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INNOVATIVE PEDAGOGICAL PRACTICES IN TEACHER EDUCATION FOR 21ST CENTURY SKILLS: A SYSTEMATIC LITERATURE REVIEW

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ABSTRACT

Education 4.0 is a framework that emphasizes rapid technological advancement to improve the quality of education. It also focuses on the importance of fostering 21st century skills. Therefore, this study focuses on the 3C's i.e., creativity, collaboration, and critical thinking. NEP 2020 also underscores the importance of 21st century skills for the holistic and well-rounded development of learners. NEP 2020, as well as NCFSE 2023, both have emphasised the inculcation of 21st century skills. Hence, the study focuses on 3C's, i.e., creativity, collaboration and critical thinking which is the core skill of 21st century skill.

Preferred Reporting Items for systematic Reviews and Meta-Analyses (PRISMA) 2020 framework have been used for this systematic literature review for investigating the pedagogical practices in teacher education for the inculcation of 21st century skills. Articles published from 2018 to October 2024 were fetched from the databases of Scopus and Web of Science. A total of 16 full texts were found eligible for the study after removing duplicates, applying inclusion and exclusion criteria as well as screening of the title and abstract. The key finding reveals that the most emphasised skill among all the skills is critical thinking and the most used pedagogical approach to inculcate these skills are technology based. However, in technological pedagogical approaches also, a wide range of innovative technological platforms such as CANVA, Zoom, and Chat GPT have been used. This study suggests the critical role of technology in education underscoring the need for balanced pedagogical strategies.

Keywords: Teacher Education, 21st Century Skills, Critical Thinking, Creativity, Technology

INTRODUCTION

Education 4.0 is a framework that emphasizes rapid technological advancement to improve the quality of education. It deals with educational technological advances, focuses on society's needs, and highlights developing 21st-century skills, especially 'critical thinking, creativity, and collaboration' (World Economic Forum, 2022). These skills also known as the 3C's are

essential for preparing individuals in rapidly changing global challenges. These 3C's are critical competencies in 21st-century education. Critical thinking requires the ability to examine, assess, and synthesize information to solve problems systematically and appropriately (partnership of 21st century skills {P21}). Creativity is the ability to think outside the box and generate new ideas across various contexts (Robinson 2011). Collaboration is the ability to do any work perfectly with others, emphasizing diverse perspectives and the ability to achieve the goal and empower in these skills (Trilling and Fadel 2009). These 3 C's empower individuals to explore the complex, powerful environment, and participate efficiently in society socially and professionally (OECD 2018).

Teacher education plays an important role in developing these competencies (skills) in the educational program, as teachers are the prime representative of any educational system (Darling Hammond 2017). The traditional teacher-education model focuses on content mastery rather than skill development (Schleicher 2018). This misplacement needs reform in teacher education programs to discourse 21st-century skills i.e. critical thinking, creativity, and collaboration (OECD 2019).

India's latest education policy, 'National Education Policy 2020', plays an important role in the country's educational reform and shifts education to competency-based learning from content-based learning. This policy also emphasizes developing 21st century skills such as critical thinking, creativity, and collaboration through innovative pedagogical approaches and experiential learning. It promotes the integration of multidisciplinary approaches and the overall development of learners to inculcate social, emotional, and cognitive skills (NEP 2020). NEP 2020 also emphasizes the reform in teacher education programs and their professional development. The policy defines the strategies to equip with the competencies to promote critical thinking, creativity, and collaboration among learners. Teacher education programs produce practice-oriented, dynamic students. NEP 2020 also deals with the United Nations Sustainable Development Goal 4 i.e. SDG 4, which ensures inclusive and equitable quality education for all. Through these skills i.e. critical thinking, creativity, and collaboration the policy tries to build a generation of lifelong learners to face global challenges.

