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INDEX

S. No.	Particulars	Page No.
1	A Comparative Study On Load Balancing Algorithms And Its Types **Methily Johri & Aditri Ashish**	1–10
2	Optimizing Supply Chain Management with Ethereum 2.0: Innovations in Blockchain Technology **Ayush Gupta & Dr. Ambuj Kumar Agarwal**	11–17
3	Smart Surveillance: "A Real-Time Crowd Analysis System for Density and Anomaly Detection" **Komal Sharma, Dr. Pankaj Kumar Varshney, Aditi Aggarwal & Gaurav Kumar**	17–22
4	AI-Driven Network Optimization: Matching Policyholders to Cost-Effective Providers Using Business Intelligence **Ruchi Mangharamani & Prof. (Dr) Sangeet Vashishtha**	23–29
5	The Future of UX: Designing for Emerging Technologies (AI, AR, VR, Voice UI) **Ojas Gupta & Prof.(Dr.) Arpit Jain**	30–37
6	Enhancing Liquidity Stress Testing: Best Practices for Modern Banking Risks **Padmini Bulani & Dr Abhishek Jain**	38–45
7	AI-Powered Investment Strategies: Optimizing Risk and Returns in Modern Banking **Aditya Mehra & Dr. Shakeb Khan**	46–53
8	Scaling Customer Journey Optimization in a Multi-Tenant Distributed System **Sumit Kumar Agrawal & Prof. (Dr) MSR Prasad**	54–61
9	Object Detection Using Convolutional Neural Networks: Advances, Techniques, and Applications	62–69

S. No.	Particulars	Page No.
	Bharath Thandalam Rajasekaran, Saravanan Thirumazhisai Prabhagaran & Prof. (Dr) Punit Goel	
10	AI-Augmented Intrusion Detection Systems for High-Speed Optical Networks **Sattvik Sharma & Prof.(Dr) Avneesh Kumar**	70–77
11	Generative AI in Data Security: Opportunities and Challenges **Vybhavreddy Kammireddy Changalreddy, Piyush Bipinkumar Desai & Prof (Dr) Ajay Shriram Kushwaha**	78–86
12	Integrating Salesforce with Cloud-Based Data Warehousing for Unified Analytics **Nidhi Shashikumar & Dr S P Singh**	87–94
13	AI-Powered Cybersecurity: A Unified Approach to Protecting Enterprise, Cloud, and SaaS Applications **Varun Grover, Khushmeet Singh & Er. Siddharth**	95–103
14	Sales and Order Analysis Using Excel-Based Dashboard: A Case Study on Vrinda Store **Mohd Ammar Khan & Harun Faridi**	104–106
15	ChatMania: A Realtime Chat Application **Dr. Kirti Shukla & Anshika**	107–110
16	Digital Surveillance and Domestic Abuse: A Legal Vacuum in Indian Marital Relationships **Vishal Nehra & Dr. Rakesh Kumar**	110–116
17	The Role of Emotional Appeal in Online Advertisements Targeting Working Women in Delhi-NCR **Mona Mishra & Dr. Praveen Mittal**	116–120
18	AI-Driven Data Governance Strategies for Enhanced Cloud Security in Enterprises **Chandana Pandey & Dr Gauri Shanker Kushwaha**	121–123

