabus is bit difficult to follow due to lack of domestic support from parents. Another general

science teacher added that absence or negligence of modern teaching and learning skills would make our learner to be lagged behind. S/He won't be able to solve his daily life problems and to face the challenges of future. In fact, these skills are needed to be inculcated from the early classes so that they can be nurtured further at higher level.

Keeping in mind the core significance of the document analysis and interviews taken from the respondents, it is obvious that the specific content/activities/strategies are being added in the general science textbook. The science textbook book is mostly activity based which are supposed to be done by students. The main problem is that the students have language barrier; they feel difficulty in writing and reading English language. They understand science through activities, but they feel difficulty in elaborating and explaining it in English. In this regard though one of the textbook authors stated that we have tried to keep language of science textbook simple so that students can understand it easily. Still students faced problem in understanding English language content. Hence, the main point is to improve their skills of basic English and Urdu language. Now the government is paying attention to improve the basic literacy skills of students. Ministry of Education in collaboration with private partners has just launched a "Reading Project" to improve all the four basic skills (reading, writing, speaking, and listening) of students at primary level. It is anticipated that the project would improve these skills of students and it would help the students to understand and comprehend the content.

Another important reason for students lagging behind in studies is the lack of support from the students' home. Accordingly, the school needs to pay more attention and focus on teachers' professional grooming and training to mitigate the adverse effects of insufficient parental assistance. One solution for such problems is that some of the activities should be done in school under supervision of teachers and some should be given as home task. The teacher should take

feedback and ask questions about the experiment and students' observation. Hence, teacher can cover all the activities and save time. But the activities should be assigned carefully so that they should not cause any harm to students or need any precautions.

Foremost purpose of science content added in SNC, and subsequent science textbook is that the students can understand the basic scientific phenomena and technology in their everyday life. For teaching science, observation is the key. Teacher should try to make students good observers. All the phenomena in our surroundings are based on simple scientific principles that need observation. Teachers should involve all students and engage them in questioning and making predictions. Teacher can divide the class in groups of mixed-ability students and ask them to support each other's learning. This tactic can also foster collaboration and communication among students. The general science textbook is totally SLO based hence the classroom teaching and learning should not be limited to learning of textbook content only. The teacher should engage students in presentations, group activities, problem-based learning, experiential learning, and innovative projects to nurture their skills. Furthermore, the teacher should be trained in how to teach and assess SLO based content.

Secondly, all the teachers and principals want that the whole syllabus to be covered. Covering the syllabus is not important but understanding the concept is important. The whole syllabus does not necessarily need to be covered. Furthermore, most of our students and teachers have language issue in understanding concepts presented in English. They lack in basic English literacy skills that hinders their comprehension and further higher order thinking. Once this language barrier task is completed, the creative impulse among the science students can be stimulated as they would comprehend the content and consequently their learning and assessment may become an easy task. Similarly, the projects-based assessment should be employed that can nurture observation,

creativity, and collaboration among students. The ground realities that may be kept in mind while designing curriculum and specially the textbook can be summarized as:

1. Overcrowded classrooms
2. Lack of professional development of teachers
3. Shortage of time and Shorter academic year
4. Lack of resources, physical facilities, etc.
5. Lengthy Syllabus and shrinking time tenures
6. Teachers' potential to implement G.Sc. in Class
7. Socio-economic background of students and lack of learning support from home

Most of the interviewee opined that there is a need to shift the entire teaching-learning paradigm for the pragmatic implementation of this Single National Curriculum (SNC). The major challenges and barriers are needed to be addressed properly to approach the goal of the effective teaching and learning. Our policy designs cannot be implemented in true letter and spirit until and unless the following notables are not taken to consideration and subsequent appropriate action:

1. The teachers teaching (G.Sc.) should have good IQ and must be capable enough.
2. There should be no quota system for recruitment in education sector.
3. Teachers should be selected on open merit system, on the basis of their abilities as in military.
4. Already recruited teachers should be trained periodically by engaging competent subject teachers from other schools.
5. There should be extensive cluster wise refresher trainings in summer vacations.
6. Teachers' licensing system should be implemented.
7. Retired professors can be hired for the said purpose as well.

8. Teachers' capacity building should be planned and focused on mastering pragmatic strategies for overcrowded classroom.
9. Implementation of SLO Based Assessment
10. School should be provided with sufficient resource, both human and financial, to implement activity-based curriculum.

Teachers have the potential, but they do not have any accountability. Like in private sector if a teacher is not teaching well, s/he can be terminated by the administration but in public sector, teachers have job security that's why they do not work very hard. Even their Performance Evaluation Reports (PERs) do not make any difference. The only key is to motivate teachers. The head teachers have all the responsibility but not any authority. So, it all depends upon the teachers how they teach and not on the books. In this context, the appraisal and promotion of teachers should be linked with their performance so that they feel responsible and accountable for their job. Primary classrooms require changes/shifts in the teaching strategies. The statements taken from the respondents on this issue transcribed that many of the public sector school have very good infrastructure with latest equipment and highly qualified teachers. But the main instrumental role of teachers is missing. Our teacher is not upgraded professionally with time. The main implementation unit is teacher and head teacher. When the teacher is not refurbished and motivated then nothing can be executed. We need to focus on teachers' training. There should be large scale massive trainings that should be mandatory for each and every teacher every year. It would be more effective if we made it promotion linked. In the implementation process the main role is of the school heads and teachers. The school leadership should be visionary and must play an effective role. The school head should be encouraging all the teachers to utilize all the provided/available facilities and make optimum use of their human as well as material capital. No

fancy document can be implemented without the professional overhauling of teachers. Secondly, there should be optimum utilization of all the available resources. There are many institutes which have lots of advanced labs and resources, but they do not use it at all, and they are just closed under lock and key. Some institutes have plenty of resources which are not being utilized because of lack of science teachers and lack of will.

The FDE respondent further added that in terms of physical resources, a 700 million project regarding provision of resources, missing facilities, ICT labs, furniture, play rides, etc. to re-structure schools has been approved. It will uplift the infrastructure and provide the missing facilities in 180 schools. Besides that, FDE has also provided furniture, play rides, sports, and science equipment to many schools from its own budget. All these things may appear as small steps but together they are bringing positive change in our education system.

The deliberation on theme 3 regarding barriers and challenges for integration of 21st century skills can be summarized as all the stakeholders held teacher as responsible and highlighted his role as a change agent to develop and integrate 21st century skills at primary level. However, no significant efforts have been made at any forum to build capacity and potential of science teachers. Mostly, the teachers currently employed are conventional and they are ignorant of modern teaching technologies. Even the small number of teachers who received training on SNC were quite naive and have no idea as how to develop and integrate skills. Commencement of various initiative like blended learning project and STEM learning are being started at elementary and secondary level. The primary section is being ignored in this regard. If the primary section is being overlooked which is the foundation level to the higher classes, then how can system nurture these skills among students at secondary level? How can system prepare students for SLO based learning and assessment without any underpinning at primary classes.

It is quite impossible to ensure the success of any training if you do not monitor the teacher whether s/he is applying the learning practically in classroom situation and do not mentor him or her in real classroom scenario. Furthermore, other influencing factors include workload of teachers, large classroom size, unavailability of resources, heavy curriculum in term of class activities, classroom management, teacher's will and motivation level, his creativity, his sense of responsibility and accountability; all these things matter and contribute.

The main challenges/ barriers/ hindrances in our public schools due to which we are unable to develop 21st century skills among our students can be counted as under:

Foremost essential is our teacher which is supposed to be our change agent. Our teachers do not have that qualification, training, motivation, experience, and vast exposure that can empower them to develop such skills in students. This is the main barrier. If you overcome this factor, a lot can, be achieved.

Secondly, in classroom practices there is no accountability on part of teachers. A teacher is only accountable for getting syllabus covered, taking the exams, and producing good results. Teacher is not accountable for what kinds of skills are being developed among children. There is no such accountability that exists. Until and unless we made teachers accountable for the development of certain skills among students instead of focusing on marks-based result, they would not pay any attention to this aspect.

Thirdly, we put unnecessary blame on the students regarding their socio-economic background. Learning is change in behavior and environment plays a major role in learning. If environment of classroom is not changed, child background and lack of parent input become merely an excuse. Background does matter but its percentage is not that much as propagated by the teachers. Research shows that a well-prepared and skilled teacher have stronger influence on the achievement of

students than the socio-economic background of the students. If in a class, teacher is active and engages the students in multiple activities, you will get different results. While in some other class, if a teacher is not that energetic and captivating, the results would be different. Consequently, here comes the main role of the head teacher as to what extent he is ambitious, dynamic and takes interest in improvement of teaching-learning activities. How he engages with the teachers, observes, and monitors their classroom practices keenly. In this way, quality of teaching can be enhanced, and more skills can be developed among both teachers and students. Now it's the high time to come out of this rat race of getting marks and should focus on conceptual building and skills development of students. Special orientation sessions should be designed for parents as well, in order to prevent them from undue pressurizing their children for this number game.

All these things that are discussed above are the main issues or the hindering factors. However, within the single national curriculum there are many issues as it is a draft curriculum. Curriculum is supposed to be a living document, and this is the very first draft and I hope its second version will be a better one. So, the main issues are missing facilities, lack of physical resources, lack of trained human resources, lack of capacity building programs and nonetheless societal factors which demotivate us when we are working within a society.

4.8 Training of Primary Teachers for SNC implementation

Another point of investigation was to explore whether the trainings on SNC were sufficient enough to empower teachers that they can translate these skills in their classrooms. It was found that not much training programs were conducted on SNC, only one batch of master trainers was trained that had to further cascade training to more science teachers but that never happened. teacher. Hence, in subject of general science, a total of 38 teachers were trained out of 422 institutions. However, as per opinion of curriculum developers, intense trainings are not required to implement

SNC. Only small orientation training programs on SNC are sufficient but it should be frequent. Private sector should also be involved in conducting the trainings, but teacher trainings must be held. Two things are important:

a) One is skill,

b) Other is motivation.

Mostly public-school teachers are skilled, they only need motivation. The key role is of head-teachers, if head-teacher has the will then as a leader s/he can lead the team and these 21st century skills can be integrated in the class. The training modules and manuals on SNC were developed by the experts and target was first to develop 21st century skills among the teachers so that they can disseminate and transfer them in their students.

In our education system we do not work in collaboration; we rather work in competition with each other. There is no teamwork or collaboration in our system. Primary level education is the foundation of higher education and plays the most important role in development of a child's personality and is reflected throughout his life and career. Recently, many projects have been initiated with the cooperation of various private NGO that are working on technology integration in public schools, some are working on blended learning, some on STEM learning, others on SMART classroom and some focusing on improving the basic literacy skills of students. However, all these projects are working in isolation and in chunks emphasizing their methodology and their identified area only. Launch of many projects which are not working in alignment with each other are confusing the teacher and making him overburden. There is a need to configure all these projects so that they should support and complement each other rather than contradicting each other and students can get maximum benefit out of them.

For this purpose, the foremost thing is that there must be adequate number of teachers who are well qualified and trained/capable to cater to the needs of students present in a school as per standard recommendations. Secondly, there must be regular and periodic capacity building of teachers so that they know how to translate the curricular activities into their teaching practices. Public school teachers have the capacity but that is subjected to capacity building programs for the teachers. Job security and financial stability make them little stagnant. Our teachers are producing good results in centralized exams. If we make their professional development structured and provide them a clear pathway along with sufficient encouragement and motivation, then they would be able to do it more effectively.

Thirdly, the environment of school must be conducive. Human and physical resources, including adequate furniture, ICT resources, teaching-learning A.V. aids, library etc., must be available in schools. There must be proper mechanism designed for the capacity building of teachers. When all these things go side by side in a structured manner; only then you can say that your SNC or SLO based teaching or incorporation of your 21st century life skills can be implemented. It's a massive and strenuous exercise.

4.9 Quantitative Data Analysis (Classroom Observation of General Science Teachers)

As discussed earlier, 38 teachers received SNC training in the category of general science. Out of which 27 were female participants and 11 were male. The study approached 10 participants: 06 females and four male teachers. After interviewing these general science teachers, researcher shortlisted 03 participant teachers one from each stratum of FDE setup i.e., F.G. Urban Schools, F.G. Rural Schools, and Model Colleges to observe ground realities of teaching-learning process through their classroom observation. Each science teacher was observed three times for 30-35

minutes. Lessons were selected as per teachers' choice and observed according to their convenience. The quantitative description of their classroom observation with reference to selected 21st century skills is given in the table 4.7 underneath.

Table 4.7 Classroom observation of science teachers with reference to 21st century skills.

Sr #	Indicators for Classroom Observation	Observed (1)	%age	Not Observed (0)	%age
1	**Creativity**				
a	Students are provided with an opportunity of being creative.	01	11.11	08	88.88
b	Any strategy/method being employed in classroom that can nurture creativity/newness/ innovation among students (e.g. story, games, role-play).	00	00	09	100
c	Students being provided with any idea creation technique such as brainstorming, discussion or concept mapping.	00	00	09	100
d	Students given opportunity to solve any problem on their own.	00	00	09	100
e	Students using different ideas to improve their work.	00	00	09	100

f	Students creating an original product/model to express their ideas.	00	00	09	100
	Total %age of Creativity	01	1.85	53	98.14
2	**Critical Thinking**				
a	Students asking questions.	06	66.66	03	33.33
b	Teacher asking questions to promote students' thinking (how, why, what if….)	03	33.33	06	66.66
c	Students giving multiple/ different ideas to solve a problem.	00	00	09	100
d	Students trying to solve a problem that have no single correct solution or answer.	01	11.11	08	88.88
e	Students making predictions and/or testing them.	04	44.44	05	55.55
f	Teacher asking a student to justify his/her stance on a certain discussion/issue.	04	44.44	05	55.55
	Total %age of Critical Thinking	18	33.33	36	66.66

3	**Collaboration**				
a	Students working collaboratively; in pairs or in small groups.	06	66.66	03	33.33
b	Students can work together in groups to set goals and create a plan for their team.	05	55.55	04	44.44
c	Students can present their group work to the whole class.	06	66.66	03	33.33
d	Teacher involving students in collecting and creating instructional materials to be used in classroom.	04	44.44	05	55.55
e	Teacher is trying to create community of learning within the classroom.	04	44.44	05	55.55
f	Teacher is encouraging students to respect their classmates and be considerate to others?	07	77.77	02	22.22
	Total %age of Collaboration	32	59.25	22	40.74
4	**Communication**				
a	Students develop communication skills (reading,	06	66.66	03	33.33

	writing, listening; within group).				
b	Students develop communication skills (As demonstrated in presentation other than paper).	06	66.66	03	33.33
c	Students can answer questions in front of an audience.	06	66.66	03	33.33
d	Students can prepare and deliver an oral presentation.	06	66.66	03	44.44
e	Active exchange of ideas in classroom.	05	55.55	04	44.44
f	Teacher flourishing listening and speaking skills of students and providing them opportunities for verbal expression.	06	66.66	03	33.33
	Total %age of Communication	35	64	19	35.18
5	**ICT as a tool for learning**				
a	Teacher utilizing technology as an instructional aid for demonstrating concepts.	00	00	09	100

b	Teacher utilizing technology in students' assessment (e.g., quiz, students' presentation)	00	00	09	100
c	Students using technology.	00	00	09	100
d	Teacher using technology to keep record of students' assignment/progress.	00	00	09	100
	Total %age of ICT	0	0	36	100
6	**Classroom Assessment**				
a	Formative assessments being used.	06	66.66	03	33.33
b	Employment of Performance based Assessment such as Presentation, illustrations, demonstration by students, project, debate, model, exhibition, table, graph, etc.	05	55.55	04	44.44
c	Employment of Personal Communication Assessment like Oral questioning, observation, interview, process description, checklists, etc.	06	66.66	03	33.33
	Total %age of assessment	17	62.9	10	37

