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A Bi- Annual Peer Reviewed Research Journal

Volume 37 April 2024 - September 2024

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A Publication of

PSS Central Institute of Vocational Education

(a constituent unit of National Council of Educational Research and Training (NCERT)
Ministry of Education, Government of India)
Shymala Hills, Bhopal - 462002, Madhya Pradesh, INDIA

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Chief Editor's Note

A paradigm shift is occurring in Indias educational system with the National Education Policy (NEP) 2020 at its center. In order to revitalize the country's educational landscape the NEP places a strong emphasis on skill development vocational education and competency integration. Achieving this goal will primarily depend on preparing students for a more diverse labor market and integrating education with the demands of the modern workforce. Programs for vocational education must be designed with local industries and needs in mind. Vocational education can be successfully incorporated into rigorous and integrated curricula in countries like Germany and Switzerland which have dual educational systems. Students are prepared for both employment and entrepreneurial endeavors by these systems which strike a balance between learning objectives and hands-on training. India can take inspiration from these models and modify them to fit its particular social and economic situation. Quality assurance is crucial for Indian skill-training institutions. Students learning experiences and results are greatly influenced by the rubric-based assessment that is used to evaluate their competencies. There may be gaps in training as a result of the fact that many rubrics do not currently adequately represent the skills needed in the workforce. To make sure that these rubrics reflect the skills that employers are looking for and the demands of the industry they must be thoroughly reviewed. By matching these rubrics to current job roles and industry requirements graduates employability will be improved and workforce transformation will be aided. The setting in which training programs take place is an important but frequently disregarded component. The physical technological and social training environment has a significant impact on the efficacy of vocational education programs. The relationship between the variables influencing training and its results is found to be moderated by the training environment according to research. Access to up-to-date resources encouraging mentors and facilities that meet industry standards can all significantly raise the standard of education. Students home environments have a significant impact on their career goals especially in underrepresented communities. Many families choose academic streams even when their children are more suited for practical work because they are unaware of the benefits of skill education and how it can lead to fulfilling lucrative careers. This emphasizes the necessity of awareness-raising initiatives that stress the value of skill development and the variety of career options. Schools should also work with local businesses to involve families and help them make decisions about their childrens futures. To ensure high standards of hygiene and patient care in the healthcare setting training for hospital cleaning and nursing staff is essential. Training delivery has changed dramatically as a result of the explosive growth of digital media especially social media platforms. Social media has an impact on training program delivery and content according to a study examining hospital staff training requirements.

The aforementioned studies provide ideal pathways for skill development as the top choice for a future career.

(Deepak Paliwal)
Chief Editor
Indian Journal of Vocational Education

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Vinay Swarup Mehrotra

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Abstract

Vocational education plays a crucial role in promoting inclusive development and preparing a skilled workforce. In today's education system, the vast complexity and beauty of the world are often reduced to mere "content" that students are expected to memorize and reproduce for standardized tests. This rigid, test-driven approach diminishes learning from an exciting, exploratory experience to a mechanical process of retention and recall. Rather than nurturing curiosity, creativity, and deep understanding, the overwhelming focus on standardized assessments forces teachers to emphasize rote memorization at the expense of critical thinking, problem-solving, and real-world application.

This paper examines its transformative impact in equipping school students with industry-relevant skills, and addressing youth unemployment. A demographic analysis highlights the potential of India's vast youth population to benefit from vocational pathways. Focusing on India's National Education Policy (NEP) 2020, the paper highlights the need to integrate vocational education into mainstream schooling while challenging societal biases. The paper also identifies key challenges due to changes in India's employment landscape, infrastructural limitations, and lack of competency-based education and training. It proposes strategies to strengthen vocational education, including public awareness initiatives, entrepreneurship training, and industry partnerships. Additionally, insights from Vocational Education and Training (VET) system in countries like South Korea, Finland, Germany, Singapore, United States of America, and Australia offer valuable perspectives on revitalizing vocational education institutions.

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Introduction

Vocational education plays a pivotal role in preparing students with specific skills aligned with the real world and workplace scenarios and to meet the skill demands of the industry. It also plays a crucial economic role in reducing youth unemployment. For developing nations aiming for economic growth, boosting investments in vocational education and training (VET) seems to be a clear and practical solution.

Vocational education often suffers from a stigma, being seen as a secondary option to academic pathways. Countries have varying perceptions of TVET[1] (Technical and Vocational Education and Training), shaped by how the system is viewed, its components, and individual experiences. A significant number of students drop out after secondary education in India, with the dropout rate for boys at 17.9% and for girls at 15.1% (Ministry of Education, Government of India, 2022).

The National Education Policy (NEP) 2020 of India aims to provide vocational education to at least 50% of learners by 2025 through school and higher education (Ministry of Human Resource Development, Government of India, 2020). The policy emphasizes the integration of vocational education into both school and higher education systems to ensure that a significant proportion of learners acquire practical and employment-ready skills by 2025. The policy also aims towards eliminating the social status hierarchy associated with vocational education by integrating vocational education programmes into mainstream education across all educational institutions in a phased manner. Starting with vocational exposure at early ages in middle and secondary schools, the NEP 2020 envisages that quality vocational education will be smoothly incorporated into school and higher education. It will ensure that every child learns at least one vocation and is exposed to several others. This approach emphasizes the dignity of labour and the importance of various vocations, including Indian arts and craftsmanship. The National Skill Qualifications Framework (NSQF)[2] is to be further developed for each discipline, vocation, and profession. Indian standards are also to be aligned with the International Standard Classification of Occupations (ISCO) maintained by the International Labour Organization (ILO). A strong foundation for the Recognition of Prior Learning (RPL), enabling dropouts from the formal education system to reintegrate by mapping their practical experience to the appropriate framework level is to be laid for upskilling and reskilling. Additionally, the credit-based system will promote seamless mobility between 'general' and vocational education pathways and provide the necessary flexibility in course offerings through the National Credit Framework (NCrF). In today's education system, the vast complexity and beauty of the world are often reduced to mere "content" that students are expected to memorize and reproduce for standardized tests. This rigid, test-driven approach diminishes learning from an exciting, exploratory experience to a mechanical process of retention and recall. Rather than nurturing curiosity, creativity, and deep understanding, the overwhelming focus on standardized assessments forces educators to emphasize rote memorization at the expense of critical thinking, problem-solving, and real-world application.

[1] *Terms like Vocational Education (VE), Vocational Education and Training (VET), Career and Technical Education (CTE), and Technical and Vocational Education and Training (TVET) are being used globally, but they all focus on equipping individuals with practical and technical skills for the workforce.*

Since the approval of the National Education Policy (NEP) 2020 on July 29, 2020, India has undertaken several initiatives to align its educational framework with the policy's vision. The traditional 10+2 system has been restructured into a 5+3+3+4 model, encompassing foundational, preparatory, middle, and secondary stages. This shift aims to cater to children's cognitive development stages. The paper identifies key challenges due to changes in India's employment landscape and proposes strategies to strengthen vocational education in schools, including public awareness initiatives, entrepreneurship training, and industry partnerships. Additionally, insights from the VET system in countries like South Korea, Finland, Germany, Singapore, United States of America, and Australia offer valuable perspectives on revitalizing vocational education institutions.

India's Employment Landscape: Changes and Challenges

India's population is projected to grow from 1.36 billion in 2021 to 1.48 billion by 2031 and 1.52 billion by 2036 (Ministry of Health and Family Welfare, Government of India, 2020). Unlike countries such as China, Japan, and the United States of America, which face challenges associated with ageing populations, India benefits from a sizable youth and working-age demographic. Annually, around 12 million individuals join the working-age population, creating a vast labour pool that, if effectively utilized, could yield a significant demographic dividend[3]. Youth in India face challenges such as limited work experience, inadequate job search skills, insufficient financial resources, and a lack of relevant skills, leading to higher unemployment rates and employment in informal jobs.

Employment Trends

India is poised to benefit from its demographic dividend for at least another decade. In 2021, youth constituted 27% of the population; however, this figure is projected to decrease to 23% by 2036. With 7 to 8 million new entrants joining the labour force annually, there is a pressing need to create avenues for their productive engagement through targeted vocational education and skill development programmes. Failure to do so could lead to underemployment or increased informal sector participation, limiting economic growth and stability.The employment landscape has undergone significant changes due to digitization and advancements in connectivity, particularly with the rise of the gig economy. This sector has grown rapidly, especially during the COVID-19 pandemic, as more individuals turned to short-term, contractual work due to job uncertainty and lockdowns. The Economic Survey 2023-24 highlighted that the Indian economy must generate, on average, 78.5 lakh non-farm jobs annually until 2030 to productively engage its growing working population. Creating quality jobs remains an ongoing endeavour and a well-recognised national priority, pivotal to ensuring inclusive and sustainable economic growth.

[2]The National Skill Qualifications Framework, introduced in 2013 and amended in 2023, is a quality assurance framework that standardizes vocational education across India, organizing qualifications into eight levels based on knowledge, skills, and aptitude. This framework facilitates clear learning pathways and ensures that vocational courses align with national skill demands.

[3]The demographic dividend refers to the economic growth potential arising from a shift in a country's age structure, where the working-age population (15 to 59 years) outnumbers the non-working-age groups.

(i) Self-Employment Dominance: Self-employment represents the largest employment category for both youth and adults in India. This trend accelerated during the COVID-19 pandemic, with significant growth in youth self-employment, particularly in unpaid household work. Rural women were disproportionately involved in such work, underscoring the gender disparities in employment quality and income generation. The Periodic Labour Force Survey (PLFS) highlighted a sharp rise in youth employment from 114 million in 2019 to 133.9 million in 2021. Notably, 83% (16.5 million) of the additional youth joined the self-employment sector (Ministry of Statistics and Programme Implementation, Government of India, 2021).

The dominance of self-employment introduces significant challenges in skill development, primarily due to the absence of structured learning environments and career progression frameworks. This often leads to a fragmented learning experience, where skill gaps in specialized areas such as data analytics, research, and innovation management emerge due to the overwhelming demands of running a business. Without proactive efforts in recognition of prior learning (RPL), continuous education and training, networking, and strategic upskilling, self-employed professionals risk falling behind in an ever-evolving job market.

(ii) Growth of the Gig Economy: The gig economy offers workers the flexibility to take on temporary or freelance jobs, often facilitated by digital platforms and freelance websites. This model appeals to those seeking independence, diverse work experiences, or additional income streams. According to NITI Aayog, the gig workforce is projected to reach 23.5 crore by 2029-30, comprising 6.7 per cent of the non-agricultural workforce and 4.1 per cent of total livelihoods, reshaping the labour market. Although gig work offers flexibility, it often lacks the security and benefits of traditional employment. Workers may not have access to health insurance, paid leave, or retirement benefits. The lack of job stability can also result in unpredictable income. The transient nature of gig work can lead to stress and isolation, with many workers struggling with burnout and a lack of support networks. The uncertainty surrounding income and job security can contribute to anxiety and other mental health challenges.

Gig workers rarely receive formal training or employer-sponsored upskilling, forcing them to learn independently. Since gig work often prioritizes short-term tasks over deep expertise, workers may struggle to develop specialized skills that require long-term practice. The lack of structured mentorship and career progression frameworks further exacerbates this issue, making it difficult for gig workers to gain in-depth knowledge in their respective fields. Additionally, the pressure to continuously adapt to shifting market demands means that workers often focus on acquiring just enough skills to complete immediate tasks rather than investing time in mastering complex competencies. This fragmented learning approach can limit career growth opportunities, reduce competitiveness in specialized industries, and create skill gaps that hinder long-term professional development. Without proactive efforts to seek high-quality learning resources, certifications, and networking opportunities, gig workers may find it challenging to transition into more stable, higher-paying roles that require deep expertise.

(iii) Increased Remote Work: The COVID-19 pandemic accelerated the shift towards remote work. Many employees transitioned to home offices, utilizing digital tools and communication platforms to perform their duties. Remote work has since become a permanent feature for many sectors, particularly tech, education, and finance.

Remote work requires proficiency in digital tools like project management software, communication platforms and cloud-based collaboration tools, making workers more tech-savvy. However, while these tools enhance efficiency, they also demand continuous adaptation as technology evolves. Additionally, managing time effectively while dealing with home distractions can impact skill development and focus on deep learning. Without a structured office environment, employees may struggle with maintaining discipline, prioritizing tasks, and dedicating time to professional growth. The blurred boundaries between work and personal life can lead to burnout, reducing the motivation to engage in upskilling. Furthermore, the lack of in-person interactions and spontaneous learning opportunities in a remote setting may hinder the development of soft skills such as teamwork, leadership, and effective communication.

(iv) Automation and AI Integration: Advances in automation and artificial intelligence (AI) have led to changes in job roles and industries. Tasks that were traditionally performed by humans are now being automated, especially in manufacturing, logistics, and customer service. This shift has created both challenges (e.g., job displacement) and opportunities (e.g., new roles in tech and data analytics).

India's National Education Policy 2020 marks a pivotal step in integrating AI into education at all levels. This policy aims to cultivate AI literacy, computational thinking, and problem-solving skills among students, laying the groundwork for an AI-driven future. In line with this vision, the AI4K12 Initiative, led by the Ministry of Education, aims to introduce AI education to 10 million school children by 2023, reflecting India's dedication to future-proofing its workforce.

The India Skills Report 2024 indicates that most AI-related job postings are concentrated in the Information and Communication Technology and Professional Services sectors (IHD and ILO, 2024). Additionally, the World Economic Forum projects that by 2025, 65% of jobs will require new skills due to the rise of automation and AI. Recognizing the importance of AI proficiency, the Indian government is heavily investing in digital infrastructure. The 'BharatNet project,' a cornerstone of this effort, seeks to provide broadband connectivity to every village, promoting digital inclusion and ensuring widespread access to online services.

AI and automation are replacing repetitive and routine tasks, making certain skills redundant. Workers in fields like manufacturing, data entry, and customer service must continuously upskill or reskill to remain relevant. Many workers face challenges in accessing the necessary training and resources to develop these skills, leading to a growing digital divide. Traditional skill development pathways, such as on-the-job training and apprenticeships need to evolve, requiring new strategies to equip workers for AI-integrated workplaces.

Skill-Level Trends

Between 2000 and 2019, employment in high- and medium-skill jobs rose from 5.1% to 9.6%, signaling gradual progress toward a more skilled workforce. Simultaneously, low-skill job shares increased from 60.5% to 65.1%, reflecting the continued dominance of agriculture, construction, and informal services. Encouragingly, the share of no-skill jobs declined from 34.4% to 25.4%, suggesting a structural shift towards more skill-intensive employment (IHD and ILO 2024). This evolution underscores the importance of expanding vocational education to bridge skill gaps and equip youth with competencies that align with evolving job market demands.

The skill-level trends influence which skills are in demand, how they are acquired, and how workers adapt to market changes. With technology evolving rapidly, today's sought-after skills may become obsolete within a few years, necessitating continuous learning and adaptation. However, barriers such as limited access to affordable training hinder many workers from upskilling effectively. Modern jobs now demand a blend of technical and soft skills—for instance, engineers must develop business acumen, while marketers require proficiency in data analytics. Yet, many training programmes fail to offer interdisciplinary education, making it challenging for professionals to stay competitive. Even after acquiring new skills, their shelf life is often short-lived, as fields like programming, digital marketing, and software tools continuously evolve, requiring professionals to engage in lifelong learning to remain relevant in the job market.

Sectoral Trends

Sectoral employment patterns, which refer to the distribution of employment across various sectors of the economy, such as agriculture, industry, and services, reflect the structure and development stage of an economy and shift over time due to factors like technological advancement, globalization, and policy changes.

(i) Primary Sector (Agriculture, Fishing, Mining): Between 2019 and 2021, 79% of additional young workers joined the agriculture sector, dominated by low- and no-skill jobs. In 2022, 88.9% of youths and 89.4% of adults were engaged in low- or no-skill jobs, while high- or medium-skill jobs accounted for 11.1% of youths and 10.6% of adults. Young women were more engaged in agriculture than men, with 56.7% of women and 32.6% of men working in this sector in 2022. The rural-urban divide showed 70% of rural young women in agriculture compared to 46.4% of men (IHD and ILO 2024).

(ii) Secondary Sector (Manufacturing and Construction): Youth participation in construction (15.1%) slightly exceeded manufacturing (14.3%). A significant gender gap exists in construction, with 19% of young men and only 3.6% of young women employed, while manufacturing saw near-equal participation (14.1% men, 14.9% women) (IHD and ILO 2024).

(iii) Tertiary Sector (Services, Retail, IT, Health): Technological advancements have driven demand for skilled workers, particularly in modern services like IT and communication. High- and medium-skill jobs dominate public administration, health, education (45.1%), and financial services (42.3%), while lower proportions are found in transport (19.7%) and trade, hotels, and restaurants (3%) (IHD and ILO 2024).

As industries evolve, the required skills change, creating several challenges for workers and organizations. Each sector has unique skill demands, making cross-industry mobility difficult. For instance, IT professionals may lack the regulatory knowledge needed in healthcare, while finance experts may struggle to adapt to tech-driven roles, limiting career flexibility. Additionally, industries with faster innovation cycles, such as technology, healthcare, and finance, require workers to constantly update their skills. However, many training programmes fail to keep pace, resulting in skill shortages in high-demand fields. Traditional education systems often do not align with evolving sectoral trends, leaving graduates without job-ready skills. Many industries now require a combination of technical, business, and soft skills, yet most training programmes focus on only one area, preventing workers from developing well-rounded expertise. For example, marketing professionals now need data analytics proficiency, while engineers benefit from project management skills. Without access to interdisciplinary and practical learning, workers face challenges in adapting to industry shifts and securing future career growth.

Challenges for VET

Challenges for VET due to demographic shift, misalignment with economic needs, inadequate teachers' training and industry experience, low status and poor working conditions of vocational teachers and instructors and resource and infrastructure deficiencies may influence the effective implementation of vocational education in the middle stage. Addressing these challenges presents an opportunity to strengthen collaboration between schools and communities, training teachers on experiential learning-teaching methods, fostering innovation and enhancing the overall quality of education. By investing in infrastructure and professional development, states/union territories can ensure that vocational education becomes an enriching and sustainable part of the learning journey for students across the country.

(i) Demographic shift: As school and higher education enrolment rates rise, the entry of young people into the workforce is increasingly delayed. Digital transformation has created demand for vocational skills in areas like cybersecurity, data analytics, and green technologies. VET can pivot towards these high-growth sectors. However, this demographic shift underscores the need for students to acquire skills that align with evolving economic structures, particularly within expanding non-farm sectors. Addressing this gap through VET offers a pathway for skill development, bridging the divide between education and employment. Despite its potential, vocational education in schools faces significant challenges that must be addressed to unlock opportunities for youth.

(ii) Misalignment with Economic Needs: Many VET programmes are not adequately aligned with the current demands of the labour market. The manufacturing sector, largely dominated by micro and small enterprises, continues to depend on manual and unskilled labour, limiting opportunities for vocational passouts or graduates. In the services sector, the demand for high- and medium-skilled workers is concentrated in specialized areas, leaving gaps in entry-level skill development.

(iii) Inadequate Teacher Training and Industry Experience: Teaching should inspire a sense of wonder in students, fostering engagement and a deeper connection to the subjects they study. This is possible across all areas of the curriculum. Most vocational teachers lack the pedagogical skills required to deliver high-quality VET. Compounding this issue, many teachers and instructors have limited or no industry experience, which hinders their ability to impart practical, up-to-date knowledge. This disconnect restricts students from gaining relevant, hands-on experience necessary for employment.

(iv) Low Status and Poor Working Conditions for Vocational Teachers: Vocational teachers often experience poor working conditions, limited career progression, and lower recognition compared to their counterparts in general education. These factors negatively impact teacher morale and motivation, contributing to a lack of enthusiasm and commitment to vocational education programmes.

(v) Resource and Infrastructure Deficiencies: Vocational education often suffers from inadequate resources, outdated equipment, and insufficient infrastructure. This lack of investment compromises the quality of practical training and reduces students' readiness for industry roles.

Revitalizing VE in Schools in line with NEP 2020 Perspectives

Vocationalisation of education in schools aims to equip students with practical skills and industry-specific knowledge, bridging the gap between traditional academic learning and workforce demands. Mehrotra (2012) stressed the need to integrate vocational skills into the mainstream school curriculum and advocated for policy-level support to create linkages between education, training, and employment. By integrating vocational education into the school curriculum, students gain early exposure to career paths in sectors such as healthcare, information technology, agriculture, and manufacturing. This approach enhances employability, reduces dropout rates, and makes education more engaging and relevant. Governments worldwide are promoting vocationalisation to address skill shortages, foster innovation and entrepreneurship, and align education systems with evolving job market needs.

(i) Adapting Curricula to Workforce Demands: Schools have the opportunity to adapt their curricula to meet the demands of the modern workforce. Emphasizing skills needed in non-farm sectors, such as technology, services, and green energy, equips students with essential tools for success. Additionally, soft skills like communication, problem-solving, creativity and adaptability are crucial for young people entering the workforce, particularly in non-manual sectors.

Training students for high- and medium-skilled roles in information technology, healthcare, and business services opens pathways to higher-paying and more stable jobs, addressing the growing demand for specialized talent. Schools should prioritize outdoor learning experiences, involve students in projects that contribute to environmental protection, and teach them to care for and understand the needs of animals and ecosystems. Ultimately, education must cultivate a generation of responsible stewards of the Earth, ensuring the survival and flourishing of our planet for future generations.

(ii) Promoting Experiential Learning: Experiential learning, as defined by David Kolb (Kolb, 1984), is "the process whereby knowledge is created through the transformation of experience." This model follows a cycle of "Do-Reflect-Decide," encouraging active participation and reflection. John Dewey's foundational work in the United States of America highlights the importance of engagement in learning rather than passive knowledge reception. Many U.S. schools implement project-based learning days, involving real-world projects, STEM (Science, Technology, Engineering and Mathematics) activities, community service, and industry visits. These initiatives enhance students' critical thinking, creativity, and problem-solving skills.

Conventional teaching methods often lead to compartmentalized knowledge lacking real-world context. In contrast, STEM education creates an organic connection between formal learning and everyday observations, ensuring a more engaging and motivational learning experience (Kavak, 2023). A meta-analysis of experiential learning programmes in the USA and Europe found that students engaged in hands-on, real-world projects were 30% more likely to retain knowledge and 25% more likely to develop critical thinking skills compared to those in traditional classrooms (Kolb, 2023). Moving away from rote memorization, the new curriculum brought out by NCERT for various subjects focuses on experiential learning. Students engage in project-based activities, experiments, and real-world applications, which enhance critical thinking and problem-solving skills. This hands-on approach aims to deepen understanding and retention of concepts. NCERT has also digitized its textbooks, making them accessible through platforms like ePathshala and DIKSHA. This initiative increases accessibility, reduces costs, and enhances the learning experience by providing interactive and multimedia resources.

The NISHTHA (National Initiative for School Heads' and Teachers' Holistic Advancement), which is a capacity-building programme of NCERT aims at enhancing the professional skills of educators. The NISHTHA - Kaushal module focuses on vocational education, aligning with the National Education Policy (NEP) 2020's vision to integrate skill development into mainstream education. It equips teachers with the necessary tools and methodologies to impart vocational skills effectively, thereby preparing students for various professions and fostering self-reliance. This module emphasizes practical, hands-on learning experiences, encouraging educators to incorporate skill-based activities into their teaching practices. The Postgraduate Diploma in Vocational Education and Training (PGDVET), a one-year program aimed at building the capacities of teachers and professionals in the VET system, offered by PSSCIVE combines theoretical instruction with practical work and internships, ensuring that educators are well-equipped to deliver vocational courses effectively.

(iii) Integrating Work-Based Learning (WBL): Work-Based Learning (WBL) integrates theoretical instruction with practical application, enhancing students' technical competencies, problem-solving skills, and adaptability. According to Mehrotra (2014), WBL bridges the gap between educational outcomes and industry requirements, fostering employability. Through WBL, students gain hands-on experience, exposure to workplace environments, and insights into career pathways. This approach mitigates skills mismatches, ensuring students are better prepared to meet professional expectations and industry standards.

Vocational Education in Middle Stage (Grades 6 to 8)

(i) Concept of Bagless Days: The National Education Policy (NEP) 2020 introduces the concept of "Bagless Days" to promote experiential learning and vocational exposure among students through activities organised by the schools. As part of this initiative, students in grades 6 to 8 are to participate in 10 bagless days annually, engaging in internships with local artisans, craftsmen, and businesses. This initiative, spearheaded by the Ministry of Education, Government of India, aligns with the vision of making education more practical and enjoyable. While "Bagless Days" might be unique to India's way of providing experiential learning opportunities to the students, similar concepts exist under different names or frameworks in many countries. In Scandinavian countries, like Finland and Sweden, students spend days learning outdoors, participating in nature-based activities to foster environmental awareness. Japan has incorporated "Integrated Studies" days into the curriculum where students explore topics like community work, environment, or culture outside the classroom. Schools in the United Kingdom and Australia often have "Co-Curricular Activity Days" where academic routines are replaced with sessions on arts, sports, or career skills. Singapore emphasizes practical and skill-based learning through designated weeks for internships, job shadowing, or creative workshops under its “Applied Learning Programme” (ALP).

(ii) Vocational Education as a Separate Subject: The introduction of vocational education in the middle stage (Grades 6 to 8) as a separate subject aligns closely with the National Education Policy (NEP) 2020, which advocates for the integration of vocational education from the early age. By introducing vocational education early, foundational skills in various work forms i.e. life, machines and materials and human services will prepare students for future educational and professional pathways, equipping them with essential life skills and fostering a spirit of lifelong learning.

Students should be encouraged to observe nature with an artistic eye, visit museums and galleries to develop a deeper aesthetic awareness, and participate in school art programmes that enhance their ability to discern the differences between beauty, mediocrity, and ugliness. "Our Wondrous World – The World Around Us”, brought out by the NCERT as an Environmental Studies (EVS) textbook for grade 3, has been designed to foster curiosity and experiential learning. The book integrates elements of science, social sciences, and environmental education. It encourages students to explore their surroundings through hands-on activities and open-ended inquiries, promoting critical thinking and problem-solving skills. Assessment ideas are embedded within chapters to help track progress and tailor teaching strategies.

These include activities like sketching routes, creating rangoli designs using natural materials, matching traffic signs, and conducting simple experiments. The "Let us reflect" section at the end of each chapters encourages students to summarize and reflect on their learning.

Rather than focusing solely on academic achievement, schools should foster meaningful discussions about human diversity, encourage students to celebrate differences and promote empathy and understanding toward those who face prejudice. NCERT's revised textbooks now incorporate arts and music into traditional academic subjects. This interdisciplinary approach is designed to make learning more engaging and to foster creativity among students. For instance, mathematics lessons may include patterns found in art and music, encouraging students to see connections across disciplines. The activity book of Vocational Education titled “Kaushal Bodh” for grade 6 brought out by the National Council of Educational Research and Training (NCERT), is an innovative and forward-looking educational resource that integrates vocational education with mainstream academic learning. This initiative is designed to foster practical knowledge, and prepare students for real-world applications of their education from an early stage. The activity book outlines illustrative projects that schools can adopt or modify based on local needs and resources.

Artificial Intelligence has been incorporated into the “Kaushal Bodh” activity book for grade 6 to provide early exposure to cutting-edge technology. AI activities are designed to fostering familiarity with automation and digital problem-solving. This early exposure to AI aims to foster a generation that possesses innate familiarity and confidence in utilizing AI tools. By embedding AI education from an early stage, the initiative seeks to develop a future workforce capable of seamlessly integrating AI across diverse sectors, driving innovation, and enhancing productivity in the evolving digital economy. This aligns with the broader emphasis of NEP 2020 on AI readiness and future skill development.