S. No.	Particulars	Page No.
19	Evolution of Social Media Advertising and Consumer Behavior **Mr. Pramod Rana & Prof (Dr) Punit Goel**	124–129
20	Sustainability Accounting Practices in Indian Manufacturing Firms **Mrs. Sonal Jain & Dr. Ajit Singh**	129–134
21	Fundamental Rights vs. Reasonable Restrictions: A Study of Evolving Judicial Balances **Mrs. Anshika Agarwal & Dr. Vijay Kumar Singh**	134–139
22	सतत शिक्षा के लिए हिंदी साहित्य की भूमिका: सतत विकास लक्ष्य-4 (गुणवत्तापूर्ण शिक्षा) का सांस्कृतिक विश्लेषण **श्रीमती रेणु गुप्ता, डॉ. बृजलता शर्मा**	140–144
23	Mind–Gut Synergy in Chronic Lifestyle Conditions: Evaluating Psychotherapy-Driven Behavioral Change and Microbiota-Mediated Metabolic Repair **Krithika. V, Dr. Sarbesh Kumar Singh**	145–151
24	प्राचीन शिक्षा प्रणाली से आधुनिक AI आधारित शिक्षा की ओर संक्रमण **गौरव जोशी, डॉ सारिका गोयल**	152–159
25	पर्वतीय क्षेत्रों में शिक्षा के डिजिटलीकरण की चुनौतियाँ एवं संभावनाएँ **राकेश उनियाल, डॉ. मीनाक्षी हर्राव वर्मा**	160–168
26	Women Leadership and Democratic Participation in India: Challenges and Opportunities in Parliamentary Politics **Renu Yadav, Dr. P.P.S. Rana**	169–176
27	Evaluating GST Effects on Competitiveness and Industrial Development **Aman Goel, Dr. Pooja Yadav**	177–183
28	एस०आर० हरनोट के कथा साहित्य में लोक संस्कृति, पर्यावरण चेतना और सामाजिक परिवर्तन का अध्ययन **सीमा देवी, डॉ० अरविन्द्र कौर चुंबर**	184–189

S. No.	Particulars	Page No.
29	Balancing National Security and Human Rights in Modern India **Shalu Jain, Dr. Vijay Kumar**	190–197
30	Economic Performance Drivers and Fiscal Resilience in Indian Airports **Lalit Kumar Sharma, Dr. Pooja Yadav**	198–203
31	Educational Governance and AI Learning Outcomes in Government Elementary Schools **Dr. Shubhra Chaturvedi**	203–210
32	Artificial Intelligence and the Future of Teacher Roles in India Classroom **Neeru Verma**	211–220
33	Research Culture Among Undergraduate Students in Indian Universities **Dr. Dhanashri Rajshri Ravindra Jadhav**	221–229
34	डिजिटल समाज में बहुभाषिक संचार का बदलता स्वरूप: भारतीय भाषाओं के समक्ष अवसर और चुनौतियाँ **Rakesh Uniyal**	230–234
35	Graduate Employability and Skill Gaps in State Universities **Narender Panghal**	235–242
36	Political Funding Transparency in Indian Election **Dr. Anand Kumar Dwivedi**	243–252
37	AI-Powered Platforms for Data Analytics and Audience Development **Sachin Sangal**	253–258
38	Engineering Leadership Models in AI Startups: Balancing Innovation and Operational Efficiency **Dr. Kalpesh Rasiklal Rakholia**	259–269
39	Challenges in Integrating CWSN in Regular Classrooms **Anil Kumar**	270–280
40	An Artificial Intelligence-Based Legal Compliance Framework for Real-Time Environmental Governance to Advance SDGs 9, 12, 13, and 16 **Dr. Jyoti Janardhan Reddy**	281–288

S. No.	Particulars	Page No.
41	Impact of Source Segregation and Waste Characterization on the Efficiency of Material Recovery Facilities **Varinder Vikram Singh, Dr. Pankaj Kumar Bharti**	289–296
42	Significance of Emotional Intelligence of schedule caste students in relation to Self-concept at secondary level **Mrs. Varsha Asher Wasker, Dr. Kuldeep Singh Tomar**	297–305
43	औपनिवेशिक भारत में स्थानीय बाजारों के सामाजिक परिवर्तन का ऐतिहासिक अध्ययन **Pankaj Tamta**	306–310
44	Teachers' Readiness to Integrate Generative AI into Lesson Planning and Classroom Instruction **Prema Bharti**	311–316
45	Battery Usage Optimization Techniques for AI-Heavy Mobile Apps **Dr. Akankasha Kathuria**	317–321
46	Gender, Technology, and Changing Family Structures in Urban India: A Socio-cultural Analysis **Prof. Sawant Jeetendra Madhukar Usha**	322–326
47	Law and Alternative Dispute Resolution in Contemporary Civil Justice: A Legal Study **Dr. Pooja Khurana**	327–331
48	English Literature and the Representation of Women in Contemporary Fiction: A Corpus-Based Study of Narrative Agency, 2000–2024 **Dr. Abu Farah Hoque**	332–336
49	Agricultural Impact of Biochar and Reduced Fertilizer on Mustard Soil Health and Yield **Dr. Bibhu Santosh Behera**	337–346
50	Ethical and Privacy Frameworks for AI-Driven Customer Data Analytics in Medical Profession **Dr. Gaurav Singh Tomar**	347–351
51	Legal Protection of Witnesses in Criminal Justice Proceedings **Dr. Jyoti Janardhan Reddy**	352–357