7	**Overall Classroom Environment**				
a	Enabling and learner-centered Class	06	66.66	03	33.33
	Teacher as a facilitator and organizer of knowledge.	05	55.55	04	44.44
c	Teacher involves all students (girls & boys, vocal & shy, active & behindhand)	06	66.66	03	33.33
d	Students are on task/engaged in their work.	06	66.66	03	33.33
e	Teacher facilitates all students (e.g listens to them, addresses their questions even if wrong, encourages them).	05	55.55	04	44.44
f	Activity/assignment/discussion connected to real world.	05	55.55	04	44.44
g	Provision of Project-based/Problem based learning.	01	11.11	08	88.88
	Total %age of Classroom environment	34	53.9	29	46

The first observed participant was from federal government school located in urban area. The teacher was B.S.Ed along with Masters in English and has 16 years of experience. During the

classroom observation, researcher noted that the teacher effectively used white board to draw figures/diagrams and tried to clarify students' concepts. Teacher used science models to address element of inquiry during her teaching. Students were made involved in different activities. Students were excited and actively participating in the activities. The classroom was overcrowded, that's why all the students were not given the chance of presentation (Total class strength comprised of 54 children). Teacher was quite active and energetic and tried to involve the students through questioning. Teacher was well prepared and followed a proper lesson plan. But still class was teacher-centered, and students were following teachers' directions/instructions. However, the overall classroom environment was conducive for student's learning. Teacher also used work sheets for students' formative assessment.

Nevertheless, the teacher reported that the school lacks teaching-learning aid and she brought/arranged the material using her own resources, which is not possible in every class. The class had no technology-based equipment; LED or computers so that the teacher could utilize the weblinks given in science textbook. In school, teachers were not provided with internet facility therefore, they could only show any content using their own mobile. Furthermore, during one of the lessons, there was no electric supply in school and students were quite exhausted due to electric power disruption as it was summer season.

In the whole scenario, the dilemma was that though the teacher was a science graduate, but she was not teaching science. She was the only science teacher in the whole school, but she was not given the opportunity of teaching science. As far as addressing 21st century skills are concerned, teacher tried to target skills of critical thinking, collaboration and but creativity was totally missing. ICT could not be employed due to lack of equipment and internet facility.

The second teacher selected for observation was teaching in a federal area (remote area) school. The school was less privileged and lacks many of the basic facilities. The classroom was overcrowded, and the students were lacking confidence. The academic qualification of teacher was Masters in Pakistan Studies and Masters in Education with 22 years of teaching experience. The classroom was very traditional and totally teacher centered. Students were not given any chance of asking questions or presentation. Teacher did not use any audio video aid and most of the time, he taught by merely reading from the textbook. Teacher himself introduced, defined and explained all the content and did not offer any opportunity to students to predict, discover or experience anything.

In one of the lessons, the teacher used balloons as audio video aid, but it did not appear as an effective method of clarifying the concept to students. Students were passive and irresponsive. Teacher was asking questions to a few of the students and rest of the class was quiet and too scared to talk; perhaps the teacher has warned them about the presence of a stranger in the classroom. The teacher did not target any of the 21st century skills. No IT based instructional aides were utilized as they were not available in the classroom, and they were kind of maintaining the discipline through their silence. Teacher was also not IT literate and don't know how to utilize technology.

The third participant teacher was teaching in a Model College of Islamabad. The teacher was masters in Biology with M. Phil in Education and had 13 years of teaching experience. The teacher was also science master trainer that receive training by NCC in collaboration with Agha Khan University. Though the teacher has science background, but she was not teaching science to primary classes. Upon researcher's request she agreed to participate in classroom observation activity. During her lessons teachers gave students the opportunity to collect teaching-learning resource material that was later used in classroom activities. Students were actively involved in

the class and were quite eager to participate. All the students were girls. Teacher also employed project-based learning in her teaching and ask students to make models using low-cost materials and present them before the class. Students were attentive and being motivated. Students were sharing their ideas within the group and with the whole class. Teacher provided equal opportunities to all students to participate and present. The students made confident presentations. Occasionally, students were also asking questions from the teachers but most of the time teacher was asking questions to engage the students. The teacher did not use any lesson plan, nor did she use to make but her teaching was quite systematic.

Keeping in view the classroom observations of 03 different strata can be summed up as the federal government (F.G.) set up was motivated, trained, and had the potential and capability but she was not teaching science though she had the science background. Sadly, the second teacher had no science background, but he received training on SNC and still was unable to reflect in his classroom pedagogies. He was least bothered or stimulated to make any preparation for his science class. Furthermore, the third teacher was well groomed and had the science background, but she was not teaching science to the primary classes. Hence, the right person for the right job was not placed. Unfortunately, the less privileged children of rural area who are more vulnerable and their education is already at risk were provided with least facilities in term of classroom environment, facilities, and resources at school and most importantly, quality education.

4.10 Classroom Pedagogies and Assessment Strategies at Primary Level

There is a separate chapter of teaching learning strategies in Single National Curriculum (2020). It focused on active learning which has its roots in constructivism. It advocated connecting and building students' new learning with their prior knowledge. One of the curriculum experts declared that along with active learning SNC has associated the notion of cooperative learning, problem

solving, activity-based learning, experiential learning, collaborative learning, and project-based learning. To inculcate all these activities, teachers are advised to engage students in group work and encourage students to ask inquiry-based questions from teacher. The teacher can also adopt whole classroom instruction along with demonstration method and can ask the students to practice it later. These skills can be developed in students by actively involving them in classroom activities. Techniques like debates, role playing, group discussion and presentation can be included in the activities part, and they can play a significant role. One of the curriculum developers cited that the activities are designed and kept teacher bit flexible in choosing the activities and strategies as per his classroom situation. A teacher can adopt any of these strategies according to his classroom environment and available resources.

Curriculum is always blended so teaching of different subjects should also be integrated. One of the curriculum developers suggested that the curriculum should be discussed thoroughly with all the teachers for deeper understanding. In this way, the teachers can identify the common topics that are overlapping in different subjects. Then those topics can be properly planned by the subject teachers collectively. This will give more innovative ideas to teach a topic for in-depth understanding and will save the academic time. Like, science teacher can also take help from language and math teacher. School coordinators can play a positive role in managing the school timetable as well. Implementation of curriculum will be more effective when teachers work in collaboration with each other.

This means that for integration of skills, the teachers should mold their teaching strategies according to the activity-based curriculum. Mostly teachers are using conventional teaching style; they become stagnant and rigid in their ideas and do not want to change their methodology. However, in order to keep pace with the modern technological world one must keep on sharpening

their saw otherwise one become irrelevant. We need to make them realize that the activity-based curriculum can make their work quite better and easier. Let the students explore and discover themselves. In order to implement this curriculum, we need to motivate and support teachers and console them in groups along with one-on-one mentoring. Although it is not an easy task to incorporate all these at a one go and get the curriculum implemented uniformly all around the country, exceptions are possible. The basic problem in this regard seemed to be the individual differences as majority of the teachers teaching this curriculum are the product of rote learning culture. They are just unable to apply activity-based learning in classroom because of professional incompetence. They have not experienced such kind of learning while they were students or even during their CPD trainings. So, the teachers need to know the authentic resource material about how to teach a particular topic with the activity-based learning and how to give a clear conceptual understanding to the students. The teacher, while teaching any given topic, should indulge the children in some creative activities so that their higher order thinking skills can be developed. The children should be taken to different excursions so they can explore by themselves. The students need to be exposed with the real-life situation in order to broaden their understanding.

However, it is a debatable point to consider that recall and understanding level as useless. Understanding and memory-based learning is also very necessary to provide foundation for learning and also to improve the writing skills for instance. If there is some idea or concept in your brain, you would be able to present it only when you have correct vocabulary and terminology for it. Science work is based on vocabulary and terminology, unless the child learns correct pronunciation of terminologies, he cannot present the concept effectively. One of the curriculum developer asserted that we should not condemn memory-based or understanding based learning as it is the foundation of higher learning domains. The thing to be focused on is as how we can lift it

to higher level in our teachings. We should improve it to the application level. But it should not be completely removed.

From the above discussion, one should not assume that the researcher is partial or advocating the concept of memory and understanding level assessment. But we should make these level as underpinning to address higher order thinking skills. For proficiency in higher order domains, basic knowledge is necessary. Unless the basic concept is not clear one cannot compare or differentiate or evaluate the pros and cons of two concepts. One cannot analyze the gaps unless you have the primary concept or understanding. The basic cognitive skills build ones' concepts, once the concept is built then you can take it to any higher level. Therefore, in order to address and nurture higher order skills, we need to strengthen basic domains.

Furthermore, another important thing is the co-curricular activities in our schools can play vital role in the implementation process of 21st century skills particularly 4Cs and ICT. It can help in improving communication skills among students. It explores creativity among children if we involve them in any art activity like making models or simulation of certain phenomena. If children are doing project-based learning, then it includes collaboration, creativity, and communication skills as well. Therefore, if we talk about holistic development of a learner then it includes all kinds of learning including both classroom learning and out of class learning.

However, there are so many challenges in the implementation process. The major challenge is time management. The academic year 2021-22 was very short (08 months only due to Covid lockdown). Teachers were not very familiar with the new textbooks and the syllabus couldn't get covered. To overcome this challenge in future, teachers are advised to plan these activities in groups which is also recommended in SNC draft. It would be very beneficial if the activities are well designed, planned and structured according to the classroom strength and availability of time and resources.

Low-cost or cost-effective materials should be used that are readily available for students. Implementing and executing these activities is more important and challenging than planning these activities. Thus, every school should plan the implementation as per their convenience.

Assessment reforms are so important that our parents and students concentrate so much on it. One of the research respondents quoted that you could understand it when you observe in evening how much rush/crowd is there in front of certain private academies. So, what is the reason?? The reason is that they are preparing your children for the exam-based study because your exam pattern is like that it evaluates students' abilities in terms of marks obtained. Let's say textbook is not very necessary but if you are teaching from textbook at least you are making the topic relevant and understandable for the students instead of dictating questions-answers only. More than preparing and practicing for examination, students should indulge in some other activities too, that includes non-linear thinking in resolving certain difficult situation, community practice and critical thinking.

Our assessment system should promote divergent thinking. It should not limit the students on certain fixed answer keys rather should enable them to explore several methods to solve a problem. Therefore, we need to learn from success stories of international system that how they investigate these things. For this, it is necessary that there should be uniformity in educational facilities, teaching environment, trained teachers, and the system of taking examinations and making assessment. Some assessment strategies that are being enacted in this SNC are formative assessment which is very significant and beneficial in improving thinking skills, communication, and collaboration in children. Formative assessment is also helpful in developing problem-solving ability in children. The teacher can make a check list of these skills as what skills have been touched and developed by the students and to what extent. The teacher can also make a list of

problems or difficulties faced by students. Then the teacher can plan future lessons accordingly and strategized how to solve students' difficulties and to address and develop these skills among students in a better way. The teacher can make heterogeneous groups of students with different abilities so that they can learn and support each other in overcoming their weaknesses.

For proper execution and monitoring, all the organizing bodies should know every modern and relevant thing. Just like that when we bring some new appliances from market, we read all the instructions given in its booklet. Similarly, as new curriculum has come, we should consider that how is it possible that only class V teacher should understand it, how can we assume that the head teacher or FDE academician do not need its orientation and only primary teachers ought to understand it. For proper execution and monitoring, principals and FDE officials should also have orientation and understanding of SNC content and activities. Even senior teachers teaching secondary classes should also understand it, so that they will also come to know what should be its progression in higher grades i.e class vi, vii, viii, and so on. They need to know the whole hierarchy. The teachers do have potential and especially the public-school science teachers have the capability to develop 21st century skills in students. There is a lot of capacity, but it is not about competence and potential only it is about direction and motivation as well. In order to fully utilize this potential, we should make these training and certain certifications mandatory and link them with their promotion/up gradation or with some monetary benefits. With such reforms things will start working and can be changed in appositive way, otherwise only changing the curriculum will not make much difference.

Though present curriculum scheme of SNC advocates SLO based assessment, our examination system is mostly recall based which is a contrasting situation. This means that without proper evaluation system we cannot address higher order thinking skills. It was asked expert opinion from

the respondents to shed light on this issue. Curriculum experts advocated that there should be formative assessment. 80% of exam should be formative and activity based and 20% should be test of writing. Mostly we focus on writing and no focus is on conceptual understanding or on practical skills. Language is also a big barrier for students that leads to rote memorization. Another problem is that our teachers work in isolation that makes conceptual understanding more difficult. In this context, one of the curriculum developers opined that the main thing is to discuss your problems for seeking appropriate solution. When the teacher can't share his/her problem; the child cannot share his problem, a principal cannot share his problems with his teachers or directors then no improvement or development can happen. You should discuss your problem with your team in a democratic way for the practical and viable solution. For complete and meaningful implementation, you have to provide all the resources and facilities. Without resolving the problems and issues you cannot reach the results. Situation analysis is very important for proper execution. For that, first the top administration has to talk to the management; you will have to sit with your juniors, unless you don't sit, a team cannot be made. In order to implement anything, formation of team is very necessary.

Another curriculum developer orated in our education system we teach our students the way they are assessed. We don't assess them for the things they are taught for. Our education system is opposite, and it is quite unfortunate. But if this is the case then why shouldn't we try to make it better and straight. If assessment is the backbone of learning, then why should we not focus on that? Mostly our assessment is based on cognitive domain only then why not we introduce the assessment that can check their affective domain as well. When we talk about transversal skills; we should also think how to assess these transversal skills. The curriculum expert added that there is lot to do, and we have taken the first step. We have laid a foundation and we will have to keep

on building on this foundation and hopefully as we move forward you will see that we will bring something good.

One of the textbook authors asserted that there should be workshops designed to focus on the development of test items that can address and assess students' skills. The Federal Board of Intermediate and Secondary Education (FBISE) has already initiated SLO based assessment and discarded book-based examination. We have a lot to learn from each other. A lot of work is being done in the provinces, especially in Punjab; a lot of work is being done on assessment. In the same way, we are working in the direction that how we can teach and realize our people that when we talk about holistic learning and about complete learner; we cannot assess them in different segments or in compartments. If in my classroom teaching all those elements are included which are present in curriculum, then the formative and summative assessment should also be aligned to what is prescribed in curriculum. The curriculum developer declared that we are very much on this task of improving the assessment strategies and in the coming days you will see that we will start work on these lines. In the current phase of curriculum, we have completed the development of standards and after standards we are moving forward towards the development of quality textbooks and then the next stage will be the teachers' training and of course, we are going to work on the assessments as well.