After the recommendation of NEP 2020, National Curriculum Framework for School Education 2023 (NCFSE 2023) came into existence to construct the NEP 2020 vision and provide a detailed guideline for the development of the curriculum. This framework emphasizes the need to focus inquiry based experiential learning, and skills based education, from rote memorization. It also gives importance in the integration of pedagogical approaches that promote critical thinking, creativity, and collaboration. This framework synthesizes 21st century skills in 'pre-service and in-service' teacher education programs. It also recommended the use of innovative pedagogical practices such as simulations, and technology based teaching to engage learners and develop effective learning competencies.

NEP 2020 and NCFSE 2023 planned to shift the education system towards holistic development of learners, skill-based education for these vocational subjects introduced from class VI onwards. these policies focus on new educational demands with innovative pedagogical methods, and competency-based education (NEP 2020).

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This systematic literature review (SLR) explores existing pedagogical approaches and how to develop 'critical thinking', 'creativity', and collaboration by synchronizing the findings from the studies 2018- 2024. For this purpose, a rigorous research process has been used, and two databases, i.e., Scopus and Web of Science (WOS) were used as they are the most authentic databases in the field of social science. This study aims to recognize the challenges and strategies that support educators in planting '21st-century skills' in their teaching-learning process and training programs.

Rationale of the Study

The synthesisation of 21st century skills such as the 3 Cs i.e. critical thinking, creativity, and collaboration into teacher education programs is important for providing students to equip global challenges fruitfully. These are crucial skills for education 4.0, empowering individuals to change the environment and contribute their participation to society (Trilling and Fadel 2009; UNESCO 2019). Regardless of the development of these skills, traditional teacher education programs emphasize content based learning and only focus on content mastery rather than skills and their development, making misplacement with policy and practice (Schleicher 2018).

NEP 2020 emphasizes the significance of competency-based learning and innovative pedagogical approaches to overall development (NEP 2020). Moreover, NCFSE 2023 highlights experiential and inquiry-based learning that takes place from rote memorization to skills based (NCFSE 2023). These policies emphasize the crucial role of teachers in developing 21st-century skills in teacher education programs. Although these reforms remain fuzzy in practice.

This study addresses the gap between policy intent and implementation by systematically reviewing existing pedagogical approaches used in teacher education to foster the 3Cs. It investigates challenges, best practices, and strategies to enhance teacher training programs. By synthesizing recent literature, the study aims to provide actionable insights to align teacher education with the visions outlined in NEP 2020 and NCFSE 2023. This research is significant for advancing teacher preparation, ensuring that educators are well equipped to develop critical competencies in learners, and contributing to a robust, future-ready education system (Darling- Hammond 2017; OECD, 2018).

Research Question

1. How is the teacher education programme integrating 21st century skills among the future educators?
2. What are the different pedagogical approaches used by teacher educators to inculcate 3C^{s} i.e. creativity, critical thinking and collaboration within teacher education programmes?

Objectives of the Study

1. To study the research methodologies adopted in the existing literatures for fostering 21st century skills in teacher education
2. To explore the various pedagogical approaches used by the teacher educators to foster 3C in the teacher preparation programme

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3. To explore the various skills covered in the existing literature related to teacher education programme

Methodology of the study

PRISMA refers to the Preferred Reporting Items for 'Systematic reviews and Meta-Analyses' is the worldwide accepted framework for systematic literature review. This framework has been adopted in various fields, including social science, for enhancing the quality and transparency of systematic literature reviews by ensuring consistency in reporting across studies (Fuentes, 2022), and this study has also used the PRISMA 2020 framework for a valid and reliable result. This systematic literature review (SLR) investigates the role of innovative pedagogical practices in teacher education for cultivating critical 21st century skills, specifically critical thinking, creativity, and collaboration (3Cs). Articles published between 2018 to October 2024 were sourced from the Scopus and Web of Science databases, using keywords including "teacher education," "21st century skills," "critical thinking," "collaboration," and "creativity." Selected studies were analysed based on their approaches to fostering the 3Cs, their methodologies, and reported outcomes.