S. No.	Particulars	Page No.
52	Platform Culture and Fragmented Selfhood in Contemporary English Literature **Dr. Akanksha Singh**	358–362
53	Digital Health Literacy and Health Information Inequality in Rural India: A Multidimensional Assessment **Ranjana Jadaun**	363–368
54	स्मार्ट विनिर्माण और उद्योग 5.0 में कृत्रिम बुद्धिमत्ता, मानव-केंद्रित तकनीक और सतत विकास का अंतःविषयक अध्ययन **Dr. Ghamendra Kumar Sahu**	369–375
55	Contribution of Yoga-Based Breathing Techniques to Daily Stress Management **Dr. Sweta Kumari**	376–387
56	Algorithmic Silence and Unspoken Meaning in Contemporary English Fiction **Dr. Jyoti Devi**	388–396
57	Cost-Benefit Analysis of Custom Image Analysis Tools in Oncology Research **Sumit Malhotra**	397–405
58	उच्च शिक्षा में सूक्ष्म अधिगम तकनीकों का शैक्षिक प्रभाव **Ram Singh**	406–412
59	Optimising Laboratory Workflows with Low-Code/No-Code Software Solutions **Dr. Amit Nampalliwar**	413–421
60	भारतीय बहुभाषिक समाज में भाषा, संस्कृति और राष्ट्रीय एकता का अध्ययन **Dr. Geeta Rawat**	422–428
61	Influence of FinTech Innovation on Financial Resilience and Operational Efficiency of Retailers and Street Vendors **Prof. Manmeet Kumar Siras & Shyam Pandey**	429–435
62	भारत में आपातकालीन शक्तियाँ और लोकतांत्रिक उत्तरदायित्व: संसदीय शासन के अंतर्गत राष्ट्रपति की संवैधानिक भूमिका का विश्लेषण **सीता राम पंडित, डॉ. पी. पी. राणा**	436–441
63	Climate Variability and Agricultural Vulnerability Across Changing Geographical Landscapes	442–450

S. No.	Particulars	Page No.
	Dr. Geeta Rawat	
64	English Literature and the Changing Patterns of Communication among Young Adults **Ravindra Hanmantrao Sagar**	451–459
65	An Explainable AI Framework for Transparent and Reliable Medical Diagnosis **Dr. Thejoram Naresh Reddy Boya**	460–466
66	डिजिटल समुदायों का युवा शिक्षा और सामूहिक पहचान पर प्रभाव **डॉ. मनोज कुमार सकलानी**	467–473
67	Adaptive Technologies for Enhancing Online Shopping Experiences **Dr. Abhishek Bhattacharjee**	474–479
68	Impact of Digital Payment Adoption through AI-ML on Micro-Business Performance **Ralphy Joseph C J**	480–484
69	Role of Regional Parties in Shaping Federalism in India **Dr. Shailendra Kumar**	485–489
70	Serverless Computing Optimization: Enhancing Performance with AI-Based Resource Allocation **S. Venkatasubramanian**	490–495
71	Student Satisfaction in Autonomous vs. Affiliated Colleges **Dr. Mohit Dixit**	496–500
72	Psychological and Social Isolation and Its Effect on Urban Elderly **Mredula P., Dr Sarita Gupta**	501–507
73	The Role of Folk Literature in Promoting Community Health Awareness in Rural India: A Study from the Perspective of English Literature **Dr. Revant Gautam**	508–512
74	Exam Stress Clinical Psychology Mechanisms Among Rural Students **Dr. Avinash D. Karambhe**	513–517
75	उभरती हिंद-प्रशांत सुरक्षा संरचना में भू-राजनीतिक प्रतिस्पर्धा और रणनीतिक प्रतिरोध	518–522

S. No.	Particulars	Page No.
	Dr. Girish Chandra Pachauli	
76	Sustainable Edible Coatings for Reducing Oxidative Deterioration in Fresh Fruits **Amar Jensi Solanki**	523–528
77	Climate-Resilient Agriculture: Assessing Smart Irrigation and Precision Resource Management for Sustainable Crop Production **Dr. Bibhu Santosh Behera**	529–534