Vocational Education in Secondary Stage (Grades 9 to 12)

In India, vocational education at the secondary stage is offered in more than 27,000 schools under the Samagra Shiksha – a centrally sponsored scheme of the Department of School Education and Literacy, Ministry of Education, Government of India, but implementation varies significantly across states/UTs. Samagra Shiksha places a strong emphasis on bridging gender and social category gaps in school education. The scheme specifically targets girls, as well as children from Scheduled Castes (SC), Scheduled Tribes (ST), minority communities, children with special needs and transgender individuals. Various interventions, including the establishment of schools in proximity to girls, provision of free uniforms and textbooks, additional teachers in remote areas, and specialised programmes like self-defense training, are implemented to promote inclusivity and gender sensitivity in the learning environment. The integration of vocational education under the Samagra Shiksha initiative, guided by the NSQF and supported by employability skills curricula represents a significant advancement in India's initiative, guided by the NSQF and supported by employability skills curricula represents a significant advancement in India's educational landscape.

By addressing skill gaps and aligning vocational education with industry needs, India is cultivating a robust and inclusive vocational education system that empowers students and strengthens the nation's workforce. The National Curriculum Framework for School Education (NCF-SE) 2023 has been developed as per the recommendations of the NEP 2020 to bring about necessary changes, such as integration of vocational education with general education, mainstreaming of vocational education, outcomes-based education and assessment, and flexibility in offering of vocational and general education subjects. The overarching objective of this NCF-SE 2023 is to help positively transform the school education system of India through corresponding positive changes in the curriculum, including pedagogy.

(i) Employability Skills: A key component of vocational subjects

The Pandit Sunderlal Sharma Central Institute of Vocational Education (PSSCIVE) has introduced the 'Employability Skills' curriculum, a key component of vocational subjects offered from grades 9 to 12. This curriculum imparts essential workplace skills, such as communication, self-management, information and communication technology, entrepreneurship and green skills. Designed modularly, the curriculum is interactive, incorporating role plays, case studies, and group projects. It fosters career readiness and entrepreneurship.

(ii) Vocational Skills: Focus on learning pathways and informed career choices

The focus on vocational education in India has gained momentum with the introduction of standardized VET guided by policies, frameworks and guidelines. The Ministry of Education, Government of India in collaboration with UNICEF-India and NCERT, has developed a comprehensive career guidance resource titled "500 Roads to Success: Navigating Life after School." Launched on July 29, 2024, during the Akhil Bharatiya Shiksha Samagam, an initiative that aligns with the National Education Policy (NEP) 2020's emphasis on providing holistic career guidance to students.

Sector Skill Councils (SSCs) are industry-led bodies established under the National Skill Development Corporation (NSDC) to bridge the gap between workforce skills and industry requirements. They play a crucial role in developing National Occupational Standards (NOS), creating Qualification Packs (QPs), accrediting training providers, and ensuring quality vocational training across various sectors. SSCs collaborate with industries to design demand-driven skill development programs, conduct assessments, and provide industry-recognized certifications, enhancing employability. Covering diverse fields such as agriculture, beauty and wellness, automotive, healthcare, IT, retail, agriculture, and tourism, SSCs contribute to strengthening India's vocational education ecosystem by aligning training with industry needs. Their efforts support initiatives like the National Education Policy (NEP) 2020 and Skill India Mission, promoting skill-based learning in schools and higher education institutions. The National Council for Vocational Education and Training (NCVET) serves as a regulatory authority that establishes standards and develops regulations for vocational education and training institutions, ensuring uniformity and high-quality VET programmes.

The learning outcomes-based curricula and textbooks for vocational subjects in schools being developed by the PSSCIVE are aligned to the National Occupation Standards (NOSs) given in the qualification packs (QPs) for the job roles approved by the National Skill Qualifications Committee (NSQC) and available on the National Qualifications Register (NQR). The vocational courses are based on the needs and demands of the local job market and industry and also keeping in view the job roles under the NSQF. Job roles are continuously evolving, and the skills in demand are shifting to align with technological advancements, societal changes, and economic trends. Curricula for new job roles in coding and computer programming, artificial intelligence, drone technology, data analysis and interpretation, cybersecurity, machine learning, digital marketing, cloud computing, internet of things, etc. are being developed for school education.

Lessons in VET from Other Countries

The integration of vocational education with general education is a global trend aimed at fostering skill development and career readiness. While countries like Finland, Singapore, Japan, and South Korea have successfully embedded vocational elements in their education systems, challenges remain, particularly in regions like China and India where vocational education faces significant social and structural barriers.

Globally, vocational education programmes demonstrate diverse structures and outcomes. In China, 78% of parents view vocational tracks as a fallback option for students with poor academic performance (Mengqing, 2023). As the global economy becomes more skills-focused, countries have adopted diverse strategies to integrate vocational or skill education into school curricula. Despite varying approaches, countries face similar challenges in implementing vocational education in the middle and secondary stage. These differences present challenges for making international comparisons and highlight the methodological limitations of our approach to VET (Cedefop, 2017). Addressing these challenges requires policy reforms, investment in infrastructure, and efforts to change societal perceptions of vocational education.

(i) South Korea

South Korea's education system includes six years of elementary school, three years of middle school, and three years of high school, followed by post-secondary education. At the high school level, students can pursue either an academic track at non-vocational high schools or a vocational track. The vocational track offers several options: specialized vocational high schools, Meister high schools, or vocational programmes within general high schools. This structure provides students with diverse pathways to develop skills aligned with their career interests and industry needs. In 2010, Korea launched the "Meister" high school initiative to meet critical skill demands in key sectors. The country showcases strong examples of collaboration between industry and training institutions, including partnerships like that of Samsung with the Korea University of Technology and Education (World Bank, 2013). Additionally, agreements between the government and organizations such as the Korea Institute of Industrial Technology and the Korea Master Society have facilitated the recruitment of "Meister teachers" from local industries, enhancing the quality and relevance of vocational education (World Bank et al., 2023).

Meister High Schools in Korea enjoy greater flexibility in designing their curricula compared to specialized vocational high schools. This autonomy helps address the mismatch between the skills students acquire and the evolving demands of industries. A key solution lies in implementing a dynamic curriculum system that can adapt to industry changes. To facilitate this, an "Industry-School Cooperation Committee" has been established, ensuring that industry needs are continuously reflected in the school curriculum, fostering stronger alignment between education and workforce requirements. Meister high schools integrate project-based learning (PBL) into their curriculum to enhance students' ability to independently identify and solve problems. To strengthen teachers' competencies in delivering PBL, an annual conference is held each December to showcase best practices. Additionally, a dedicated faculty of PBL developers and experts offers training sessions, providing teachers with representative examples and practical strategies to effectively implement project-based approaches in their classrooms. South Korean middle school students engage in craft-based classes such as carpentry, electronics, and culinary arts. Career counselling and workplace visits are standard components of the curriculum. South Korea introduced the "Work-Learning Dual System" in 2014, incorporating elements from the apprenticeship models of Germany and Switzerland, adapted to Korean societal contexts. Emphasis is placed on technology integration and fostering entrepreneurship skills from an early stage (Korean Ministry of Education, 2023). In this system, companies recruit young individuals for on-the-job training in partnership with educational institutions. After completing their training, participants are assessed by the government or industry bodies to earn recognized qualifications (Lee et al. 2013). The system, guided by the "National Competency Standards" (NCS), emphasizes practical, job-related teaching by company instructors. The system is expected to solve the mismatch in the labour market by providing early employment for job seekers and reducing re-education expenses for newly hired employees for companies (FICCI, 2022). Despite its successes, the competency-based model requires further refinement to address evolving needs.

(ii) Finland

In Finland, primary and secondary schools offer all children not only excellent educational services, but also psychological counselling, health and nutrition care, and various special or inclusive education services (Kosenchuk et al., 2023). Students from grade 6 onwards can opt for courses in life skills, entrepreneurship, home economics, and craft-based subjects. Practical subjects such as coding, robotics, and woodworking are integrated into the curriculum. Schools frequently collaborate with local businesses to provide job shadowing and career days, fostering early career awareness and hands-on learning (Education Finland, 2023). Finland's vocational education system allows students to choose between three years of general upper-secondary education or vocational education after nine years of comprehensive education. Approximately 40% of students pursue vocational education after primary school, with competency-based programmes aligned with industry requirements (Statistics Finland, 2020). Vocational programmes are competency-based, ensuring that graduates acquire industry-relevant skills. Strong partnerships between educational institutions and businesses help mitigate skill shortages and foster workforce readiness.

Finland's vocational education system is distinguished by its “flexibility”, “student-centered approach”, and “strong integration with general education”. Students can tailor their learning paths by combining vocational and academic subjects, allowing seamless transitions between different tracks and promoting lifelong learning. The system focuses on competency-based learning, allowing students to advance by demonstrating skills rather than completing fixed hours. A key feature is the emphasis on work-based learning, where students gain hands-on experience through apprenticeships and real workplace settings, ensuring their skills align with industry needs. Additionally, vocational education in Finland offers pathways to higher education, ensuring no dead ends for students pursuing further academic or professional growth. This collaborative model, developed in partnership with industries, ensures that VET remains relevant, inclusive, and responsive to the evolving job market.

(iii) Singapore

In Singapore, lower secondary school students (ages 12 to 14) are introduced to vocational tracks through taster modules. These modules cover electronics, coding, culinary arts, and creative media. This approach allows students to explore potential career pathways while still engaging in general education (Ministry of Education, Singapore, 2023). The "SkillsFuture" initiative integrates technology into vocational education, ensuring relevance to emerging sectors such as IT and green energy (Ministry of Education, Singapore, 2023).A key feature of Singapore's VET system in schools is its “early skills development” and “career-focused pathways”. From secondary school, students can choose applied learning tracks through programmes like the Normal (Technical) stream and the Applied Learning Programme (ALP), which emphasize hands-on, practical skills alongside academic subjects. Schools work closely with the Institute of Technical Education (ITE) and polytechnics to introduce students to technical and vocational skills early, fostering interest in industries such as engineering, IT, and design. This early exposure helps students identify their strengths and career interests, preparing them for further education in technical institutions or direct entry into the workforce. The system ensures that vocational education is seen as a valuable and prestigious pathway, supporting Singapore's goal of developing a highly skilled and adaptable workforce.

(iv) Japan

Japan's "Integrated Studies Period" (sogo gakushu), which takes place in junior high school (grades 7-9), is designed to offer students a well-rounded education that encourages active, hands-on learning. This period includes activities that span a wide range of subjects, including vocational education. Students often engage in practical experiences such as cooking, crafting, and farming, which are meant to give them a glimpse into different types of work and life skills. Additionally, career education is promoted through activities like workplace visits, community service projects, and "vocational fairs" where students have the opportunity to interact with local businesses and industries. These initiatives aim to help students understand the world of work and its various fields while encouraging practical skills development (MEXT 2020).

In Japan, a unique feature of the education system is the emphasis on life skills, responsibility, and character development through activities like “classroom cleaning and cooking”. Known as “gakko soji” in Japanese, meaning 'school cleaning' or 'cleaning at school', students are responsible for cleaning their own classrooms, hallways, and common areas as part of their daily routine. This practice instills a sense of teamwork, respect for shared spaces, and humility from a young age. Similarly, home economics (kateika) classes teach students practical skills such as cooking, sewing, and budgeting, preparing them for everyday life. These activities reflect Japan's holistic approach to education, which not only focuses on academic achievement but also on fostering independence, responsibility, and a strong work ethic.

In high schools, Japan's specialized vocational tracks focus on fields such as engineering, commerce, agriculture, and healthcare, blending classroom learning with hands-on training. Students gain practical skills through internships, industry visits, and practical workshops, ensuring they are job-ready upon graduation. Japan's VET system also emphasizes Kaizen (continuous improvement), fostering a culture of lifelong learning and skills upgrading. Collaboration between schools and industries ensures that curricula stay relevant to evolving workforce needs. Additionally, vocational students can pursue higher education or enter technical colleges (Kosen), reflecting Japan's commitment to providing flexible pathways for career advancement and workforce development.

(v) China

Vocational education in China starts at the middle school level, where students receive basic skills training in sewing, farming, and cooking. Career education often involves visits to factories, farms, and local businesses. China has over 11,000 vocational schools with nearly 30 million students enrolled (Niu, 2024). Secondary vocational schools enroll around 40% of students. However, rigid exam-oriented models limit the system's adaptability to industry needs (UNESCO, 2023; Mengqing, 2023).

Vocational schools collaborate closely with enterprises, offering “work-integrated learning through internships, apprenticeships, and on-the-job training”. This dual-track approach ensures students gain real-world experience alongside theoretical knowledge. Additionally, the government has heavily invested in expanding and modernizing VET institutions, promoting skill competitions and entrepreneurship programmes to enhance innovation and technical proficiency. The system offers multiple progression pathways, allowing students to transition from secondary vocational schools to higher vocational colleges or universities, ensuring flexibility and lifelong learning opportunities. Vocational education in China is still perceived negatively by parents, who see it as inferior to general education. This perception is driven by concerns over outdated facilities, underqualified teaching staff, and fears of social stigma (Mengqing, 2023). In 2022, China introduced policies to coordinate the development of general and vocational education. However, the "vocational education diversion" policy implemented in 2023 has led to 50% of middle school students being diverted into vocational tracks, primarily based on test scores (Mengqing, 2023).

This policy has drawn criticism, particularly in rural areas where vocational education is viewed as a less desirable option compared to general education. Furthermore, the diversion of students into vocational or general education is primarily based on test scores, leading to a system that effectively separates "elite" students from those considered "disadvantaged." The vocational diversion policy disproportionately affects students from rural and economically disadvantaged backgrounds, limiting their opportunities for higher education and career advancement (Niu, 2024). These students are often left with limited options, contributing to economic disparities.

(vi) Germany

In Germany, approximately 50% of students enroll in vocational programmes following lower secondary education. Germany offers exceptional “internship programmes” for VET students, providing hands-on experience in various industries, including automotive, information technology, manufacturing, and engineering. These internships, often integrated into dual education systems, allow students to apply theoretical knowledge in real-world settings, fostering skills essential for career advancement. Companies like BMW (Bayerische Motoren Werke), Siemens, and Bosch actively participate in these programmes, offering structured internships that include mentorship, project involvement, and industry exposure. Typically lasting between three to six months, VET internships not only enhance technical competencies but also improve soft skills such as teamwork and problem-solving. The German dual system, recognized as one of the most successful vocational education models globally, achieves a 90% post-apprenticeship employment rate (CEDEFOP, 2022). This model relies on collaboration between schools, companies, and the government to align curricula with industry standards. Apprenticeships frequently lead to stable employment, as companies consider vocational trainees valuable future employees. However, the dual system requires significant financial investment from both private enterprises and the state, posing a challenge for replication in countries with limited resources. Switzerland follows a similar VET model, with over 70% of young people enrolling in VET programmes after completing compulsory education. With Germany's strong focus on apprenticeships and vocational education, these internships serve as a bridge to full-time employment, ensuring students are well-prepared to meet industry demands.

(vii) Australia

In Australia, the VETiS (Vocational Education and Training in Schools) programme covers the training fees for VET courses that align with in-demand jobs and skills, helping secondary school student's transition into employment and further vocational education opportunities. It complements other successful initiatives like the “Gateway to Industry Schools Programme”, “School-based Apprenticeships and Traineeships”, and “Trade Tasters” — all of which focus on guiding students toward employment pathways. Nationally recognized qualifications are developed in collaboration with industry to equip students with the skills and knowledge required for specific jobs. Training is provided by Technical and Further Education (TAFE) and accredited training providers under the Skills Assure Supplier (SAS) framework.

The system offers vocational training in collaboration with industry. Over 88% of graduates secure employment or continue education within six months (Department of Employment and Workplace Relations, 2023). Students can participate in VET at school through delivered by schools registered as training organisations (RTOs). By covering training fees for courses linked to high-demand industries, VETiS helps students transition smoothly from school to work or further vocational education.

Way Forward

To establish India as a global leader in vocational excellence, a comprehensive strategy is essential—one that prioritizes early skill development, enhances training infrastructure, and strengthens industry collaboration. This includes setting up state-of-the-art skill training institutes in partnership with international leaders in vocational education and developing specialized academies in fields such as robotics, carpentry, web development, healthcare, and mechatronics. A key challenge, however, is the low uptake of vocational pathways among students, often driven by a lack of awareness or societal stigma. To overcome this, efforts must focus on improving the perception of vocational education through media campaigns and the promotion of success stories. Matching students' interests and aptitudes to appropriate vocational tracks is essential for ensuring the effectiveness of VET.

Labour Market Information Systems (LMIS) play a vital role in bridging the gap between education and employment by utilizing labour market data to align students' skills with in-demand careers. These systems offer comprehensive insights into industry trends, required competencies, and emerging job opportunities, enabling students to make informed vocational decisions. By ensuring that training aligns with workforce demands, LMIS minimizes skill mismatches and boosts employability. Dynamic updates to curricula and career guidance based on real-time data empower students and educators to adapt to evolving market conditions, fostering a workforce prepared for the future.

To bridge the gap between the supply and demand of skilled labour, states and union territories are to be encouraged to conduct comprehensive “skill gap analyses”. The primary objective of these analyses is to identify sectors with high demand for skilled labour and assess the existing workforce's capabilities. By understanding these dynamics, vocational programmes or courses can be tailored to align with specific regional and sectoral needs. This targeted approach not only enhances the employability of the workforce but also improves productivity by ensuring that training efforts are focused on areas with significant economic potential. Creating flexible pathways between VET and general education can enhance student mobility, allowing for smoother transitions between vocational and academic tracks. This integration encourages lifelong learning and provides students with multiple exit and entry points within the education system.

Schools are addressing administrative needs by adopting solutions such as School SIS (Student Information Systems), ERP (Enterprise Resource Planning), CRM (Customer Relationship Management), and digital learning platforms. Digital teaching-learning

tools, like Virtual Reality (VR) and Virtual Skill Labs (VSLs) provide immersive, interactive, and hands-on learning experiences. Virtual Skill Labs provide cloud-based or software-based practical training experiences that allow students to practice skills remotely. These technologies bridge the gap between theoretical knowledge and practical skills, making vocational training more effective, accessible, and engaging. VR learning makes vocational training more engaging by incorporating game-based elements, interactive challenges, and scenario-based decision-making. For example, it can simulate patient care, medical procedures, and emergency response training. Learners can assemble and repair vehicle engines using VSL before working on actual machines. Students can repeat simulations as many times as needed without additional costs, improving their proficiency. These educational technologies can be used for streamlining school operations, enhancing communication, and supporting personalized learning experiences, contributing to the modernization and efficiency of educational institutions.

India is actively fostering skill development at the school level through initiatives aligned with "India Skills" and "WorldSkills" programmes, aiming to equip students with industry-relevant competencies that drive innovation, creativity, and competitiveness on national and global platforms. The Union Budget for 2024-25 introduced the PM Internship Scheme (PMIS), aimed at providing internship opportunities in 500 leading companies to one crore youth over five years. The scheme covers 24 sectors, including oil, gas, energy, travel, hospitality, automotive, banking, and financial services, among others. Mentorship programmes involving industry experts and former India Skills or WorldSkills champions can further inspire and guide students. Additionally, internships and immersive boot camps will provide real-world exposure, bridging the gap between theory and practice. To encourage participation and excellence, offering scholarships, grants, and rewards for top-performing students in skill competitions can significantly boost engagement and motivation, ensuring India's sustained growth in the global skills landscape.

Entrepreneurship education fosters critical skills such as problem-solving, creativity, decision-making, and leadership. These skills not only support business creation but also enhance overall employability and career adaptability. This education bridges the gap between schooling and employability by promoting self-employment and job creation.

In India, with its large youth population, fostering entrepreneurship in schools can significantly reduce unemployment, drive economic growth, and contribute to regional development. Practical approaches, such as project-based learning, mentorship programmes, and hands-on activities, can provide students with the confidence and skills to navigate real-world challenges. Integrating entrepreneurship education into vocational training is essential for equipping students with the skills and resilience needed in today's economy. With increasing emphasis on innovation and self-reliance, as exemplified by India's "Atmanirbhar Bharat" initiative, schools have a crucial role in nurturing entrepreneurial potential. Investing in the training and upskilling of vocational teachers or educators is crucial to maintaining the quality of programmes. The State Councils of Educational Research and Training (SCERTs) and the District Institutes of Education and Training (DIETs) play a crucial role in the implementation of Samagra Shiksha scheme, particularly in the strengthening and upgrading of teacher training.

Comprehensive teacher development programmes that emphasize both vocational pedagogical skills and industry exposure are essential. Encouraging partnerships with industry for teacher placements and continuous professional development can significantly improve teaching quality and relevance. Digital tools and online platforms can be utilized to improve the accessibility and effectiveness of vocational education, making it more inclusive and adaptable.

Vocational education programmes in schools can be tailored to meet the needs of specific sectors, such as information technology, finance, and education—industries where remote work is prominent. This ensures that graduates possess job-ready skills that align with remote job roles. State and Union Territory governments should actively foster partnerships between educational institutions and industries to enhance the relevance and adaptability of vocational education. This approach mirrors Finland's model, where students can seamlessly transition between academic and vocational tracks, ensuring education aligns with evolving industry needs and career pathways. By broadening the scope of education beyond standardized tests, schools can help shape well-rounded individuals who value creativity, inclusivity, and environmental stewardship—qualities essential for a more just and sustainable future.

Conclusion

The future of vocational education lies in creating inclusive and adaptive systems that align with the demands of a rapidly evolving global economy. Vocational education is being integrated into mainstream education from the middle stage, aiming to expose students to at least one vocational skill by the time they complete secondary stage. Policymakers must adopt international best practices and tailor them to local contexts to ensure vocational education remains relevant and impactful. Industries should partner with vocational training institutions to develop customized training modules and reduce the mismatch between the demand and supply of skilled manpower. Teachers are to be provided with opportunities for continuous professional development to adapt to the new pedagogical demands and curricular changes. They must be trained to integrate digital tools effectively into vocational curricula. Traditional report cards are to be replaced with holistic progress cards that provide a comprehensive overview of a student's cognitive, affective, and psychomotor domains. Occupational Safety and Health (OSH) regulations be upheld as fundamental measures to ensure safe and dignified working conditions, fostering a sense of security and confidence among the workforce. By fostering partnerships, embracing technology, and emphasizing lifelong learning, vocational education can play a transformative role in shaping the workforce of tomorrow.

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Article of Significant Interest

Study on Employment Trends, Skill Development, and Workforce Transformation in India

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Abstract

This study examines the evolving employment landscape in India from 1998 to 2024, focusing on sectoral shifts, unemployment trends, and the impact of skill development initiatives. Descriptive and inferential statistical analyses reveal a steady decline in agricultural employment, with a corresponding rise in manufacturing and service-sector jobs, particularly in rural areas. Unemployment trends from 2017-18 to 2023-24 indicate persistent rural-urban disparities, with urban unemployment at 5.1% and rural unemployment at 2.5%, disproportionately affecting women. A thematic analysis of qualitative reports highlights the mixed success of skill development programs such as Skill India and PMKVY, which have improved employability but face challenges in accessibility, industry alignment, and post-training placements. The findings underscore the need for targeted policy interventions, enhanced vocational training and stronger public-private collaborations to bridge skill gaps and promote inclusive employment opportunities. Strengthening these initiatives will be crucial in ensuring India's workforce remains adaptable to technological advancements and global economic shifts.

Keywords: Employment Trends, Unemployment Rates, Rural-Urban Dynamics, Sectoral Shifts, Skills Gap, Skill Initiatives, Workforce Transformation.

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Introduction

India's employment landscape has evolved significantly over the past few decades, reflecting structural shifts in the economy (Khare, M., & Arora, S., 2023). As the nation transitions from an agrarian economy to one increasingly characterized by industrial and service sectors, significant shifts in employment patterns have emerged (Singh, J., 2023). The data spanning from 1998 to 2023, drawn from official Government of India survey reports listed in the Data Sources section, provides a comprehensive view of employment distribution across rural and urban areas. This article examines the employment trends by sector, primary, secondary, and tertiary, highlighting how these shifts have impacted the labour market in India and influenced employability. As the economy transitions, understanding these trends is crucial for addressing the skills gap and enhancing job opportunities, particularly in a rapidly changing job environment (Thomas, J. J., 2023). Analysing the interplay between sectoral employment distribution and employability will shed light on the challenges and opportunities within India's labour market. This paper aims to illuminate these trends and their implications for policy and economic development in India.

The employment landscape in India has undergone significant changes since the 1990s. While the early 2000s saw accelerated employment growth, particularly in rural areas, this trend reversed in the latter half of the decade (Thomas, J. J., 2023). Recent studies on employment and unemployment trends in India reveal significant shifts in the labour market (Singh, J., 2023; Khare, M., & Arora, S., 2023). There has been a transition from agriculture to manufacturing sectors, with rural men increasingly taking up casual jobs (Karhad, 2024; Prasad et al., 2022). However, female employment in rural areas has declined across most states (Apte et al., 2018). The unemployment rate has accelerated in recent years, with convergence across states (Mitra & Singh, 2020). Factors contributing to unemployment include educational deficiencies, economic slowdowns, and labour market mismatches (Karhad, 2024). The relationship between per capita income and unemployment rate is not straightforward, but structural changes and educational attainments show strong effects (Mitra & Singh, 2020). Government interventions like MGNREGA and Skill India have had a notable impact on mitigating unemployment (Karhad, 2024). Regional disparities in employment opportunities persist, emphasizing variations across geographical regions and socio-economic groups (Karhad, 2024; Prasad et al., 2022).

Research Objectives

1. Study the shift in jobs from agriculture to manufacturing and services over the years.
2. Examine changes in unemployment rates and differences between regions and genders.
3. Evaluate the effectiveness of skill development programs in helping people gain employment.
4. Investigate the impact of technology on job opportunities and required skills.
5. Suggest ways for the government and private sector to improve employment and skill development.
6. Identify workforce challenges and propose solutions to improve job opportunities.

Methodology

The methodology for this research followed a mixed-methods approach, combining both quantitative and qualitative data analysis. Primary data was sourced from Government of India reports, such as the Economic Survey, India Skills Report, Statistics on Indian Economy, and World Economic Forum publications, as well as reports from the Ministry of Finance, Ministry of Labour and Employment, Ministry of Skill Development and Entrepreneurship, and other relevant government and international sources, as listed under Data Sources below the references. Secondary data was gathered from credible online databases, including Google Scholar, to analyse scholarly articles, research papers, and statistical reports on employment patterns and unemployment rates. National and regional surveys, such as the Periodic Labour Force Survey (PLFS), were reviewed to assess labour market trends. Online sources, including government websites, policy documents, and statistical data portals, were also analysed to understand the scope and effectiveness of various skill development initiatives in addressing employment challenges. Data was analysed using both descriptive and inferential statistical methods to examine the relationship between employment, skill development programs, and unemployment trends. A thematic analysis of qualitative reports, case studies, and interviews was conducted to gather insights into the impact of skill development policies and their implementation at local and national levels.

Results and Discussion

Rural Employment Trends

In rural areas, agriculture and allied activities, collectively termed the primary sector, have historically dominated employment. In 1998, about 755 out of every 1000 workers were employed in the primary sector. However, over time, this reliance has steadily diminished. By 2023, this figure had dropped to 510 per 1000 workers, reflecting the gradual movement of labour out of agriculture as the Indian economy diversified and other sectors expanded.

Despite the decline, agriculture remains a key employer in rural India, although there has been a notable rise in employment in the secondary and tertiary sectors. The secondary sector, which includes manufacturing, mining, and construction, has seen a slight increase in its share of rural employment, rising from 103 per 1000 workers in 1998 to 254 per 1000 in 2023. This growth is indicative of increased industrial and infrastructure development in rural regions.