Table 1: Databases used for the study

Database used			
S.No	**Keywords**	**Scopus**	**Web of Science**
1	Teacher education AND 21st-century skills	195	74
2	Teacher education AND creativity AND collaboration AND critical thinking	11	02

Table 2: Inclusion and Exclusion criteria of the study

Inclusion Criteria	**Exclusion Criteria**
Research studies published in English	Non-English studies were excluded
Studies published between 2018- October 2024	Studies published before 2018 were excluded
Only open-access studies were included	Studies which were not open accessed were excluded
	Books were excluded from the study
	Book Chapters were excluded from the study

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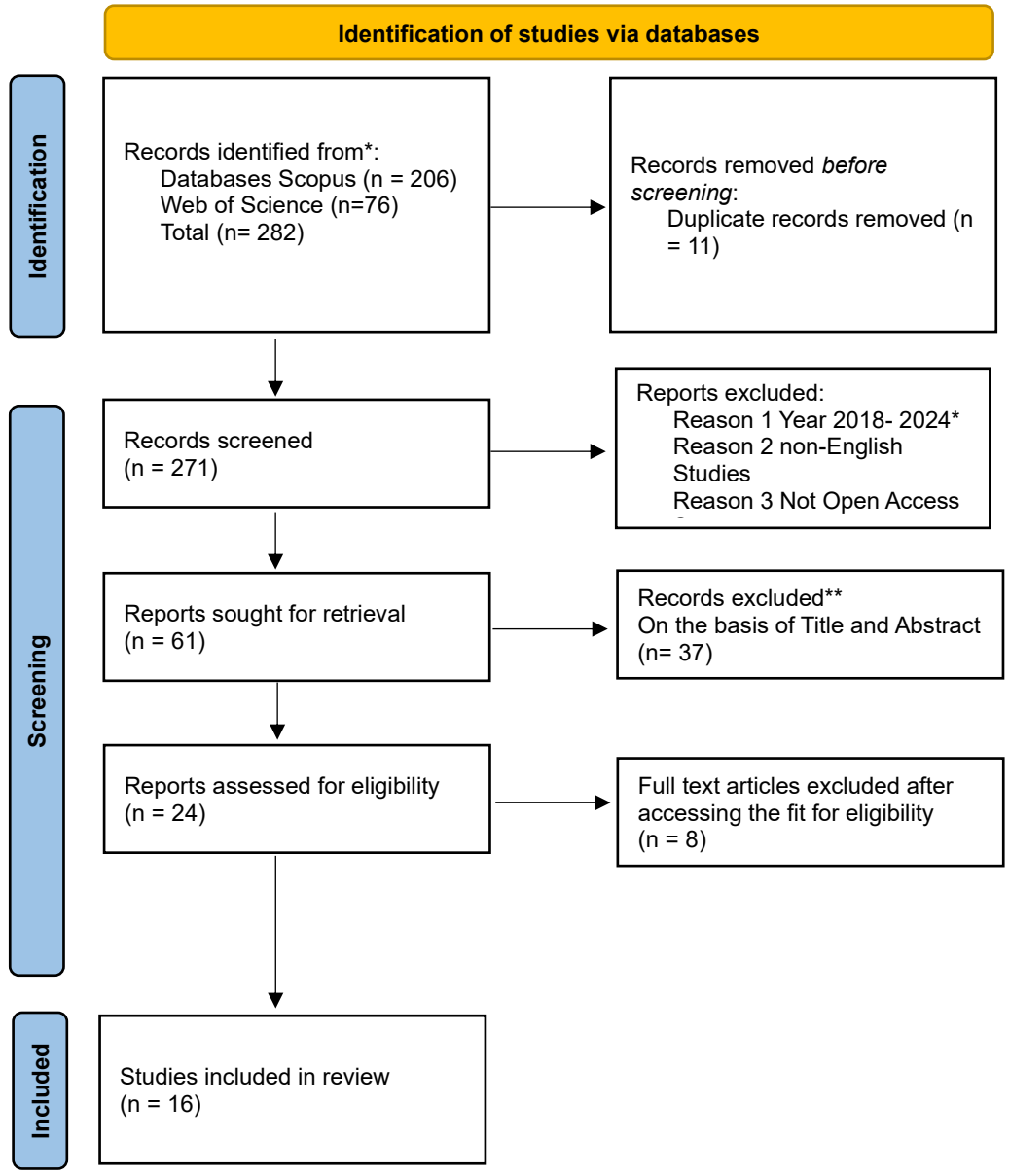
The studies accessed from Scopus (n=206) and Web of Science (n=76). After removing 11 duplicates, 271 studies were found, and after inclusion and exclusion criteria, 61 studies were included for this systematic review (SLR). After screening the title and abstract, 24 studies were assessed for full-text papers; only 16 papers were found eligible for this study.