INDEX (CONTINUED)

S. No.	Particulars	Page No.
78	Innovations in Healthcare Product Management Through AI and Machine Learning **Dr. Navdeep Singh**	**535–538**
79	Psychological Effects of Music and Memory Recall in Elderly Patients **Lindamulage Mithun Dilantha Deva Adithiya**	**539–544**
80	Comparative Study of Formative Assessment in Government vs. Private Schools **Dr. Roopali Chandra**	**545–549**
81	Educational Learning Needs of Orphaned Children in Institutional Homes **Ajitha. P. M**	**550–554**
82	Behavioral Differences in Joint vs. Nuclear Family Children **Rajeevan Edadan Puthiya Veetil**	**555–559**
83	Leveraging Data Architecture to Enhance Business Intelligence in Retail and Finance **Dr. Priyanka Gosain**	**560–563**
84	Effect of Pelvic Floor Exercises on Women’s Health and Functional Recovery **Dr. Kapila Jain**	**564–569**
85	Acceptance of AI-Assisted Drug Information Systems by Pharmacists **Dr. Tarun Sahani**	**570–574**
86	Jane Austen’s Portrayal of Marriage and Society in English Literature **Serjana Thapa**	**575–581**
87	Employability Skill Gaps in Engineering Graduates (2013–2016) **Dr. A. H. Khan**	**582–586**

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Employability Skill Gaps in Engineering Graduates (2013–2016)

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Abstract— Engineering graduates often face a mismatch between the technical competencies acquired during their academic programs and the employability skills demanded by industry. This study examines the employability skill gaps among engineering graduates who completed their programs between 2013 and 2016. Using a structured survey administered to a sample of 200 recent graduates across various engineering disciplines, the research identifies core areas—such as communication, teamwork, problem-solving, ethical reasoning, and adaptability—where deficiencies are most pronounced. Quantitative analysis reveals that over 65% of respondents perceive communication skills as insufficiently developed, while 58% report inadequate exposure to real-world problem-solving scenarios during their coursework.

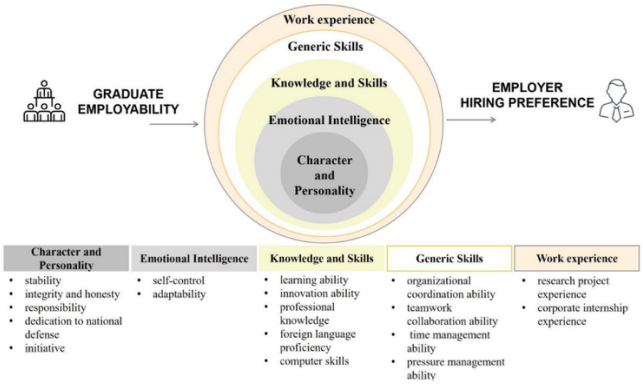


Fig.1 Employability Skill Gaps in Engineering,Source([1])

The study triangulates survey findings with input from 20 industry recruiters through semi-structured interviews, confirming the critical nature of these gaps. Based on these insights, the paper proposes targeted curricular and co-curricular interventions—such as integrated soft-skills modules, project-based learning, internships, and mentorship programs—to bridge the divide between academia and industry. The research contributes to the broader discourse on engineering education reform by offering evidence-based recommendations aimed at enhancing graduate employability and aligning engineering curricula with evolving workforce needs.

Keywords

employability gap; engineering graduates; soft skills; industry alignment; project-based learning

Introduction

Over the past decade, the rapid evolution of engineering practice—driven by technological advances, globalization, and interdisciplinary collaboration—has heightened employers' expectations of graduates' skill sets. While traditional engineering curricula emphasize domain-specific knowledge (e.g., thermodynamics, circuit theory, programming), industry stakeholders increasingly prioritize transferable skills such as effective communication, teamwork, critical thinking, and adaptability. However, multiple reports indicate a persistent employability gap: graduates often lack the non-technical competencies necessary to thrive in professional environments.[1] [2] This divide not only hampers individual career progression but also constrains organizational innovation and productivity.