The teachers can also adopt and opt variant pedagogical skills in their classrooms that can develop 21st century skills among students. These strategies can be counted as:

a) The teachers should be provided with the self-experiences, simulations, working in groups, role-plays should be included in teachers' training programs which can help them to learn.
b) Another important aspect starts with the motivation which is both intrinsic and extrinsic. One of the FDE officials thinks that the most important is our pre-service teaching and in-

service teacher training. You have to inculcate these skills in both and specially he stressed more on pre-service training as prospective teachers need knowledge and development of these skills to be taught as a subject along with complete Continuous Professional Development (CPD).

c) When you plan a CPD these 21st century skills must be a part and parcel of that CPD that every teacher must know, as how to inculcate critical thinking in the students; how to make them think. Children are inquisitive by nature and curiosity is in their instinct. Mostly we discourage students to ask question in the name of maintaining class discipline or completing the learning task in classroom. Make students learn to ask the questions and which questions should be asked and to whom they should go to ask those questions and if you have to search by yourself what are the rules of it???? In other words, they should know the theory of knowledge as how one should learn. The students should be urged to find multiple ways to solve a problem and could be able to utilize different methods to complete a task.

Previously in assessment process only knowledge and understanding level was being touched and the higher level of application and analysis was not included in most of the cases. Less weightage was given to the SLO based questions which is now replaced with the higher percentage of advanced learning domains. But unfortunately, the decision was made at the end of the academic year. The directions have been conveyed and delivered to the teachers to teach according to revised paper pattern. But now as the entire syllabus was being covered in educational institutes and the whole teaching-learning process was being completed as per previous practices, it was difficult to implement the abrupt decision of Federal board regarding executing SLO based assessment. The implementation of SLO based assessment should have applied from next academic session when

both teachers and students become familiar to it. Right now, you could just sensitize and mentally prepare the people for it. The academic section could plan for SLO based teaching and learning. The examination section could prepare its staff and trained paper-setter and marker for SLO based assessment. However, the examining board claimed that our teaching practices are always assessment oriented; the way students would be assessed in exam. When we talk about activities mentioned in curriculum or in textbook; they are not being done in appropriate manner because teachers justify that as the assessment of these activities would not be done that's why we are not performing them as these activities would waste students' academic time. The teachers' stance is that when the exam will be based on questions/answers so why should not we teach students in a way that can produce better results? The experiment and activity-based portion of general science textbook is about 60-70 % and previously there was no assessment designed for it. But this year we have created 15-marks of assessment addressing activities of science textbook so that this portion should be taught by teachers as well. This year we have facilitated the teachers by providing them with a source book (training manual) but next year we will not do so. Hence, this time teachers will get the idea that if there are activities in the book then activity-based questions with also come in the paper and they have to prepared students for those practical activities in the class.

Another general science teacher opined that SLO based teaching is not happening and students have no idea about SLO based assessment. They even ask what SLO is. She added, honestly, we are not teaching according to SLOs. We should tell our students that what are SLOs and how they should be covered and assessed. It's a good initiative but both students and teachers do not have that understanding and learning level as per requirement of SLO based assessment. It will take

time to prepare teachers for SLO based teaching and students for SLO based assessment. But still, we are following the traditional method of memorizing the question and answers.

The government initiative was to include all the core skills in SNC so that these skills could be developed in students and subsequently the content was designed in the same way. Again, the implementation of SNC depends upon the amendments in teaching practices as well as how the teachers are teaching in classroom. But there is no any particular project exclusively launched to develop life-skills in students. One of the general science teachers pronounced that FDE is paying attention to these skills. That's why we got this training as master trainer, and we will cascade this training in future to other teachers. But in reality, it did not happen and only one batch of teachers were trained.

In SNC, besides inclusion of core 21st century skills the major shift is the incorporation of ICT, the digital literacy skills of the modern world. After reviewing curriculums of modern countries, the team of curriculum experts identified that the globe is focusing on skill transfer instead of theories. The main emphasis is on the integration of technology within the given content and particularly provision of a weblink that can take the students directly to some authentic subject matter/cite of that concept. One of the curriculum developers proclaimed that we have included reliable weblinks and authentic online resources in our curriculum through various reputed organizations like "Taleemabad", "Sabaq.pk", "knowledge Platform", "Idara e Taleem o Agahi" and "Muse App". It is very important that the students should have an idea how to apply their classroom learning skills in daily life. Hence, we have added a separate skill-based chapter that includes activities relevant to content but also have practical applications. Children should be made to learn how to work in collaboration and present their work effectively. Development of skills among learners was the major focus and this was done through putting students in real life

situation. Nature will teach children more than any textbook or teacher. One of the curriculum experts opined that the learning of children should not be limited to textbook content only. There can be many answers to a question, and anything can be right in its own context. You have to emphasis students' conceptual understanding and relate it with their memory in terms of knowledge of terminologies. The children should learn the basic terminologies and rest should be their conceptual understanding.

The content of the previous curriculum was fairly good, but mostly teachers were unable to understand how to develop and transfer thinking skills among students. In current curriculum, we have presented our content in form a cooking recipe that the teacher should teach this topic by using this activity and following this particular weblink or technology integration. The traditional chalk and talk method has been replaced by activity-based method and focus is on development of skills. By engaging students in various activities, their thinking skills, collaborative skills, and skills of better communication can be developed.

4.11 Teacher Training On SNC

The most significant and crucial component is teacher training that should be given the prior importance in all. One of the curriculum developers declared that a die heart effort was made to create separate teachers' training manuals of all the subjects which describe how a certain activity should be done and what would be its outcomes. Unfortunately, these training manuals could not reach every science teacher. The representative of curriculum wing stated that the NCC along with its experts from the developing partners like Agha Khan University have trained master trainers and now these masters trainers should train more teacher trainers. He added that the teachers' training institutes were supposed to be involved with the training on curriculum and textbook specially FDE should play a central role so that there could be more and more capacity building

programs for teachers on SNC as there is a dire need of it. Otherwise SNC will not be implemented in true spirit. If the training module seems bit difficult for teachers, then it can be molded according to the needs and available resources of teachers. So, Teachers' training modules have been provided to the trainers, the one who received training here. The curriculum expert added that the training institutions should disseminate the training further in their sectors. National Curriculum Council (NCC) is a curriculum developing agency. We have developed the curriculum and provided the basic training. Now it's the duty of the institutes to cascade it in their respective organizations as per their needs and requirements.

Private partners like JICA and CIDA tried to emphasis on pedagogical aspects of teachers training, and not to conceptual or subject teaching. Teacher training is such a power that refines teachers' methodology of teaching, make him empowered, confident and provide awareness that from where he can take further assistance in case of any difficulty. Teacher training not only improves your teaching practices but also guides you from where you can find the relevant resources and support. For this, there is huge role of teachers training institutes.

The teachers who attended the SNC training were asked to give their feedback about the effectiveness of the training program. One of the general science teachers replied that the training on SNC was merely a refresher orientation course. Multiple trainings are needed because this one training was insufficient to cover all the pedagogical and content areas of newly launched curriculum. In training, there should be development of concepts which are related to the content and after that teaching methodology should be focused as how it should be delivered in the class. Then there should be a portion of assessment and after that reflection portion to improve pedagogical and communication skills. When all these things are combined, then teacher training is completed. The teacher has to take along all 30-40 students of different learning abilities. For

that, the teacher has to keep some component of curiosity and creativity in it. He has to consider active and sharp students as well and should engage them in higher order thinking activities as per their learning styles. If a teacher does not keep this point, then the lesson will be boring and a kind of book-chapter prototype. Making lesson interesting and engaging is a challenging task in which teacher has to take along all the three types of children in class; sharp children, medium thinking children as well as slow learners and he has to satisfy their learning needs as well.

However, the trainings based on SNC implementation and skill acquisition were just introductory and conducted to pilot the teacher training module developed by experts of NCC and Agha Khan University. But no further training was conducted afterwards. Furthermore, the most crucial problem was that many of the nominated teachers were not teaching science at primary level, and some do not even have the science background. Moreover, only 38 science teachers received SNC training from 23-28th August 2021 in the subject of science out of 422 educational institutions (Source: FDE letter No. F.1-236/2019 Academics(FDE) dated: August 13, 2021 enclosed at Appendix L). The suitable nomination for the training was another problematic area. When asked, one of the FDE representatives responded that we are struggling with this issue as we are dependent upon AEOs and head teachers. Many a times we get inappropriate and irrelevant people. Selection of right person for the right job is very important.

Nevertheless, some of the misunderstandings related to Single National Curriculum are also being clarified in these training like it is assumed that Single National Curriculum is a book; but in real it is not merely a book. This concept was very important to make people understand. Secondly, it was significant to make people realize that in Single National Curriculum the content is almost the same; like in Mathematics you would find 70-80% of those same topics but then the difference comes in teaching methodology; how you are supposed to teach those topics. How to make the

students learn those topics; difference will come there. So, when you tell them that the real difference is modification in teaching methods which was very much required.

Many sorts of restructurings in teachers' training are required to support implementation of these curriculum reforms. These can be counted as:

a) It is very important that we should have an effective monitoring system; after incorporating these modifications in the pre-service and in-service teaching programs.
b) Second point is quite essential particularly for Islamabad and for other places as well; that there should be defined roles as who is going to lead the training. For example, if we are thinking that NCC would lead the training or it would be led by FDE or some private partners will come along, whoever it is; that role needs to be defined. Like if we are asking whether effective SNC training is being conducted in 422 Institutions of Islamabad or not, then we should be very clear who should be asked this question and who is accountable for that?
c) Even in FDE various trainings are being conducted by different agencies in their own format/agenda and sometimes by FDE trainers itself, sometimes by AEPAM and at times private partner is conducting training. All this is being conducted in isolation. If we keep on working in isolation and there is no link and nexus in our activities, then all this exercise goes useless.
d) Need analysis is much needed. For instance, one private/development partner approaches FDE or Ministry of Education and shares we are working on certain area; then you should know what are needs of your teachers in this particular field. What we have already told our teachers and to whom we have told this (trainee audience level). We need to make a network which can go along with that training model. If a development partner comes to

work with you then you should not bring them directly to the teachers but ask them to prepare master trainers that you could utilize in future.

e) Thus, in Islamabad there is no separate training department who is responsible and accountable for the training. A distinct training department in which you have special trainers who are specialist in various fields, who know the norms of training, what is a training pitch, what is the training need assessment, what is reporting of training need analysis, what is planning ahead of training and so on. Thus, the trainers must be aware of all the steps, must be using them and it should be their sole responsibility. When one individual is nominated for certain training, he should fully concentrate on that only thing. It should not be the case that one has to go to school or college in morning; has to give lectures there and on weekend he has to prepare for the training as well and it will keep on going like this and nothing is going perfect because of lack of attention and multitasking. Therefore, if you want to bring some change we need to think out of the box.

f) We also need to focus that our students must keep on asking questions out of their mind and teacher should work to stimulate and keep motivating them. Teacher should urge the inquisitiveness among students. Success of any program depends upon its viewership. Similarly, success of classroom learning depends on how active your children are, the vitality and alertness of the students should not diminish. But in our scenario, we try to reduce the activeness of children, we want that they should sit quietly in class and should not ask unnecessary questions or inquires for the sake of classroom management.

4.11.1 Current Status of Teachers' Training

Recently, Federal Directorate of Education (FDE) has revived its teacher's training programs in collaboration with Federal College of Education (FCE) under 02 main courses:

(1) Induction training course and

(2) Promotion-linked training course

These training programs catered 1000 teachers including head-teachers, lecturers, secondary and elementary school teachers. The training was organized from June-August 2023 and conducted in 05 batches; each batch comprised of 05 groups. As stated earlier, the researcher had multiple meetings with FDE educational managers (interviews regarding integration of 21st century skills) during her data collection field work. These discussions and deliberations raised sufficient awareness regarding significance, need and implementation strategy for integration of 21st century skills. Consequently, a session on 21st century skills was included in each training course for the orientation of novice teachers as well as those who are on the verge of promotion. The researcher, being master trainer was part of these training courses as resource person (official letters annexed at M). This is the humble contribution that this study has made to impact the teachers' training program at ICT level.

4.12 Challenges Encountering in Implementation of SNC

Following challenges and issues were stumbled upon in the path of SNC implementation as indicated by the research participants:

- Less potential is found among the teachers who are supposed to be the change agents and executors of the curriculum. FDE need to build the capacity and capability to implement the SNC and 21st century skills in true spirit in their classroom's environment.
- Though many of the teachers have capacity to integrate but more effort is required. It is not the case that the teachers do not want to learn, but their problem is that they are not able to transform their ideas and to convince themselves how necessary it is. For example, when a new teacher is recruited, he is very energetic, motivated, and committed at the start of his

> career. If proper induction training is being provided to a novice teacher and then after that FDE keep an eye on his classroom practices and progress, continue his monitoring and mentoring then you would find that he would apply his training in his teaching. Afterwards you will observe that he would become consistent, and these things would become part of his teaching. On the other hand, if he gets adjusted in the staffroom conventional environment then that will take him no-where. He will be drowned by the classroom environment as the senior teachers in the staffroom will be telling him that we have seen a lot of people who have done lots of initiatives and make efforts to make revolutions, but nothing has changed here, and nothing will happen in future as. Such negative talks demotivate the new teachers and they become part of the same orthodox system.

Teaching strategies play essential role which is to put efforts and includes balance between teachers' input and students' contribution. Teachers' participation should be lessened, and teachers' role should be of a facilitator and enabler. The teaching-learning process should be student-centered, and the teaching-learning paradigm needs to be reversed.

Yet another issue remains that needs to be highlighted and is about the changes in the classroom practices that acts as a hurdle in the implementation of SNC or to address 21st century skills.

Generally speaking, a lot of changes are required in classroom teaching. Actually, we are still unable to shift from conventional teaching. We talk about student-centered learning, but we don't implement it practically in our classrooms. We think that if we apply student-centered learning, it will be a waste of time. Our content won't be covered, and we will lag behind in covering the syllabus. But it is not true. If your child is confident, his basic literacy and communication skills are good then the other skills are being developed according to the standards of his level then the content can be covered on a faster pace. So, we need a whole paradigm shift in our teaching. The

teacher should leave the traditional method of teaching in their classroom and should come towards applying the modern teaching methods.