Source: Page MJ, et al. BMJ 2021;372:n71. doi: 10.1136/bmj.n71.

Figure 1. PRISMA Flowchart for 21st Century Skills

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Research Methodology Used in the Studies	Sum of Frequency Distribution	Percentage of Research methodology used
Bibliometric Analysis	1	6.25%
Case Studies	1	6.25%
Mixed method	3	18.75%
Qualitative	6	37.50%
Quantitative	4	25.00%
SLR	1	6.25%
Grand Total	**16**	**100.00%**

Result and Discussion:

The analysis of the research methodology employed in 16 studies on 21st century skills and pedagogical approaches reveals key trends and preferences among researchers. The findings are summarised below:

Result and discussion of objective 1: To study the research methodologies adopted in the existing literatures for fostering 21st-century skills in teacher education.

Table 3: Research Methodology Used in the Studies

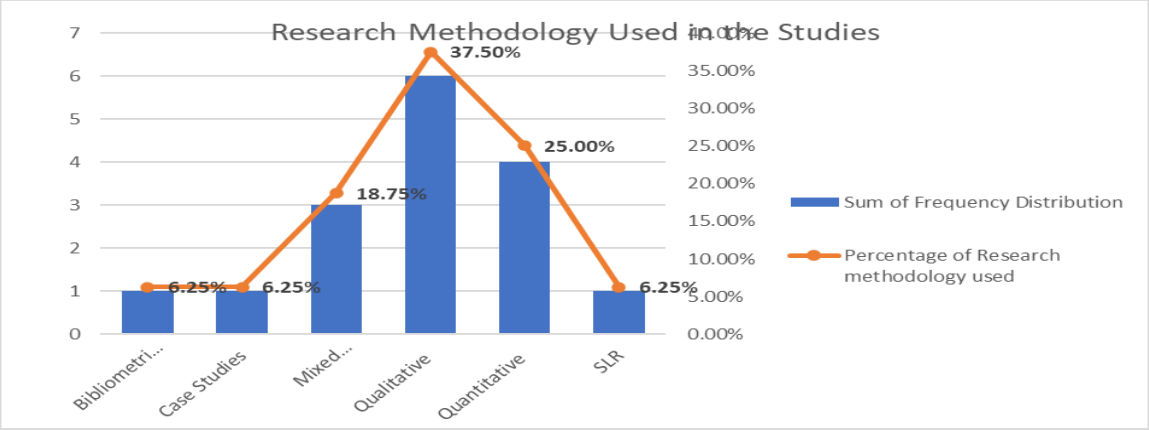

Figure 2: Research Methodology Used in the Studies

Table 3 and Figure 2 reveal that the most used research was qualitative in nature, accounting for 37.5% of the total studies, 25% of the studies were quantitative, and 18.75% of the total studies employed mixed method research. Furthermore, the bibliometric analysis or systematic

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literature review, or case studies approach was limited, which emphasizes its need to have deep insight into the integration of 21st century skills and the different pedagogical approaches needed to effectively integrate it in the teacher education programme.