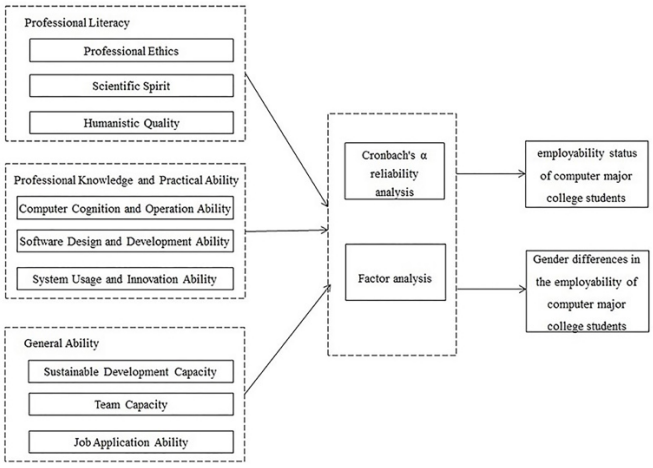


Fig.2 Employability Skill Gaps,Source([2])

In India, where engineering institutions annually produce over a million graduates, the challenge is particularly acute.[3] Despite accreditation standards mandating outcome-based education, anecdotal evidence suggests that academic programs struggle to integrate experiential learning and soft-skills development at scale. Moreover, the period from 2013 to 2016 witnessed significant curricular revisions in many universities—yet the impact of these changes on graduates' employability remains under-examined. This study aims to

fill that gap by systematically assessing the skill deficiencies perceived by engineering graduates from this cohort and corroborating these perceptions with industry recruiter insights.

The objectives of this research are threefold: (1) to quantify the extent of employability skill gaps among engineering graduates of 2013–2016; (2) to identify specific competencies where gaps are most pronounced; and (3) to propose curriculum-linked strategies to mitigate these deficiencies. By focusing on a clearly defined graduation window and combining survey data with recruiter interviews, the study offers a nuanced understanding of the interplay between academic preparation and workplace expectations.

Literature Review

Employability Skills Frameworks. The concept of employability extends beyond technical prowess to encompass a suite of transferable skills, attitudes, and behaviors that facilitate workplace effectiveness. Yorke and Knight (2006) define employability as "a set of achievements—skills, understandings, and personal attributes—that make graduates more likely to gain employment and be successful in their chosen occupations."[4] Frameworks such as the Tuning Project (González & Wagenaar, 2005) and the National Association of Colleges and Employers (NACE) emphasize clusters of competencies, including communication, teamwork, problem-solving, leadership, and ethical reasoning.[5]

Skill Gaps in Engineering Education. Multiple empirical studies have documented a misalignment between engineering curricula and industry needs. A survey by the World Economic Forum (2016) highlighted that over 50% of employers worldwide report difficulty finding graduates with adequate soft-skills.[6] In the Indian context, Mascarenhas (2014) found that 62% of recruiters consider written communication as the most significant shortcoming among engineering hires.[7] Meanwhile, Kumar and Tripathi (2018) reported that project-based learning initiatives improved students' critical thinking abilities but were not uniformly adopted across institutions.[8]

Curricular Innovations and Experiential Learning. To address skill deficiencies, many engineering programs have experimented with pedagogical reforms. Problem-Based Learning (PBL) incorporates real-world scenarios to develop analytical and teamwork competencies (Hmelo-Silver, 2004).[9] Capstone courses and industry-sponsored projects aim to bridge theory and practice (Felder & Brent, 2003).[10] Additionally, colleges have introduced dedicated soft-skills modules, often delivered by external trainers, to enhance communication and leadership skills. However, the effectiveness of these interventions varies widely depending on institutional support and faculty engagement (Voogt & Pareja Roblin, 2012).[11]

Graduate Perceptions vs. Recruiter Expectations. A critical insight emerging from recent scholarship is the divergence between graduates' self-assessment and recruiters' evaluations. Thomas et al. (2019) found that while 70% of engineering students rated their problem-solving skills as "good" or "excellent," only 40% of recruiters concurred.[12] This perceptual gap underscores the importance of integrating objective assessments—such as standardized tests or portfolio reviews—into academic programs to calibrate student confidence with actual performance.