4.13 Towards the Resolution of Challenges/Barriers

Now as the issues were identified, it was questioned from the stakeholders what they think about the resolution of these challenges. Many of the participants responded openly and clearly. One of the research participants replied that while hiring new staff we must advertise the pre-requisite skills besides academic qualification, for instance their computer proficiency and good communication skills. Secondly, there must be induction trainings of in-service teachers. New inductees should be oriented with the necessary teaching methodologies and ICT skills. There must be mandatory teacher's training linked with promotions at least once a year. Furthermore, if we compare teachers of public and private sector, we will come to know that the public-school teachers are more qualified but the private sector focus more on grooming and polishing skills of their employee through continuous training that can be observed in their whole system. The public sector had a lot of potential but is far behind. Our public-school teachers are more competent and more experienced as compared to private sector. But there is no proper utilization of human resources in public institutions. Having a qualified teacher is one thing and utilizing his optimum potential is another thing.

It is the fundamental right of every citizen of Pakistan to get equal educational opportunities. Since the establishment of Pakistan till today, a class-based and exploitative education system has been going on with a lot of discrepancy. The difference between the curriculum taught and the facilities provided in the educational institutions of backward areas of country and the curriculum of elite private schools is evident of this class discrimination. Due to this exploitation and unfairness in education, the poor and under-privileged sections of the country are suffering from further

deprivation. Many social and political people have raised their voices on this issue in different periods, but it is still prevailing in the system. Various governments have also taken some serious measures, but there was no adequate solution to this problem.

CHAPTER 5

Summary, Findings, Discussion, Conclusion and Recommendations

5.1 Summary

The study was conducted to discover the extent 21st century skills are being integrated in the recent curriculum reforms (SNC), in subsequent science textbook (class 5) and teaching learning process. The central objective of the study was (1) To explore integration of 21st century skills in Single National Curriculum of General Science at Primary Level. To accomplish the objective following research sub-objectives were developed as: (1) To explore content of Single National Curriculum in subject of General Science at Primary Level with reference to 21st century skills. (2) To explore the content of General Science textbook (class 5) with reference to integration of 21st century skills at Primary Level (3) To explore the role of teachers' training on Single National Curriculum in subject of General Science for integrating 21st century skills at Primary Level. (4) To explore the science classroom pedagogies and strategies for students' assessment adopted for integration of 21st century skills at Primary Level. (5) To explore the availability and utilization of physical facilities in relation to integration of 21st century skills at Primary Level. The study was further guided by the research questions which are stated as: (RQ1) In what ways Single National Curriculum (SNC) gives provision for integration of 21st century skills; (creativity, critical thinking, collaboration, communication, and ICT) in subject of General Science (Class 5)? (RQ2) In what ways General Science textbook of Class 5 translates and integrates 21st century skills (creativity, critical thinking, collaboration, communication, and ICT)? (RQ3) How teachers' training on Single National Curriculum (SNC) in subject of General Science (Class 5) is helpful for facilitating teachers in integrating 21st century skills; (creativity, critical thinking, collaboration, communication, and ICT) at Primary Level? (RQ4) In what ways are pedagogies

being utilized for integration of 21st century skills; (creativity, critical thinking, collaboration, communication, and ICT) in Science class at Primary Level? (RQ5) What strategies of students' assessments are being utilized in science classrooms which integrates 21st century skills (creativity, critical thinking, collaboration, communication, and ICT) at Primary Level? (RQ6) In what ways are physical facilities (infrastructure and technology) being available and utilized for integration of 21st century skills; (creativity, critical thinking, collaboration, communication, and ICT) in Primary Schools? The study was descriptive in nature and utilized "interactive mixed methods" approach. The researcher followed "multiphase sequential design" to examine and analyze narratives and perspectives of stakeholders including curriculum experts, science textbook authors, FDE officials and science teachers regarding integration of selected 21st century skills in curriculum documents, science textbook and the teaching learning process. The study initiated with the quantitative method that included document analysis of Single National Curriculum (SNC) in subject of General Science and subsequent General Science textbook. Metrics framework and code book was developed to conduct the quantitative document analysis. The quantitative document analysis method informed and guided about tool development for the next phase of the investigation i.e, interviews with relevant stakeholders. Furthermore, the content analysis was also scrutinized qualitatively in form of thick description within the themes of SNC and units of science textbook to add more depth and meaning to the quantitative analysis. The study then proceeded to semi-structured interviews with the research informants (04 curriculum developers, 02 science textbook authors, 03 FDE officials and 10 science teachers). Sperate interview protocols were developed for each strata of the respondents. Interview protocols were piloted, and their validity and trustworthiness was also ensured. The interview data were audiotaped and then were transcribed in verbatim. Furthermore, the computerized typed versions were sent back to research

informants for member check. The interview data were then coded and looked over for similar patterns that led to their placements in relevant themes. Thus, it provided a holistic outlook regarding perception of all the relevant stakeholders regarding 21st century skill integration in SNC and the other sub-component of teaching learning process. Qualitative method of data collection and analysis remained dominant during the study and provided relevant and meaningful information. It also helped in sample selection for the next phase of the study i.e., identification of science teachers for classroom observation. Three science teachers were selected from each set-up of FDE i.e., urban area schools, federal area schools and model colleges. Each science teacher was observed 03 times as per their convenience. A structured tally sheet was developed to make the classroom observation which was analyzed quantitively. However, rich description of field notes, researchers' reflection and teachers' demography and traits added value to the quantitative classroom observation. This part of the research provided us with a reality check about the teaching and assessment strategies of actual classroom that could be compare with the narratives of the stakeholders. The research ended and arrived on following findings as.

5.2 Findings

The investigation revealed multiple aspects regarding recent curriculum reforms (Single National Curriculum, SNC) and the prevailing science teaching learning practices and situation in the primary schools as investigated in the light of research questions of the study. The results were drawn from analysis of Single National Curriculum (SNC) and subsequent science textbook, perspectives of education stake holders (curriculum developers, textbook authors, academicians from Federal Directorate of Education and science teachers) and enacted science classroom practices regarding integration of selected skills among primary students.

The research findings from three stages of the research can be illustrated via Table 5.1 underneath.

Table 5.1 Results of different data source analysis regarding integration of 21st century skills.

Sr #	Data Source	Findings
1	Curriculum and textbook analysis (Document Analysis)	• Development of 21st century skills among students is one of the key considerations in curriculum reforms. • Active learning, learner-centered, teacher as enabler, flipped classroom, activity based learning, collaborative learning, problem and project-based learning. • Assessment based on higher level of cognition.
2	Perspectives of stakeholders (Interview Analysis)	• Have awareness about the need and significance of skills. • Lack of teachers' capacity and professional development. • Activity based learning, group work, utilization of audio video aids.
3	Classroom Pedagogies (Classroom Observation Analysis)	• Teacher directed classrooms, only teacher asking questions. • Use of whiteboards, activities, group work and student's presentation. • Main focus on covering the syllabus. • Less consideration on development of higher cognitive skills.

The present study explored the extent of integration of 21st century skills in contemporary curriculum reforms made in the country. The overarching objective of this investigation was: To explore integration of 21st century skills in Single National Curriculum of General Science at Primary Level. The research is further guided by subsequent research questions. The research findings withdrawn from the data analysis are described with respect to research questions as follows.

5.2.1 ***Findings related to RQ1:*** *In what ways Single National Curriculum (SNC) gives provision for integration of 21st century skills; (creativity, critical thinking, collaboration, communication, and ICT) in subject of General Science (Class 5)?*

The very first finding of the research study was that the selected 21st century skills are adequately enclosed in the document of Single National Curriculum except the skill of creativity. The skill of creativity needs to be focused more in the document of SNC. It was observed that inclusion of 21st century skills is among the key deliberations in revising the science curriculum with the desire to streamline learning with the international standards. One of the main goals of curriculum reforms in subject of general science was to promote scientific literacy among students through arousing their curiosity and critical thinking. In quantitative content analysis of SNC themes, the relative frequency of 21st century skills and selected skills i.e creativity, critical thinking, collaboration, communication, and ICT was found 3.53, 22.35, 7.06, 11.76,21.18 and 34.12 respectively. However, these numbers only quantify their presence in different chapters of SNC. To seek in-depth evidence, the researcher also conducted thematic analysis of SNC document in the subject of general science for class 5. The thematic analysis of science curriculum revealed that the student learning outcomes and subsequent content give provision of higher order thinking skills especially critical thinking. The term of active learning along with critical thinking, collaborative learning,

problem-based learning was coined in the document of SNC. The active learning strategies mentioned in the SNC include group/pair discussion, questioning techniques, debates, role play, group work and presentations that has the potential to integrate 21st century skills among students. It was also found that the "Curriculum Review Committee" involved in the development of science curriculum mostly constituted of subject experts, teachers, head teachers, directors and academic coordinators included from the provinces as well as from Islamabad. However, opinion of some of the curriculum experts should be taken into account to review the curriculum and science textbook in order to ensure its suitability as per age and cognitive level of students. Many of the science teachers show their concern that the science textbook is too heavy in terms of content and activities for the students. The interviews with curriculum developers revealed that they were quite mindful and conscious of the need for and importance of 21st century skills. The curriculum developers claimed that a thoughtful and deliberate effort was made to address the 21st century skills in the curriculum development and restructuring process.

The finding on first research question are summed up as below.

1. SNC is well integrated with 21st century skills under the notion of life-skill based education.
2. SNC implementation in true spirit can be helpful in integrating 21st century skills in teaching-learning process.
3. Teachers' competence and training are the major challenges in execution of Single National Curriculum in true spirit.

The following Table 5.2 illustrates findings of content analysis of Single National Curriculum (SNC) with reference to its provision regarding integrating of selected 21st century skills.

Table 5.2 Thematic Analysis of SNC regarding integration of 21st century skills.

Sr#	Themes of SNC	Findings
1	Goals, standards, and Benchmarks	• Inclusion of 21st century skills as key consideration. • Introduction of life-skills based education (LSBE). • Prepare students to meet the challenges of 21st century.
2	Learning content and SLOs	• Address higher order cognition. • Multiple activities suggested to enhance students' curiosity, critical thinking and collaboration. • Provision of relevant weblinks.
3	Teaching & Learning	• Active learning, collaborative and experiential learning. • Strategies suggested as pair and group discussion, questioning, group work and presentations. • Flipped classroom and problem-based learning.
4	Assessment	• Independent learner and critical thinker. • Work in collaboration as a team not in competition. • Constructed response question to assess higher learning domains.
5	Guidelines for the authors	• Content and activities that engage students' thinking and creativity. • Provision of IT related activities.

5.2.2 ***Findings related to RQ2:*** *In what ways General Science textbook of Class 5 translates and integrates 21st century skills (creativity, critical thinking, collaboration,*

communication, and ICT)?

The findings on research question 2 indicates that though the selected 21st century skills are being addressed in content and activities of General Science Textbook however, the skills of creativity was being less integrated. The G.Sc. textbook put restrictions on teachers' autonomy on "how to teach". It also contradicted SNC's aim towards development of "independent learner" and "learning without boundaries". The findings with reference to General Science Textbook content analysis are illustrated in the Table 5.2 given below.

Table 5.3 Thematic Analysis of Science Textbook regarding integration of 21st century skills

Sr#	Themes of G. Science Textbook	Findings
1	SLOs of Science Textbook	• In accordance with SLOs of SNC. • Target higher order cognition level mostly up to analyzing level. • Skill of creativity is hardly addressed.
2	learning content & activities in Science Textbook	• Variety of engaging activities that target critical thinking, collaboration, and communication of students. • Activities are too directional, hinders students' creativity and imagination. • More focus is on making students observe.
3	Assessment in Science Textbook	• Constructed response questions involve students' critical thinking.

- Provision of project based learning but that's too in the form of receipt book; less scope for students to be innovative.
- Most of the assessment is based on understanding and comprehension domain.

The content analysis of science textbook exposed that it is in alignment with the student learning outcomes mentioned in the Single National Curriculum (SNC). The textbook content was analysed both quantitatively and qualitatively. The quantitative content analysis revealed that the relative frequency of selected 21st century skills i.e., creativity, critical thinking, collaboration, communication, and ICT as a tool for learning in the science textbook is 2.73, 35.91, 25.91,26.82 and 8.64 respectively. Among all the skills, creativity was least focused while in SNC document it was given much importance to enhance students' curiosity and imagination through inquiry, meaningful learning experiences and creative tasks. The content prescribed in the textbook also gives provision of higher order thinking skills especially critical thinking. The activities given in science textbook of Grade 5 also target active learning specially the projects mentioned at the end of each unit. However, the activities described in textbook seemed to be over rigid and directives that hinders students' creativity and imagination.

The interviews with General Science textbook authors revealed that enclosure of selected 21st century skills within the science content was one of the key considerations while science content development. The textbook writers affirm that they adhered to instructions given in the curriculum for including content and activities that target students' higher cognitive skills. The findings on second research question are sum up as follows.

1. Textbooks are in consonance with spirit of SNC and can help in translating 21st century skills in classroom. However, the skill of creativity is least integrated.
2. Science textbook is embedded with student-centered activities and open-ended probes that can instigate higher order thinking skills among students.
3. Change in curriculum or textbook would not make any difference unless our teachers change their philosophy and methodology.

However, the science teachers who were the main executor of the SNC in the field through the science textbook affirmed that the science textbook is too heavy for the primary schoolers (9-11) in terms of content and activities, and it is too difficult for them to cover the whole syllabus in the academic year. It would not only burden the students, but they would also lose their interest, natural curiosity, and creativity in exploring science. Furthermore, textbooks reached late in schools, academic year was made shortened due to pandemic, and it was too difficult for teachers to cover an activity based yet lengthy syllabus in short period and to adopt new teaching learning strategies of active learning.

Furthermore, the content analysis of science textbook uncovered that among the selected 21st century skills the skill of creativity is least addressed in the science content because of too much structured activities. The most considered and integrated weas the skill of collaboration that was embedded through activities, group-work, and projects. The skill of ICT was also well unified through providing weblinks at the end of each unit.

5.2.3 Findings related to RQ.3*: How teachers' training on Single National Curriculum (SNC) in subject of General Science (Class 5) is helpful for facilitating teachers in integrating 21st century skills; (creativity, critical thinking, collaboration, communication, and ICT) at Primary Level?*

The findings on research question 3 indicates that very a smaller number of teachers were trained for SNC in a single batch. The interviews with general science teachers, who received orientation training on SNC revealed that they were familiar with the notion of 21st century skills, activity-based learning, project, and problem-based learning. Thus, training helped them in providing sufficient awareness about these skills. However, the science teachers need to improve their understanding and capacity as how to target and translate these skills in their classroom practices.There was lack of motivation and incentives for teachers to develop their professional competence.

1. The whole process of curriculum development and execution was so rapid and abrupt that there was very less time left for the teachers training, before implementing the curriculum. Consequently, insufficient number of teachers were trained on SNC(only 38 science teachers were trained from 422 institutions).
2. There were irrelevant training nominations due to lack of coordination.
3. There was no follow up and no established monitoring and mentoring mechanism to support the trained teachers.
4. Unfortunately, no department (National Curriculum Council or Federal Directorate of Education) took responsibility for teachers' training in the area of Single National Curriculum (SNC) at federal level and only one batch of teachers were trained.