Result and Discussion of Objective 2:

To explore the various pedagogical approaches used by the teacher educators to foster 3C in the teacher preparation programme

Table 4: Pedagogical Approaches Used in the Studies

Pedagogical Approaches Used in the Studies	Count of Pedagogical Approach	Percentage of Pedagogical Approach used
Art Education	1	6.67%
CANVA	1	6.67%
Microteaching	1	6.67%
Music	2	13.33%
Problem solving	2	13.33%
Technology	8	53.33%
Grand Total	**15**	**100.00%**

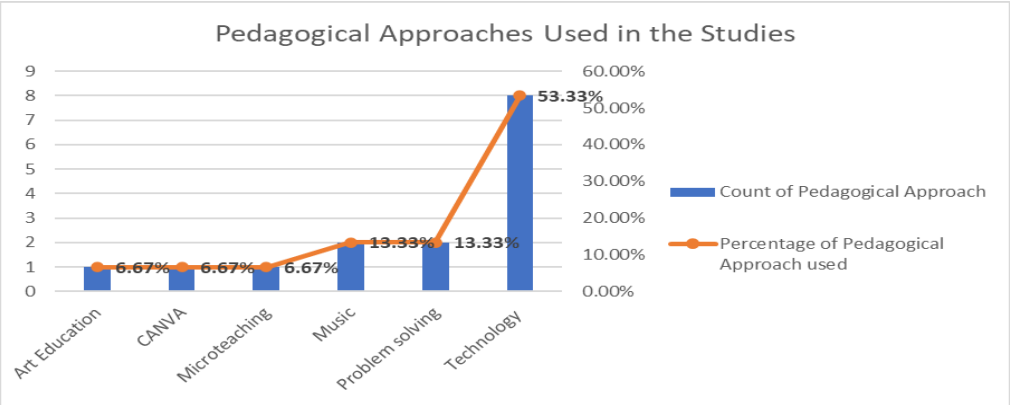

Figure 3: Pedagogical Approaches Used in the Studies

Table 4 and Figure 3 depict that the most used pedagogical approaches for developing the skill are based on technologies, accounting for 53.33% of the total approaches used. Problem solving and music represent 13.33% of the total approaches used, while microteaching, CANVA, and art education accounted for 6.67% each. This finding is consistent with the finding of Fernandez Vicente (2025), which suggested that using technology-based approaches like Project-Based Learning and digital tools like CANVA can be used to foster 21st-century skills.

The data reveals the dominating role of technology, whereas other creative approaches like art education or music or microteaching are being less used for developing skills. However, studies like Silitubun et al. (2024) suggest project-based learning (Tariq, 2024) suggests inquiry-based learning, and project-based learning, Karmilah et al. (2024) suggest project based learning and problem based learning can be used for inculcating 21st century skills.

Result and Discussion of Objective 3: To explore the various skills covered in the existing literature related to the teacher education programme

Table 5: Skills Covered in the Studies

Skills Covered in the Studies	Count of Skills Covered in the Studies	Percentage of Skills Covered in the Studies
21st-century skills	6	18.75%
Collaboration	4	12.50%
Communication	4	12.50%
Creative Thinking	1	3.13%
Creativity	4	12.50%
Critical Thinking	8	25.00%
Emotional Growth	1	3.13%
problem-solving	1	3.13%
Social Skills	1	3.13%
Thinking Skills	1	3.13%
Virtual Collaboration	1	3.13%
Grand Total	**32**	**100.00%**