Gap Analysis for 2013–2016 Cohort. Although several studies have assessed undergraduate competencies, few isolate specific graduation periods to evaluate the longitudinal impact of curricular revisions. The 2013–2016 window is notable for the introduction of the National Board of Accreditation's emphasis on outcome-based education in India (NBA, 2012), aiming to shift teaching from content delivery to competency attainment.[13] Yet empirical validation of these reforms' outcomes remains sparse, justifying the present study's focus.

Objectives of the Study

1. **Assess Perceived Skill Proficiency:** To measure engineering graduates' self-reported proficiency in key employability skills—communication, teamwork, problem-solving, adaptability, and ethical reasoning.
2. **Identify Critical Skill Gaps:** To quantify the magnitude of gaps between desired and actual skill levels as perceived by graduates and recruiters.
3. **Recommend Pedagogical Strategies:** To formulate evidence-based curricular and co-curricular interventions that address the most significant skill deficiencies.

Research Methodology

Research Design

A mixed-methods approach was adopted, combining quantitative survey data with qualitative recruiter interviews. This design allows triangulation of perspectives and enriches the interpretation of results.

Sample and Sampling Technique

The study targeted engineering graduates who completed their degrees between 2013 and 2016 from five prominent technical institutions in India (three public universities and two private universities). A stratified random sampling technique ensured representation across five major disciplines: Mechanical, Electrical, Civil, Computer Science, and Electronics & Communication Engineering. From an initial database of 1,200 alumni, 200 respondents were selected and contacted via email and social media platforms.

Data Collection Instruments

1. **Survey Questionnaire:** A structured instrument comprising 30 items measured on a five-point Likert scale (1 = "Strongly Disagree" to 5 = "Strongly Agree"). The questionnaire assessed proficiency and preparedness in five skill domains: Communication, Teamwork, Problem-Solving, Adaptability, and Ethical Reasoning. Demographic items (discipline, institution type, current employment status) were also included.
2. **Recruiter Interviews:** Semi-structured interviews were conducted with 20 industry recruiters from multinational corporations, mid-sized firms, and startups. The interviews focused on recruiters' expectations of new graduates, observed skill gaps, and perceptions of academic program effectiveness.

Procedure

Surveys were administered online over a four-week period. Reminders were sent after one and two weeks to boost response rates. Of the 200 invited alumni, 164 completed the survey (82% response rate). Interviews were scheduled at respondents' convenience and conducted via video conferencing; each lasted approximately 30 minutes and was recorded with consent.

Data Analysis

Quantitative data were analyzed using descriptive statistics (means, standard deviations) and gap scores (difference between "importance" ratings provided by recruiters and "proficiency" ratings by graduates). Qualitative interview transcripts were coded thematically to extract recruiters' insights on skill deficiencies and recommendations.

Ethical Considerations

Participation was voluntary; informed consent was obtained from all respondents. Confidentiality was maintained by anonymizing survey responses and interview transcripts. The study received ethical clearance from the lead author's institutional review board.

Results

Demographic Profile

Of the 164 survey respondents, 58% were male and 42% female. Discipline distribution was: Computer Science (28%), Electronics & Communication (24%), Mechanical (18%), Electrical (16%), and Civil Engineering (14%). Employment status: 75% were employed full-time, 15% pursuing higher studies, and 10% unemployed at the time of the survey.

Skill Proficiency vs. Importance

Table 1 presents mean proficiency and importance ratings for each skill domain, along with gap scores (Importance – Proficiency).

Skill Domain	Mean Proficiency	Mean Importance	Gap Score
Communication	3.1	4.5	1.4
Teamwork	3.4	4.3	0.9
Problem-Solving	3.5	4.4	0.9
Adaptability	3.2	4.1	0.9
Ethical Reasoning	3.7	4.2	0.5