5.2.4 Findings for RQ.4: *In what ways are pedagogies being utilized for integration of 21st century skills; (creativity, critical thinking, collaboration, communication, and ICT) in Science class at Primary Level?*

The classroom observation revealed that most of the classrooms were traditional, and teacher centred. Though the teachers engaged students in some activities, but these were all teacher

directed and hardly focused on developing students' creativity or critical thinking. However, the skills of collaboration and communication were utilized in classroom practices through group work and students' presentations. ICT could not be employed as a learning tool for the reason that all the classrooms were deprived of the computer facility and internet. The findings on research question 4 can be summarized as follows.

1. Science teachers were familiar with the notion of 21st century skills but they still require to enhance their understanding and expertise in addressing or integrating these skills in their classroom teaching.
2. Classroom pedagogies were mostly teachers' demonstration.
3. Activity based learning was also employed but it was teacher directed and students were merely following the instructions passively.
4. Students worked in groups and made classroom presentations.
5. Over-crowded classrooms, difficult to employ activity based learning in groups due to insufficient space.
6. Lack of resources and facilities, no guidance or mentoring, lack of teachers' motivation and will, heavy syllabus and short academic year were the challenges.
7. There was no mechanism to ensure SNC execution or the integration of 21st century skills. The monitoring unit at FDE level was limited to check the basic logistics regarding cleanliness, attendance of staff and basic facilities only.

Big shift is required in term of classroom pedagogies. All the classes observed were teacher centred and students were merely following the directions. Provision of activities made them little excited, but they were still bounded to remain disciplined and follow the instructions. Teaching was least stimulating, and students were not asking any questions or making any inquiries. Large classroom

size/overcrowded classes not only burden the teachers but also hinder in developing students-teacher close relationship. Teachers were found much occupied and were unable to pay attention and monitor the learning progress of every student. Besides teaching in class, they have to check the students' notebooks, paper making and checking, and other duties and responsibilities at school. Teachers were also being involved and deputed in census duty, election duty, deworming duty, and tasks other than teaching in classroom. After completing all these tasks, teachers got very less time to complete the syllabus.

5.2.5 Findings for RQ.5 *What strategies of students' assessments are being utilized in science classrooms which integrate 21st century skills (creativity, critical thinking, collaboration, communication, and ICT) at Primary Level?*

Single National Curriculum (SNC) advocates employment of formative assessment and diagnostic assessment to monitor students' learning progress, to plan and modify the teaching instruction and to diagnose students' learning difficulties. However, the classroom observation uncovered that the teachers were quite ignorant of the use of formative or diagnostic assessment. They relate formative assessment simply with the recapitulation of the lesson or asking some questions to the students at the end of some activity or lesson. The findings on fifth research question regarding discoveries on students' assessment strategies can be concise as follows.

1. Mostly teachers were not familiar with the notion and usage of formative and diagnostic assessment in classroom.
2. There was no record of formative assessment, only end-term assessment is recorded.
3. No performance-based assessment is monitored during group work or classroom presentations.

4. There was no record of students' portfolios, projects-based assignments, or classroom participation.

5.2.6 Findings for RQ.6 *In what ways are physical facilities (infrastructure and technology) being available and utilized for integration of 21st century skills; (creativity, critical thinking, collaboration, communication, and ICT) in Primary Schools?*

Though the FDE officials were also heedful about the significance of 21st century skills. However, they have no vision or policy plan as how to develop these skills among students. They opined that the schools are being upgraded time to time, but no particular support or facilities are provided in schools for integration of 21st century skills among students nor the teachers have been provided with the training to address or develop these skills. The findings on RQ.6 can be summated as follows:

1. The FDE authorities know the need for and importance of 21st century skills.
2. No facilities, resources or projects initiated in particular for integration of 21st century skills or for executing "active-learning" spirit of SNC.
3. Only white board was available as teaching aid.
4. In few lessons, teachers utilized some material but that was arranged by her/his own means.
5. No computer in class, no internet in school.

It appeared that the government has focused only on the content and product, while the learning experiences offered to students have been completely ignored. The education budget was reduced under the then government.

5.3 Discussion

The current study revolved around Single National Curriculum (SNC) and integration of 21st century skills (4Cs and ICT), both concepts are relatively new in the context of research conducted

in Pakistan at PhD level. The study was explorative in nature that's why the researcher adopted qualitative method for seeking the narrative and perspective of stakeholders in addition to quantitative content analysis. The principal objective of the current research was to discover the extent Single National Curriculum (SNC) offers provision for integration of 21st century skills in subject of general science at primary level. To achieve this objective, the document analysis of SNC and science textbook was conducted. The study also sought out perspectives of stakeholders regarding their perception on inclusion of 21st century skills (4Cs and ICT) in science curriculum and textbook. It investigated narrative regarding teachers' training on SNC and provision of facilities and resources in schools. The researcher then observed the implication of these curriculum reforms in actual classroom pedagogies. The overarching objective of the study was fragmented into six research questions which were scrutinized during the investigation. The detailed description on account of research questions along with the findings are discussed as follows:

5.3.1 Single National Curriculum and Integration of 21st Century Skills

The first research question was: In what ways Single National Curriculum (SNC) gives provision for integration of 21st century skills; (creativity, critical thinking, collaboration, communication, and ICT) in subject of General Science (class 5)? To answer this research question, document analysis of SNC in subject of general science was scrutinized for the selected 21st century skills. The analysis was made quantitatively as well as thematically. During the thematic analysis, it was observed that inclusion of 21st century skills was among one of the key contemplations during curricular restructurings. SNC was launched with the activities and project-based learning, use of information and communication technologies and inclusion of 21st century skills to meet the challenges of modern era. SNC specifically mentioned insertion of "Life Skill-Based Education"

along with critical thinking, creativity, and innovation. For the inclusion of skills, several conferences were organized at national level to sensitize the shareholders and to ensure their enclosure at different levels. During the SNC document analysis, it was revealed that though there was no notable change regarding the science content, the students' learning outcomes tried to capture students' higher order thinking. The action verbs of "identify", "investigate", "examine", "differentiate", "suggest", "demonstrate", "illustrate", "justify" and "appreciate" were used for the purpose. It was revealed that the SNC content has addressed up to "applying" and "analyzing" level of cognition. The level of evaluation and creativity were not included in SLOs. However, the suggested activities in achieving these SLOs offered students the opportunity to "design", "plan" and conduct" that can nurture their creativity and imagination. Provision of different project-based activities, for instance making certain models, designing some experiments, scheming certain signs and symbols; and conducting some campaigns can also flourish students' originality and creativity. The teaching and learning prescribed in SNC paid special focus on students' critical thinking and creativity as appropriate to their age level. SNC expects students to experience science and to know how to communicate their knowledge of scientific inquiries. SNC coined the term "active learning" for the pedagogical approach of science classroom. Active learning involves collaborative learning, problem-based learning and experiential learning that tend to flourish higher thinking skills among students. SNC also described strategies for active student's learning as pair and group discussions, group work and presentations, that nurture pupils' collaboration and communication skills. SNC advocated that the students should experience variety of learning experiences with investigative and creative tasks. Students should be invited to think, analyze, and to ask questions. SNC promoted use of ICT as a tool for learning and mentioned its utilization for understanding science processes through simulations, model making, instructional audios and

videos, pod casting, graphics, and data manipulation. SNC also suggested authentic weblinks in each science unit that can take the user to the relevant content for further understanding of certain concept. SNC proposed the idea of "flipped classroom" where students take charge of their learning, can experience activities that involve higher order thinking and learn in collaboration with each other. Another suggested classroom organization in SNC document was "problem-based learning" that has the potential to enhance creativity, critical thinking, and collaborative skills of students.

The assessment part of SNC document suggested that the students should be made capable of their own self-assessment. The learner should be able to utilize critical thinking and should work in collaboration with each other rather in competition with each other. For the written examination, the test items should assess students' higher order thinking and try to seek creative response through constructed response questions. In chapter of "Guidelines to the textbook authors", SNC directed textbook writers that the science textbook should include variety of thinking activities that engage and develop students' higher-level thinking, creativity, and investigation skills.

It was mentioned in the SNC document that a comprehensive "Teachers' Guide" would be developed for teachers that include description of important concepts and would inform teachers how to best utilize the textbook for optimum students' learning. Unfortunately, no such guidebook was available to teachers. If a teachers' manual was provided or accessible, it could be beneficial for more teachers who could not get the opportunity of SNC training.

Additionally, Women's Action Forum Policy stated that, "The SNC is quite heavy for primary level schoolers (4-10 years of age). Students would lose interest in learning and their intellectual curiosity and creativity would be killed (Hussain and Saigol, 2020)". Furthermore, SNC did not cover vocational education or content on vocational training at primary level. In Pakistan, the

dropout ratio of students at primary level is about 40%. The students who left the school at primary level would not have any practical or vocational skills as SNC is silent on this aspect.

SNC is one of the overblown and amply hyped initiative of the previous government that came up with the slogan of "One Nation-One Curriculum". But curriculum reforms alone cannot bear any fruits to the nation, government has to take serious measures for delivering quality education. It is also pertinent to quote that the current government has changed the name of Single National Curriculum (SNC) with National Curriculum of Pakistan (GoP, 2023) with the notion that it would make it more inclusive and "national". At the time of synopsis approval of this study (2021), the term of SNC was in use. Now the curriculum is being re-named as National Curriculum of Pakistan (NCP) in 2023, but the study has been culminated. However, the curriculum content along with its objectives and SLOs are the same and nothing has been changed. So, the SNC term may be taken as NCP.

5.3.2 General Science Textbook and Integration of 21st Century Skills

The second research question pertaining to current research was: In what ways General Science textbook of class 5 translates 21st century skills (creativity, critical thinking, collaboration, communication, and ICT)? In exploring answer to this research question, general science textbook at primary level was examined thoroughly. The quantitative content analysis revealed that the relative frequency of selected 21st century skills i.e., creativity, critical thinking, collaboration, communication, and ICT as a tool for learning in the science. The qualitative analysis of science textbook exposed that the content sufficiently targeted students' critical thinking by posing thought provoking questions at the beginning of each unit. Likewise, the sections of "points to ponder" and "constructed response questions" at the end of each lesson also engaged students' critical thinking. The science content is supplemented with multiple activities, but the activities are too structured

and directional that leave less leverage for students' creativity and curiosity, same is the case with projects given at the end of each lesson. Some of the activities and projects could be left open-ended in term of giving students' choice of selecting material to perform an activity or complete a project. This could nurture student's imagination and creativity and every student could come up with different ideas in completing his/her project. Different methods of performing an activity could be discovered.

Furthermore, the content analysis of science textbook uncovered that the assessment exercises mostly targeted first three domains (remembering, understanding, and applying) of students' cognition. Fourth level of cognition i.e., "analyzing" is rarely addressed in science content or assessment though the relevant action verbs were mentioned in SLOs part of textbook; but that too was not very often. Science textbook was full of activities that call students to work in groups and present their work. Hence, we can assume that the skills of collaboration and communication were well integrated in science textbook at primary level. The skill of ICT was also well attended and integrated in science textbook as each, and every unit has relevant weblinks to enhance students' knowledge of the concept.

It was noticed that the science textbook was overloaded with activities and content. The academic year was short due to COVID-19 pandemic and teachers were in rush to cover the syllabus. The teachers were over-burdened and occupied. These findings are endorsed by the study conducted by Faize (2011) that the textbooks are stuffed and loaded with content and hardly achieve desired student' learning outcomes. Furthermore, as the curriculum was developed on emergency basis, the consequent textbooks were developed and published late. The books were delayed almost 03 months after the new academic year started so covering the whole syllabus and made students perform all the activities was a challenge (Abbas et al., 2022).

5.3.3 Teacher Training on SNC and Integration of 21st Century Skills

The third research question formulated was: How teachers' training on Single National Curriculum (SNC) in subject of General Science (class 5) is helpful for facilitating teachers in integrating 21st century skills (creativity, critical thinking, collaboration, communication, and ICT) at Primary Level? At the very beginning of the investigation, the researcher collected data on the number of teachers trained on SNC from training wing of FDE. It was found that subject wise training was organized in different phases. In the first phase, master trainers were trained who were supposed to cascade the training to other science teachers. In the subject of science, 06 master trainers were trained in a 06-day training workshop organized by National Curriculum Council (NCC) in collaboration with experts from Agha Khan University at the venue of Allama Iqbal Open University (AIOU), Islamabad. It was a comprehensive training that gave sufficient orientation on all aspects of SNC. Furthermore, out of these 06 master trainers, 02 trainers disseminated training to 32 science teachers. Hence, only 38 science teachers received training on SNC. Though this second batch of 32 teachers was supposed to further surge training in their respective sectors but no supplementary training was planned on SNC after that. Many of the science teachers have not even seen the curriculum document. They were made familiar with the SNC merely through textbook. The problem is that there is no planning and consistency in training as far as educational institutes of Islamabad under FDE is concerned. After 18th amendment in constitution, there is no institute at ICT level who is responsible for training. When there is no responsibility, there is no accountability. AEPAM and FCE also conduct teachers training under different projects, but they did not organize any workshop on SNC. There are several private partners as well who in the name of public-private partnership organise their trainings with FDE teachers under their own agendas. Consequently, the teacher who is supposed to be the prime change agent is deprived of due

professional development which is the need of hour. Velez (2012) conducted research, “Preparing the students for the future-21st century skills”. One of the findings of the study were that teachers could not develop 21st century skills among students due to lack of a concrete professional development program that could enable them to teach and integrate 21st century skills in their teaching. Findings of the current study are in concurrence with the investigation conducted by Fisser & Thijs (2015) that the training provided to science teachers was insufficient and inconclusive with the teaching of 21st century. To integrate 21st century skills in the education and to develop these skills among students, the teachers should know as how to address and translate these skills in classroom teaching. Moreover, Abbas et al., (2022) argued that the new curriculum reforms are somewhat difficult to taught for majority of teachers at primary level and for that they need meticulous training courses to utilize it effectively.

Fisser & Thijs (2015) also conducted a study on integration of 21st century skill in Dutch curriculum at primary level and concluded that comprehensive and extensive professional development of teachers along with development of network for sharing knowledge is required for successful implementation of these skills. Furthermore, there should be the training of head teachers also as if the principal of the school would have the vision and awareness then he/she would be sensitized and only then execution of 21st century skills would be possible in true spirit. In this way he/she would also be in position to mentor the teachers if they face any shortcomings.

5.3.4 Classroom Pedagogies in Primary Classroom and Integration of 21st Century Skills

The fourth research question was: In what ways are pedagogies being utilized for integration of 21st century skills; (creativity, critical thinking, collaboration, communication, and ICT) in Science class at Primary level? The general science teachers who received training on SNC were interviewed to fetch information regarding this question. It was uncovered that though public-

school science teachers were familiar with the notion of 21st century skills, realized their need and significant but had no idea as how to develop these skills or what kind of changes they should make in their teaching methodology to integrate these skills in their classroom learning. This is also in agreement with the findings of Symonds, Schwartz, & Ferguson (2011); Fink (2013); Voogt et al., (2013) and Wilcox, D. (2017). These researchers concluded that though teachers recognised the need for 21st century skills yet these skills were not targeted in their teaching practices. The science teachers mentioned the terms of activity-based learning, project-based learning, group work and classroom presentation but they were clueless as how to employ and utilize these activities for skill development. These findings were similar to the results of the study carried by Fox (2011) and Egnor (2013) in which school leaders were found familiar with the skills of 4Cs, but they were not clear in their perception as how to implement these skills in elementary school while science teachers had very less knowledge about how to teach these skills to students.