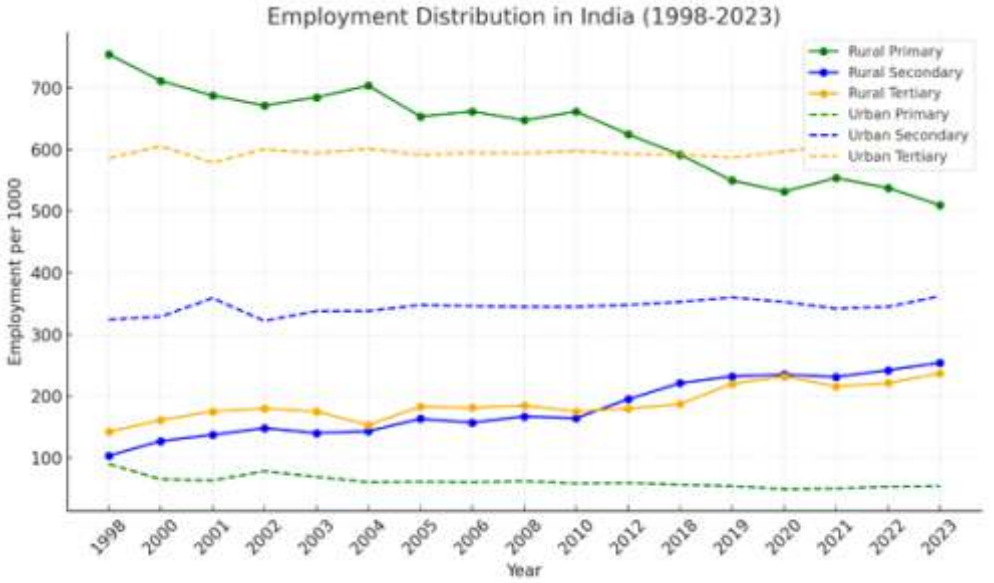
The most significant growth, however, has occurred in the tertiary sector (services), which includes trade, transport, and communication. Employment in this sector grew from 142 per 1000 workers in 1998 to 237 per 1000 in 2023. This shift demonstrates the increasing importance of services in rural areas, driven by greater connectivity, improved infrastructure, and the rising demand for various services.

Urban Employment Trends

In contrast to rural areas, urban employment has consistently shown a more balanced distribution across sectors, with a strong inclination toward the tertiary sector. In 1998, 586 per 1000 urban workers were employed in the services sector, a number that remained relatively stable, reaching 584 per 1000 workers by 2023. The tertiary sector in urban areas includes trade, hospitality, transport, communication, and other services, which have continued to absorb a large portion of the urban workforce, fuelled by the growth of urbanization and consumer markets.

The primary sector's role in urban employment is minimal, with only 90 per 1000 workers employed in agriculture-related activities in 1998, and this number further dropping to 54 per 1000 in 2023. Urbanization has largely displaced agricultural activities in these regions, and this trend is reflected in the data.

The secondary sector, which includes industries such as manufacturing and construction, remains an important component of urban employment. The proportion of urban workers in this sector was 324 per 1000 in 1998 and saw a slight increase to 362 per 1000 in 2023. While the secondary sector has experienced steady growth, it is clear that the urban labour market remains primarily service-oriented.



Sectoral Shifts and Economic Implications

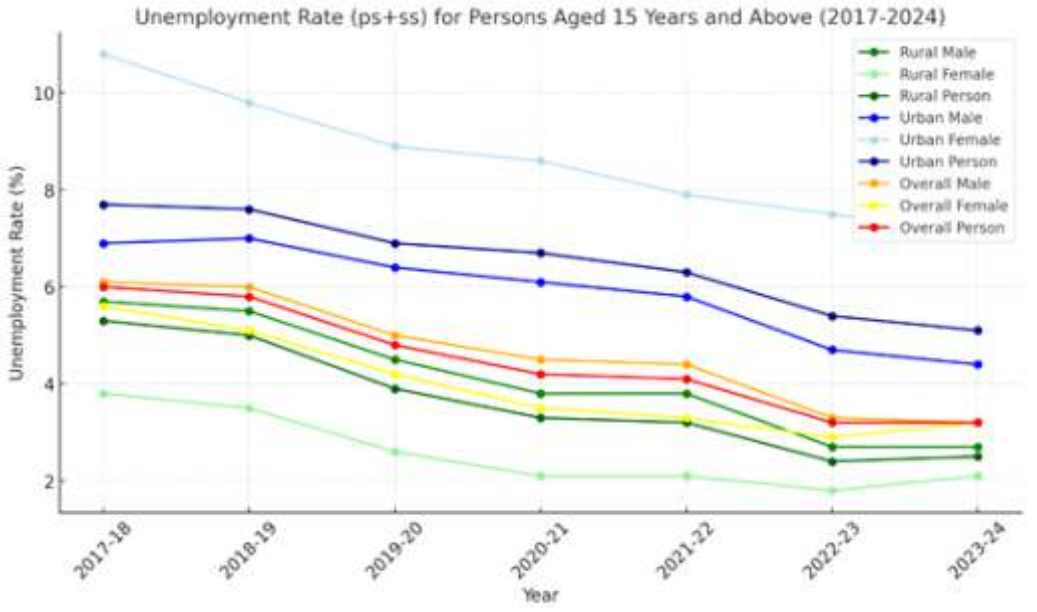
The shift in employment patterns highlights broader changes in India's economic structure. The decline in primary sector employment, particularly in agriculture, suggests that rural areas are moving away from traditional forms of livelihood. This trend is often associated with increased mechanization and productivity in agriculture, which reduces the need for labour, coupled with urban migration and opportunities in other sectors.

The growth in secondary and tertiary sector employment, especially in rural areas, points to a gradual industrialization and service-sector expansion outside urban centres. The rise in rural employment in the tertiary sector reflects improvements in rural infrastructure, connectivity, and services that cater to a growing demand for trade, hospitality, and communication services.

In urban areas, the strong presence of the tertiary sector reinforces the role of cities as hubs of commerce, finance, education, and modern services. The slight rise in secondary sector employment in urban areas indicates steady industrial growth, while the shrinking of the primary sector confirms the increasing marginalization of agriculture in cities.

Unemployment Rate

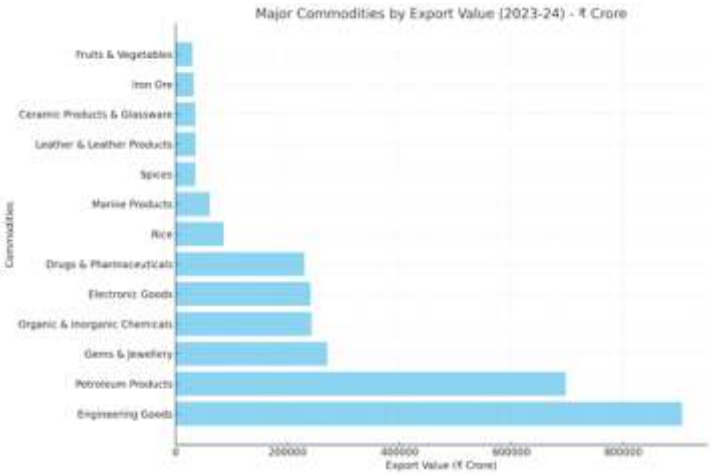
The unemployment rate (UR) in India, for persons aged 15 years and above, shows notable trends across rural and urban regions from 2017-18 to 2023-24. The data reveals a significant gap between rural and urban unemployment rates, with urban areas consistently experiencing higher unemployment, especially among females. In 2023-24, the overall unemployment rate stood at 3.2%, marking a stabilization compared to previous years. The rural unemployment rate has remained relatively low, around 2.5% for persons in 2023-24, while the urban rate, though improved from previous years, was 5.1%. Female unemployment rates have consistently been higher in urban areas (7.1% in 2023-24) compared to rural areas (2.1%). Over the years, the data reflects gradual improvements in unemployment rates, particularly in urban areas, with a narrowing gender gap in rural regions.



The graph illustrates the unemployment rates for individuals aged 15 years and above in India, from 2017-18 to 2023-24. It highlights significant trends for rural and urban areas, distinguishing between male, female, and total (person) unemployment rates.
Rural areas consistently show lower unemployment rates, with males and females converging around 2.5% in 2023-24.
Urban areas show higher rates, particularly for females, which peaked at 10.8% in 2017-18 and stabilized at 7.1% in 2023-24.
The overall national unemployment rate has declined from 6% in 2017-18 to 3.2% in 2023-24, reflecting gradual improvement.

Indian Export Market and Employment

The total export value of India for 2023-24 is ₹ 3618952 crores. The bar graph given below illustrates the export values of major commodities, ranked by their export value in ₹ crore. The export of major commodities like engineering goods, petroleum products, gems and jewellery, chemicals, and pharmaceuticals plays a pivotal role not only in boosting India's economy but also in generating significant employment opportunities. Sectors like engineering goods and petroleum products demand a highly skilled workforce, offering jobs in manufacturing, logistics, and infrastructure development. The growing export of electronic goods and chemicals provides opportunities for technicians, engineers, and workers in research and development, reflecting a shift toward more tech-based jobs. Similarly, the thriving pharmaceutical industry contributes to employment in drug production, quality control, and distribution. The agricultural sectors, such as rice, spices, and fruits & vegetables, which also rank among the major exports, create a vast array of jobs, from farming and harvesting to processing and packaging. The demand for marine products and leather goods sustains employment in fishing, tanning, and artisan work, respectively, while the ceramics and glassware industry support jobs in manufacturing, craftsmanship, and design. Export-oriented industries offer not only direct employment in production but also indirect jobs in transportation, warehousing, marketing, and international trade services, contributing to the overall employment landscape in India.



India's services exports experienced significant growth, rising from ₹26.68 lakh crore in FY 2022-23 to ₹27.83 lakh crore in FY 2023-24. This growth highlights India's increasing competitiveness in sectors such as IT, business outsourcing, and financial services, which continue to drive the country's export performance. On the other hand, services imports saw a slight decline, dropping from ₹14.93 lakh crore in FY 2022-23 to ₹14.56 lakh crore in FY 2023-24. This decrease suggests a shift towards more domestic sourcing of services or a reduced demand for certain foreign services, further strengthening India's trade balance in the services sector.

Technological Advancement and Employment Changes

Technological advancements, particularly since the COVID-19 pandemic, have significantly altered employment dynamics in India. Analysis of the published data from the government sources, reveals a steady decline in the share of low-skilled workers across all sectors, primary, secondary, and tertiary, over the last five years, with a concurrent rise in skill intensity. While automation has increased demand for complementary skills, it has also raised concerns about job displacement, particularly for low-skilled workers. However, contrary to trends in developed markets, India has not experienced job market polarization. Skilled workers, including women, have seen better employment prospects, but low-skilled workers are likely to face challenges in the near future as industries continue to adopt new technologies and automation.

Technological Upgrading and the Educational Composition of the Workforce

Technological upgrading in India significantly influences the educational composition of the workforce through several key factors. As technology evolves, the job market increasingly demands new skills related to electronics fabrication, 5G networks, renewable energy, and the electric vehicle (EV) industry, necessitating continuous learning and skill development among young professionals. The Indian government has prioritized vocational education to align with market needs, emphasizing employability skills through a three-tier technical education and vocational training system. However, barriers such as lack of financial resources, awareness of available technologies, risk aversion, low levels of indigenous research and development, inadequate management skills, and a shortage of technically qualified personnel hinder technology adoption. Additionally, socio-cultural norms and low levels of education and skilling limit individuals' ability to take advantage of new digital opportunities, exacerbating labour market inequities. Overall, technological upgrading enhances the educational and skill requirements of workers and reshapes firms' roles in the task-based distribution of labour in production.

Indian Current Economic Profile

India's working-age population is steadily increasing, reaching an estimated 923.9 million by 2026 and 988.5 million by 2036. The demographic opportunity stems from its large and youthful population, with around 26% in the 10–24 age group. This demographic trend presents a significant opportunity for economic growth if

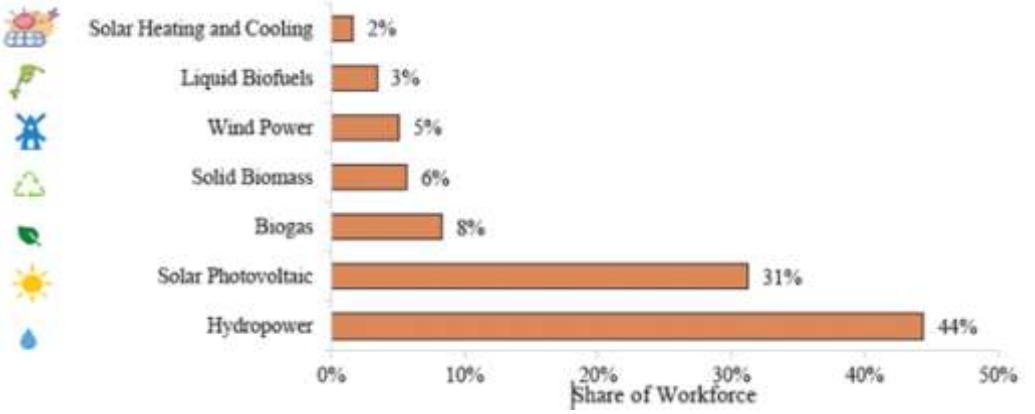
supported by job creation and skill development. In 2023-24, the Worker Population Ratio (WPR) varied across Indian states, with only 12 states having a WPR below the national average of 43.7%. Notably, 14 states saw a WPR increase of over 10 percentage points compared to 2017-18, reflecting improved employment trends. In 2023-24, 12 states had a Labour Force Participation Rate (LFPR) below the national average of 45.1%, indicating regional employment disparities. About 11 states recorded an increase of over 10 percentage points in LFPR compared to 2017-18, showing positive workforce engagement trends. In 2023-24, the share of the workforce in regular wage/salaried jobs was 21.7%, slightly declining from 22.8% in 2017-18. Meanwhile, self-employment increased significantly, rising from 52.2% in 2017-18 to 58.4% in 2023-24, reflecting a shift towards entrepreneurship. In 2023-24, 46.1% of workers were in agriculture, 11.4% in manufacturing, and 29.7% in services, with a notable rise in female agricultural employment. In 2023-24, 64.4% of female workers were in agriculture (up from 57% in 2017-18), while 40.1% were in services. For males, 36.3% worked in agriculture (down from 40.2% in 2017-18), with higher participation in manufacturing, construction, and trade-related services. India's female Labour Force Participation Rate (LFPR) rose from 23.3% in 2017-18 to 41.7% in 2023-24, driven mainly by rural women. Government initiatives, skill development programs, and increased entrepreneurial opportunities have significantly contributed to this growth. The government has launched initiatives like Mudra Yojana, Stand-Up India, and the Women Entrepreneurship Platform to support female entrepreneurs. Programs such as PM Micro Food Processing Scheme and Start-up India Seed Fund provide financial aid, skill training, and mentorship. In 2023-24, wages and earnings showed positive trends, with regular wage/salaried workers' earnings growing at a CAGR of 5%, while casual workers saw a 9% increase, highlighting stronger wage growth in urban areas. In rural India, wages rose by 5.7% for men and 7% for women in agriculture, with women experiencing a higher real wage increase. The unincorporated sector enterprises also saw a 13% rise in average emoluments per hired worker, led by growth in manufacturing. Factory employment expanded by over 7% in FY23, adding 22 lakh jobs since pre-pandemic levels, with large factories playing a crucial role. India's formal job sector grew significantly, with EPFO net payroll additions doubling from 61 lakh in FY19 to 131 lakhs in FY24, reflecting increased job formalization and workforce integration.

Job Creation

The Indian government has taken significant steps to enhance job creation by improving the ease of doing business, labour market flexibility, and workforce skilling. The simplification of labour laws, including the four Labour Codes, aims to boost employment, ensure worker protection, and promote industrial growth. Various states have implemented reforms, such as increasing thresholds for retrenchment approvals and allowing women to work night shifts under safety provisions. Government initiatives like Skill India, Start-Up India, and Mudra Yojana have encouraged entrepreneurship, vocational training, and self-employment. The focus on emerging sectors like the digital economy, renewable energy, and manufacturing offers vast potential for high-quality job creation, ensuring inclusive and sustainable growth.

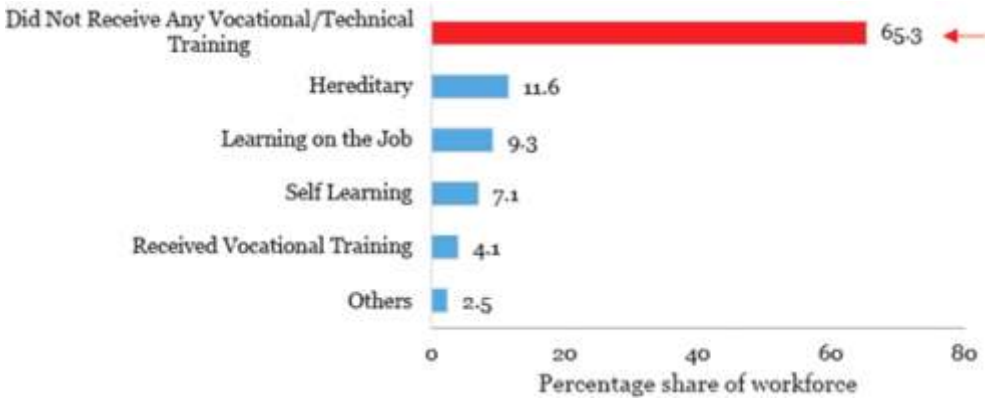
India's digital economy is creating vast employment opportunities through startups, e-commerce, fintech, and IT services, driving innovation and job growth. Government initiatives like Digital India and Skill India are enhancing digital skills, boosting employability in emerging tech sectors.

India's renewable energy sector is emerging as a key driver of green job creation, with growing opportunities in solar, wind, and bioenergy industries. Government initiatives like PM-KUSUM, National Green Hydrogen Mission, and FAME (Faster Adoption and Manufacturing of Electric Vehicles) are accelerating workforce demand in clean energy. The sector is expected to generate millions of jobs in areas like solar panel manufacturing, battery storage, energy efficiency, and sustainable infrastructure development. Skill development programs are being implemented to equip workers with the expertise needed for green jobs, ensuring India's transition to a sustainable and low-carbon economy. Share of jobs in the renewable energy sector is given below.



Skill Development Ecosystem

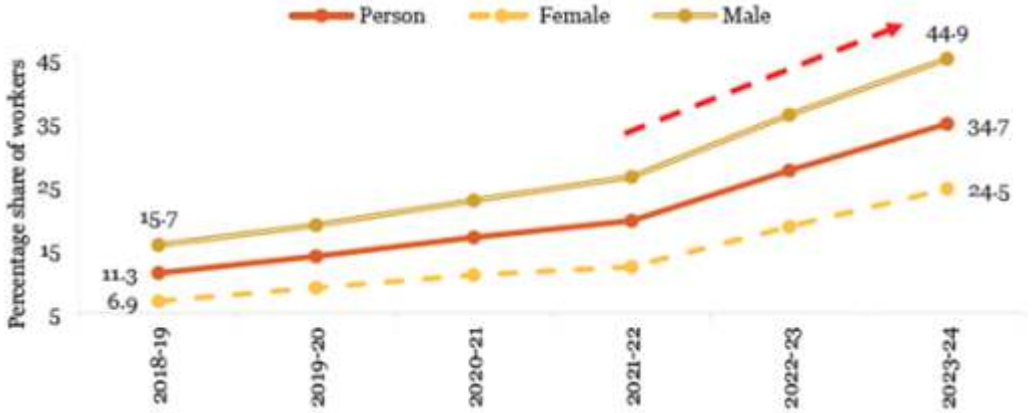
India's skill development ecosystem is rapidly evolving to meet the demands of a changing job market through upskilling, reskilling, and new skilling initiatives. Programs like Skill India, PMKVY (Pradhan Mantri Kaushal Vikas Yojana), and National Apprenticeship Promotion Scheme focus on equipping workers with industry-relevant skills in digital technologies, renewable energy, and advanced manufacturing. The government is also fostering public-private partnerships to align training with global employment trends. With the rise of automation and AI, emphasis on technical, vocational, and entrepreneurial skills is crucial to enhance workforce adaptability and capitalize on India's demographic dividend. Status of vocational training in India for 2023-24 (age group 15-59 years) is given below.



Matrix of mismatch between education skills and occupations is given below.

Education level/skills of workers				
Occupational skill of workers	**Primary Education, or 10 years of education or informal education**	**Secondary Education, or 11-13 years of education**	**Graduate Degree**	**Postgraduate degree or above**
Elementary skill	32.13	19.25	3.22	0.96
Semi-skilled	66.3	72.18	50.3	28.12
High competency skill	0.29	2.79	8.25	7.67
Specialised skills	1.28	5.77	38.23	63.26

Increase in the share of workers receiving vocational/technical training (15 to 59 years of age) is given below.



Skill Development Initiatives

India is strengthening its skill development ecosystem through targeted programs that align with industry needs and global trends. Initiatives like Skill India Mission, PMKVY, and National Apprenticeship Promotion Scheme focus on equipping youth with future-ready skills in sectors like AI, digital economy, renewable energy, and advanced manufacturing. Public-private collaborations and international partnerships are enhancing training quality and employability, ensuring a skilled workforce for India's economic growth.

Package of Schemes for Employment and Skilling

The government has introduced a comprehensive package of employment and skilling schemes to boost job creation and workforce readiness. Key initiatives include Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) for rural jobs, PM-DAKSH for marginalized communities, and Rozgar Mela for formal sector recruitment. Stand-Up India and Mudra Yojana promote entrepreneurship and self-employment, while Deendayal Antyodaya Yojana (DAY-NULM & NRLM) focuses on urban and rural livelihood enhancement. These schemes collectively aim to bridge skill gaps, generate sustainable employment, and empower India's workforce.

Skill Framework and Internship Programmes

India's tiered skill framework is designed to create a structured pathway for upskilling, reskilling, and new skilling, catering to different workforce levels. Internship programs play a vital role in this framework by providing hands-on industry experience, bridging the gap between theoretical learning and practical application. Initiatives like National Apprenticeship Promotion Scheme (NAPS) and AICTE internships enhance employability by integrating on-the-job training with skill development. The AI Skills Pyramid follows a three-tiered approach: the foundation level focuses on digital literacy and basic AI awareness, the intermediate level equips professionals with machine learning and data analytics skills, while the advanced level fosters expertise in deep learning, AI ethics, and AI-driven innovation. Government programs like FutureSkills Prime, AI for All, and PMKVY AI modules ensure that India's workforce is future-ready and globally competitive in the digital economy

PM Internship Scheme

The PM Internship Scheme aims to democratize experiential learning by providing hands-on industry exposure to students and young professionals. This initiative integrates learning with practical work experience, ensuring that individuals acquire job-ready skills aligned with industry demands. By promoting internships across diverse sectors, the scheme helps bridge the gap between academic knowledge and real-world applications, fostering innovation, employability, and entrepreneurship. With a focus on inclusive participation, it enables youth from all backgrounds to gain valuable insights, making them competitive in the evolving job market.

International Mobility and Cooperation

India is actively promoting the global mobility of its skilled workforce by aligning domestic skill development programs with international standards. Agreements with countries like Japan, Germany, the UAE, and Australia facilitate mutual recognition of skills, enabling Indian professionals to access high-quality job opportunities abroad. Programs like the Skill India International Centre and India-EU Mobility Partnership further support overseas placements, enhancing India's role as a global talent hub.

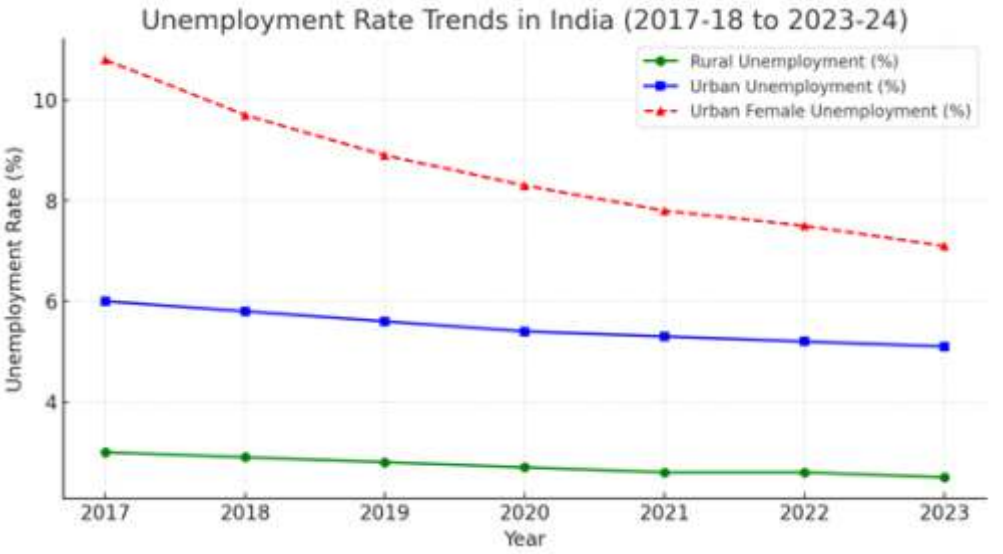
India is strengthening international cooperation through partnerships with global institutions and governments to enhance vocational training and industry-specific skills. Collaborations with organizations like WorldSkills, ILO, and OECD help in adopting best practices and ensuring skill certification meets global benchmarks. Bilateral agreements, such as the India-Japan Technical Intern Training Program (TITP) and India-UAE Skill Harmonisation, foster cross-border knowledge exchange, improving employability for Indian workers in high-demand global sectors.

A Critical Analysis

India's employment landscape has undergone significant transformations over the past two decades, driven by structural shifts in the economy and evolving labour market dynamics. Descriptive statistical analysis reveals a clear sectoral shift from agriculture to manufacturing and services, particularly in rural areas. Between 1998 and 2023, agricultural employment in rural regions declined from 755 to 510 per 1000 workers, while secondary and tertiary sector jobs grew substantially. Urban employment trends remained predominantly service-oriented, with 584 per 1000 workers engaged in the tertiary sector by 2023. The unemployment rate trends from 2017-18 to 2023-24 highlight persistent rural-urban disparities, with urban unemployment at 5.1% and rural unemployment at 2.5%, particularly affecting women.

Inferential statistical analysis underscores a strong correlation between skill development initiatives and employment trends. Programs like Skill India and PMKVY have contributed to reducing unemployment by equipping workers with industry-relevant skills. However, gaps remain, particularly in the inclusion of women in urban employment and the adaptation of workers to automation-driven job markets. Regression analysis suggests that an increase in vocational training participation is linked to lower unemployment rates, reinforcing the need for continued investment in skill development policies.

The visual representation below illustrates the unemployment rate trends across rural and urban areas from 2017-18 to 2023-24, showing the narrowing gap over time while highlighting persistent challenges for female employment.



The graph above illustrates the unemployment trends in India from 2017-18 to 2023-24. It highlights the persistent gap between rural and urban unemployment rates, with urban unemployment consistently higher. Notably, female unemployment in urban areas has remained significantly elevated, although it has declined over time. These trends emphasize the need for targeted policies focusing on skill development and gender-inclusive employment initiatives.

Impact of Skill Development Policies

A thematic analysis of qualitative reports, case studies, and interviews reveals that skill development policies in India have had a mixed impact on employment outcomes at both local and national levels. Programs such as Skill India, PMKVY, and the National Apprenticeship Promotion Scheme have improved workforce readiness, particularly in high-growth sectors like IT, manufacturing, and renewable energy. Case studies highlight successful upskilling initiatives in rural regions, where vocational training has enhanced employability and self-reliance, particularly among women and marginalized communities. However, interviews with industry stakeholders indicate persistent gaps between training curricula and industry demands, with employers often finding graduates lacking practical experience. Furthermore, challenges such as limited access to training in remote areas, low female participation in urban job markets, and inadequate post-training placement support hinder the full realization of these policies. While national-level reports suggest a positive trend in skill acquisition, local implementation disparities highlight the need for better infrastructure, stronger industry-academia linkages, and gender-inclusive training programs to maximize employment opportunities.