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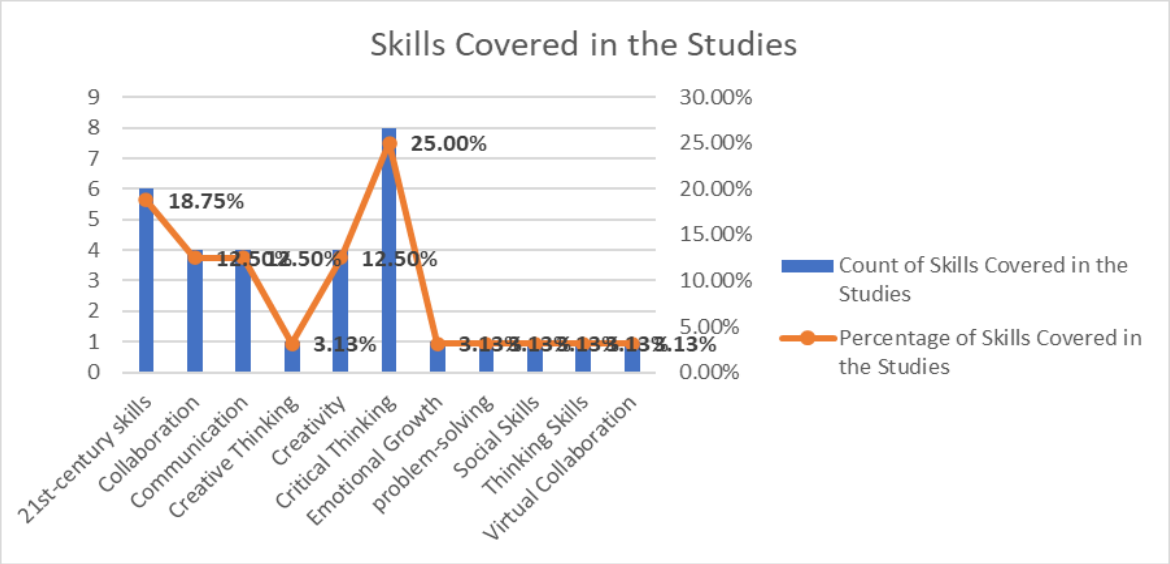

Figure 4: Skills Covered in the Studies

Table 5 and Figure 4 depict the various skills covered in the studies. Critical thinking emerged as the most addressed skill, followed by 21st century skill, accounting for 25% and 18.75% respectively.

Table 5 and Figure 4 show a varied emphasis on 21st century skills, with critical thinking receiving the highest coverage. The findings are summarized as follows:

Critical thinking emerged as the most addressed skill, accounting for 25% of all the types of skills analysed, followed by 21st century skills, accounting 18.75% of the skills covered in the study. Skills like Collaboration, Communication, and Creativity accounted for 12.50% each, whereas skills such as Creative Thinking, Problem Solving, Social Skills, Thinking Skills, Virtual Collaboration, and Emotional growth accounted for 3.13% each. The findings suggest that there is a strong emphasis on skills like critical thinking, collaboration, communication, and 21st century skills. This finding also aligns with the study of Akyol (2023); Diquito et al. (2022), whose finding states that skills like creativity, critical thinking, innovative technology use, communication, problem solving, and cooperation skills are used in the teaching and learning process.

Table 6: Technology Based Pedagogical Approaches used in the studies

Technology Based Pedagogical Approaches	Count of Pedagogical Approach in Technology	Percentage of Pedagogical Approach in Technology
Blended Learning	1	11.11%
CALL (computer-assisted language learning)	1	11.11%
Chat GPT	1	11.11%
Cybergogy	1	11.11%

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Google Suite	1	11.11%
ICT (Information and Communication and Technology)	1	11.11%
OER	1	11.11%
TPACK	1	11.11%
Zoom	1	11.11%
Grand Total	**9**	**100.00%**