Moreover, the researcher observed science lessons of 03 willing teachers. It was found that 02 teachers employed activity-based learning and engaged students in group work and presentation. But the real shift from teacher-centred to learner centred classroom was totally missing. All the lessons were teacher directed. Intensive teacher training should be planned to develop attitudinal change in teaching strategies. The third teacher of rural area made least effort to employ any active learning strategy to implement spirit of SNC or to address any higher order skill among students. Moreover, due to large classroom size it was difficult for teachers to arrange group work in small rooms and inappropriate furniture/chairs. The teachers also faced discipline problems when students were made independent and working in groups due to large number of students. Teachers' perception was that as academic year was short so class time should be focused on covering the syllabus and learning the content rather than trying new teaching methodologies. The teachers

required technical support, additional resources, and professional support to learn, adept and adapt these skills. Current scenario was also affirmed by the study conducted by Dede (2010) and by another study conducted by Ananiadou and Claro (2009) who asserted that there is lack of support and resources for teachers to adopt these new pedagogical tools. Non-conducive working environment is also found to be a challenge in teachers' motivation and performance (Shah, Akhtar, Zafar, & Riaz, 2012).

Job security in terms of permanent job and lack of link between performance, recognition and reward are some of the reasons due to which teachers pay little attention in improving their practices (Ahsan, 2021). They would keep on receiving the same perks even if they do not show good performances. That make teachers less ambitious and least motivated in learning new skills and improving their conduct (Gemeda, & Tynjala, 2015; Shah, Akhtar, Zafar, & Riaz, 2012). This deficiency is a substantial motivational challenge in improving teaching practices of teachers. There is no concept of performance-based teachers' appraisal linked to the promotion and other monetary benefits for teachers in Pakistan. Every government teacher receives the same salary and annual increment despite of the effort and performance. It is time to focus on recognition and reward in order to impact teachers' intrinsic motivation that can lead to improvement in classroom practices (Ali & Ahmed, 2008). There is a dire need for the introduction of performance-based promotion criteria of the teachers. A comprehensive evaluation standard may be formulated on which the teachers may be monitored whole year and they may be informed of all the indicators. Furthermore, this portfolio may be reflected in the Performance Evaluation Reports (PERs) and be linked to their promotion and monetary benefits. This would not only make teachers more vigilant and mindful in discharging their duties but would also facilitate in execution of reforms and initiatives taken by authorities.

5.3.4.1 Current Status on Classroom Observation

Recently a workshop was conducted by NCC regarding teachers' classroom observation and monitoring mechanism at primary level in which head of schools were invited. But unfortunately, the teachers were not made part of it, nor they were supposed to be in future. The researcher herself attended the workshop and asked it would be better if the teachers were made part of it as well. When a teacher would be ignorant of the indicators and the criteria on which s/he is going to be evaluated how could s/he consider and include such elements in his/her teaching? But the authorities there refused to accept the point. The prescribed "Observation Performa" was appeared to be too lengthy and complicated that even many head teachers were finding difficulties in understanding it in a 02-hour training session.

5.3.5 Assessment Strategies Employed in Classroom for Integration of 21st Century Skills

The fifth question of the research study was: What strategies of students' assessments are being utilized in grade 5 Science classroom which integrate 21st century skills (creativity, critical thinking, collaboration, communication, and ICT) at primary level? During the classroom observation, the researcher found that only one teacher utilized formative assessment through work sheet and Q/As to review students' learning about a certain concept. Rest of the 02 teachers only recapitulated their lessons and simply asked the students whether they have grasped the concept or not. Two teachers asked the students to present their group work in front of class, hence tried to address skills of collaboration and communication. The researcher also examined formal tests of general science (term question papers as well as annual centralized exam paper). It was found that only 15% of the assessment target students' applying and analysing skills while rest of the paper was based on remembering and understanding based questions. The questions were just picked in verbatim from the unit exercises. One of the teachers orated that mostly centralized exam question

papers are book-based which is the reason that majority of teachers focus on memorizing the questions to students so that they can secure more marks in remembering the concepts. Therefore, they don't "waste" time on activity-based learning as it is not very rewarding in terms of acquiring good marks. These findings were also in agreement with the findings of research conducted by Faize (2011) and Naeem Ullah (2007) that our assessment pushed students towards rote learning and memorization of the content. It is also pertinent to mention that the training on SNC did not cover assessment measures compatible to SNC or evaluating whether students develop certain skills or not. Assessment being the most crucial pillar of education system also needs reforms with more focus and teachers training. Voogt et al., (2013) also recommended that the prevailing assessment frameworks are in dire need of revision to ensure the integration of skills and competencies and to complement teaching and learning of 21st century. All policies and reforms in Pakistan follow top-down approach, a series of workshops were organised on assessment and evaluation mechanism for SNC and assessment of higher cognition learning but unfortunately, the main executor of all these reforms, the teachers were not mostly included in it. Very small number of teachers were made part of such workshops and seminars. Furthermore, the FDE has recently started working on SLO based assessment at primary level for the academic year (2023-24) and they are trying to ensure assessment of higher learning domains. The authorities are now sufficiently sensitized on the development of higher order skills and are working on it to improve the prevailing assessment practices.

5.3.6 Provision of Physical Facilities Regarding Integration of 21st Century Skills

The last research questions developed was: In what ways are physical facilities (infrastructure and technology) being available and utilized for integration of 21st century skills; (creativity, critical thinking, collaboration, communication, and ICT) in primary schools? During the semi-structured

interviews all the stakeholders confessed the pivotal role of facilities, equipment, and teaching-learning resource material regarding integration of skills. However, when the schools were visited, it was discovered that there was a disparity in schools as far as provision of physical facilities and infra-structure is concerned. Model schools have well established infrastructure equipped with all the necessary facilities and resources. The dilemma is that in F.G setup the rural schools, where students being more vulnerable regarding their learning loss were provided with least facilities. The teachers were less competent and least motivated. During classroom observation, the teaching-learning resource material used in the activities were mostly arranged by the teachers, though it was low cost. The classrooms were deprived of the computer facilities, even in the model setup. Though there were computer labs, but science teachers did not take the students to the computer lab as primary classes were allowed to visit the lab only in the period of computer. Furthermore, the computer labs were destitute of internet facility hence, the weblinks could not be utilized and consequently ICT was not being integrated in teaching-learning process at classroom level.

During the interviews with FDE educational managers, it was revealed that the FDE lacks vision regarding integration and development of skills hence they were least interested in providing any resources or training of these skills. A study, "Learning 21st century skills: Implementation of programs and practices" by Hillman (2012) concluded that if an institute doesn't have a clear vision, then there would be no consistency regarding its purpose and practices. This endorses findings of the present study as well. In order to execute 21st century skills, the FDE has to have an articulated vision and devote in term of resources regarding the development of these skills.

SNC promoted project-based learning that demands a complete learning eco-system along with full-fledged facilities and resources. It requires investment beyond classroom, but the school environment and funds were not upgraded in that direction. Hence, by only changing the one pillar

of curriculum you cannot deliver quality or standard education and integrate skills among students. This finding in also endorsed by Chaudhary and Alam (2020). Furthermore, Ağaoğlu, & Demir (2020) in a study regarding integrating 21st century skills in education in Turkish context endorsed that the role of classroom environment is very crucial in acquiring 21st century skills. They further recommended that the classroom environment should be organized that can foster activity-based learning. The endorsed that the learning environment should be well equipped with recent technologies like mobile applications, LEDs in classroom connected by high-speed internet, simulations, etc. Likewise, Lewin and McNicol (2015) endorsed in a study that traditional classroom learning environment need transformation specially in terms provision of infrastructure and technology along with internet access. They asserted that we need to extend the conventional classroom boundaries for fostering and integrating 21st century skills in our teaching and learning. Government needs to pay serious attention for establishing societal trust on public school as a research study conducted exposed that even the under-privileged parents prefer private schools over public schools regrading admission of their children as quality of public-school education is a question mark (Manzoor, Rasul, Ahsan & Safdar, 2017). Government ought to emphasis in making schools' environment conducive for learning and ensure teachers' training and provision of necessary resources on effective use of technology for imparting learning to the students of 21st century in an interesting and efficient manner (Ahsan, 2021).

5.4 Conclusions

Based on the data analysis and findings of the investigation, conclusions were drawn as under:

As proclaimed, most of the selected 21st century skills including ICT skills are sufficiently integrated in SNC. The activities, teaching- learning strategies and assessment mechanism mentioned in SNC were in consonance with the development and integration of higher order

cognition. But the portion of suggested activities was found quite rigid and in form of a cookbook. Activities were too directional for both the teachers and the taught that it inhibited the element of creativity and curiosity. Too many directions may stifle students' imaginative and innovative tendencies. The SLOs mentioned in SNC, and Science textbook mostly covered first three cognition level. Only 1-2 SLOs in each unit involve students' higher order thinking skills, that too up to analysis level. Most of the learning outcomes were understanding and comprehension based. Likewise, the activities and projects encompassed in the science textbook were also too structured and prescriptive. In this way, the textbook failed to translate the vision of SNC i.e to arouse critical sense of curiosity and wonder among students. In addition to stifle students' creativity and innovation, it also put restrictions on teachers' autonomy on "how to teach". It also contradicted SNC's aim towards development of "independent learner" and "learning without boundaries". The skill of creativity was the least mentioned among the selected skills and integrated minimally in the science textbook content and activities, though it was highly recommended in SNC document. Government put least efforts on professional development of science teachers. Training of only 38 science teachers is very inadequate in number. Furthermore, inappropriate training nomination and no monitoring mechanisms, left question mark on the quality of training effectiveness.

The teachers need to enhance and develop their capabilities as how to address and integrate 21st century skills in their classroom teaching and how to develop these skills among students. Teachers' competence and capacity building is one of the major challenges in integration of 21st century skills or execution of SNC. The FDE has no proper monitoring mechanism to ensure the quality of instruction or to follow up whether the trained teachers were executing the training received.

Assessment of 21st century skills by employing formative assessment in classroom was a neglected area. It partially involved skills of collaboration and communication. Curriculum reforms alone would not lead to integration of 21st century skills if the assessment system is not made equally compatible and matched with this modification. As assessment of practical activities and projects were not made part of examination at any level, therefore the teachers did not pay much attention on this part of science content. The focus was on covering and remembering the syllabus so that the students can secure good grades.

The curriculum was renewed, and new textbooks were developed. But the appropriate facilities and resources were not provided at the time of its launch that could reinforce SNC implementation in true letter and spirit. SNC and skill integration demand activity based and project-based learning which is not feasible without teaching learning resources. ICT integration could not be culminated as the students have no access to computers and there was no internet facility in schools. Without capitalising compatible resources, facilities, and conducive learning environment, SNC alone would not render any desirable results. Active learning and skills' integration is likely to be impossible without uplifting the classroom environment.

5.4.1 Current Status on Provision of Facilities in Schools

Recently in 2023, the Federal Directorate of Education (FDE) signed MOUs with private partners like Telenor, Taleemabad, Pakistan Alliance for Maths and Science (PAMS) and World Bank. The alliance with these development partners would lead to supply computers, LEDs, audio systems, multimedia, clickers along with high-speed fibre internet connection. These organizations aim to provide teacher training on blended learning and effective use of technology. Teachers would be trained as how to employ on-line and off-line activities in classroom coupled with online students' assessments. They would be facilitated in utilizing web-based resources and supported in handling

the hardware. Such kind of initiatives would not only upgrade teachers' professional competence but also help in integrating skills of ICT at school level. The project has just rolled out and it would take time to impact classroom teaching and learning. Unequal system regarding infra structure, distribution of funds and resources was found in different schools under the ambit of FDE. A huge disparity in terms of funding and facilities was found among different streams of public that further widened the prevailing inequalities in the education system.

While translating and executing the curriculum, the minimum standards of learning were assumed as maximum that usually happens when initiative are based on consensus and the lowest common denominator becomes the ideal. In Pakistan, education has been treated as a political tool to secure self-serving agendas of the government of the day. Crafting education for own ideological and political agenda refrain education from its own pedagogical aims and produce gullible ideological followers. There is a dire need to free education from undue political hegemony. It is our duty to provide our progeny with inclusive, quality education which is unbiased and has the potential to inculcate critical thinking and can nurture their creativity and innovative tendencies. It is the need of the hour to focus on rising the analytic skills, rational thinking, and scholastic capabilities of our students to meets the challenges and standards of 21st century.

5.5 Recommendations

The research findings and conclusions lead to following recommendations.

5.5.1 Recommendations for National Curriculum Council regarding Curriculum and Textbook Development

1. The SNC being a "living document" may be revised to nurture creativity among students. It may be made more flexible for students and teachers in term of choosing activities, materials/resources, and methodology as per their expediency, to integrate creativity.

2. More SLOs in SNC and science textbook may be added that can target higher cognition level. SLOs may be revised to captivate students critically with scientific concepts. More opportunities may be offered to students to “analyse”, “differentiate”, “critically examine”, “demonstrate”, “plan”, “generate”, “modify” or “assess” the subject matter. Open ended questions and flexible project assignments may be incorporated in General Science Textbook to stimulate students’ curiosity.
3. The content of science textbook may be reduced, keeping in view the cognition level of students as well as other ground realities. Both the students and teachers may not be in a rush to cover the syllabus rather than understanding the science. Science may be made captivating and stimulating and not a burden.

5.5.2 Recommendations for Federal Directorate of Education

4. Curriculum reforms alone cannot integrate 21st century skills until and unless the teachers have the potential, capability and ambition to translate skills in their instructions. Training sessions on 21st skill development may be organised so that the teachers may be able to address and nurture them in their students. Training on SNC may be resumed with particular focus on how to adopt, develop and assess 21st century skills in the classroom teaching.
5. The educational mangers and the head teachers may be sensitized regarding significance, integration, and nurturing of skills. Special orientation sessions, trainings and workshops may be organized for the awareness and strengthening capacity of teachers and head teachers so that they can take appropriate measures in term of formulating strategic plan at their end to ensure the execution of 21st century skills.