Implications for Policy and Economic Development in India

The evolving employment landscape in India underscores the urgent need for targeted policy interventions to foster sustainable economic development and enhance employability. As the country transitions from an agrarian-based economy to an industrial and service-driven workforce, skill development policies must align with emerging industry demands. Strengthening vocational education, expanding digital literacy programs, and promoting lifelong learning initiatives are crucial for bridging the skills gap. Additionally, gender disparities in urban employment highlight the need for policies that encourage female workforce participation, such as flexible work arrangements, mentorship programs, and financial incentives for women-led enterprises. Public-private partnerships can play a pivotal role in modernizing training infrastructure, integrating technology in skill development, and ensuring industry-relevant education. Furthermore, enhancing employment opportunities in renewable energy, digital economy, and advanced manufacturing will be key to sustaining job creation in the face of automation and technological disruptions. A holistic, inclusive, and future-oriented approach to workforce development will ensure that India's economic progress translates into meaningful employment opportunities for all segments of society.

Conclusion

India's employment landscape has undergone a significant transformation over the past two decades, shifting from an agriculture-dominated workforce to an economy driven by manufacturing and services. While unemployment rates have shown signs of improvement, regional and gender disparities persist, particularly in urban areas where female unemployment remains high. The impact of skill development programs like Skill India and PMKVY has been positive, yet challenges in industry alignment, accessibility, and post-training employment opportunities continue to limit their effectiveness. The rise of automation and digitalization further emphasizes the need for continuous upskilling and reskilling to ensure workforce adaptability. Going forward, a strategic focus on inclusive policies, vocational training, and industry partnerships will be crucial in harnessing India's demographic dividend. By bridging the skills gap, promoting equitable job opportunities, and fostering a resilient labour market, India can sustain economic growth and create a more inclusive and future-ready workforce.

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Spotlight

Neuromarketing in 21st century

Neuromarketing is a new and exciting field that combines neuroscience and marketing, helping businesses understand how the human brain influences consumer behavior. In markets where there are many choices, companies need new ways to understand what their customers really want in 21st century. Neuromarketing is becoming a powerful tool to help with this. It studies how people's brains respond to different products, ads, and experiences, helping companies make better decisions about what will attract and engage their customers.

Concept: Neuromarketing uses ideas from neuroscience, which is the study of the brain. It helps companies understand how people react to marketing messages, products, and ads. By studying the brain's response, companies can learn what catches people's attention and what they like. It does this by studying the brain's activity and looking at how people react emotionally to different products or ads. Scientists use tools like functional magnetic resonance imaging (fMRI) and electroencephalography (EEG) to see what happens inside our brains when we make decisions about buying things. This helps marketers see what works and what doesn't in a better way. Traditional surveys or focus groups often miss these deeper insights.

An example of neuromarketing is when Coca-Cola and Pepsi used brain scans to see how people's brains reacted to their drinks, revealing that branding influenced preferences more than taste.

Using tools like fMRI, which measures brain activity by detecting changes in blood flow, or EEG, which tracks electrical activity in the brain, marketers can see how a consumer's brain responds to a product or advertisement. These tools help determine whether something triggers a positive, negative, or neutral response. This data can be analyzed to understand what works best in grabbing attention, evoking emotions, or motivating people to buy.

The Future of Neuromarketing: As technology continues to evolve, neuromarketing is expected to become an even more important tool for businesses. Companies that embrace this approach will be better equipped to understand and meet their customers' needs. In a world where standing out is becoming more challenging, neuromarketing offers a way for businesses to connect with consumers on a deeper, more personal level.

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Evaluation of Quality of Rubrics Used in Technical Institutions of India

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Abstract

The valid, reliable, and transparent assessment is gaining importance in 21st-century higher education. Rubrics are versatile educational and assessment tools used for self-assessment, peer assessment, and assessment by the course teacher to improve the learning process and learning outcomes. The quality of assessment depends on the quality of assessment tools used. An evidence-based study was conducted to evaluate the quality of the rubrics on scientifically derived criteria. 50 rubrics were gathered from faculty members working in different technical institutions in India. The rubrics are evaluated on scientifically derived criteria. 62 per cent of rubrics do not mention learning outcomes. Most of the rubrics prepared are used for summative evaluation, which is holistic in nature, and some are prepared for project work assessment. The overall quality of rubrics on scientifically derived criteria is moderate, which means the validity of the rubrics for assessment is in question. The study is limited to rubrics drawn from technical programmes and the sample size is small. The study contributed to developing scientific criteria for evaluating rubrics, reporting the current quality of rubrics being used, and providing direction for designing valid and reliable rubrics in outcome-based education.

Keywords: Assessment criteria, descriptors, learning outcomes, levels, rubrics, reliability, validity,

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Introduction

The assessment of the attainment of learning outcomes is vital for improving the learning, development, and transformation of learners. In criterion reference assessment, valid and reliable assessments are mandatory to certify the attainment of learning outcomes. The validity and reliability of assessments are essential in formative assessment for providing objective feedback to learners to improve learning, formulate higher levels of learning outcomes, and achieve the same. In multidisciplinary education, learner-centric approaches, self-determined learning, and self-learning through online and distance mode assessment and feedback rubrics are used to improve learning and learning achievements. The quality of the rubrics plays a significant role in determining the accuracy of the assessment and the effectiveness of feedback. It is proved through various studies that rubrics improve the quality of the instructional process and learning of students in higher education (Reddy & Andrade, 2010; Robert et al., 2017; Chowdhury, 2019; Vercellotti, 2021; Gupta & Gupta, 2021; Gupta & Gupta, 2024). Rubrics enhance reliability in assessment among raters and clear expectations of the course teachers to students (Farrag, 2020). The poorly designed, vague, and subjective rubric may be a frustrating experience for the learners and assessors. The weak design of the rubric is related to questioning its validity; as stated by Reddy & Andrade (2010), the validity of the rubrics needs to be studied more. It may waste time, effort, and energy and limit learning in some situations. The literature review is carried out to generate criteria for analyzing the quality of rubrics.

Literature Review

A literature review was conducted to evaluate the quality of rubrics and related assessment areas. A brief account of the review is given below:

- Gupta and Gupta (2024) emphasized rubrics for developing and assessing core and critical terminal course outcomes, which significantly contribute to the achievement of programme and programme-specific outcomes. They reported that using rubrics for various purposes is low and needs to be enhanced.
- Benjamin et al. (2024) concluded that clarity and specificity of rubric descriptors are major concerns while developing the rubrics.
- Teresa (2023) stated that rubrics are intentionally and carefully designed in light of the learning outcomes. Rubrics incorporate criteria and descriptors that help students integrate learning and processes centred on developing sustainable and lifelong learning skills.
- Gupta & Gupta (2021) stated that rubrics are used as self-learning, peer learning, group learning and assessment tools. These are used as formative and summative assessment tools. These are used in decision-making to improve the policies related to curriculum design, instructional strategies and assessment.
- Doug et al. (2021) stated the importance of feedback rubrics over analytical rubrics, as feedback rubrics help learners know their progress and improve their learning. These are adaptable rubrics to develop process skills in the learners.
- Ahmet and Selcuk (2020) developed a rubric that checked for content and construct validity and then used it for evaluating 3-D printed prototype performance.

- Shah et al. (2020) described the process of rubric development to assess teaching portfolios using a pedagogical competence framework. The steps used are identifying criteria, defining the levels of evaluation, and measuring the reliability of rubrics.
- Suryanti and Nurhuda (2021) concluded through a quasi-experimental study on problem-based learning using analytical rubrics enhances critical thinking skills.
- Vercellotti (2021) stated that rubrics are more quality-focused, and they distinguish the quality of performance, separate scores for each criterion, and describe performance levels.
- Noll et al. (2021) concluded that rubrics with ten levels and yes no type of rubrics are consistent in assessment, but yes no type of rubrics consumes more time than 10-point rubrics.
- Mahmood and Jacobo (2019) proposed the concept of a sliding rubric to motivate the students to learn and demonstrate their learning. The sliding rubric is used for self-learning, peer learning and feedback to improve the learning.
- Zenobia & Ho (2019) concluded through a qualitative study that the best practices in rubrics are standardization of evaluation, objectiveness in evaluation, guidelines for students' work, and transparency in evaluation. Authors have noted bad practices in rubrics viz. vague description in marking rubrics and failure to provide a range of marks.
- UGC (2019) stated that developing rubrics includes identifying learning outcomes, deciding criteria based on learning outcomes, selecting performance levels, and writing descriptors.
- Chowdhury (2019) describes rubric concepts, types, and purposes in instructional process and assessment. The author stated that the design of the rubric should be such that when it is used, it should not give different interpretations.
- Tomas et al. (2019) concluded that holistic and analytical rubrics offer promising and productive learning to improve marks concerning criteria.
- AICTE (2018) recommended using scoring rubrics as a powerful tool for assessment and grading, a transparent and inspiring guide to learning, communicating expectations in assessment and important to assessment.
- Brookhart (2018) stated that appropriate criteria are the key and should be substantive. The number of criteria varies in rubrics, but three, four, and five levels are used.
- David (2018) concluded that rubrics are effective and impactful, as perceived by students. Female students find it more impactful than male students.
- Francis (2018) concluded that rubrics produce better results in the performance of the students when these are discussed with students and used for marking purposes along with additional learning resources.
- Dawson (2017) stated rubric design elements viz specificity, secrecy, exemplars, scoring, evaluative criteria, quality levels, quality definitions, judgement complexity, users and uses, quality processes, feedback information, presentation and explanation.
- Chen & Zhang (2017) concluded through experimental research that students' attitudes are positive toward using rubrics for learning and assessment; rubrics improve students' meta-cognitive awareness and learning achievements.
- Robert et al. (2017) established a model of using scoring rubrics by students for self and peer assessment and by the teacher for diagnostic and feedback

purposes, and using a dialogue approach between the teacher and students enhances the self-regulation and self-efficacy of the students, which results in improved performance.

- Company et al. (2017) developed a web-based system for adaptable rubrics, which involves creating and modifying the rubric and using it for assessment and feedback. The assessment data are also available in the system, which may be analyzed, and the design of the rubrics may be improved.
- UNC (2017) stated the steps of creating the rubric, viz. review learning outcomes where rubrics can be used, identify student work through which achievement of learning outcomes can be assessed, derive the performance criteria, identify the scale or levels, determine the minimum threshold for successes, and pilot the rubric. An example of a rubric on the rubric is given in the document in which three criteria, viz. selection and clarity of criteria, distinction between levels and quality of writing, are stated. Three levels are used for each criterion viz acceptable, developing and unacceptable.
- Simona & Fitzgerald (2013) concluded that using rubrics significantly improved the scores in literature class assignments. The inclusion of rubrics in the teaching-learning process enhances the competence of teachers as well as students.
- Wolf & Stevens (2007) stated that performance criteria, performance levels and descriptors are the essential components of rubrics. The performance criteria are derived from the learning outcomes. They stated that the assessment is valid and reliable when rubrics are used. They stated that rubrics clarify the learning outcomes and guide the instructional process. The assessment process is accurate and fair. Rubrics are used as tools for self and peer assessment and advance the student's learning.
- Through empirical research, Anders & Svingby (2007) concluded that rubrics enhance the reliability of performance assessment, facilitate valid assessment using a comprehensive framework, and promote learning.
- Silvestri and Oescher (2006) stated that rubrics enhance the reliability of assessment and are helpful in developing students' intellectual capabilities.

Discussion on literature review

The purposes and benefits of using rubrics compel teachers, students, and peer learners to use the rubrics for various educational purposes. Rubrics are measurement tools for learning progress and achievement of learning outcomes. The design aspects of measuring tools are crucial, viz., the quality of measuring tools used to achieve many claimed purposes. Quality of design of the rubrics and scientific method to use it, viz., use of the right tool in the right way at the right time by the right person. We could not find any study which addresses the issue of the quality of rubrics. We have formulated the problem to evaluate the quality of the rubrics being used in higher education institutions in the context of outcome-based education and provisions of National Education Policy 2020 (MHRD, 2020). The research questions are as follows:

Research Questions

1. What is the level of quality of learning outcomes stated in the rubrics?
2. Does the rubric design align with learning outcomes?
3. What was the purpose of preparing the rubrics?
4. Which types of rubrics are prepared?
5. Which domains of learning outcomes are assessed using rubrics?
6. What is the quality level of rubrics?
7. How many performance criteria are used in rubrics?
8. What is the quality of articulation of the performance criteria?
9. Do different criteria have different weights?
10. How many performance levels are used in rubrics?
11. What is the quality of articulation of performance levels?
12. What is the quality of articulation of performance descriptors?
13. Does the rubric contain instructions for users?

Methodology

An evidence-based study is used to achieve the stated research objectives. An evaluative approach is used to assess the quality of the rubrics prepared and used in technical education by course teachers. The study is completed in four phases, as stated in Figure 1. The evaluation is done manually using pre-decided rubric quality evaluation criteria, as reported in the results. The rubric quality evaluation criteria are derived from the literature review and are available in scattered form in different articles. These are derived from articles on rubrics with different themes such as good rubric and bad rubrics (Zenobia & Ho, 2019), quality of rubrics (Grainger, 2021; Vercellotti, 2021), the process of developing good rubrics (UNC, 2017; Teresa, 2023; Shah et al., 2020), validity and reliability of rubrics (Silvestri & Oescher, 2006; Anderson, 2007; Ahmet & Selcuk, 2020), use of rubrics for various purposes (Gupta & Gupta, 2024) appropriate and substantive criteria (Wolf & Stevens, 2007; Brookhart, 2018) rubric descriptors quality (Benjamin et al., 2024, Noll et. al, 2021), rubric design elements (Dawson, 2017). The rubrics considered for evaluation are those provided by willing teachers in the last five years.

Figure 1. Research Methodology

Results and Discussion

The total number of 50 rubrics from undergraduate engineering disciplines such as computer, civil, electrical, electrical and electronics, mechanical, chemical, and architecture are analyzed for their quality concerning learning outcomes. Out of 50 rubrics, 15 were prepared for students' project work, and one rubric was for industrial training. The remaining 34 rubrics were prepared for assessing learning outcomes different from project-related outcomes.

Quality of learning outcomes

The quality of the rubric is decided based on the quality of stated learning outcomes (LOs). The articulated learning outcomes are stated in measurable and observable terms. The rubric should be a suitable assessment tool to assess the achievement of learning outcomes by the students accurately. The analysis of 50 rubrics on the quality of learning outcomes is shown in Figure 2.

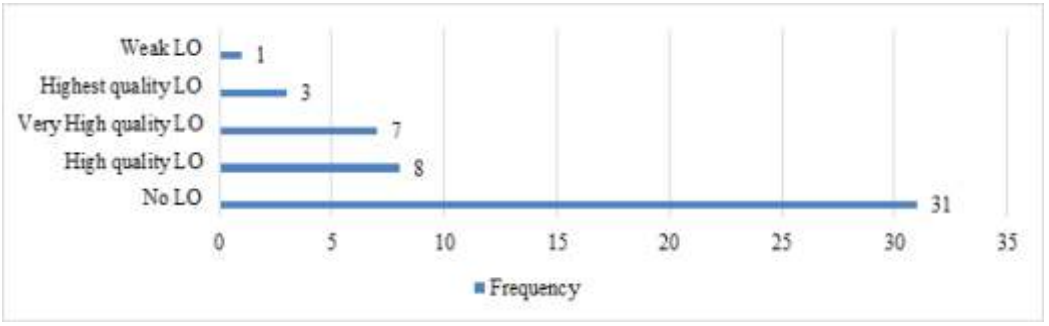

Figure 2. Quality of Rubrics

Source: Authors

62 per cent of rubrics have not mentioned learning outcomes. Therefore, it is challenging to measure the validity of the rubrics. In other words, the alignment of the rubrics with the learning outcomes can not be established. In the remaining rubrics, the learning outcomes are formulated using covert verbs, weakly articulated statements, vague and subjective statements, and levels of verbs are process-related. In two rubrics, learning outcomes are simply the extrapolation of content. The learning outcomes related to by-product learning out of pedagogy are not stated in any of the rubrics in which learning outcomes are stated.

Alignment of rubrics with learning outcomes

The alignment of most of the rubrics with the learning outcomes is moderate, where learning outcomes are stated. As the learning outcome quality is moderate, the moderate alignment of the design rubrics further dilutes its quality.

Purpose of preparing the rubrics

All the rubrics are prepared for summative evaluation of learning outcomes, and one rubric is prepared for summative and formative assessment of learning outcomes. It is inferred from the rubrics that they need to be prepared with a purpose to be used for self-assessment, peer assessment, and feedback.

Type of rubrics prepared

47 rubrics are holistic, one rubric is analytical, and two rubrics are grading rubrics. 47 rubrics are prepared for marking, and two are for grading purposes. The observational, feedback, and other type of rubrics need to be prepared.

Assessment of domain-specific learning outcomes rubric

The domain-specific distribution of assessment rubrics is shown in Figure 3. 62 per cent of rubrics are prepared for assessing the learning in all three domains of learning. 22 per cent of rubrics are prepared for assessing the learning outcomes in two learning domains, and 16 per cent are prepared for assessing the learning outcomes in only one domain. In each educational programme, there are critical learning outcomes in a single domain of learning that need to be assessed using rubrics.

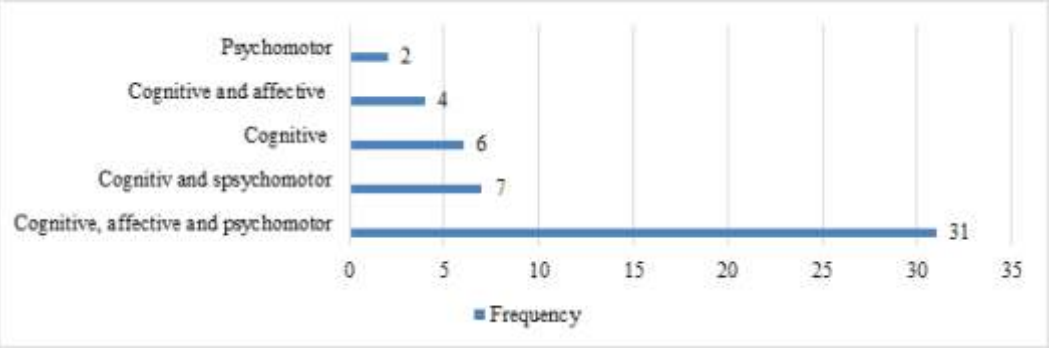

Figure 3. Domain-specific assessment rubrics

Source: Authors

Quality of Rubrics

The quality of rubrics was analyzed on three quality criteria viz quality of performance criteria, quality of performance levels and quality of performance descriptor on a four-point scale, four being the highest, three - very high, two - high and one - poor. As shown in Figure 4, out of fifty rubrics, none was rated highest on any of the three criteria used for analyzing the quality of the rubrics. Reddy and Andrade (2010) stated that the validity of rubrics depends on the clarity and appropriateness of language used in criteria, levels and descriptors. Gupta (2023a) stated that in the context of the national education policy 2020 and formative assessment, the assessment process should be holistic, valid, reliable, transparent and credible. The proper selection of the format of the rubric enhances the validity.

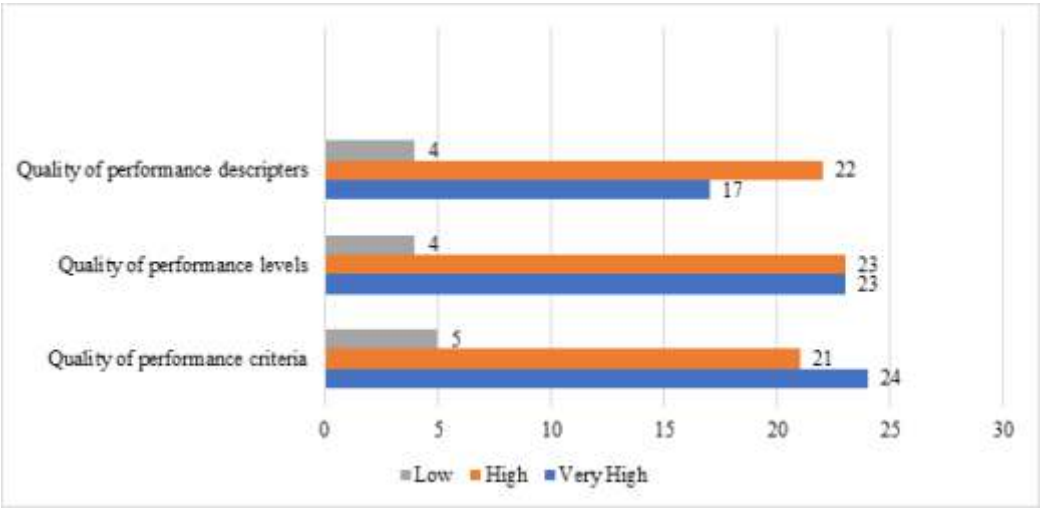

Figure 4. Quality of rubrics

Source: Authors

Number of criteria used in rubrics

Rubrics are prepared in matrix or tabular form in which the first column indicates the broader assessment criteria. As shown in Figure 5, 72 % of rubrics used 5-8 criteria, which are manageable for learning and assessment. The remaining 28% rubrics may not be manageable when the one-time assessment is carried out using more than eight criteria and with three levels of performance indicators. It becomes difficult for the rubric designers to articulate more than 24 accurate performance descriptors. Wolf and Stevens (2007) stated that three to six performance criteria are best for calculating scores with different weights. Chowdhury (2019) stated that 3 to five levels of performance are adequate for assessing performance. Gupta (2023b) stated that holistic rubrics may have five to ten criteria. As shown in Figure 3, 48 per cent of rubrics were rated as having very high-quality performance criteria, i.e., at level three on a four-point scale.

Articulation of the criteria

The criteria are stated in observable and measurable (quantity, quality and time) form and not in vague form. The criteria are articulated following rules such as clear, distinct, observable, measurable, significant, substantial, and threshold. In our study, we found that most of the criteria need to be professionally articulated following the rules.

Weightage is given to criteria

Different weightage is given to different criteria considering their importance in learning outcomes. In ten rubrics, different weights are given to different criteria to show the importance of a significant few criteria from trivial ones. Wolf & Stevens (2007) recommended 'having different weights to different performance criteria to assess the core performance with more weightage'. The differential weightage enhances the validity of the rubric for summative assessment.

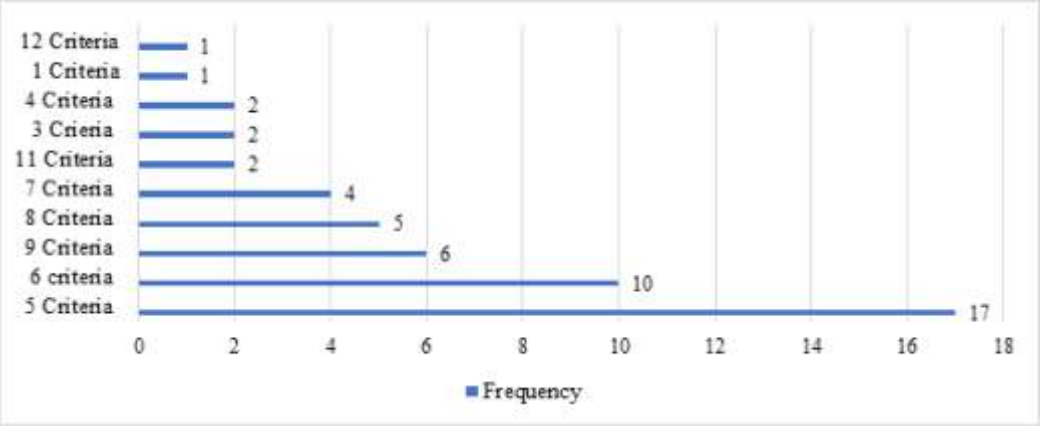

Figure 5. Number of criteria used

Source: Authors

Number of levels used in rubrics

As shown in Figure 6, 86 per cent of rubrics used four to five performance levels. The number of levels describes the precision level in measuring and assessing a particular criterion. At the same time, the increase in the number of levels creates more challenges for the rubric designers and users to observe performance on a particular criterion and record it correctly. It requires more time and effort from rubric designers and assessors. The number of performance levels in the rubric also indicates the level of proficiency in a particular criterion to be measured. For assessing critical and core learning outcomes in an educational programme, the levels may be more than three and may go up to seven. Wolf & Stevens (2007) stated that 'more levels are used when the purpose of the rubric is to produce learning and offer feedback for improvement'. The more criteria and levels are used in rubrics for self-assessment, peer assessment, and assessment in online and distance learning programmes where the purpose of the rubric is to develop learning outcomes and proficiency. Rubrics used in summative assessment incorporate only terminal performance criteria, also called threshold criteria (UNC, 2017) and levels. Therefore, the criteria and performance levels are less for summative assessment rubrics, as Wolf & Stevens (2007) suggested.

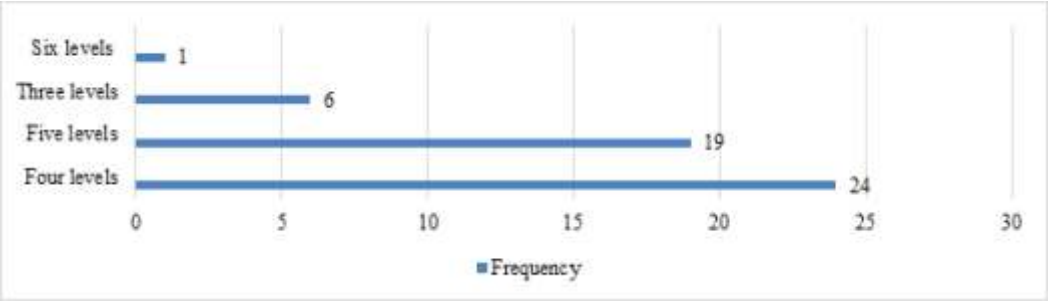

Figure 6. Number of levels in rubrics

Source: Authors

Articulation of performance levels in the rubrics
The micro-level performance or level of proficiency on particular criteria is measured and assessed using the level of performance or stage of learning concerning criteria. Different levels differentiate levels of performance and proficiency. The levels in most of the rubrics are not distinct and appropriate.

Articulation of performance descriptors
Descriptors are stated in measurable, specific, and unambiguous terms. In most of the rubrics, the descriptors are subjective and need to be more clearly articulated. The clearly articulated descriptors could be more helpful in objectively and precisely measuring the achievement of learning outcomes. It indicates that, in a real sense, it is not a rubric but a rating scale.

Instructions to users
No rubric contains instructions to users, experiences of using a particular rubric, validity, reliability, conditions under which it should be used, and purpose of the rubric.

Conclusion

The quality of rubrics used in technical institutions to assess achievement of learning outcomes achieved by students is moderate on alignment of rubrics with learning outcomes. Rubrics are prepared for summative evaluation and not for formative assessment. It means the power of rubrics to motivate the students to learn based on the learning outcomes and criteria of assessment and producing learning needs to be harnessed fully. The potential of rubric for assessing the learning in all three learning domains is used only partially. The quality of rubrics is moderate on performance assessment criteria, levels, and descriptors, which threatens the validity and reliability of the rubrics for assessment and evaluation, especially in summative evaluation. No instructions to use the rubrics are recorded, which means the other assessors may not use them scientifically, resulting in repetitive efforts made by different assessors to develop rubrics for different batches of students to assess the same learning outcomes.

Limitations of the Study

The study is based on the rubrics collected from willing faculty members working in technical institutions across India. This study may be considered a purposive sample study, so it inherits the limitations of a purposive study. The sample size is small, so it may not be an accurate representation of the population. The results of the study should be used cautiously. The rubrics are evaluated by researchers who may need more expertise in the evaluation of rubrics.

Practical Application

The criteria derived from the literature and experiences of the researchers may be used to evaluate the quality of the rubrics to enhance their validity and reliability before they are used to assess the achievement of learning outcomes by the students.