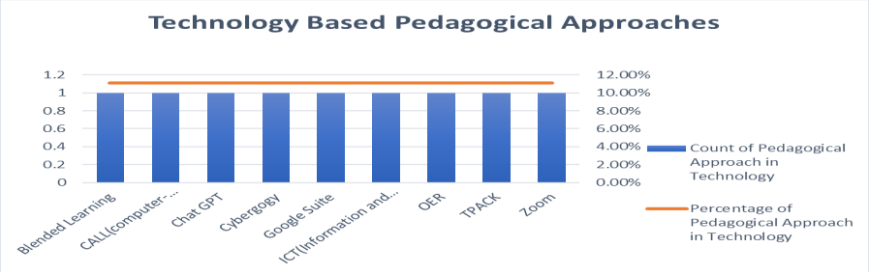

Figure 5: Technology Based Pedagogical Approaches

Table 6 and Figure 5 show the analysis of technology-based pedagogical approaches reveals a balanced distribution among various methods, indicating diverse applications of technology in educational practices. The findings are as follows:

Each approach, including Blended Learning, CALL (Computer-Assisted Language Learning), Chat GPT, Cybergogy, Google Suite, ICT (Information and Communication Technology), OER (Open Educational Resources), TPACK (Technological Pedagogical Content Knowledge), and Zoom, was employed in one study, contributing equally (11.11%) to the total.

This distribution highlights the variety of technology-driven pedagogical tools available and the equal emphasis placed on each in the studies analyzed. The findings of this study are consistent with the findings of Goradia (2018), which suggest TPACK as a medium to develop 21st-century skills. Solorzano Aveiga et al. (2025) suggest the flipped classroom. However, some studies (Kumbo et al., 2023) suggest innovative pedagogies such as gamification, virtual reality field trips, and collaborative coding projects for fostering 21st-century skills by enhancing student engagement and promoting critical thinking, creativity, and collaboration.

The findings suggest an openness to exploring diverse technological approaches in education, but they also point to the need for deeper investigation into the comparative effectiveness of these methods to determine best practices for different educational contexts.

Conclusion

This study was based on 3Cs in teacher preparation programmes while the result shows that many studies focussed on 4Cs i.e, critical thinking, creativity, communication and collaboration

as well as on 21st century skills. In the study a wide range of pedagogical approaches have been addressed to inculcate the skills. The most emphasized skills among all the skills covered in the study is critical thinking and the most used pedagogical approach is based on technology which shows the importance of technology for the 21st century learners. However, in technology a wide range of innovative platforms have been used such as CANVA, Zoom or Chat GPT. Furthermore, creative and experiential pedagogical approaches like microteaching and art education were underutilized.

The key findings suggest the critical role of technology in education while underscoring the need for balanced pedagogical strategies that integrate creativity, critical thinking, and collaboration to address the varied needs of learners. As per the NEP 2020, para 5.1 "Teachers are the one who shape the future of our nation and hence empowerment of teachers is required to ensure the best possible future for our children and our nation." Teachers should be equipped with the right weapons to shape the future of our nation and the best can be equipping the teachers with 21st century skills for future career demand which is the need of the hour.

Research Implications

The 21st century skills in teacher education play a significant role in preparing educators to navigate the complexities of modern classrooms and societal demands. Therefore, the stakeholders, i.e., educators, curriculum developers, and policy makers should collaborate with each other so that future teachers translate theory into practice and can create a learning environment that can meet the needs of the diverse learners of the 21st century, where students engage actively and apply it in their learning and day-to-day activities.

1. **For Educators:** For fostering 3Cs, teachers need knowledge and resources, and therefore, professional development of teacher educators is essential to prepare the future teachers so that these developments can be seen in real classroom practice.
2. **For Curriculum Developer:** The curriculum should be revised and updated to reflect the demand of contemporary education and develop skills like collaboration, creativity, critical thinking, communication, social skills, virtual collaboration, emotional growth, problem solving, and most important, digital literacy among the learners.
3. **For Policy Makers:** Policy makers play an important role in shaping the direction and priorities in the education system, so they should realign the educational system to foster above mentioned skills.
4. **For Researchers:** Future researchers can focus on various 21st-century skills and the effective pedagogical approaches to foster these skills among the learners.

By addressing these implications, educational stakeholders can work collaboratively toward an inclusive and effective learning ecosystem that prepares students for the challenges of the 21st century.

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