6. FDE needs to ensure relevant and suitable training nominations. Only right person for the right job can deliver the desired results.
7. Intensive training regarding efficient use of ICT may be arranged for teachers and it should be well practiced so that the teachers can be proficient in its usage and integrate it in their classroom pedagogies. FDE may ensure provision of internet in every school. All the teachers and primary students may be provided access to computers and internet in schools. Both the students and teachers may be introduced to Open Educational Resources which are available on internet and can be used off-line also, may also improve the quality of teaching learning.
8. Classroom pedagogies may be re-examined and remodelled. Till now teachers only understand the concept of student-centred active learning but have no clue as how to employ it in the classroom. A shift in mind-set is required as how to engage students in higher order thinking skills and how to flourish their skills. For this, FDE may upgrade capacity of teachers and facilitate them through continuous training, monitoring, and mentoring. There may be specialized sessions on problem and project-based learning.
9. Our education system is assessment directed. For meaningful integration of these skills, FDE need to put particular emphasis on the assessment of these skills. Practical assessment of skills may be initiated at primary level centralized examination conducted by FDE so that both the students and teachers focus on performing activities and project-based learning. 21st century skills like collaboration and communication cannot be assessed in conventional paper-pen test. The assessment of these skills may be made when students working in group in routine classrooms. A proper record of such assessment may be

maintained and that may be reflected in their annual evaluation. Assessment needs to be revamped as per requirements of 21st century education.

5.5.3 Recommendations for Ministry of Federal Education and Professional Training

10. The government needs to make genuine investments in education sector. The education budget may be increased to uplift the infrastructure of public schools. Libraries and computer labs may be in access of primary students. The students may be exposed with different science books that include variety of activities so that their vision and understanding of concepts can be widened. It would also inculcate habit of inquiry and research in young minds from the early classes.
11. All the public schools, despite their location, may be equally placed in term of funding and resources to bridge the prevailing inequalities in the system. Equal and fair distribution of resources and facilities in all public schools may be ensured. The government need to ensure that a certain standard of quality education is provided in all state schools and the necessary funding to ensure the minimum standards of infrastructure, equipment and teacher's trainings is delivered so that the gap between state and private schools is reduced.
12. The higher authorities who are at policy formulating and decision-making level i.e., Secretary Education and Director General Education (FDE) may focus more on primary level teaching and learning as it is the foundation of higher levels. Inclusion of age-appropriate skills at the early classes may help in making students lifelong learner.

5.6 Recommendations for Future Research

For future investigation, following proposal may be undertaken for exploration.

1. The study was exploratory with mixed method design. Experimental research may be designed for future research that may focus on teachers' capacity building and in

developing and assessing 21st century skills. Research may be planned in assessing the teachers' competence in developing 21st century skills among students at different level.

2. An experimental study may be planned by developing and employing a module on project-based learning that may be executed in the real classroom to evaluate its effectiveness in developing and integrating 21st century skills.
3. Prospective research may be conducted with quantitative method of data collection and analysis using questionnaire and survey. On the other hand, it may be pure qualitative by adopting case study design and in-depth classroom observation of 3-4 teachers for a longer duration may be conducted. Furthermore, the concept of 21st century skills can be investigated as a separate phenomenon as well as a case study.
4. The current study was glimpse of the curriculum reforms and its consequences. Future studies may be conducting in the extent of assessing 21st century skills among students and teachers at each grade level. Moreover, the comparative analysis of skills acquired by students of private and public sector schools can be conducted.
5. The study focused on subject of Science at Primary level. Future investigation may explore other subjects at primary level and even at Secondary level as National Curriculum of Pakistan is now being executed at secondary level.
6. The study was delimited to 4Cs and ICT. Future studies may target other 21st century skills like citizenship, interpersonal skills, empathy, leadership, adaptability and flexibility, conflict management and resolution, peace and can be explored in social sciences discipline.

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Appendix A

Topic: Integration of 21st Century Skills in Single National Curriculum: A Mixed Method Approach

Sub Objective 1: To explore content of Single National Curriculum in relation to 21st century skills.

Research Questions:

1. In what ways Single National Curriculum (SNC) gives provision for integration of 21st century skills; (creativity, critical thinking, collaboration, communication and ICT) in subject of General Science (class 5)?

Unit of Analysis: 1. Document Analysis of Single National Curriculum (2020), General Science Class 5 (RQ.1)
2. Interviews with General Science Curriculum Developers and Reviewers (RQ.1)

1. Metrics Framework for Document Analysis: Single National Curriculum (General Science) with Reference to selected 21st century skills

Area	Selected 21st century skills							
Themes of SNC	Concept of 21st century skills	Creativity	Critical Thinking	Collaboration	Communication	ICT as a tool for learning	F	Rel. f
Goals, Strands, Standards & Benchmarks								
Learning Contents & SLOs								
Teaching & Learning								
Assessment & Evaluation								
Guidelines to the Textbook Authors								
F								
Rel.f								

Appendix B

2. Metrics Framework for Semi-structured Interviews with Single National Curriculum (General Science) Developers with Reference to selected 21CS

Sr #	Construct/ Themes	Interview Questions	Probes
1	SNC Provision regarding integration of 21st century skills 4Cs & ICT	Q.1 Does SNC address 21st century skills?	(i) Can you explain with some examples… how?
		Q.2 How do you perceive the idea for inclusion and integration of 21st century skills in SNC?	
2	SNC Provision regarding integration of 4Cs & ICT	Q.3 Does SNC addresses 4Cs? How and in what ways?	(ii)What kind of classroom pedagogies and assessment strategies are directed in SNC that can integrate 4Cs at primary level? Can you specify some methods or activities?
3	SNC Provision for Integration of ICT as a tool for learning	Q.4 Does SNC addresses ICT? How and in what ways?	(iii) What kind of classroom pedagogies and assessment strategies are directed in SNC that can integrate employment of ICT at primary level? Can you specify some methods or activities?
4	SNC Implementation and Integration of 21st century skills (4Cs & ICT)	Q.5 In your opinion, how can we develop 21st century skills among students? Q.6 Do you think that the SNC curriculum reforms can be	(iv) What kind of benchmarks/standard you design to enhance 21st century skills in students?

		helpful in integration of 21st century skills (4Cs and ICT)? Q.7 Mostly our examination system targets recall and understanding level, as an educationist what do you suggest for implementing of SLO based assessment focusing higher order thinking skills? Q.8 What do you suggest for teachers regarding implementation of SNC and development of 21st century skills among students?	(v) How and in what ways? Shifts in teacher development? In provision of facilities/ resource?
5	Challenges/Barriers for integration of 21st century skills	Q.9 In your opinion, what are the main hinderances/ challenges for integrating 21st century skills in our education system? Q.10 Do you think that our public-school teachers have the potential to translate and integrate 21st century skills (4Cs & ICT) in their classrooms?	(vi) Can it be lack of facilities and resources, training deficit, teachers' competence…. (vii) If yes, please specify some indicators or quote reference? If no, what can be the possible solution?
		Q.11 Do you think that the training on SNC was sufficient enough to empower teachers for translating and integrating 4 Cs & ICT in their classrooms?	

Appendix C

INTERVIEW PROTOCOL SHEET

(FOR SCIENCE CURRICULARISTS/ CURRICULUM DEVELOPERS)

Research Study: Integration of 21st Century Skills in Single National Curriculum:

A Mixed Method Approach

Date: _____ **Time: _____**

Location: Offices of selected respondents

Interviewer: Researcher

Interviewee: Name: C-1

Position: **(**Science experts being involved in SNC development)

Notes to Interviewee: Thank you for sparing time out of your busy schedule for participating in this interview. Your input will be highly valuable in completing this study. Interview will take approximately 25 minutes and we have 13 major Questions.

Purpose of Study:

The study concentrates on exploring the integration of 21st century skills in public schools of Islamabad Capital Territory at primary level. As you were involved in the process of development of new "Single National Curriculum" under guidance of Ministry of Federal Education and Professional Training as a science expert, therefore your input regarding key considerations for planning and development of SNC is very important. The study is about investigating integration of 21st century skills in Single National Curriculum at primary level (General Science, class V) following a mixed-method approach. We have delimited our study to 4Cs (creativity, critical thinking, collaboration, communication) and ICT. We will focus on the themes of SNC that can give provision of incorporation of these skills.

Appendix D

Interview Questions for Curriculum Developers

1. SNC Provision regarding integration of 21st century skills 4Cs & ICT

Q.1 Does SNC address 21st century skills? Can you explain how?

Respondent's Answers:

_____

_____

_____

Q.2 How do you perceive the idea for inclusion and integration of 21st century skills in SNC?

Respondent's Answers:

_____

_____

_____

2. SNC Provision for Integration of Creativity, Critical Thinking, Collaboration and Communication (4C, Thinking and working skills)

Q.3 Does SNC addresses 4Cs? How and in what ways?

Respondent's Answers:

_____

_____

_____

Probe: What kind of classroom pedagogies and assessment strategies are directed in SNC that can integrate 4Cs at primary level? Can you specify some methods or activities?

Respondent's Answers:

_____

_____

_____

3. SNC Provision for Integration of ICT as a tool for learning

Q.4 Does SNC addresses ICT? How and in what ways?

Respondent's Answers:

Probe: What kind of classroom pedagogies and assessment strategies are directed in SNC that can integrate employment of ICT at primary level? Can you specify some methods or activities?

Respondent's Answers:

4. SNC Implementation and Integration of 21st century skills (4Cs & ICT)

Q.5 In your opinion, how can we develop 21st century skills among students? What kind of benchmarks/standard you design to enhance 21st century skills in students?

Q.6 Do you think that the SNC curriculum reforms can be helpful in integration of 21st century skills (4Cs and ICT)? How and in what ways?

Respondent's Answers:

Q.7 Mostly our examination system targets recall and understanding level, as an educationist what do you suggest for implementing of SLO based assessment focusing higher order thinking skills?

Respondent's Answers:

Q.8 What kind of changes/shifts are required for employment of curriculum reforms? Shifts in teacher development? In provision of facilitates/resources?

Respondent's Answers:

Q.9 What do you suggest for teachers regarding implementation of SNC and development of 21st century skills among students?

Respondent's Answers:

8. Challenges/Barriers for integration of 21st century skills

Q.10 In your opinion, what are the main hinderances/challenges in integrating 21st century skills in our education system? Can it be lack of facilities and resources, training deficit, teachers' competence….

Respondent's Answers:

Q.11 Do you think that our public-school teachers have the potential to translate and integrate 21st century skills (4Cs & ICT) in their classrooms? If yes, please specify some indicators or quote reference? If no, what can be the possible solution?

Respondent's Answers:

Q.12 Do you think that the training on SNC was sufficient enough to empower teachers for translating and integrating 4 Cs & ICT in their classrooms?

Respondent's Answers:

Q.13 Tell us something about teacher manual that you developed to facilitate teachers.

Respondent's Answers:

_____
_____

Reflection/Notes by Interviewer:

_____
_____
_____
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_____
_____

Closure:

- Thanks again to interviewee for his/her time and input.
- Reassure confidentiality.
- Ask permission for follow-up interview, if required.

Appendix E

Topic: Integration of 21st Century Skills in Single National Curriculum: A Mixed Method Approach

Sub Objective: 2 To explore how the General Science Textbook integrate 21st century skills at primary level.

Research Questions:

2. In what ways General Science textbook of class 5 translates 21st century skills (creativity, critical thinking, collaboration, communication and ICT)?

Unit of Analysis: 1. Document Analysis of General Science Textbook (2021) (RQ.2)
2. Interview with General Science Textbook Writer and Reviewer (RQ.2)

1. Metrics Framework for Document Analysis: General Science Textbook (Class 5) with reference to 05 selected 21CS (RQ.2)

		Selected 21st century skills						
Themes of G. Science Textbook	Concept of 21st century skills	Creativity	Critical Thinking	Collaboration	Communication	ICT as a tool for learning	F	Rel. f
Student Learning Outcomes								
Learning Content								
Learning Activities								
Assessment								
F								
Rel.f								

Appendix F

Interview Questions for Textbook Author

1. G. Sc. Textbook provision regarding integration of 21st century skills (4Cs & ICT)

Q.1 Does G. Sc. Textbook addresses 21st century skills (4Cs and ICT)? How and in what ways?

Respondent's Answers:

_____

_____

_____

2. General Science Textbook with reference to 4Cs (Creativity, Critical Thinking, Collaboration and Communication)

Q.2 What kind of content and classroom pedagogies /methodologies are being directed in General Science Textbook that can develop 4Cs (Creativity, Critical Thinking, Collaboration and Communication)? Can you specify some strategies, methods or activities?

Respondent's Answers:

_____

_____

_____

Probe: What kind of assessment is being recommended in General Science Textbook that can direct integration of 4Cs?

Respondent's Answers:

_____

_____

_____

3. General Science Textbook with reference to ICT as a tool for learning

Q.3 How General Science Textbook give provision for employment of ICT as a tool for learning? Can you quote some examples?

Respondent's Answers:

_____

_____

_____

4. General Science Textbook implication for integration of 21st century skills

Q.4 Do you think that the new General Science Textbook can be helpful in integration of 21st century skills (4Cs & ICT)? How and in what ways?

Respondent's Answers:

_____

_____

_____

Q.5 What kind of changes/shifts in classroom pedagogies are required for the effective utilization of General Science Textbook? Can you elaborate with some examples?

Respondent's Answers:

_____
_____
_____

5. Challenges/Barrier for integration of 21st century skills

Q.6 In your opinion what are the main hinderances/challenges in integrating 21st century skills in our education system?

Respondent's Answers:

_____
_____
_____

Q.7 As a science expert do you think that the SLO based assessment focusing analytical thinking and critical reflection are being practiced in public schools?

Respondent's Answers:

_____
_____
_____

Q.8 Do you think that our public-school teachers have the potential to translate and integrate 21st century skills (creativity, critical thinking, collaboration, communication and ICT) in their classrooms?

Respondent's Answers:

_____
_____
_____

Reflection/Notes by Interviewer:

_____
_____
_____
_____
_____
_____
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_____
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Closure:

- Thanks again to interviewee for his/her time and input.
- Reassure confidentiality.
- Ask permission for follow-up interview, if required.

Appendix G

Interview Questions for FDE Officials

1. Need for and Importance of 21st century skills

Q.1 Do you think that there is a need to develop 21st century skills (4 Cs & ICT) among students particularly at primary level?

Respondent's Answers:

_____
_____
_____
_____

Q.2 Do you think that 21st century skills (critical thinking, collaboration, collaboration, communication and ICT) are important to improve the quality of science education?

Respondent's Answers:

_____
_____
_____

2. SNC Training & integration of 21st century skills

Q.3 Do you think that the training on SNC was sufficient enough to empower teachers for translating and integrating 4 Cs & ICT in their classrooms?

Respondent's Answers:

_____
_____
_____

Probe: How do you ensure appropriate training nomination?

Respondent's Answers:

_____
_____
_____

Probe: Is there any follow up mechanism particularly with reference to SNC training?

Respondent's Answers:

3. Provision of Physical facilities, co-curricular activities and 21st century skills

Q.4 What kind of physical facilities (infrastructure and technology) are available/being provided in schools that can integrate 21CS (4Cs & ICT)?

Respondent's Answers:

Q.5 Do you think co-curricular activities in schools can play any role regarding integration of 21CS (4Cs & ICT) among primary students? How?

Respondent's Answers:

Q.6 Has any kind of learning resource material being provided by FDE in primary schools that can be helpful in integration of 21CS (4Cs & ICT) among students? If yes, can you please explain its utility?