The evaluation of rubrics before they are used to assess the achievement of learning outcomes by students will prevent potential conflict, complaints, and disputes related to the validity and reliability of the rubrics. Suppose the rubrics are used to learn higher levels of learning outcomes. In that case, the evaluated rubrics using the criteria mentioned in this paper will motivate the students to use the rubric to achieve intended learning outcomes. The criteria derived in this study will guide the rubric developers in developing the rubric scientifically to ensure its quality. The criteria developed in the study will guide the assessors in selecting the correct rubric from the rubric bank for assessing the student's learning outcomes.

The researchers in the field of measurement, assessment, and evaluation of achievement of learning outcomes may further refine the rubric evaluation criteria through empirical and action research studies. The criteria for rubrics evaluation may be used to generate guideline documents to develop quality rubrics at institute levels and maintain uniformity.

Declaration of Conflicting Interests

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The Moderating Role of Training Environment on the Causal Chain relationship among Factors, Levels, and Effectiveness of Training

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Abstract

Training effectiveness (TE) can be defined as the evaluation of the influence that training has on learners' knowledge, skills, and performance. The objective of this paper is to study the moderating effect of level of Training Environment on the Factors of Training Effectiveness grounded on Kirkpatrick's model levels, on the primary data collected from 357 beneficiaries of PMKVY scheme. Using Jamovi 2.3.13, a prominent Free Open-Source Software (FOSS) data analytics tool the required analysis were performed. Exploratory factor analysis (EFA), was conducted to identify and extract nine (09) factors related to training effectiveness (TE). A basic linear regression analysis was conducted to predict the TE based on Levels of training effectiveness: *Reaction, Learning, Behaviour, and Results. The level of Training Environment,* specifically in the PMKVY programme, acts as significant moderator in the relationship between various factors and the levels of TE as shown by this study.

Keywords: Training Effectiveness, Kirkpatrick (1959) model, PMKVY Training, Training' Environment, Factors of Training Effectiveness, Moderating role of Training Environment, Chain relationship, Training Factors, Training Levels, PMKVY Scheme in Sikkim, Training Quality

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Introduction

In the present 21st era of knowledge and technology development, training has emerged as a crucial factor in the advancement of human resources inside public and commercial organisations. The provision of managerial skills training, particularly in time management, has demonstrated its efficacy in enhancing the organisational and performance capabilities of managers and executives. Evaluation of training is a procedure that involves analysing the training to determine whether the training's goals were accomplished in an efficient and effective manner. Training improves organisational commitment, job performance, morale, knowledge, skills, work environment, problem-solving skills, and confidence. Training has evolved into strategic training, supporting long-term organisational goals. *The Pradhan Mantri Kaushal Vikas Yojana (PMKVY)* programme is a promising initiative by the Government of India to provide employment to millions of young people who have abilities that have been concealed from view and entrepreneurial talent that has yet to be discovered. The PMKVY scheme's goal is to develop aptitude towards employable skills and to boost working efficiency of potential and existing daily wage earners by providing monetary awards and rewards as well as excellent training. According to Kirkpatrick (1959), evaluation has four levels. *The levels are reaction, learning, behaviour, and results in order.* The first level, the Reaction level, refers to trainees' subjective evaluation of training relevance and quality. Kirkpatrick suggests evaluating every programme at this stage to improve programmes for training. Evaluation assesses satisfaction among those who participated in the course. The impact of training on participants' attitudes, knowledge, and abilities can be measured as learning. A third evaluation level involves modifications in job behaviour or performance. This involves examining how training affects job behaviour. Level four evaluation evaluates training based on organisational outcomes.

Review of Literature

(Sanjeevkumar V. , 2011) through his study shows that the training environment, the work environment, and the characteristics of the employees are all related to the effectiveness of the training that is provided by the Kedah State Development Corporation Company. It was observed that the training environment was the most important factor in determining the effectiveness of training in Kedah State Development Company *(Hajjar & Alkhanaizi, 2018).* identifies a strong, straight-line link between the five factors (training content, presentation styles, training schedule, facilities and supplies, and training environment) and how well training worked. This finding helped the people in charge of training make plans for the programmes. Trainers and instructional planners may also be able to figure out what makes training programmes work by making the most of the output based on the learners' learning abilities and skills. *(Vembar, Amritharaj, & Vanathi, 2014)* investigated hotel sector training and development practises and how demographic and environmental factors affect effectiveness. The type of hotel, working department, training attendance status, experience, and style of training all affect hotel training efficacy. Industry Associations are the top environmental elements affecting hotel training and development. *(Rinku & Rani, 2021)* sought to define the role of PMKVY in developing

employability skills and discovered that the majority of PMKVY training centres are covered under category E, which refers to training centres that do not qualify for performance-based goal reallocation. The percentage of PMKVY training centres that fall under category E is largest in Haryana. *(Sharma & Khandelwal, 2020)* examined PMKVY's concept, components, and sector performance. The goal was to maximise PMKVY. Only PMKVY Recognition Prior Learning and Short-term Learning programmes were studied. The results showed significant differences between sectors and a lack of uniform resource distribution for training. *(Lin & Shariff, 2008)* used Kirkpatrick's model to identify whether the objectives of the training have been met or not. When investing in training, it is important to examine factors that contribute to its effectiveness. The objectives of the paper are to evaluate prior literature and identify factors affecting training efficacy and outcomes. This research focuses on Malaysian Semiconductor Wafer Fabrication Companies. The study uses Participant, Trainer, Training material, Training program, Training material, Organization, working environment, Technology as the factors that affects the levels of training effectiveness. Results shows Training program, Organization and Technology does not affect the Reaction Level of Training Effectiveness. Training material, working environment, Technology does not affect the Learning level of Training Effectiveness. Participants and Training Program does not affect the Behaviour level of Training Effectiveness. Participants, Training material, Training program does not affect the Results level of Training Effectiveness. Trainer traits impact the effectiveness of training. This study reveals that trainers keep classes active and learning. *(Diamantidis & Chatzoglou, 2012)* identifies training parameters that most impact trainees' learning and training usefulness. A novel study approach examines trainer performance, training programme components, learning outcomes, and training usefulness. Using data from 126 employees who participated in different training programmes, structural equation modelling is used to verify this model's validity. Trainer performance, training environment and goals, content, material, and process all affect learning results and training usefulness. *(Choi, Lee, & Jacobs, 2015)* conducted the study with the intention of determining the hierarchical linear relationship that exists between structured on-the-job training (S-OJT) activities, trainee characteristics, trainer characteristics, training environment characteristics, and organisational characteristics of workers in small and medium-sized enterprises (SMEs).

The term "physical training environment" (or "PTE") refers to an environment that is related to the various physical resources that are required to achieve a particular training aim.

According to the findings of this research, a planned training environment is the type of physical training setting that influences S-OJT activities. Creating a planned training environment involves methodically organising the specifics required for the S-OJT activities to occur, such as the training venue, tasks, modules, and performance indicators – all of which are defined prior to the actual execution of the S-OJT. This will result in the production of a training environment that is conducive to planned training.

(Orpen, 1999) investigates the links between an organization's training environment and its employees' attitudes and behaviours towards the training they were offered. Participants also reported their levels of interest in the training and their opinions on the effectiveness of their employers' training programmes. Only three of the eight links between individual factors and results were statistically significant, but eight between organisational factors and results were all significant. The findings are seen as evidence that organisational factors, such as the availability of resources, the presence of training incentives, and the significance of the training's need, are more important than the characteristics of the learners themselves*. (Venkatesh, 2000)* evaluates two training techniques for teleworkers to enhance their IT skills. Research indicates that game-based training enhances user motivation and increases their propensity to use the technology. This is crucial for improving team and individual telework efficiency and reducing social isolation.

(Jeanne & Cellar, 1998) The impacts of a diversity training session on self-perceptions of behaviour and importance of associated management practises among 99 middle managers in a multinational firm were explored. It also compared environmental and training criterion variables. Hypothesised that the workshop would improve behaviour and importance ratings and that work and social settings would influence training outcomes. Environmental variables were analysed to evaluate their direct or indirect impact on training criterion variables. The workshop participants rated diversity management practises as more important and perceived themselves as engaging in them more than a control group. The social environment variable indirectly influenced post-test assessments of diversity-related management practises and self-perceptions of behaviour by affecting beginning levels, but the work environment measure was not connected to the criteria variables. According to the model of the transfer process developed by *(Baldwin & Ford, 1988)* Baldwin and Ford (1988), learner characteristics, training design, and the work environment each play a crucial role in learning and retention, and as a result, in the generalization and maintenance of learning after it is transferred back to the job.

The work environment can significantly impact the effectiveness of training. This can motivate trainees to attend, participate, learn, and use new skills and information on the job. Alternatively, it may deter trainees from implementing new methods at work. Research indicates that the work environment, including organizational climate and supervisor and coworker reinforcement and feedback, significantly impact skill transfer from training to the workplace *(Daniel, 1985); (Huczynski, 1980); (Komaki, Banvick, & Scott, 1978); (Rouiller & L, 1993); (Marx, 1982). (Byerly, Worrell, Gahimer, & Elizabeth, 1994)* findings supported Fisher et al.'s finding that environmental circumstances had the least impact on adherence. The setting should suit the athlete's needs. The issue pertains to scheduling and support from others. When the sports training room is overcrowded, athletes may not receive personalized care. A survey found that 56% of Certified Athletic Trainers and 74% of athletes feel that training room environment impacts rehabilitation adherence.

Training Enviroment

The training environment refers to the conditions of the medium where the curriculum is conducted. *(Sanjeevkumar & Yanan, 2011)* suggest that effective training requires clear sound, appropriate lighting, necessary hardware and devices, site organisation, and other resources. The learning environment connects learning to the designated region. It includes design, structure, content, control, and how to apply these foundations for learning. Assessment is based on trainee reactions in Level 1 of Kirkpatrick's evaluation model, along with aspects such as presentation methodology, trainer, materials, and audio-visuals. *(Niwaz & Muhammad, 2011)* suggest that a program's instructional activity can be evaluated based on factors such as classroom convenience, chair organisation, and access to water, toilets, and fresh air. Research indicates that the training environment significantly impacts training efficacy in any organisation. It also had a functional control over trainees' predicted results. An effective link was found between the training setting and work environment as independent variables and training effectiveness as dependent variable. When creating objectives, it is crucial to identify all factors that may impact results to increase the likelihood of programme success *(Sanjeevkumar V. , 2011).* Research indicates that establishing a training plan might positively impact effectiveness and learning results *(Chukwu, 2016).* All organisations aim for training programme quality. High-quality training needs attention to all programme features, including venue setup.

Gap of the Study

Training environment plays a very important role in making training effective. Poorly planned training environments can hinder participant engagement *(Lendahls & Oscarsson, 2017).* Limited research exists on the impact of environmental factors on training effectiveness, including lighting, brightness, colour, angle, sound clarity, level, echo, and noise sources *(Shabha & Gaines, 2013).* Effective implementation of training programmes relies on this essential component. Training environment creates positive learning atmosphere; therefore, it is important to investigate the influence of *level of Training Environment* of PMKVY training programs on the levels and factors of Training Effectiveness.

Objectives of the Study

The presents study aims to identify the casual chain relationship among training factors, training levels and training effectiveness with reference to level ***of Training Environment*** as a moderator.

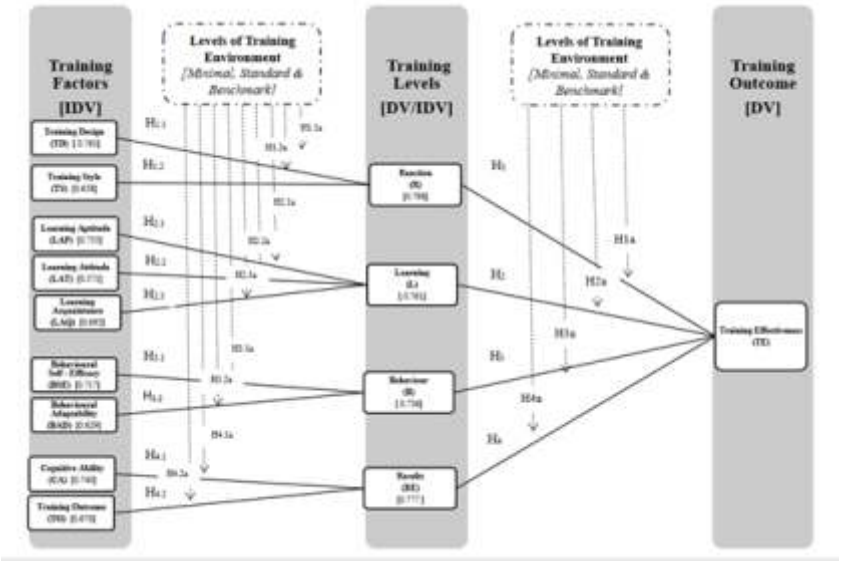
Research Methodology

The study is based on a primary sample survey of 357 PMKVY respondents from the four Sikkim districts. It depicts 21 individuals from each of 17 PMKVY job roles. The data collected is from the period of 2017 to 2022. The researcher uses a standardised

structured pre-tested questionnaire to collect the data. Basic institutional / demographic data about the training centres and respondents are also needed, as well as ten (10) qualitative statements to assess each level of training effectiveness (Reaction, Learning, Behaviour, and Results) and fifteen (15) qualitative statements to assess the PMKVY trainers' expertise using a 5-point Likert scale. The data is than entered an electronic spreadsheet for basic data cleansing, coding, and assessment. Factor Analysis has been performed and the factor scores generated were not normal distributed, hence have been normalized for the study (Table 2). A simple linear regression has been used to predict the dependent variable based on the independent variables. Further moderation analysis has been used to determine the influence of level of training environment on the training levels and training factors of Training Effectiveness. Based on the summative scores, trifurcated into the different ordered levels such as Minimal (< Mean – 1SD), Standard (< Mean – 1SD to > Mean + 1SD) and Benchmark (> Mean + 1SD) by using the visual binning feature in IBM SPSS.

Result and Discussion

The conceptual model 1.0 shows the training factors, training levels and training outcome. The model includes reliability test results. Training effectiveness is measured using **Kirkpatrick's- Four Level Training Evaluation Model**. The model is divided into four training levels namely Reaction, Learning, Behaviour and Results. Using exploratory factor analysis, the following given factors have been obtained at different training levels. Regression analysis have been performed to see the influence of predictor on the dependent variable. Level of training environment has been taken as the moderator.



Source: *Model Computed by the author adopting Kirkpatrick's- Four Level Training Evaluation Model*

Regression Analysis Results

As shown in (refer to Table 3), the R-square value is 0.472, indicating that the independent variable, Reaction, accounts for 47.2% of the variation in the dependent variable, Training Effectiveness. The ANOVA analysis reveals a p-value of 0.000, which is below the significance level of 0.05. Therefore, we conclude that there is a statistically significant link between Reaction and Training Effectiveness. The beta value of 0.687 indicates that a one unit change in Reaction will result in a 0.687 unit change in Training Effectiveness. In addition, the beta value is positive, indicating a positive correlation between Training Effectiveness and Reaction. To clarify, an increase of one unit in Reaction will result in a corresponding rise of 0.687 units in TE.

As shown in (refer to Table 3), the R-square value is 0.576, indicating that the independent variable, Learning, accounts for 57.6% of the variation in the dependent variable, Training Effectiveness. The ANOVA analysis reveals a p-value of 0.000, which is below the significance level of 0.05. Therefore, we conclude that there is a statistically significant association between Learning and Training Effectiveness. The beta value of 0.759 indicates that a one-unit change in Learning will result in a 0.759 unit change in Training Effectiveness. In addition, the beta value is positive, indicating a positive correlation between Training Effectiveness and Learning. To clarify, a one unit increase in Learning will result in a corresponding rise of 0.759 units in Training Effectiveness.

As shown in (refer to Table 3), the R-square value is 0.620, indicating that the independent variable, Behaviour, accounts for 62.0% of the variation in the dependent variable, Training Effectiveness. The ANOVA results indicate a statistically significant link between Behaviour and Training Effectiveness, as evidenced by a p-value of 0.000, which is below the threshold of 0.05. The beta value of 0.787 indicates that a one-unit change in Behaviour will result in a 0.787-unit change in Training Effectiveness. In addition, the beta value is positive, indicating a positive correlation between Training Effectiveness and Behaviour. To clarify, a one-unit rise in Behaviour will result in a corresponding gain of 0.787 units in Training Effectiveness. As shown in (refer to Table 3), the R-square value is 0.648, indicating that the independent variable, Results, accounts for 64.8% of the variation in the dependent variable, Training Effectiveness. The ANOVA analysis reveals a p-value of 0.000, which is below the significance threshold of 0.05. Therefore, we conclude that there is a statistically significant link between Results and Training Effectiveness. The beta value of 0.805 indicates that a one-unit change in Results will result in a 0.805-unit change in Training Effectiveness. Moreover, the beta coefficient is positive, indicating a positive correlation between Training Effectiveness and Results. To clarify, an increase of one unit in Results corresponds to an increase of 0.805 units in Training Effectiveness.

According to the data presented in Table No. 3, the R-square value is 0.502. This indicates that the independent variable, Training Design, is responsible for causing a 50.2% change in the dependent variable, Reaction. The ANOVA analysis reveals a p-value of 0.000, indicating a statistically significant association between Training Design and Reaction. The beta value of 0.709 indicates that a one-unit change in

Training Design will result in a 0.709 unit change in Reaction. In addition, the beta value is positive, indicating a positive correlation between Reaction and Training Design. To clarify, an increase of one unit in Training Design corresponds to a 0.709 unit increase in Reaction. According to the information provided in Table No. 3, the R-square value is 0.337. This indicates that the independent variable, Training Style, is responsible for a 33.7% change in the dependent variable, Reaction. The ANOVA findings indicate that the p-value is 0.000, which is below the significance level of 0.05. Therefore, we conclude that there is a statistically significant link between Training Style and Reaction. The beta value of 0.581 indicates that a one-unit change in Training Style will result in a 0.581 unit change in the outcome. Moreover, the beta coefficient is positive, indicating a positive correlation between Reaction and Training Style. To clarify, a one-unit rise in Training Style corresponds to a 0.581 unit increase in Reaction.

According to the information provided in Table No. 3, the R-square value is 0.346. This indicates that the independent variable, Learning Aptitude, is responsible for a 34.6% change in the dependent variable, Learning. The ANOVA findings indicate that the p-value is 0.000, which is below the significance level of 0.05. Therefore, we conclude that there is a statistically significant association between Learning Aptitude and Learning. The beta coefficient is 0.588, indicating that a one-unit change in Learning Aptitude will result in a 0.588-unit change in Learning. In addition, the beta value is positive, indicating a positive correlation between Learning and Learning Aptitude. To clarify, an increase of one unit in Learning Aptitude corresponds to a 0.588 unit increase in Learning. According to the information provided in Table No. 3, the R-square value is 0.321. This indicates that the independent variable, Learning Attitude, is responsible for a 32.1% change in the dependent variable, Learning. The ANOVA findings indicate that the p value is 0.000, which is below the significance level of 0.05. Therefore, we conclude that there is a statistically significant association between Learning Attitude and Learning. The beta value of 0.567 indicates that a one-unit change in Learning Attitude will result in a 0.567 unit change in Learning. In addition, the beta value is positive, indicating a positive correlation between Learning and Learning Attitude. To clarify, an increase of one unit in Learning Attitude corresponds to a 0.567 unit increase in Learning.

As shown in Table 3, the R-square value is 0.165, indicating that the independent variable, Learning Acquaintance, accounts for a 16.5% variation in the dependent variable, Learning. The ANOVA findings indicate that the p value is 0.000, which is below the threshold of 0.05. Therefore, we may conclude that there is a statistically significant association between Learning Acquaintance and Learning. The beta coefficient is 0.406, indicating that a one-unit increase in Learning Acquaintance will result in a 0.406-unit increase in Learning. In addition, the beta value is positive, indicating a positive correlation between Learning and Learning Acquaintance. To clarify, an increase of one unit in Learning Acquaintance corresponds to a 0.406-unit gain in Learning.

According to the information provided in Table No. 3, the R-square value is 0.455. This indicates that the independent variable, Behavioural Self-Efficacy, is responsible for a

45.5% change in the dependent variable, Behaviour. The ANOVA analysis reveals a p-value of 0.000, which is below the significance threshold of 0.05. Therefore, we may conclude that there is a statistically significant association between Behavioural Self-Efficacy and Behaviour. The beta coefficient is 0.675, indicating that a one-unit increase in Behavioural Self-Efficacy will result in a 0.675-unit increase in Behaviour. In addition, the beta value is positive, indicating a positive correlation between Behaviour and Behavioural Self-Efficacy. To clarify, an increase of one unit in Behavioural Self-Efficacy corresponds to a 0.675 unit rise in Behaviour.

As shown in Table 3, the R-square value is 0.409, indicating that the independent variable, Behavioural Adaptability, accounts for 40.9% of the variation in the dependent variable, Behaviour. The ANOVA analysis reveals a p-value of 0.000, which is below the significance threshold of 0.05. Therefore, we conclude that there is a statistically significant association between Behavioural Adaptability and Behaviour. The beta value of 0.639 indicates that a one-unit change in Behavioural Adaptability will result in a 0.639 unit change in Behaviour. Moreover, the beta coefficient is positive, indicating a positive correlation between Behaviour and Behavioural Adaptability. To clarify, an increase of one unit in Behavioural Adaptability corresponds to a 0.639 unit rise in Behaviour.

As shown in Table 3, the R-square value is 0.419, indicating that the independent variable, Cognitive Ability, accounts for 41.9% of the variation in the dependent variable, Results. The ANOVA analysis reveals a p-value of 0.000, which is below the significance threshold of 0.05. Therefore, we conclude that there is a statistically significant association between Cognitive Ability and Results. The beta value of 0.648 indicates that a one-unit change in Cognitive Ability will result in a 0.648 unit change in Results. Moreover, the beta coefficient is positive, indicating a positive correlation between Results and Cognitive Ability. To clarify, an increase of one unit in Cognitive Ability corresponds to a 0.648 unit increase in Results.

As shown in Table No. 3, the R-square value is 0.460, indicating that the independent variable, Training Outcome, is responsible for a 46.0% change in the dependent variable, Results. The ANOVA analysis reveals a p-value of 0.000, which is below the significance threshold of 0.05. Therefore, we conclude that there is a statistically significant association between Training Outcome and Results. The beta value of 0.678 indicates that a one-unit change in Training Outcome will result in a 0.678-unit change in Results. Moreover, the beta coefficient is positive, indicating a positive correlation between Results and Training Outcome. To clarify, a one unit increase in Training Outcome corresponds to a 0.678 unit increase in Results.

Moderation Analysis

For the moderation to be supported, two conditions must be met. First, the causal predictor variables, *Reaction, Learning, Behaviour and Results* must significantly predict *Training Effectiveness* (TE) in the simple effect model (step 1). Secondly, the interaction model (step 3) and moderation model (step 4) must explain significantly more variance of TE and Reaction, Learning, Behaviour and Results than the non-

interaction model (step 2). If either of these conditions fail, moderation is not supported. Moderation analysis was conducted using Jamovi 2.2.2 to assess if Trainer of the PMKVY training institutes moderated the relationship between *Reaction & Training Effectiveness, Learning & Training Effectiveness, Behaviour & Training Effectiveness, Results & Training Effectiveness.* In the first step, a simple effect model was created using linear regression with Training Effectiveness as the outcome variable and *Reaction, Learning, Behaviour and Results* as the predictor variables. In the second stage, a non-interaction model was created by adding Trainer to the predictor in the linear model in step 1 (simple effects model). Now, moderation analysis was performed using *Reaction, Learning, Behaviour and Results (Independent variables) and Training Effectiveness as dependent variables; and Trainer as moderating variables*. Again, for the moderation to be supported, two conditions must be met. First, the causal predictor variables, *Training Design, Training Style, Learning Aptitude, Learning Attitude, Learning Acquaintance, Behavioural self-efficacy, Behavioural Adaptability, Cognitive Ability and Training Outcome* must significantly predict *Reaction, Learning, Behaviour and Results* in the simple effect model. Secondly, the interaction model and moderation model must explain significantly more variance of *Reaction, Learning, Behaviour and Results* than the non-interaction model. If either of these conditions fail, moderation is not supported.

Moderation analysis was conducted using Jamovi *2.2.2 to assess i*f level of expertise of trainer of the PMKVY training institutes moderated the relationship between *Training Design (TD) and Reaction, Training Style (TS) and Reaction, Learning Aptitude(LP) and Learning, Learning Attitude(LAT) and Learning, Learning Acquaintance(LAQ) and Learning, Behavioural Self-efficacy (BSE) and Behaviour, Behavioural Adaptability(BA) and Behaviour, Cognitive Ability(CA) and Results, Training Outcome (TO) and Results., Training Outcome and Results.* In the first step, a simple effect model was created using linear regression with *Reaction, Learning, Behaviour and Results* as the outcome variable and *Training Design, Training Style, Learning Aptitude, Learning Attitude, Learning Acquaintance, Behavioural self-efficacy, Behavioural Adaptability, Cognitive Ability and Training Outcome a*s the predictor variables. In the second stage, a non-interaction model was created by adding *level of expertise of Trainer* to the predictor in the linear model in step 1 (simple effects model). In the third step, an interaction model was created by adding the interaction between *Training Design and Reaction, Training Style and Reaction, Learning Aptitude and Learning, Learning Attitude and Learning, Learning Acquaintance and Learning, Behavioural self-efficacy and Behaviour, Behavioural Adaptability and Behaviour, Cognitive Ability and Results, Training Outcome and Results* in the linear model in step 2 (non-interaction model). Now, moderation analysis was performed using *Training Design, Training Style, Learning Aptitude, Learning Attitude, Learning Acquaintance, Behavioural self-efficacy, Behavioural Adaptability, Cognitive Ability and Training Outcome as predictors (Independent variables) and Reaction, Learning, Behaviour and Results as dependent variables;* and the level *of expertise of Trainer* as moderating variables.

Thirteen moderation analyses were performed taking *level of Training environment of* the PMKVY training institute as moderator; *Reaction, Learning, Behaviour and Results as predictors (independent variables); and Training Effectiveness* as dependent variable in the first stage ***(See table 4)***. The interactions between Reaction, Learning, Behaviour and Results were found to be statistically significant *(β = 1.15, t = 7.70, p = < .001; β = 0.655, t = 6.40, p = < .001; β = 0.896, t = 7.02, p = < .001; β = 0.920, t = 6.76, p = < .001)* supporting H1a, H2a, H3a and H4a. At average, low, and high moderations, the conditional effect was all effective (p < 0.001). Further, *taking Reaction as dependent variable and Training Design and Training Style* as independent variable, the interaction effect of level of *Training Environment of* PMKVY *institute between them was found to be statistically significant (β = 0.360, t = 6.05, p = < .001; β = 0.486, t = 7.60, p = < .001)* supporting *H1.1a and H2.2a.*

Now, taking *Learning* as dependent variable and *Learning Aptitude, Learning Attitude and Learning Acquaintance* as independent variable, the interaction effect of *level of Training Environment* of PMKVY institute between them was found to be statistically significant for *Learning Aptitude, Learning Attitude (β = 0.218, t = 2.16, p = 0.031; β = 0.218, t = 2.37, p = 0.018) and insignificant for Learning Acquaintance (β =* 0.029, *t =* 0.327, *p = 0.744)* supporting $H_{2.1a}$, $H_{2.2a}$ but not $H_{2.3a}$.

Taking *Behaviour* as dependent variable and *Behavioural self-efficacy and Behavioural Adaptability* as independent variable, the interaction effect of *level of Training Environment* of PMKVY institute between them was found to be statistically significant for *Behavioural self-efficacy* and insignificant for *Behavioural Adaptability (β = 0.162, t = 2.29, p = 0.022; β = 0.103, t = 1.60, p = 0.110)* supporting $H_{3.1a}$ but not $H_{3.2a}$.