Respondent's Answers:

4. New Curricular Reforms and Integration of 21st century skills (4Cs & ICT)

Q.7 Do you think that the new curricular reforms and subsequent Science Textbook can be helpful in integration of 21st century skills (4 Cs & ICT)?

Respondent's Answers:

Q.8 What kind of changes/shifts in classroom pedagogies are required for employment of curriculum reforms that can also promote 21st century skills?

Respondent's Answers:

_____

_____

_____

Q.9 As an educationist do you think that the SLO based assessment focusing analytical thinking and critical reflection are being practiced in public schools? Please quote some examples.

Respondent's Answers:

_____

_____

_____

Q.10 What kind of initiatives are being taken at government level that can integrate 21st century skills (4Cs & ICT) among students?

Respondent's Answers:

_____

_____

_____

Probe: Can you specify some programs/projects that are addressing integration and development 21st century skills among students?

Respondent's Answers:

_____

_____

_____

5. Challenges/Barrier for integration of 21st century skills

Q.11 In your opinion, what are the main hinderances/challenges in integrating 21st century skills in science classroom?

Respondent's Answers:

_____

_____

_____

Q.12 Do you think that government is focusing on development of 21CS (critical thinking, collaboration, collaboration, communication and ICT) among primary students? How?

Respondent's Answers:

_____

_____

_____

Q.13 Do you think that our public-school teachers have the potential to translate and integrate 21st century skills (critical thinking, collaboration, collaboration, communication and ICT) in their classrooms?

Respondent's Answers:

_____

_____

_____

Reflection/Notes by Interviewer:

_____

_____

_____

_____

_____

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Closure:

- Thanks again to interviewee for his/her time and input.
- Reassure confidentiality.
- Ask permission for follow-up interview, if required.

Appendix H

Interview Questions for General Science Teachers

1. Need for and Importance of 21st century skills (4Cs & ICT)

Q.1 How do you perceive 21st century skills?
Respondent's Answers:

_____
_____
_____
_____

Q.2 Do you think that there is a need to develop 21st century skills (4Cs & ICT) among students particularly at primary level?
Respondent's Answers:

_____
_____
_____

Probe: Do you think that 21st century skills (critical thinking, collaboration, collaboration, communication and ICT) are important to improve the quality of science education?
Respondent's Answers:

_____
_____
_____

2. General Science classroom pedagogies with reference to Creativity, Critical Thinking, Collaboration, Communication (4Cs)

Q.3 How do you address Creativity, Critical Thinking, Collaboration, Communication in your science teaching?
Respondent's Answers:

_____
_____
_____

Probe: What kind of classroom pedagogies and assessment in G. Sc. teaching can nurture 4Cs among students? Can you mention some examples?
Respondent's Answers:

_____
_____
_____

3. General Science classroom pedagogies with reference to ICT

Q.4 How do you employ ICT as a tool for learning in your science teaching? Please quote some example for utilization of ICT?

Respondent's Answers:

_____
_____
_____

4. SNC Training & integration of 21st century skills

Q.5 How was your experience of participation in SNC training? What new things you learned about SNC particularly with reference to 21st century skills (4Cs & ICT)?

Respondent's Answers:

_____
_____
_____

Q.6 Did you receive/develop/ use any kind of learning resource material in SNC training that can be helpful in integration of 21CS (4 Cs & ICT) among your students?

Respondent's Answers:

_____
_____
_____

Q.7 Do you think that the training on SNC is well enough to empower teachers for translating and integrating 21st century skills (creativity, critical thinking, collaboration, communication ICT) in their classrooms?

Respondent's Answers:

_____
_____
_____

Q.8 As a science teacher do you think that the SLO based assessment focusing analytical thinking and critical reflection are being practiced in public schools?

Respondent's Answers:

_____
_____

5. Provision of Physical facilities, co-curricular activities and 21st century skills

Q.9 Do you think that the provision of physical facilities (infrastructure and technology) is important to integrate 21CS?

Respondent's Answers:

_____
_____
_____
_____

Q.10 What kind of physical facilities (infrastructure and technology) are available/being

provided in schools that can integrate 21CS (4Cs & ICT)?

Respondent's Answers:

_____

_____

Q.11 Do you think cocurricular activities in schools can play any role regarding integration of 21CS (4Cs & ICT) among primary students?

Respondent's Answers:

_____

_____

6. New Curricular Reforms and Integration of 21st century skills (4Cs & ICT)

Q.12 Do you think that the new curricular reforms and subsequent Science textbook can be helpful in integration of 21st century skills (4Cs & ICT)? How? In what ways?

Respondent's Answers:

_____

_____

_____

Q.13 What kind of changes/shifts in classroom pedagogies are required for employment of curriculum reforms? Please specify with some examples.

Respondent's Answers:

_____

_____

_____

7. Challenges/Barrier for integration of 21st century skills

Q.14 In your opinion, what are the main hinderances/challenges in integrating 21st century skills in science classroom? Please specify with some examples.

Respondent's Answers:

_____

_____

Q.15 Do you think that FDE is focusing on development of 21CS (4Cs & ICT) at primary level? Any initiative, support or service being provided?

Respondent's Answers:

_____

_____

_____

Q.16 Do you think that our public-school teachers have the potential to translate and integrate 21st century skills (4Cs & ICT) in their classrooms?

Respondent's Answers:

_____
_____
_____

Reflection/Notes by Interviewer:

_____
_____
_____
_____
_____
_____
_____
_____
_____

Closure:

- Thanks again to interviewee for his/her time and input.
- Reassure confidentiality.
- Ask permission for follow-up interview, if required.

Appendix I

Tally Sheet for Classroom Observation of General Science Teachers (Class V)

Name of Teacher: _____ **Date: _____**

Qualification: _____ **Experience: _____**

School Name: _____ **Time & Duration: _____**

Topic: _____

Sr #	**Indicators for Classroom Observations**	**No (0)**	**Yes (1)**	**Comments**
1	**Creativity**			
1	Students are provided with an opportunity of being creative.			
2	Any strategy/method being employed in classroom that can nurture creativity/newness/ innovation among students (e.g. story, games, role-play).			
3	Students being provided with any idea creation technique such as brainstorming, discussion or concept mapping.			
4	Students given opportunity to solve any problem on their own.			
5	Students using different ideas to improve their work.			
6	Students creating an original product/model to express their ideas.			
	Critical Thinking			
1	Students asking questions.			
2	Teacher asking questions to promote students' thinking (how, why, what if….)			
3	Students giving multiple/different ideas to solve a problem.			
4	Students trying to solve a problem that have no single correct solution or answer.			
5	Students making predictions and/or testing them.			

6	Teacher asking a student to justify his/her stance on a certain discussion/issue.			
	Collaboration			
1	Students working collaboratively; in pairs or in small groups.			
2	Students can work together in groups to set goals and create a plan for their team.			
3	Students can present their group work to the whole class.			
4	Teacher involving students in collecting and creating instructional materials to be used in classroom.			
5	Teacher is trying to create community of learning within the classroom.			
6	Teacher is encouraging students to respect their classmates and be considerate to others?			
	Communication			
1	Students develop communication skills (reading, writing, listening; within group).			
2	Students develop communication skills (As demonstrated in presentation other than paper).			
3	Students can answer questions in front of an audience.			
4	Students can prepare and deliver an oral presentation.			
5	Active exchange of ideas in classroom.			
6	Teacher flourishing listening and speaking skills of students and providing them opportunities for verbal expression.			
	ICT as a tool of learning			
1	Teacher utilizing technology as an instructional aid for demonstrating concepts.			
2	Students utilizing technology in students' assessment (e.g. quiz, students' presentation)			
3	Students using technology.			
4	Teacher using technology to keep record of students' assignment/progress.			
	Classroom Assessment			

1	Formative assessments being used.			
2	Employment of Performance based Assessment such as Presentation, illustrations, demonstration by students, project, debate, model, exhibition, table, graph, etc.			
3	Employment of Personal Communication Assessment like Oral questioning, observation, interview, process description, checklists, etc.			
	Overall Classroom Environment			
1	Enabling and learner-centered Class			
2	Teacher as a facilitator and organizer of knowledge.			
3	Teacher involves all students (girls & boys, vocal & shy, active & behindhand)			
3	Students are on task/engaged in their work.			
4	Teacher facilitates all students (e.g listens them, addresses their questions even if wrong, encourages them).			
5	Activity/assignment/discussion connected to real world.			
6	Provision of Project-based/Problem based learning.			

Reflection/Notes by Researcher:

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Appendix J

CODE BOOK

Sr #	THEME	DESCRIPTION/EXPLANATION	INDICATOR
01	21st century skills	An overarching notion that includes knowledge, skills and attributes one needs for survival and success in rapidly changing world.	Higher order skills beyond basic knowledge that involves real life problems and context.
02	Creativity	Creativity is the skill to generate novelty into already existing ideas, knowledge, methods or approaches. It refers to originality and innovation.	To enhance imaginative thinking skills among students.
03	Critical Thinking	Critical Thinking includes asking relevant questions, collecting and sorting pertinent information from different sources, comparing and relating new information to the previous one, draw and evaluate reliable conclusions.	To ask questions to solve the problem.
04	Collaboration	Collaboration involves students of different abilities working together in groups to achieve a shared goal.	Working together cooperatively as a team.
05	Communication	Communication in classroom involves enabling students to think critically and express themselves effectively in verbal, non-verbal, inter-personal, small group and public presentations.	Chance to communicate or exchange information/ideas by speaking, writing, or using some other medium.
06	ICT (Information and Communication Technologies)	ICT comprise of technological resources and tools that are employed to create, store, transmit or exchange information. It includes computers, multimedia, internet, television, video players, telephone, etc.	Using ICT to collect and deliver information, to understand and clarify concept.

UNESCO (2020), International Bureau of Education: Retrieved on 22-01-22 from following sources:

http://www.ibe.unesco.org/en/glossary-curriculum-terminology/t/twenty-first-century-skills

http://www.ibe.unesco.org/en/glossary-curriculum-terminology/c/creativity-creative-thinking

http://www.ibe.unesco.org/en/glossary-curriculum-terminology/c/critical-thinking

http://www.ibe.unesco.org/en/glossary-curriculum-terminology/c/collaborative-learning

http://www.ibe.unesco.org/en/glossary-curriculum-terminology/i/information-and-communication-technologies-ict

Appendix K

EXPERTS CONSULTED FOR VALIDATION OF INSTRUMENT

Sr#	Name	Designation	Institute
1	Dr. N.B. Jumani	Professor	International Islamic University, Islamabad
2	Dr. Arshad Bashir	Consultant, HEC.	Higher Education Commission of Pakistan, Islamabad.
3	Dr. Amina Nadir	Senior Research Officer	National Skills University, Islamabad.
4	Dr. Tanvir Afzal	Assistant Professor	Allama Iqbal Open University, Islamabad.
4	Dr. Farkhunda Rasheed	Assistant Professor	Allama Iqbal Open University, Islamabad.
5	Dr. Sadaf Zamir	Assistant Professor	Air University, Islamabad.

Appendix L

CERTIFICATE OF VALIDATION FOR THE DOCUMENT/CONTENT ANALYSIS, INTERVIEW PROTOCOLS AND OBSERVATION SHEET

For the PhD Study "Integration of 21st Century Skills in Single National Curriculum: A Mixed Methods Approach"

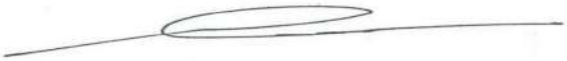
By
Shoaiba Mansoor
Registration # 5-PhD/Edu-S20 (Roll No. PD-Edu-S20-151)
National University of Modern Languages, Islamabad.

This is to certify that the tools/metrics framework for document analysis (content analysis of Single National Curriculum (SNC) and General Science Textbook (class V) along with interview protocols and the classroom observation sheet developed by the scholar for her thesis "Integration of 21st Century Skills in Single National Curriculum: A Mixed Methods Approach" have been assessed by the undersigned and found suitable for data collection. They are according to the research objectives and seem appropriate to answer the research questions developed for the said study. It assures adequate face and content validity according to the purpose of the research and can be used for data collection by the researcher with fair amount of confidence.

Name: Prof. Dr. Nabi Bux Jumani

Designation: Professor

Institution: International Islamic university, Islamabad Pakistan



Signature: _____

Date: 20-02-2022

Stamp: _____

Prof. Dr. N. B. Jumani
Professor
Faculty of Education,
International Islamic university, Islamabad Pakistan

ANALYSIS, INTERVIEW PROTOCOLS AND OBSERVATION SHEET

For the PhD Study "Integration of 21st Century Skills in Single National Curriculum: A Mixed Method Approach"

By

Shoaiba Mansoor

Registration # 5-PhD/Edu-S20 (Roll No. PD-Edu-S20-151)

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Name: Dr. Arshad Bashir

Designation: Consultant, HEC

Institution: HEC

Signature: 0321-501-3555

Date: 10/02/2022

Stamp: DR. ARSHAD BASHIR
Consultant Academics
HEC, Islamabad

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Name: DR. AMINA NADIR

Designation: Senior Research Office

Institution: National Skills University

Signature: _____

Date: 21 - 2 - 22

Stamp: Dr. Amina Nadir
Senior Research Officer
National Skill University
Sector H-8/1, Islamabad

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Name: Dr. M. Tanveer Afzal

Designation: Asst. Prof.

Institution: AIOU

Signature: _____

Date: 24-02-2022

Stamp: Dr. Muhammad Tanveer Afzal
Assistant Professor
Science Education Department
AIOU, Islamabad

CERTIFICATE OF VALIDATION OF THE DOCUMENT/CONTENT ANALYSIS, INTERVIEW PROTOCOLS AND OBSERVATION SHEET

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Name: Dr. Farkhunda Rasheed Ch.

Designation: Assistant Professor

Institution: Allama Iqbal open University, Islamabad.

Signature: Farkhunda

Date: 25/02/2022

Stamp: Dr. Farkhunda Rasheed Choudhary
Assistant Professor
Faculty of Education, AIOU, Isb.
Farkhunda.rasheed@aiou.edu.pk

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Name: Dr. Sadaf Zamir Ahmed

Designation: Assistant Professor

Institution: Air University, Islamabad

Signature: Sadaf-Zamir

Date: 9-2-2022

Stamp:
DR. SADAF ZAMIR
Assistant Professor
Department of Education
Air University, Islamabad

DEPARTMENT OF EDUCATION
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ML.1-3/2021-Edu

Dated: 21-02-2022

WHOM SO EVER IT MAY CONCERN

Ms. Shoaiba Mansoor D/O Mansoor Ahmad, student of PhD (Edu) Department of Education National University of Modern Languages Islamabad is engaged in project of Research Work.

She may please be allowed to visit your Institutions to obtain the required information for her Research Work.

This information shall not be divulged to any unauthorized person or agency. It shall be kept confidential.

National University of Modern Languages
Education Deptt
N.C. Islamabad

21/2/22

Dr Wajeeha Shahid
Head,
Department of Education.