Now, for *Results* as dependent variable and *Cognitive Ability and Training Outcome* as independent variable, the interaction effect of *level of Training Environment* of PMKVY institute between them was found to be statistically significant *(β = 0.322, t = 4,50, p = < .001; β = 0.241, t = 3.94, p = < .001)* supporting $H_{4.1a}$ and $H_{4.2a}$. At average, low, and high moderations, the conditional effect was all effective *(p < 0.001)*.

Simple Slope Analysis Results

The simple slope plots show the moderated relationships between *Reaction, Learning, Behaviour, Results (IV)* and *Training Effectiveness. In the later stage, the simple slope depicts the moderated relationships between Training Design and Reaction, Training Style and Reaction, Learning Aptitude and Learning, Learning Attitude and Learning, Learning Acquaintance and Learning, Behavioural self-efficacy and Behaviour, Behavioural Adaptability and Behaviour, Cognitive Ability and Results, Training Outcome and Results.* The results shows that *level of Training Environment* of the

PMKVY training centres moderated the relationship between *Reaction and Training Effectiveness, Learning and Training Effectiveness, Behaviour and Training Effectiveness, Results and Training Effectiveness, Training Design and Reaction, Training Style, and Reaction, Learning Aptitude and Learning, Learning Attitude and Learning, Behavioural Self- Efficacy and Behaviour, Cognitive Ability and Results, Training Outcome and Results.* In other words, the results of simple slope analysis are conducted for better understanding of the nature of the moderating effect which are shown in **Figures (1-13) given below**.

As seen in **Figures 1, 2 and 3** the line is steeper at the Benchmark level of training environment in the PMKVY training Institute, indicating that the impact of *Reaction on Training Effectiveness, Training Design and Training Style on Reaction* is substantially the best at the benchmark level of Training Environment of the PMKVY training Institute. This implies that at the benchmark level of Training Environment at PMKVY training institutions, it can provide better training than with minimal (low) levels of training environment and facilities. The amount of the effect on *Training Effectiveness*, *Training Design and Training Style* increases as the level of training environment increases. The slope for the minimal level of training environment shows low level in the training effectiveness [1.01] and at the benchmark level it shows high [2.80]. For *Training Design* [0.573] at the minimal level and the benchmark level of training environment gives an impactful *Training Design* [1.134] in the PMKVY training institute. Similarly, minimal level of training environment shows low level of impact in the *Training Style* [0.410] than the benchmark level of training environment in *Training Style* [1.168] in the PMKVY training Institute.

As seen in the **Figures 4, 5 and 6** the line is much steeper for the benchmark level of training environment proving that there is an impact of *Learning on Training Effectiveness*, *Learning Aptitude on Learning and Learning Attitude on Learning* at the PMKVY training Institute. This implies that at the benchmark level of training environment, the learning of the trainees is high [2.43], then at minimal [1.41] level of training environment. Similarly, the Learning Aptitude [0.948] and Learning attitude [1.003] of the trainees are high at the benchmark level of training environment and low (Learning Aptitude [0.616], Learning Attitude [0.664]) at the minimal level of training environment. The hypothesis for the Training Environment of the PMKVY institutions, has an insignificant moderating effect on the positive relationship between *Learning Acquaintance and Learning*. Therefore, the research hypothesis is rejected as **shown in Figure 7**.

As seen in **Figures 8 and 9** the slope is steeper for the benchmark level of training environment and low for minimal level of training environment showing the impact of

Behaviour on Training Effectiveness and Behavioural self-efficacy on Behaviour at the PMKVY training institute. At the benchmark level of training environment, the behaviour [2.95] and behavioural self-efficacy [0.970] of trainees are high than at minimal level [1.56, 0.717] of training environment. It implies that the behaviour and behavioural self-efficacy of trainees are high at the benchmark level of training environment than at the minimal level. The hypothesis for the Training environment has an insignificant moderating effect on the positive relationship between *Behavioural Adaptability and Behaviour.* Therefore, the research hypothesis is rejected as show in **Figure 10.**

As shown in **Figure 11, 12 and 13** the line is steeper at benchmark level expertise of training environment of the PMKVY training Institute, indicating that the impact of *Results on Training Effectiveness*, *Training Outcome and Cognitive Ability on Results* is significantly sturdier at the benchmark level expertise of Training Environment of the PMKVY training Institutes.

This implies that the benchmark level of Training Environment at PMKVY training institutions can provide better [3.01] training effectiveness than trainers with minimal [1.57] levels of training environment. The amount of the effect on *Training Outcome and Cognitive Ability* increases as the level of Training environment increases. The slope for the low level of training environment shows minimal level [0.503] in affecting the *Cognitive ability* of PMKVY trainees whereas the impact on *Cognitive ability* is high [1.005] while the training is conducted at the benchmark level of Training Environment. The benchmark level of Training Environment [1.012] delivers better *Training Outcome* from the PMKVY training Institutes than the minimal level of Training Environment [0.636]. The table below shows the summary of the hypothesis testing.

Table 1: Showing Summary of Hypothesis Tests

HYPOTHESIS	**RESULTS**
MAIN EFFECTS	
H_1. Reaction → Training Effectiveness	**Supported**
H_2. Learning → Training Effectiveness	**Supported**
H_3. Behaviour → Training Effectiveness	**Supported**
H_4. Results → Training Effectiveness	**Supported**
$H_{1.1}$. Training Style → Reaction	**Supported**
$H_{1.2.}$ Training Design → Reaction	**Supported**

$H_{2.1.}$ Learning Aptitude → Learning	**Supported**
$H_{2.2.}$ Learning Attitude → Learning	**Supported**
$H_{2.3.}$ Learning Acquaintance → Learning	**Supported**
$H_{3.1.}$ Behavioural self-efficacy → Behaviour	**Supported**
$H_{3.2.}$ Behavioural Adaptability → Behaviour	**Supported**
$H_{4.1.}$ Cognitive Ability → Results	**Supported**
$H_{4.2.}$ Training Outcome → Results	**Supported**
MODERATING EFFECTS	
H_{1a}. Reaction * Training environment → Training Effecti veness	**Supported**
$H_{1.1a}$. Training Style * Training environment → Reaction	**Supported**
$H_{1.2a}$. Training Design * Training environment → Reaction	**Supported**
H_{2a}. Learning * Training environment → Training Effectiveness	**Supported**
$H_{2.1a.}$ Learning Aptitude * Training environment → Learning	**Supported**
$H_{2.2a}$ Learning Attitude * Training environment → Learning	**Supported**
$H_{2.3a.}$ Learning Acquaintance * Training environment → Learning	Not Supported
$H_{3a.}$ Behaviour * Training environment → Training Effectiveness	**Supported**
$H_{3.1a.}$ Behavioural self-efficacy * Training environment → Behaviour	**Supported**
$H_{3.2a.}$ Behavioural Adaptability * Training environment → Behaviour	Not Supported
$H_{4a.}$ Results * Training environment → Training Effectiveness	**Supported**
$H_{4.1a.}$ Cognitive Ability * Training environment → Results	**Supported**
$H_{4.2a.}$ Training Outcome * Training environment → Results	**Supported**

Conclusion

The study displays the effect and significant of levels of expertise of the training environment in supporting the quality training in any training programs to make it more efficient and effective. The past literatures trace the importance of the training environment in supporting and providing an effective training. It also points out the factors affecting training environmental. They are clear sound, appropriate lighting, necessary hardware and devices, site organisation, classroom convenience, chair organisation, and access to water, toilets, and fresh air etc. The training environment influences the training effectiveness and shows that benchmark level of training

environment helps the most in providing the quality Training Design and Style, Learning Aptitude, Learning Attitude, Behaviour and Behaviour self-efficacy and Cognitive Ability and Training Outcome. The level training environment shows no effect on the Learning acquaintance and Behavioural Adaptability of the PMKVY trainees.

Table 2: Test for Normality of Data

	Factor Scores					*Normalized Scores*				
Factors & Levels	***Mean***	***SD***	***Skewness***	***Kurtosis***	***Normality Test Stat.***	***Mean***	***SD***	***Skewness***	***Kurtosis***	***Normality Test Stat.***
Training Design	0.00	1.00	-0.50	-0.16	0.076^{***}	-0.00	0.98	-0.01	-0.17	0.011^{NS}
Training Style	-0.00	0.99	-0.53	-0.01	0.089^{***}	0.00	0.98	-0.01	-0.14	0.009^{NS}
Learning Aptitude	0.00	1.00	-0.96	0.80	0.096^{***}	-0.00	0.99	0.00	-0.16	0.007^{NS}
Learning Attitude	0.00	1.00	-1.07	2.07	0.094^{***}	0.00	0.98	0.00	-0.12	0.009^{NS}
Learning Acquaintance	0.00	1.00	-1.08	2.48	0.111^{***}	0.00	0.97	0.05	-0.23	0.011^{NS}
Behavioural Self Efficacy	0.00	1.00	-1.13	1.16	0.113^{***}	-0.00	0.98	-0.00	-0.14	0.006^{NS}
Behavioural Adaptability	-0.00	1.00	-0.64	0.01	0.080^{***}	0.00	0.98	-0.01	-0.15	0.009^{NS}
Cognitive Ability	0.00	0.99	-0.71	-0.00	0.096^{***}	-0.00	0.97	-0.01	-0.24	0.010^{NS}
Training Outcome	0.00	1.00	-0.59	1.20	0.061^{***}	0.00	0.99	0.00	-0.17	0.007^{NS}
Reaction	36.73	5.68	-1.26	1.75	0.118^{***}	36.67	5.55	-0.02	-0.19	0.053^{NS}
Learning	38.41	5.04	-0.91	0.24	0.164^{***}	38.36	4.94	-0.00	-0.17	0.065^{NS}
Behaviour	37.49	5.12	-0.84	0.40	0.129^{***}	37.43	5.00	-0.00	-0.18	0.062^{NS}
Results	36.92	5.35	-0.89	0.61	0.138^{***}	36.91	5.25	-0.01	-0.19	0.056^{NS}
Training Effectiveness	75.03	8.85	-1.34	1.32	0.191^{***}	75.02	8.70	-0.01	-0.17	0.051^{NS}

Note: n > 50 therefore Kolmogorov-Smirnov Test used for checking the normality assumption

Table 3. Regression Analysis Results

Hypothesis	***Predictor***	***Path***	.	***t***	***R***	***R²***	***F***	***p***	***Decision***
H_1	*Reaction [R]*[#]	R → TE	0.687	17.773	0.687	0.472	315.874	< .001	Supported
H_2	*Learning [L]*[#]	L → TE	0.759	21.893	0.759	0.576	479.33	< .001	Supported
H_3	*Behaviour [B]*[#]	B → TE	0.787	24.039	0.787	0.620	577.89	< .001	Supported
H_4	*Results [RE]*[#]	RE → TE	0.805	25.512	0.805	0.648	650.88	< .001	Supported
$H_{1.1}$	*Training Design*[TD][^]	TD → R	0.709	18.865	0.709	0.502	355.88	< .001	Supported
$H_{1.2}$	*Training Style*[TS][^]	TS → R	0.581	13.401	0.581	0.337	179.59	<.001	Supported
$H_{2.1.}$	*Learning Aptitude* [LAP][$]	LAP → L	0.588	13.672	0.588	0.346	186.91	< .001	Supported
$H_{2.2.}$	*Learning Attitude* [LAT][$]	LAA → L	0.567	12.919	0.567	0.321	166.90	< .001	Supported
$H_{2.3.}$	*Learning Acquaintance* [LAQ][$]	LAQ → L	0.406	8.352	0.406	0.165	69.75	< .001	Supported
$H_{3.1}$	*Behavioural self efficacy*[BSE][*]	BSE → B	0.675	17.181	0.675	0.455	295.17	< .001	Supported
$H_{3.2.}$	*Behavioural Adaptability*[BAD][*]	BAD →B	0.639	15.615	0.639	0.409	243.82	< .001	Supported
$H_{4.1.}$	*Cognitive Ability* [CA][@]	CA → RE	0.648	15.966	0.648	0.419	254.91	< .001	Supported
$H_{4.2.}$	*Training Outcome* [TO][@]	TO → RE	0.678	17.337	0.678	0.460	300.58	< .001	Supported

*^ Dependent Variable (DV): Reaction; $ Dependent Variable (DV): Learning; *Dependent Variable (DV): Behaviour; @ Dependent Variable (DV): Results #; Dependent Variable (DV): Training Effectiveness*

Table 4. Showing moderation analysis results

Reaction [R] ✻ Training Environment [TEV]									
Moderation	***Estimates***	***SE***	***Z***	***p***	***Slope***	***Estimates***	***SE***	***Z***	***p***
Reaction	1.91	0.117	16.28 ***	<.001	**Standard**	1.91	0.126	15.09 ***	<.001
TEV	-1.65	0.176	-9.42 ***	<.001	**Minimal**	1.01	0.214	4.71 ***	<.001
R ✻ TEV	1.15	0.149	7.70 ***	<.001	**Benchmark**	2.80	0.124	22.57 ***	<.001
Training Design [TD] ✻ TEV									
Training Design	0.853	0.0474	18.00 ***	<.001	**Standard**	0.853	0.0497	17.18 ***	<.001
TEV	-0.474	0.0593	-8.00 ***	<.001	**Minimal**	0.573	0.0753	7.60 ***	<.001
TD ✻ TEV	0.360	0.0595	6.05 ***	<.001	**Benchmark**	1.134	0.0616	18.42 ***	<.00 1
Training Style [TS] ✻ TEV									
Training Style	0.789	0.0492	16.03 ***	<.001	**Standard**	0.789	0.0531	14.84 ***	<.001
TEV	-0.383	0.0609	-6.29 ***	<.001	**Minimal**	0.410	0.0823	4.98 ***	<.001
TS ✻ TEV	0.486	0.0639	7.60 ***	<.001	**Benchmark**	1.168	0.0652	17.91 ***	<.001
Learning [L] ✻ TEV									
Learning	1.923	0.0793	24.24 ***	<.001	**Standard**	1.92	0.0838	22.9 ***	<.001
TEV	-1.459	0.1604	-9.10 ***	<.001	**Minimal**	1.41	0.1377	10.3 ***	<.001
L ✻ TEV	0.655	0.1023	6.40 ***	<.001	**Benchmark**	2.43	0.0925	26.3 ***	<.001
Learning Aptitude [LAP] ✻ TEV									
Learning Aptitude	0.782	0.0781	10.01 ***	<.001	**Standard**	0.782	0.0786	9.94 ***	<.001
TEV	-0.612	0.0901	-6.79 ***	<.001	**Minimal**	0.616	0.1316	4.68 ***	<.001
LAP ✻ TEV	0.212	0.0984	2.16 *	0.031	**Benchmark**	0.948	0.0831	11.40 ***	<.001
Learning Attitude [LAT] ✻ TEV									
Learning Attitude	0.834	0.0714	11.68 ***	<.001	**Standard**	0.834	0.0720	11.59 ***	<.001
TEV	-0.692	0.0883	-7.83 ***	<.001	**Minimal**	0.664	0.1139	5.83 ***	<.001
LAT ✻ TEV	0.2 18	0.0918	2.37 *	0.018	**Benchmark**	1.003	0.0878	11.42 ***	<.001
Learning Acquaintance [LAQ] *TEV									
LA	0.8800	0.0710	12.387 ***	<.001	**Standard**	0.880	0.0711	12.39 ***	<.001
TEV	-0.7103	0.0885	-8.027 ***	<.001	**Minimal**	0.857	0.1100	7.80 ***	<.001
LAQ ✻ TEV	0.0290	0.0886	0.327 NS	0.744	**Benchmark**	0.903	0.0869	10.39 ***	<.001
Behaviour [B] ✻ TEV									
Behaviour	2.254	0.0999	22.56 ***	<.001	**Standard**	2.25	0.107	21.15 ***	<.001
TEV	-1.546	0.1627	-9.50 ***	<.001	**Minimal**	1.56	0.175	8.88 ***	<.001
B ✻ TEV	0.896	0.1277	7.02 ***	<.001	**Benchmark**	2.95	0.115	25.64 ***	<.001
Behavioural Self -Efficacy [BSE] *TEV									
BS E	0.844	0.0561	15.04 ***	<.001	**Standard**	0.844	0.0565	14.93 ***	<.001
TEV	-0.341	0.0655	-5.22 ***	<.001	**Minimal**	0.717	0.0938	7.65 ***	<.001
BSE ✻ TEV	0.162	0.0707	2.29 *	0.022	**Benchmark**	0.970	0.0609	15.92 ***	<.001
Behavioural Adaptability [BAD] ✻ TEV									
BAD	0.890	0.0507	17.55 ***	<.001	**Standard**	0.890	0.0509	17.49 ***	<.001
TEV	-0.520	0.0619	-8.39 ***	<.001	**Minimal**	0.809	0.0816	9.91 ***	<.001
BAD ✻ TEV	0.103	0.0646	1.60 NS	0.110	**Benchmark**	0.970	0.0601	16.13 ***	<.001

Results [RE] ✻ TEV									
Results	2.292	0.104	22.01***	< .001	Standard	2.29	0.111	20.68***	< .001
TEV	-1.194	0.164	-7.28***	< .001	Minimal	1.57	0.188	8.39***	< .001
RE ✻ TEV	0.920	0.136	6.76***	< .001	Benchmark	3.01	0.116	26.02***	< .001
Cognitive Ability [CA] ✻ TEV									
Cognitive Ability	0.754	0.0533	14.15***	< .001	Standard	0.754	0.0549	13.73***	< .001
TEV	-0.524	0.0609	-8.61***	< .001	Minimal	0.503	0.0943	5.33***	< .001
CA✻ TEV	0.322	0.0716	4.50***	< .001	Benchmark	1.005	0.0595	16.90***	< .001
Training Outcome [TO] ✻ TEV									
Training Outcome	0.824	0.0490	16.80***	< .001	Standard	0.824	0.0500	16.47***	< .001
TEV	-0.506	0.0618	-8.19***	< .001	Minimal	0.636	0.0750	8.48***	< .001
TO✻ TEV	0.241	0.0610	3.94***	< .001	Benchmark	1.012	0.0633	15.97***	< .001

**TEV- Training Environment*

Figures showing simple slope analysis plots (1-13)

1. Moderation relationship direction for TEV , TE and Reaction

2. Moderation relationship direction for TEV , Reaction and Training Design

3. Moderation relationship direction for TEV , Reaction and Training Style

4. Moderation relationship direct ion for TEV , TE and Learning

7.Moderation relationship direction for TEV, Learning and Learning Acquaintance

8.Moderation relationship direction for TEV, TE and Behaviour

9.Moderation relationship direction for TEV, Behaviour and Behavioural Self-Efficacy

10. Moderation relationship direction for TEV, Behaviour and Behavioural Adaptability

11.Moderation relationship direction for TEV, TE and Results

12.Moderation relationship direction for TEV, Results and Cognitive Ability

13.Moderation relationship direction for TEV, Results and Training Outcome

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Spotlight

Is Artificial Intelligence the Answer to Global Food Security?

Artificial Intelligence (AI) is rapidly transforming various sectors, particularly the food industry, offering innovative solutions that promise to revolutionize food production, processing, and consumption. From farm to fork, AI is poised to reshape the way we interact with food, promising a future of greater efficiency, sustainability, and personalized nutrition.

One of the most significant applications of AI in food technology is in the domain of precision agriculture. By analysing vast amounts of data on soil conditions, weather patterns, and crop growth, AI-powered systems can optimize planting schedules, irrigation systems, and fertilizer applications. This not only increases crop yields but also minimizes environmental impact by reducing the use of water and chemical inputs.

In the food processing industry, AI is being used to automate quality control processes. Computer vision systems can identify defects, contaminants, and inconsistencies in food products with remarkable accuracy, ensuring that only the highest quality products reach consumers. AI-powered robots are also being deployed in food production lines, performing tasks with precision and speed that far surpasses human capabilities.

AI is playing a crucial role in developing novel food products. By analysing consumer preferences and dietary needs, AI algorithms can create personalized nutrition plans and design food products that cater to specific tastes and health goals. This opens up a world of possibilities for customized and tailored food experiences.Another exciting application of AI in food technology is in the area of food safety. AI-powered systems can monitor food production processes in real-time, detecting potential hazards and outbreaks before they can cause harm. This helps to ensure the safety and security of the global food supply chain.

The integration of AI into the food industry also raises concerns about job displacement, data privacy, and ethical considerations. It is crucial to address these challenges proactively and ensure that the benefits of AI are distributed equitably.AI is navigating in a new era of food innovation, promising to address global challenges such as food security, sustainability, and personalized nutrition. By proper utilisation of AI, the food industry can unlock its full potential and create a more sustainable and efficient food system for the future.

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Occupational Aspiration and Its Relationship with Home Environment of Karbi Students with Special Reference to Kamrup District, Assam

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Abstract

Occupational aspiration plays a pivotal role in shaping students' educational goals, career paths, and future success. Home environment appears to significantly influence occupational aspiration. The study focuses on the association between family environment and occupational aspirations of Karbi students, an indigenous community in northeast India. The Karbis recognized as scheduled Tribes (ST- H) of Assam. They are the third largest tribal community of Assam After Boros and Mising Community The investigators have selected the Kamrup metro district for the study area. The present study is based on descriptive survey method. The study sample consisted of 130 Karbi secondary school students (70 boys and 60 girls). The tools used in the study were an adapted home environment inventory developed by Aaliya Akhtar and A self-constructed occupational scale. The data was analyzed using appropriate statistical techniques such as mean, parentage, and t-test. The findings indicate that Karbi students have an average level of occupational aspiration. Additionally, no significant gender differences were observed in their aspirations. The study also reveals that Karbi students generally have a moderately favourable home environment, which shows a significant positive correlation with occupational aspiration. Emphasizing the levels of vocational aspiration and their relationship with the home environment could be essential for guiding the students' future success.

Keywords: Occupational Aspiration, Home environment, Karbi students, Higher secondary students.

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Introduction

Occupational aspiration is often defined as the ideal career path an individual envisions for themselves. Vocational aspiration is a fundamental element in shaping one's educational trajectory, career planning, and eventual life outcomes. Without a career aspiration, a student is like a ship in the midst of the sea without any clue of direction. As per Kindo & Astalin (2020), Career awareness is the initial stage of career development when choosing the right career. In the current era of globalization and industrialization, occupation is vital for human life. It plays a crucial role in maintaining balance in life by providing access to life's necessities and comforts. Today the level of competition is very high, necessitating significant risk to achieve one's goals. The present study focuses on Karbi students, a tribal community in Northeast India. Despite being a culturally rich group, Karbi students often face unique challenges such as limited educational infrastructure, higher dropout rates, and economic constraints. These challenges contribute to a pronounced disparity in educational outcomes and career aspirations between Karbi and non-tribal students, which, if left unaddressed, may widen the social and economic divide. Understanding the occupational aspirations of Karbi students within the context of their home environment is essential to addressing these educational inequities and ensuring their potential is fully realized. In today's society, a person's success is often determined by their attitude, academic excellence, educational qualifications, and ultimately, the career or vocation that the student chooses for himself. Aspiration has been considered as a strong yearning to accomplish something, a goal, or an aim that one desires. Notably, students' occupational aspirations and expectations are recognized as pivotal determinants of academic achievement. Boro K (2018) notes that Occupational aspiration refers to what an individual views as an ideal vocation for him. Influenced by numerous factors such as family environment, parental occupation, parental income, socio-economic status, education of parents, and psychological factors (Khobragade 1990). School facilities also significantly impact students' career aspirations, as seen in Kalita's (2014) study. Behera (2021) connected study habits with higher occupational aspirations, while Pal & Sarkar, (2022) highlighted socio-economic limitations as key barriers to higher career aspirations, especially for first-generation learners. According to Nugent (1996), while Indian and white youth share similar perceptions of the aspiration dimension of mobility orientation, their expectation is more differentiated by their social position. Studies further illustrate the impact of subject choice on career aspirations. For instance, Pradhan (2002), found that students from the arts stream mostly aspire to teaching, social welfare, administration, and clerical, whereas science students gravitate toward engineering, medical, and health sectors. Baruah Hemanta (2018) disclosed differences in interest areas, noting no significant gender differences in urban students' interest in literacy, executive, agricultural, and household areas. However, distinctions appeared in artistic, scientific, and commercial interests. Gender and geographic factors also play a role. Phibanker (2014) reported that male students generally have higher occupational ambitions than females, with urban students having higher occupational aspirations than their rural counterparts. Additionally, Momin and Chetry (2018) found higher occupational aspirations among males. Studies also show that non-tribal

students tend to aspire more than tribal students and students in the commerce stream often aim for sales, business, and administration, while students from the vocational stream aspire for engineering careers. Choudhury R & Saikia (2020) found that most students have an average vocational maturity, with no significant gender differences. However, while considerable research exists on occupational aspirations among various indigenous groups, but studies focused specifically on Karbi students are limited. This study seeks to address the research gap by examining the correlation between occupational aspirations and home environment of Karbi secondary school students in Assam.

Karbi Tribes in Assam

One of the most prominent tribes residing in the North-East East, especially in Assam, is the Karbis. They are both plain as well as hill dwellers. In earlier times, the Karbis were known as Mikir. The Karbis are an indigenous tribe of Assam. They are the third largest tribal community in Assam after Boro and Misings. Bishnu Prasad Rabha, a doyen of Assamese culture and nationalism, called the Karbis the Columbus of Assam. From the racial point of view, the Karbis belong to the Mongoloid group, and Linguistically, the Karbi are Tibeto- Burman group. In Assam Karbi Anglong, Dima Hasao, Kamrup, Morigaon, Golaghat, Sonitpur, Cachar, Lakhimpur, and Nagaon are considered the centre of the Karbi People. They also live in the Ri-Bhoi districts of Meghalaya and they identify themselves as the Dumurali Karbis.

Objectives of the Study

1. To examine the Occupational Aspirations of Karbi students
2. To find out the differences in occupational aspirations among Karbi students based on gender.
3. To investigate the home environment of kabi students
4. To explore the relationship between Occupational Aspirations and home environment in Karbi students.

Hypotheses of the Study

H^{01}: There exists no significant difference in occupational aspirations of Karbi students with regard to gender.

H^{02}: There exists no significant relationship between Occupational Aspirations and home environment of Karbi students.

Methods

The investigator used descriptive survey method for the current study

Population of the Study

For the present study, the population included all the Karbi Students studying in H.S. 1st year of Govt. Provincialized secondary schools under the Assam Higher Secondary Education Council (A.H.S.E.C.) in the academic year 2023-2024 in Kamrup Metro district of Assam.

Sample Size and Sampling Technique

The study has been conducted on 130 secondary school Karbi students, out of which 60 are male and 70 are female. To select the sample Simple random sampling technique has been used.

Research Tools

In the study, the investigator employed an Adapted questionnaire that focuses on the occupational aspirations of secondary school students. It consisted of 40 statements containing five options -strongly agree, agree, undecided, disagree, and strongly disagree. For the assessment of home environment, the investigator employed the Standardized Home Environment scale developed by Aaliya Akhtar and Shail Bala Saxena. It consisted of 50 items out of which 40 positive items and 10 negative items. Containing five options such as always, often, sometimes, least, and never for each of the statements. Scores of 4,3,2,1, and 0 are given to positive items for Always, Often, Sometimes, Least, and Never, respectively. The scores on negative items are done in reverse order.

Study Area

The study covered secondary school Karbi students from different secondary schools in Kamrup district of Assam, India.

Procedure of Data Collection

The investigator used descriptive survey method for the current study

Delimitation of the Study

1. Only secondary school students studying in Class 11th belonging to Karbi tribes were included in the study.
2. The study is delimited to Kamrup Metro District of Assam.

Statistical Tools for Analysis of Data

The researcher applied appropriate statistical techniques to analyse the data namely - Mean, Standard Deviation, Percentage, t-test, Correlation and Graphical representation.

Results and Interpretation of Data

Objective 1 : To examine the Occupational Aspirations of Karbi students

Table 1. Levels of Occupational Aspiration among Karbi studen

Category	Range of raw scores	Frequency	Percentage
High Aspiration	151 & above	11	8.5 %
Above average Aspirations	141 to 150	19	14.6 %
Average Aspirations	130 to 140	60	46.2 %
Below average Aspiration	120 to 129	32	24.6 %
Low Aspirations	119 and below	8	6.2 %
	Total	130	100.0

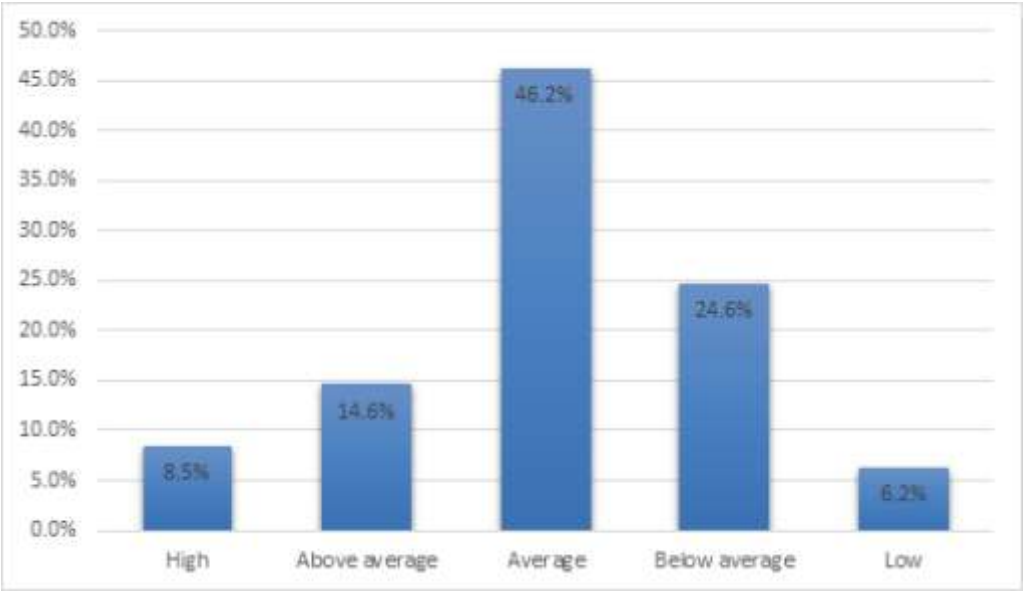

Figure 1. Shows the Percentage of students' occupational aspirations on different levels.

Table No. 1 and Figure.1 depict the different levels of occupational aspiration among Karbi secondary school students. In the table, it can be see that maximum number of students (46.2%) have average or moderate levels of occupational aspiration, followed by below-average levels of occupational aspiration (24.6 %), then above-average occupational aspirations (14.6 %), then high levels of occupational aspirations (8.5%) and low occupational aspirations 6.2 %). This indicates that the proportion of students with an average level of occupational aspiration is highest compared to other levels. Therefore, it is evident that H.S. Karbi students predominantly have an average level of vocational aspiration.

Objective 2: To find out the differences in occupational aspirations among Karbi students based on gender.

Table 2: Difference between Boys and Girls regarding the level of Occupational Aspiration

Variable	Gender	N	Mean	SD	p-value	.05 level o Significance
Occupationa Aspiration	Boys	60	134.28	10.17	.558	Not Significant
	Girls	70	135.31	9.8		

**** Not significant at the .05 level of significance**

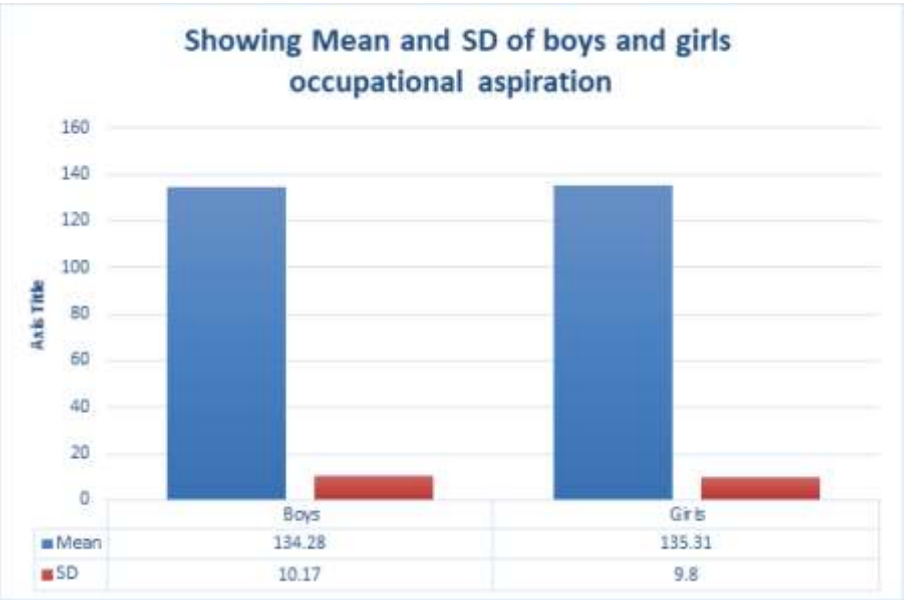

Figure 2. Mean and SD of Boys and Girls Occupational Aspiration

Table no.2 shows the difference between boys and girls regarding the levels of occupational aspirations. It has been found that the mean and standard deviation of boys in occupational aspiration are 134.28 and 10.17, respectively, and again, the mean and standard deviation of girls' students are 135.31 and 9.8, respectively. The calculated p-value of the scores of boys and girls in occupational aspiration is .558, which is not significant at both the 0.05 and 0.01 levels of Significance. Thus, there exists no significant difference between boys and girls on levels of occupational aspiration. This indicates that boys' and girls' levels of occupational aspirations are the same. So, the null hypothesis (H01) can be accepted that H01: 'There exists no significant difference between Karbi boys and girls regarding the level of occupational aspirations.'

Objective 3: To investigate the home environment of Karbi students

Table 3: Home environment of Karbi secondary school students

Level of home Environment	Range of raw score	frequency	Percentage
Extremely Favourable	169 and above	2	1.5%
Highly Favourable	158 to 168	9	6.9%
Above average favourable	146 to 157	36	27.7%
Moderately favourable	130 to 145	46	35.4%
Unfavourable	118 to 129	22	16.9%
Highly Unfavourable	106 to 117	11	8.5%
Extremely Unfavourable	105 and below	4	3.1%

Table 3 shows that Those students who scored 169 and above fall under the category of Extremely Favourable students who scored 158 to 168 fall under the category of Highly Favourable, students scored 146 to 157 fall under the category of Above average favourable, students who scored 130 to 145 fall under the category of Average or Moderately favourable, students scored 118 to 129 fall under the category of Unfavourable, students scored 106 to 117 fall under Highly Unfavourable and students who scored 105 and below fall under Extremely Unfavourable groups.
It is inferred from the above table that 2 students out of 130 which is 1.5 % of the total students fall under the extremely favourable level of Home environment, 9 students which is 6.9% of the total students fall under the highly favourable level of home environment, 36 students which is 27.7% of the total students fall under the Average or Moderately favourable level of home environment, 22 students which is 16.9% of the total students fall under the unfavourable level of home environment, 11 students which is 8.5% of the total students fall under the highly unfavourable level of home environment and remaining 4 students which is 3.1% of the total students fall under the extremely unfavourable home environment.

It is evident from the data that most of the students have average or moderately favourable (35.4%) levels of home environment indicating a home provides a supportive, nurturing, and stable atmosphere conducive to the well-being and development of its members.

Objective 4: To explore the relationship between Occupational Aspirations and home environment in Karbi students.

Table 4 : Correlation between occupational aspiration and home environment of boys and girls students

Correlations			
		Occupational Aspiration	Home Environment
Occupational Aspiration	Pearson Correlation	1	.400**
	Sig. (2-tailed)		.000
	N	130	130
Home Environment	Pearson Correlation	.400**	1
	Sig. (2-tailed)	.000	
	N	130	130
**. Correlation is signific ant at the 0.01 level (2 -tailed).			

Table no.4 shows the relationship between occupational aspirations and home environment in terms of the total scores of the students. Pearson correlation was run to determine the relationship between occupational aspiration of students and home environment. The correlation coefficient was found .400 which was statistically significant (r = .400, n=130, p=.000). The magnitude of the correlation coefficient determines that the relationship between occupational aspirations and home environment in terms of the total scores of the students is strongly positive and significant. With the increase in the scores of occupational aspirations, there is a relative increase in the home environment scores and vice versa. Thus in this case, the null hypothesis that there is no significant relationship between occupational aspirations and home environment can be rejected.

Findings and Conclusion:

The study shows that Karbi students have an average level (46.2 %) of occupational aspiration, which is supported by the study conducted by Saharaia (2021). who also reported that Higher secondary school students possess an average level of occupational aspiration. The present study also reveals that Gender differences regarding occupational aspirations have not been found among Karbi students. Boys' and girls' students almost have the same level of occupational aspiration. Similar findings have been reported by Kaur & Ahuja (2018), Lalthanpui & Larintluangi (2019), and Behera D (2021). They also found in their study that there is no significant difference in occupational aspiration based on the respondents' gender. The current study shows that most of the students have moderately favourable home environments. The results are in line with the study conducted by Jain & Mohta (2019), and Doley (2018). The present study also examined the relationship between occupational aspiration and home environment and it was hypothesised that there was no relationship between these two variables. The results showed that two variables were positively associated with each other. These results are in line with other studies, a study conducted by Tirkey & Antony (2020) and another similar study carried out by Gairola S (2022). These studies revealed a positive relationship of occupational aspiration with the home environment.

It can be concluded despite numerous challenges including limited access to education, high dropout rates, poor socio-economic condition of family, geographical area, and poor family background the students possess high aspirations though the number is much less than other levels in the study. There is no shortage of capability and intelligence in tribal communities, given the right environment, proper guidance, family support and opportunity, and necessary resources they can overcome these challenges and achieve remarkable successes.

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Exploring the Relationship between Self-Regulated Learning and Collaboration Skills among Vocational Education Students: A Gender-Based Analysis

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Abstract

This study examines the relationship between self-regulated learning (SRL) and collaboration skills, with a focus on potential gender differences among vocational education students. A sample of 80 vocational education students was analysed to explore whether higher levels of SRL correlate with improved collaboration skills and to determine if gender plays a significant role in these skills. The results indicate a moderate positive correlation coefficient value (r = 0.462) between SRL and collaboration skills, but no significant gender differences were found. These findings suggest that enhancing self-regulation can positively impact collaboration skills, irrespective of gender and raise employability skills among vocational education students.

Keywords: Self-Regulated Learning, Collaboration Skills, Gender Differences, Educational Research, Vocational Education Students

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Introduction

Self-regulated learning (SRL) and collaboration skills are critical components of successful educational outcomes. SRL involves students' ability to manage their own learning processes through goal setting, self-monitoring, and self-reflection (Zimmerman, 2008). Self-regulated learning (SRL) involves a set of cognitive and metacognitive strategies that includes goal setting, self-monitoring, self-evaluation, and adaptive learning strategies (Zimmerman, 2002). SRL empowers students to take ownership of their educational journey, leading to enhanced academic performance and greater persistence in the face of challenges. Self-regulated learning focuses on developing key skills, such as establishing clear objectives for learning, utilising techniques to meet those objectives, tracking progress, and adjusting the learning environment to support these goals (Zimmerman & Schunk, 2021). Collaboration skills, on the other hand, refer to the ability to work effectively with others towards shared goals (Johnson & Johnson, 2009). These skills are essential for navigating complex social and academic environments. They include effective communication, teamwork, and problem-solving abilities (Johnson & Johnson, 1999). Collaborative learning environments encourage students to engage in joint activities, negotiate, and share diverse perspectives, thereby enriching their educational experience and fostering a deeper understanding of the subject matter (Gillies & Boyle, 2010). As educational environments increasingly emphasise collaborative learning and self-directed study, understanding the interplay between these skills becomes crucial. The interplay between SRL and collaboration skills is a significant area of interest in educational research. Effective self-regulation can enhance an individual's ability to contribute positively to group work, as students who are skilled in self-regulation are often better at managing their tasks, setting goals, and reflecting on their performance (Boekaerts & Corno, 2005). Conversely, collaborative experiences can provide valuable opportunities for practicing and refining self-regulation strategies, as students engage in mutual feedback and shared problem-solving (Vermunt & Verloop, 1999). Moreover, gender differences in SRL and collaboration skills add another layer of complexity to this dynamic. Research on gender differences in education has revealed varying patterns of behaviour and achievement. For instance, some studies suggest that females may exhibit higher levels of cooperation and interpersonal skills, which could influence their collaboration outcomes (Gorrell & Hwang, 1995). However, findings on gender differences in SRL are less consistent, with some research indicating that gender may have a limited impact on self-regulation abilities (McClelland et al., 2006).

Self-regulated learning (SRL) is key to building lasting knowledge, making it essential for schools, classrooms, and lifelong learning. In vocational education, SRL supports the development of future professionals by enhancing their ability to manage and adapt their own learning processes. This study followed 159 vocational education students in either SRL-focused or traditional classes, using Perry et al.'s (2018) framework that emphasises the cognitive, motivational, and emotional aspects of SRL. Multilevel analysis revealed differences in cognitive development, though motivational and emotional changes were less pronounced. The findings suggest that SRL interventions should address all key components to provide a balanced, effective

approach. Also, recent research has highlighted the importance of SRL in improving academic performance and overall learning outcomes (Pintrich & De Groot, 1990). Collaboration skills are similarly valued for their role in fostering teamwork and problem-solving abilities. However, the relationship between SRL and collaboration skills, and the potential impact of gender on these skills, remains underexplored.

This study addresses these gaps by investigating the correlation between SRL and collaboration skills and examining whether gender differences influence these skills. Understanding how SRL and collaboration skills interrelate and how these factors are influenced by gender is crucial for designing effective educational interventions. By examining these relationships, this study aims to provide insights into how self-regulation and collaboration skills contribute to student success and how gender may influence these dynamics. The findings from this research could inform strategies to enhance learning experiences and outcomes for all students, ensuring that educational practices are responsive to diverse needs and abilities.

In summary, this study seeks to investigate the relationship between self-regulated learning and collaboration skills, with a particular focus on examining gender differences among vocational education students. By exploring these aspects, the research aims to contribute to a deeper understanding of how SRL and collaboration skills can be fostered and leveraged to support academic achievement, employability skills and personal growth. By analysing a sample of vocational education students, this research provides insights into how self-regulation might affect collaboration and whether educational strategies should be tailored based on gender.

The objectives and hypotheses of the study are as follows:

Objectives:

1. To examine the correlation between self-regulated learning (SRL) and collaboration skills among vocational education students.

2. To analyse potential gender differences in self-regulated learning and collaboration skills.

Hypotheses:

Hypothesis 1: A positive correlation exists between self-regulated learning (SRL) and collaboration skills among vocational education students.

Hypothesis 2: There are no significant gender differences in self-regulated learning (SRL) and collaboration skills among vocational education students.

Review of Related Literature:

Self-regulated Learning: Self-regulated learning is a process by which learners take control of their own learning activities, including goal setting, self-monitoring, and self-reflection (Zimmerman, 2002). It involves several key components, such as

cognitive strategies, metacognitive awareness, and motivational factors. Self-regulation has been linked to academic success, as students who effectively manage their learning processes tend to perform better academically (Schunk, 2003). Mejeh and Held (2022) emphasise that self-regulated learning (SRL) plays a pivotal role in fostering sustainable knowledge and preparing students for their careers, especially in vocational education. Their study reveals distinct differences in SRL components among vocational education students, reinforcing the importance of comprehensive approaches that nurture cognitive, motivational, and emotional dimensions to effectively support student development.

Collaboration Skills: Collaboration skills involve the ability to work effectively with others, including communication, cooperation, and problem-solving abilities (Johnson & Johnson, 2009). Collaborative learning environments have been shown to enhance students' critical thinking and interpersonal skills, making collaboration an essential component of modern education. Hidayatulloh and Ashoumi explore vocational school students' work readiness in the context of 21st-century skills, particularly focusing on communication and collaboration. Their study of 350 students employed the Self-Perceived Communication Competence, Work Readiness Scale, and Teamwork Scale for Youth to assess the impact of these skills. Results reveal that communication and collaboration skills significantly enhance work readiness, with teachers playing a key role in skill development within schools, and parents supporting through supervision outside school environments.

Correlation between SRL and Collaboration Skills: Research has demonstrated that self-regulation and collaboration are interconnected. Effective self-regulation can lead to better collaboration because students who manage their learning processes well are likely to contribute more effectively to group work (Pintrich & De Groot, 1990). Conversely, engaging in collaborative activities may enhance self-regulation by providing opportunities for self-monitoring and reflection.

Vocationalisation of school education in India: The Government has implemented Vocationalisation of School Education under 'Samagra Shiksha, which is an "Integrated Scheme for School Education". The scheme endeavours to integrate vocational education with general academic education to prepare an educated, employable and competitive human resource for various sectors of the economy and the global market. The scheme covers Government and Government aided schools across India. As per NEP 2020, States/UTs are to cover vocationalisation up to 50% of students at the upper primary level by 2025 and vocational subjects are accordingly offered in schools.

Gender Differences: The influence of gender on SRL and collaboration skills has been a topic of interest in educational research. Some studies suggest that gender differences exist in learning styles and collaborative behaviours, while others indicate that these differences are minimal (Hyde, 2005). This study aims to clarify whether gender significantly impacts SRL and collaboration skills.

This research addresses significant gaps in the existing literature by examining the direct relationship between SRL and collaboration skills, assessing gender differences in these skills, and applying validated measurement tools. Existing studies have explored the impact of self-regulation and collaboration on work readiness in vocational education students; however, none have comprehensively examined the combined influence of both school-based teaching and parental support in developing these skills, leaving an important gap in understanding a holistic approach to work readiness. The findings contribute to a better understanding of how SRL influences collaboration and provide insights for designing effective educational interventions. However, further research is needed to explore these relationships in different contexts and with larger, more diverse samples to enhance the generalisability and applicability of the findings.

Methodology

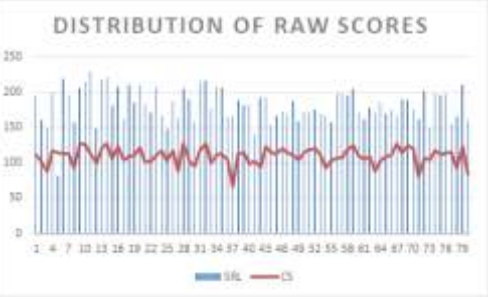
Population and Sample: The population for this study consists of all vocational education students in the National Capital Region (NCR) of Delhi. Through random sampling a secondary school was chosen, consisting of 80 vocational education students. This school represented a typical group of students who had vocational subjects, offering a glimpse into the educational experiences of this specific student population. The sample size of 80 students of Grade 10 was chosen.

Tools used: Self-regulated learning data was measured using the Self-regulated Learning Questionnaire developed by Gupta and Mehtani (2019). This tool evaluates various aspects of self-regulation, including goal setting, self-monitoring, and self-reflection. Collaboration skills were measured using the Collaboration Skills Assessment Tool by Boyraz (2018), which assesses communication, cooperation, and problem-solving abilities.

Procedure: Data collection involved administering the SRL and Collaboration Skills questionnaires to the vocational education students. The questionnaires were distributed during a scheduled class period, and participants were asked to complete them independently. Once the data were collected, they were analysed to explore the relationship between SRL and collaboration skills, and to examine any gender-based differences in these skills. The analysis aimed to identify any significant correlations between the two variables and to determine whether there were any notable gender differences in SRL or collaboration skills.

Analysis of Data and Discussion:

The chart illustrates the distribution of scores for Self-Regulated Learning (SRL) and Collaboration Skills (CS), showing how individual scores are spread across the scale.



The descriptive statistics of Self-regulated Learning and Collaboration skills are given in Tables 1-3.

Table 1: The descriptive statistics of Self-regulated learning and Collaboration Skills

	Mean	Std. Deviation		N
SRL	181.24	23.67		80
COLLABORATION	109.34	11.96		80

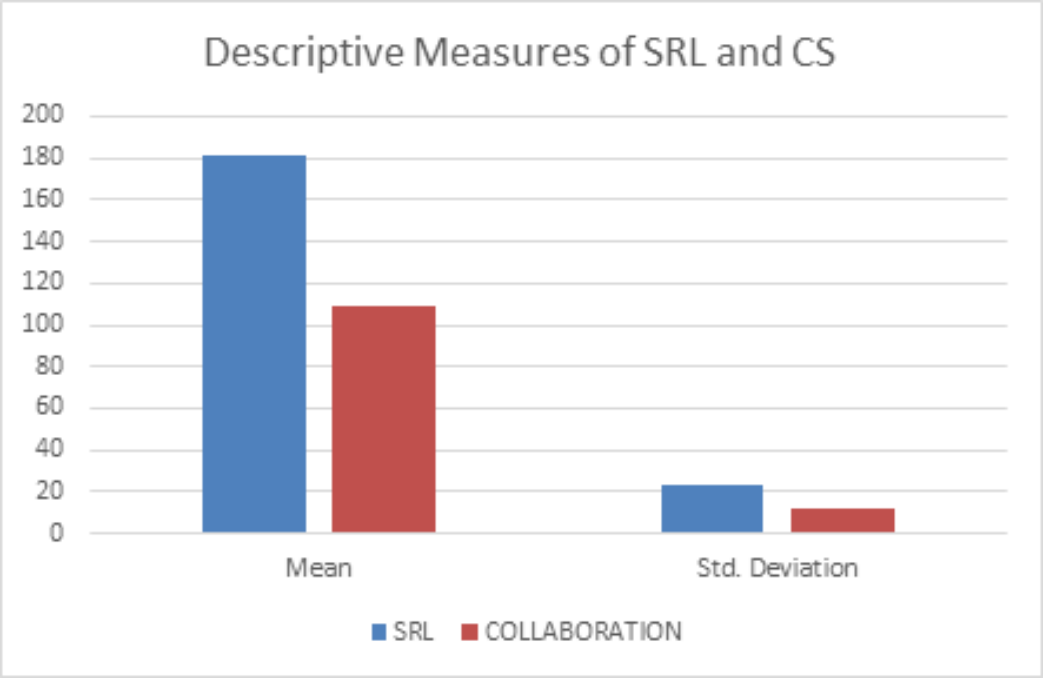


Figure .1 Descriptive Measures of SRL and CS

Discussion:

Table 1 presents the descriptive statistics for Self-Regulated Learning (SRL) and Collaboration Skills (CS) among a sample of 80 students show that the average SRL score is 181.24 with a standard deviation of 23.67, indicating a moderate level of variation around the mean. For Collaboration Skills, the average score is 109.34 with a standard deviation of 11.96, suggesting slightly less variability in comparison to SRL scores.

Table 2: SRL Group Statistics

	Gender	N	Mean	Std. Deviation
SRL	Female	40	180.36	21.39
	Male	40	182.07	25.89

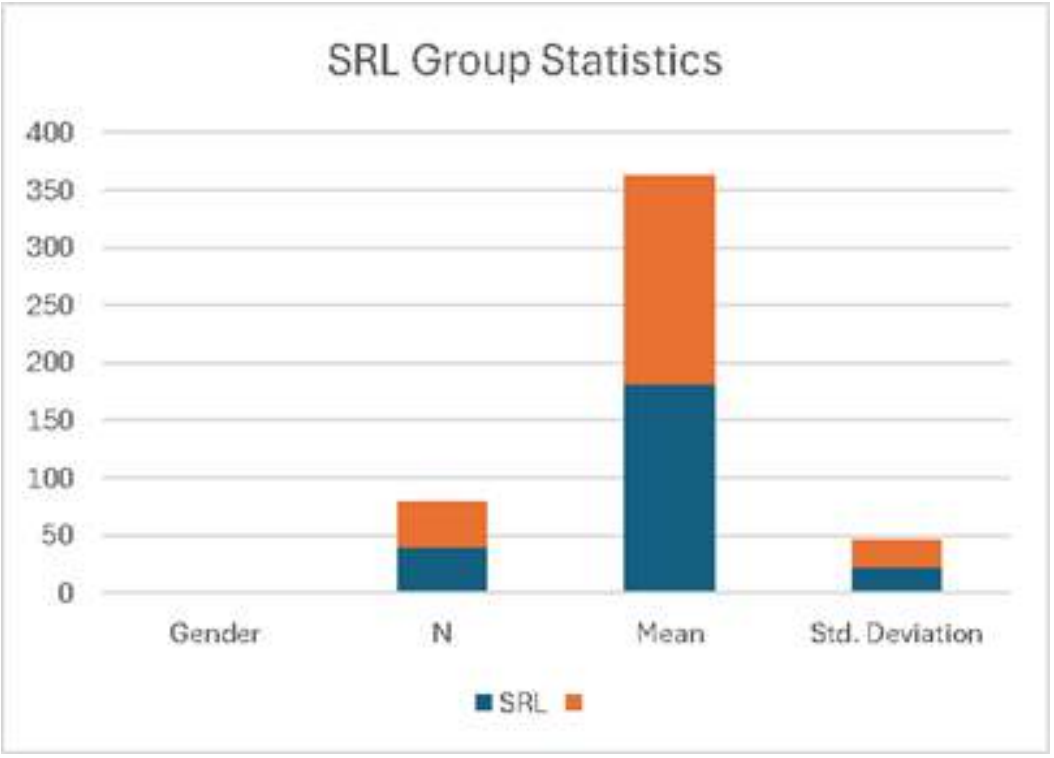


Figure .2 SRL Group Statistics

Discussion:

Table 2 presents the group statistics for Self-Regulated Learning (SRL) scores by gender. Among the 40 female students, the average SRL score is 180.36 with a standard deviation of 21.39, showing a moderate spread of scores around the mean. In comparison, the 40 male students have a slightly higher average SRL score of 182.07 with a standard deviation of 25.89, indicating slightly more variation in scores. These results suggest minor differences in SRL scores between male and female students in the sample.

Table 3: Collaboration Skills Group Statistics

	Gender	N	Mean	Std. Deviation
CS	Female	40	107.79	12.94
	Male	40	110.80	10.90

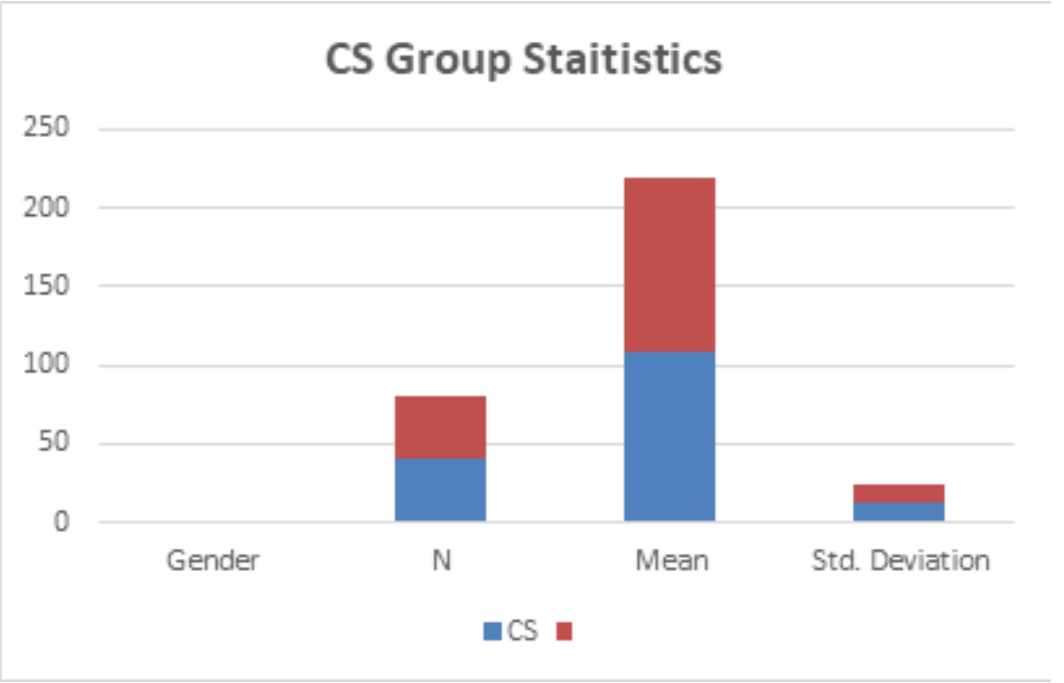


Figure .3 Collaboration Skills Group Statistics

Discussion:

The group statistics for Collaboration Skills (CS) scores in Table 3 show that female students (N = 40) have a mean score of 107.79 with a standard deviation of 12.94, while male students (N = 40) have a slightly higher mean score of 110.80 and a standard deviation of 10.90. This indicates that, on average, male students have slightly higher scores in collaboration skills compared to female students.

The objectives-wise and hypothesis-wise data analysis and interpretation are given below:

The researcher analysed the objectives of the study using statistical methods such as Correlation Analysis and Independent Samples t-Test.

Objective 1: To examine the correlation between self-regulated learning (SRL) and collaboration skills among vocational education students - This objective aimed to determine whether higher levels of SRL are associated with better collaboration skills, thereby exploring the direct relationship between these two variables.

Hypothesis 1: A positive correlation exists between self-regulated learning (SRL) and collaboration skills among vocational education students. This hypothesis predicts that vocational education students who exhibit higher levels of self-regulated learning will also demonstrate stronger collaboration skills.

Correlation Analysis: The result in Table 4 shows a correlation between vocational education students' self-regulated learning and collaboration skills.

Table 4. The correlation between vocational education students' self-regulated learning and collaboration skills

	SRL	COLLABORATION
SRL	1	.462**
COLLABORATION	.462**	1

** significant at .0.01 level

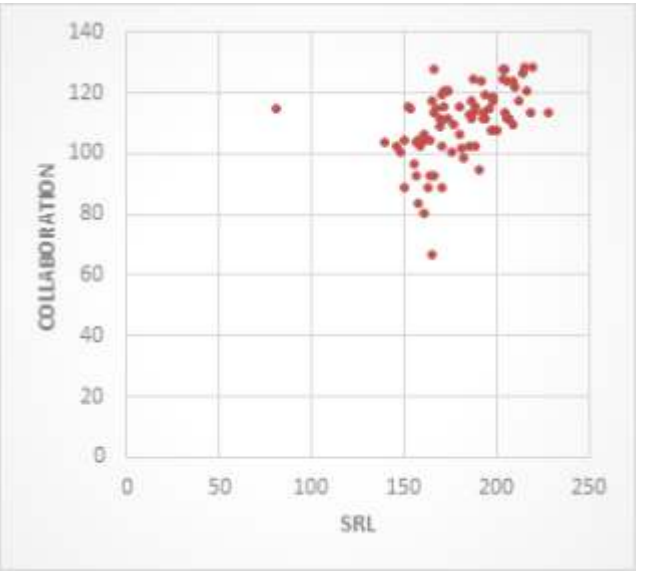


Figure .4 Correlation between SRL and CS Scores

Discussion:

Pearson's correlation coefficient in Table 4 reveals a moderate positive correlation between SRL and collaboration skills (r = 0.462, p = 0.001). The p-value of 0.001 indicates that the correlation is statistically significant at the 0.01 level. This direct relationship suggests that vocational education students who are more proficient in self-regulated learning also tend to have better collaboration skills. The correlation is statistically significant, indicating that the relationship is unlikely due to chance. Thus, hypothesis 1 is accepted.

Objective 2: To analyse potential gender differences in self-regulated learning and collaboration skills. This objective seeks to identify whether there are significant differences in SRL and collaboration skills between male and female vocational education students, contributing to the understanding of gender-related influences on these skills.

Hypothesis 2: There are no significant gender differences in self-regulated learning (SRL) and collaboration skills among vocational education students. This hypothesis posits that male and female vocational education students will show similar levels of SRL and collaboration skills, indicating that gender does not significantly affect these abilities.

Independent Samples t-Test: The independent samples t-tests were conducted to analyse differences in SRL and collaboration skills between male and female vocational education students.

Table 5: Independent Samples t-Test for SRL for gender differences

	t	df	p- value	Levene's Test
SRL	-.322	78	.748	.502

Discussion:

The results of the Independent Samples t-test for Self-Regulated Learning (SRL) in Table 5 indicate that there is no significant difference in SRL scores between male and female vocational education students. Levene's Test for Equality of Variances shows a p-value of 0.502, which is greater than 0.05, suggesting that the assumption of equal variances holds true. The t-test statistic is -0.322 with 78 degrees of freedom, and the p-value is 0.748, which is well above the 0.05 significance level. This means that gender does not significantly influence SRL scores.

Table 6: Independent Samples t-Test for CS for gender differences

	t	df	p- value	Levene's Test
CS	-1.127	78	.263	.536

Discussion:

The results of the Independent Samples t-test for Collaboration Skills (CS) in Table 6 show no significant difference between male and female vocational education students. Levene's Test for Equality of Variances has a p-value of 0.536, which is greater than 0.05, indicating that the assumption of equal variances is not violated. The t-test statistic is -1.127 with 78 degrees of freedom, and the p-value is 0.263, which is greater than the 0.05 significance level. This suggests that gender does not significantly impact CS scores.

Findings and Educational Implications

The findings of this study reveal a significant positive correlation between self-regulated learning (SRL) and collaboration skills, indicating that enhancing SRL can improve vocational education students' ability to collaborate effectively. This supports previous research showing that self-regulation is essential for successful collaboration (Pintrich & De Groot, 1990). Vocational education students, who are preparing for real-world, teamwork-driven environments, particularly benefit from developing SRL skills, as these skills enable them to manage tasks, set goals, and work collaboratively in a structured and independent manner. Additionally, the lack of significant gender differences in SRL and collaboration skills suggests that educational strategies to promote these skills can be applied universally without specific adjustments for gender. This finding aligns with the gender similarities hypothesis, which posits that males and females are more alike than different in many psychological traits (Hyde, 2005). For any vocation and corresponding employability skills, where work readiness is paramount, this implies that SRL and collaboration interventions can be uniformly implemented across male and female students.

Given the positive correlation between SRL and collaboration skills, teachers in vocational settings should consider incorporating SRL-enhancing strategies within collaborative learning activities. For instance, teaching vocational education students effective goal-setting, time management, and self-monitoring techniques can boost both their individual and group performance. Since gender differences were not significant, educational interventions can focus on the unique needs of individual students rather than gender-specific approaches. This suggests that universal strategies for improving SRL and collaboration skills may be equally effective across genders, providing vocational education students with the necessary employability skills to thrive in collaborative, real-world environments.

Conclusion

This study offers valuable insights into the relationship between self-regulated learning (SRL) and collaboration skills among vocational education students, revealing a positive correlation that suggests enhancing SRL can improve collaborative performance thus improving their employability skills in the future. The absence of significant gender differences in SRL and collaboration skills indicates that universal educational strategies focusing on SRL may be effective across genders in enhancing collaborative abilities. These findings support the implementation of SRL-centered approaches to strengthen collaborative skills in vocational education. Further research is recommended to explore additional factors and varied contexts to expand on these findings and refine educational practices.

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Spotlight

Defence Manufacturing and Nanotechnology

Defence manufacturing includes the making of various military tools and technologies, from communication systems to different types of weapons and defence systems. Key advancements in this area include the use of new materials that are lightweight yet strong, and furthermore the introduction of 3D printing, which allows fast creation of parts and also reduces the need for long supply chains. Robotics and automation will also help in improve the accuracy and efficiency of manufacturing processes.

Nanotechnology, works with materials at a very small scale (atomic or molecular level), has also been used by defence manufacturing industries. As it helps in creating military equipment's which are stronger, more efficient but light in weight and easy to use. For example, Nano sensors can detect threats like chemicals or biological agents and weapons of mass destruction at very low levels. Nanotechnology is also leading the new medical treatments for soldiers, such as personalized drug delivery, and better energy storage systems.

However, there are challenges in using nanotechnology for defence area. Ethically using advanced military technologies has been always biggest concern for military safety protocols. As using new technologies needs lots of training and safety programs. Moreover, it needs adaptation of rules and regulations. Most important concern is the need of the potential environmental and safety risks of nanomaterials must be addressed. It's important to balance innovation with responsible use to make sure these advancements are safe and beneficial and can be easily monitored and controlled.

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Training Needs Assessment for Hospital Cleaning and Nursing Staff: A Case Study Analysis with Social Media Influence

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Abstract

Hospitals are intended to be sanctuaries of healing, yet inadequate sanitation and improper nursing practices can undermine patient care and safety. This case study examines critical deficiencies in the training and performance of hospital cleaning and nursing staff, as observed in a private Indian hospital. These gaps jeopardize hygiene standards and patient health, highlighting the urgent need for targeted interventions. The study evaluates the training needs, identifies lapses in safety, cleanliness, and quality of care, and explores the potential of social media as a tool for raising awareness and providing effective training to healthcare workers. Based on these findings, recommendations are made for implementing focused training programs and enhancing quality control mechanisms to improve healthcare outcomes.

Keywords: hospital hygiene, nursing practices, staff training, patient safety, healthcare quality

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Introduction

Overview of Hospital Hygiene and Nursing Practices

Hospitals are centres of healing and recovery, but they are also high-risk environments for infections, patient harm, and even fatality if proper hygiene and care protocols are not followed (Joshi, R. K., et al., 2023). In India, healthcare facilities face immense challenges related to patient safety, cleanliness, and the quality of nursing care (Gandra, S., et al., 2024). Ensuring that hospital environments remain clean and safe is vital to prevent hospital-acquired infections (HAIs) and ensure patient well-being. In many hospitals, the gap between best practices and actual conditions can be significant, leading to compromised care (Thakkar, J., et al., 2023).

Importance of Training in Healthcare Settings

To maintain safe hospital environments, both hospital cleaning and nursing staff must be adequately trained. Hospital cleaning staff, often considered peripheral to patient care, play an essential role in controlling the spread of infections, while nurses are critical in ensuring the safety, care, and treatment of patients (Devi, V.R., & Rao, M.M., 2012). Without sufficient training, errors in sanitation and patient care can compromise hospital effectiveness.

Current Standards for Hospital Cleaning and Nursing Practices

Healthcare facilities globally are guided by protocols that ensure hospital environments are clean and patient care is safe. The World Health Organization (WHO, 2023) emphasizes the importance of hand hygiene, proper disposal of medical waste, and maintaining a sterile environment in its infection control guidelines. Similarly, national guidelines, such as the Indian Council of Medical Research (ICMR, 2023) guidelines, outline procedures to prevent the spread of infections in hospitals. However, implementing these standards requires regular training and monitoring. Central Pollution Control Board (2016) has published Guidelines for Management of Healthcare Waste as per Biomedical Waste Management Rules, 2016.

Challenges in Healthcare Quality and Safety in India

Healthcare facilities in India, particularly private and public hospitals, face several challenges such as overcrowding, understaffing, and inadequate infrastructure, which complicate maintaining proper hygiene and patient care (Kasthuri A., 2018). In addition, low levels of training among cleaning and nursing staff contribute to substandard care. Hospitals often struggle to manage these challenges due to a lack of resources, time, and emphasis on training, exacerbating issues related to hospital-acquired infections and patient dissatisfaction.

Importance of Training in Reducing Hospital-Acquired Infections (HAIs)

Training programs focused on infection control have been shown to significantly reduce the incidence of HAIs. Proper education of cleaning staff on the use of

disinfectants, surface cleaning techniques, and waste management can prevent infections (Thakkar, J., et al., 2023). For nurses, adequate training on sterilization, patient care protocols, and medication administration is crucial to reduce errors that could compromise patient health.

Research Findings

Training needs assessment is crucial for healthcare organizations to improve the quality of patient care and staff competencies. Studies have identified gaps in various skills among nursing staff, including clinical skills, team spirit, and enthusiasm for learning (Devi & Rao, 2012). Research activities, supervisory/managerial tasks, and clinical tasks were found to be areas requiring the most training for doctors and nurses in a tertiary care hospital in India (Kaur & Singh, 2022). The importance of evaluating training needs for nursing staff in multi-specialty hospitals has been emphasized, considering their key role in the healthcare industry (Salunkhe, 2023). Additionally, the often-neglected role of hospital cleaners in patient safety, particularly in maternity units, has been highlighted. Improved training, recognition, and working conditions for cleaning staff are essential to enhance environmental hygiene and reduce healthcare-associated infections (Cross et al., 2019). These findings underscore the need for comprehensive training programs tailored to different healthcare roles.

Objective of the Study

This case study seeks to:

1. ***Evaluate the training needs*** of hospital cleaning and nursing staff in a private Indian hospital.
2. ***Identify gaps*** in their current practices related to safety, cleanliness, and quality of care.
3. ***Recommend targeted training interventions*** to enhance these practices.
4. ***Explore the potential of social media*** as a tool for raising awareness and providing training to healthcare workers and professionals.

Methodology

This study used a qualitative research design, employing non-participant observation in private hospitals over a few weeks to identify gaps in cleaning and nursing staff practices. Data was gathered through unstructured observations, focusing on cleaning staff's sanitation, linen management, and waste disposal, and nursing staff's patient care, hygiene, medication administration, and communication. Informal interviews with staff were also conducted. The study was conducted in few private hospitals in Bhopal, India, chosen for their representative practices. Data was analysed by comparing observed practices with government standards. Limitations include the small sample size and focus on specific departments, suggesting the need for broader studies.

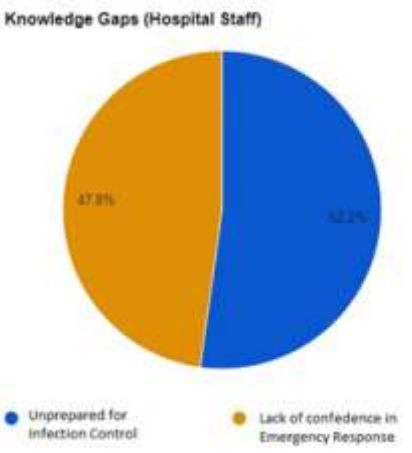
Results

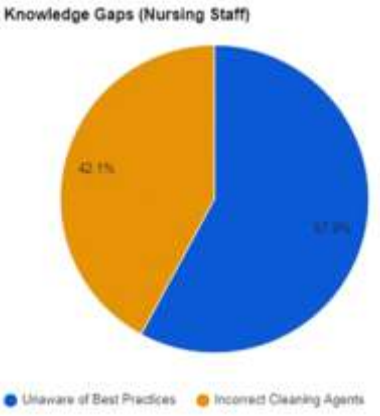
Results from the present study reveal significant gaps in training and adherence to hospital cleaning and nursing protocols, impacting patient safety and care quality. According to the Lancet Medical Journal's Global Burden of Disease Study, India ranks 145th out of 195 countries, but its healthcare access and quality index score has improved from 44.8 in 2015 to 67.3 in 2020. Data from secondary sources indicate that only 45% of nursing staff have completed formal training on infection control, with just 30% receiving specialized training in cleaning and disinfection protocols. Furthermore, 50-60% of nursing staff were unaware of the latest cleaning guidelines for high-touch surfaces, and only 40% could correctly identify cleaning agents for specific contaminants. Compliance with cleaning protocols is low, with only 60% of nursing staff adhering to them and 55% following recommended cleaning frequencies for patient rooms. The gaps in training have contributed to a 20-30% increase in hospital-acquired infections (HAIs), leading to significant financial implications globally.

The study also identified limited accessibility to training programs, as only 35% of hospitals offer structured cleaning protocol training, with less than 5% of hospital budgets allocated to infection control. Moreover, 70% of nursing staff expressed a need for ongoing education, with 60% reporting no skill refreshers in the past year. For broader hospital staff, 50% had completed mandatory infection control training, and 40% had role-specific training, with an average score of 65% in infection control knowledge assessments. Observational studies revealed that 55% demonstrated inadequate hand hygiene and equipment sterilization practices. Only 30% of hospital staff had easy access to continuous training, while less than 7% of hospital budgets were dedicated to staff training. Despite these challenges, staff expressed a strong interest in further education, with 70% calling for more training in communication, conflict resolution, and clinical skills.

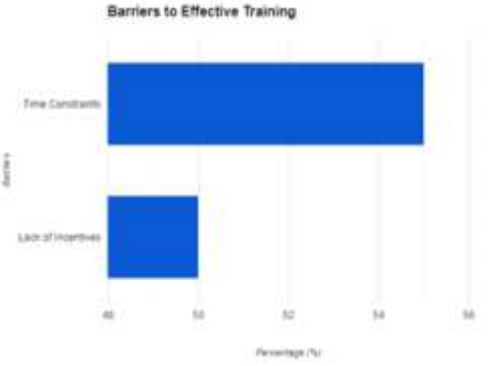
Direct observations in hospitals uncovered several deficiencies in cleaning practices, including inadequate surface cleaning and improper use of equipment, such as microfiber mops that accumulated dirt. Patient rooms were frequently found with visible dust and hair, and high-touch surfaces like table tops were often neglected. Additionally, improper linen changes released dust into the air, and staff frequently failed to follow biomedical waste segregation guidelines. Sanitation and pest control issues were evident, with mosquitoes and cockroaches present in patient areas. Patient care protocols were also neglected, with cleaning staff performing body wipes without gloves during high-fever cases, creating a risk of cross-contamination.

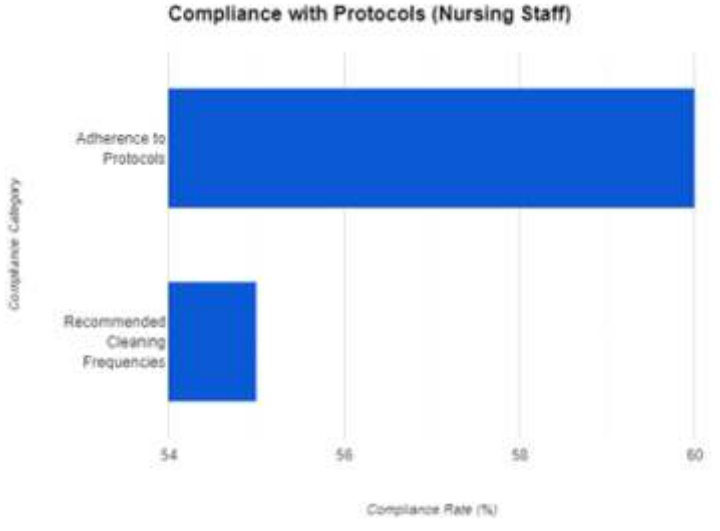
Nursing practices also revealed concerning gaps, particularly in-patient hygiene and medication administration. Nurses often delegated patient body wipes to untrained cleaning staff, while medication administration errors, such as incorrect dosages and unsafe IV practices, were observed. Additionally, nurses frequently failed to communicate effectively with patients, leading to confusion and anxiety. Hand hygiene protocols were not consistently followed, with many nurses moving between patients without sanitizing hands or using appropriate protective gear. The observations underscore the critical need for enhanced training, supervision, and adherence to hospital protocols to ensure patient safety.


Knowledge Gaps (Hospital Staff)
47.8%
52.2%
Unprepared for Infection Control
Lack of confedence in Emergency Response


Knowledge Gaps (Nursing Staff)
42.1%
57.9%
Unaware of Best Practices
Incorrect Cleaning Agents


Training Completion Rates
Formal Training
Infection Control
Mandatory Training
Specialized Training
Nursing Staff
Hospital Staff


Barriers to Effective Training
Time Constraints
Lack of Incentives


Compliance with Protocols (Nursing Staff)
Adherence to Protocols
Recommended Cleaning Frequencies
Compliance Category
54
56
58
60
Compliance Rate (%)

Discussion

The study highlights major deficiencies in both cleaning and nursing staff training, which have a direct impact on hospital hygiene, patient care, and safety. The gaps in cleaning practices, including improper surface sanitation and inadequate pest control, are alarming, as they directly contribute to the spread of HAIs and other complications in hospital environments. Similarly, the observed deficits in nursing protocols for medication administration, patient communication, and hand hygiene underscore the urgent need for more effective and structured training programs.Hospitals must address these gaps by developing tailored training initiatives that focus on advanced cleaning techniques, biomedical waste management, and strict infection control practices. Furthermore, continuous education and skill refreshers are crucial, especially in the context of evolving healthcare protocols and new technologies. Improved staff supervision, combined with routine audits, is essential for ensuring consistent adherence to protocols, thereby reducing the risk of infections and improving patient outcomes.The study also underscores the critical role of social media in delivering targeted training and facilitating continuous learning. Platforms like YouTube and WhatsApp offer staff accessible, real-time educational content, while discussion forums provide opportunities for peer learning and problem-solving. However, challenges such as digital literacy and staff engagement need to be addressed to fully leverage social media as a training tool.

Role of Social Media in Training Needs Assessment and Training

Social media has emerged as a powerful tool for Training Needs Assessment (TNA) and training delivery in hospital settings, particularly for cleaning and nursing staff. It facilitates data collection through surveys, polls, and feedback forms on platforms like Facebook, WhatsApp, and LinkedIn, enabling real-time insights into staff knowledge gaps and challenges. Discussion forums on platforms such as Reddit and Facebook groups allow staff to share experiences, revealing areas that need targeted training, like the improper use of disinfectants or inadequate waste disposal practices. Social media also enhances training by providing easy access to educational videos and tutorials on platforms like YouTube, Instagram, and TikTok, making it simple for staff to learn critical skills such as sterilization techniques and PPE usage. Live sessions and webinars on platforms like Facebook Live and Zoom allow for interactive learning and immediate feedback. Peer learning is encouraged through closed groups on WhatsApp or Telegram, where staff can exchange tips and collaborate. Additionally, social media builds awareness through targeted campaigns promoting hygiene practices, with infographics and short videos shared on Twitter and Instagram, and provides real-time updates via apps like WhatsApp to keep staff informed of new safety guidelines. Social media fosters positive attitudes toward continuous learning by making training resources readily accessible, encouraging staff to stay updated with best practices and technologies. Recognition and reward systems can further reinforce positive behaviours, motivating staff to adopt good hygiene and care practices. However, challenges such as digital literacy and maintaining engagement remain, as not all staff may be comfortable using social media platforms. Creative strategies, like gamification and reward systems, are necessary to keep staff motivated. Despite these challenges, social media significantly enhances TNA and training, promoting a culture of learning, collaboration, and improved healthcare outcomes.

Recommendations

For Cleaning Staff:

1. ***Advanced Surface Cleaning Techniques:*** Provide comprehensive training on proper use of microfiber mops, disinfectants, and surface cleaning methods.
2. ***Biomedical Waste Management:*** Train staff on strict segregation and disposal of medical waste to comply with national guidelines.
3. ***Pest Control Training:*** Implement regular training on pest control, emphasizing its importance for patient safety.

For Nursing Staff:

1. ***Infection Control Protocols:*** Conduct regular, mandatory training on hand hygiene, sterilization, and PPE use to reduce infection risks.
2. ***Medication Safety and Administration:*** Train nurses on accurate dosage, timing, and sterile handling of medications to prevent errors.
3. ***Patient Communication Skills:*** Develop training modules focused on clear communication of medical procedures and medications to patients.

Policy Recommendations:

1. ***Mandatory Refresher Training:*** Hospitals should require regular refresher courses for both cleaning and nursing staff to ensure up-to-date knowledge and practices.
2. ***Enhanced Supervision and Auditing:*** Implement a robust auditing system that regularly monitors staff adherence to hygiene and patient care protocols.
3. ***Increased Budget Allocation:*** Allocate more hospital resources to staff training, especially in infection control and patient safety.

Use of Social Media:

1. ***Training and Peer Collaboration:*** Leverage platforms like YouTube, WhatsApp, and Facebook for sharing educational videos, organizing webinars, and facilitating peer-to-peer learning.
2. ***Real-Time Alerts***: Utilize messaging apps to deliver instant updates on new hospital protocols and training opportunities.

These measures will help bridge the existing gaps in staff training and ensure higher compliance with health and safety protocols in hospital settings.

Future Research Directions

Further research could focus on longitudinal studies that assess the impact of training programs on healthcare quality and patient outcomes. Additionally, exploring technological solutions for real-time monitoring of staff adherence to hygiene and patient care protocols would be beneficial.

Conclusion

The findings from this case study emphasize the urgent need for comprehensive training programs for both hospital cleaning and nursing staff. The gaps identified in cleaning practices, such as inadequate surface sanitation and improper waste management, pose significant health risks. Likewise, the nursing staff's lack of adherence to infection control and medication administration protocols compromises patient safety. Only through targeted training interventions, continuous monitoring, and effective supervision can hospitals ensure a safer, cleaner, and more patient-friendly environment.

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A Poem on Vocational Education in Schools...

In the classroom, pencils scratch,
As students ponder life's long match, What will they do when school is done? Where will they go, what work begun?

With paths so many, options abound, But one stands out, sturdy and sound, Vocational education, a vital key,
To unlocking doors, for all to see.

Rich soil and shining sun, Drones at work, Sowing seeds, Plowing fields, tilling earth, Irrigating with added supplements, Bountiful harvest, nature's worth.

In trades and skills, students excel, Learning trades that serve them well, Welding, carpentry, mechanics too, Offer jobs to those with know-how.

In healthcare fields, training shines, Pharmacists, nurses, and techs divine, Working hard to help us heal,
Their skills and knowledge, so very real.

From farm to table, food processing, Brings us all delicious blessings, Fruits and veggies, meats and grains, All transformed, without any pains.

In culinary arts, students savor, Creating feasts of flavors,
Chefs and cooks, feeding the masses, Foodies unite, in classes.

A machine of metal and steel, Roaring down the highway at full zeal, A symbol of freedom and speed,
The automobile, an icon indeed.

Clothing that we choose to wear, A reflection of our style and flair,
From casual to formal, there's a pair, Apparel for all occasions, everywhere.

Tourism, a world of wonder, Adventures to make us ponder, New sights and sounds to explore, Memories that we'll adore.

In all these fields, and many more, Vocational education opens doors,
To careers that match students' dreams, The pathway to success, so it seems.

So let us celebrate, and stand tall,
For vocational education serves us all, A chance to build and grow each day, To forge a bright and hopeful way.

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PSS Central Institute of Vocational Education

The Pandit Sunderlal Sharma Central Institute of Vocational Education (PSSCIVE), set up in 1993 at Bhopal by the Government of India is an apex research and development organization in the field of vocational education. It is a constituent unit of National Council of Educational Research and Training (NCERT), established by the Ministry of Education, Government of India.

The PSSCIVE is a UNESCO-UNEVOC (International Project on Technical and Vocational Education) Centre in India.

The Institute advises and assists the central and state governments on the various aspects of planning and implementation of vocational education and training programmes. It develops guidelines, national curricula, courseware, training modules and e-learning materials for a wide spectrum of target groups, including children with special needs. The PSSCIVE collaborates with national and international organizations/institutions/agencies for organizing national/international seminars, conferences, and workshops and development of course materials.

The Institute, which is built on a 37 acre campus, has all the facilities including Auditorium, Hostel, Guest House, Conference Room, Labs, etc. for teaching and training. The faculty members of the Institute are specialists in a variety of disciplines including agriculture, horticulture, fisheries, plant protection, community medicine, healthcare, early childhood education, engineering, information and communication technology, etc. The Institute organizes working group meetings to garner the contributions of the experts and professionals for development of curricula and courseware.

What PSSCIVE Offers:

- Expertise in curriculum development
- Pioneering vocational educational research
- Professional teacher development programmes
- Customised professional development programmes
- Access to experienced teacher educators
- High quality vocational learning programmes for teachers and trainers
- Innovative e-learning technologies and systems
- Training in the applications of ICT
- New ideas and innovation in teaching and training
- Consultancy on implementation of vocational education and training courses

Joint Director

PSS Central Institute of Vocational Education

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