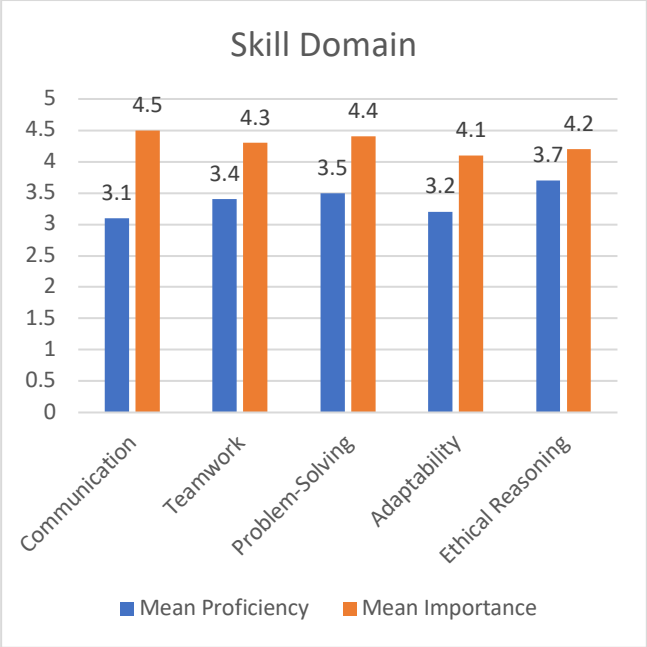


Fig.3 Skill Proficiency vs. Importance

Key Finding 1: Communication skills exhibited the largest gap (1.4), indicating the most critical deficiency. Over 65% of graduates rated their communication proficiency as "average" or below.

Key Finding 2: Ethical reasoning showed the smallest gap (0.5), suggesting that academic programs more successfully instill professional ethics.

Recruiter Perspectives

Qualitative analysis of recruiter interviews revealed three dominant themes:

1. **Limited Written and Verbal Communication:** Recruiters noted frequent errors in technical report writing and difficulty articulating complex ideas clearly.
2. **Insufficient Team-Based Project Experience:** While group assignments were common, structured

facilitation of teamwork dynamics (e.g., conflict resolution, role rotation) was lacking.

3. **Gap Between Theory and Practice:** Recruiters expressed that graduates often excelled in theoretical exams but struggled to apply concepts in ambiguous, real-world scenarios without explicit guidance.

Discipline-Specific Variations

Civil and Mechanical graduates reported larger problems in adaptability, possibly reflecting less exposure to emerging digital tools compared to Computer Science graduates. Conversely, Computer Science alumni demonstrated higher self-rated problem-solving skills but faced challenges in ethical reasoning related to data privacy and intellectual property.

Discussion

The findings confirm that while engineering programs between 2013 and 2016 succeeded in imparting core technical knowledge and ethical foundations, they underperformed in developing communication and adaptive skills. This aligns with prior studies (Mascarenhas, 2014; Thomas et al., 2019) highlighting similar deficiencies. The pronounced communication gap underscores the need to embed language and presentation skills within technical courses rather than treating them as stand-alone modules.

The discipline-specific differences point to the importance of contextualizing soft-skills training to each engineering field. For instance, Civil Engineering students could benefit from industry-partnered field projects that require collaborative problem-solving in dynamic construction environments. Meanwhile, integrating ethical case studies on data security into Computer Science curricula would further strengthen graduates' moral reasoning.

Recruiter insights emphasize the value of structured project-based learning with reflective components—such as post-project debriefs—to cultivate metacognitive awareness of teamwork processes. Additionally, micro-internships and co-op programs can provide authentic contexts for skill application, thereby bridging the theory-practice divide.

Conclusion

This study illuminates persistent employability skill gaps among engineering graduates of the 2013–2016 cohort in India, particularly in communication and adaptability. By combining graduate self-assessments with recruiter perspectives, the research provides robust evidence for targeted curricular reforms. Key recommendations include:

1. **Integrated Communication Training:** Embed technical writing and presentation tasks within core engineering subjects.
2. **Enhanced Project-Based Learning:** Adopt structured PBL frameworks with clear teamwork guidelines and reflective assessments.
3. **Experiential Industry Engagement:** Expand internship and co-op opportunities, ensuring graduates confront real-world challenges.
4. **Discipline-Specific Soft-Skills Modules:** Customize modules to address unique field-related competencies, such as site-based adaptability for Civil Engineers or ethical data handling for Computer Scientists.

By implementing these strategies, engineering institutions can better prepare graduates for the evolving demands of the workforce, thereby reducing recruitment costs, fostering innovation, and enhancing national competitiveness. Future research should longitudinally track the impact of such reforms on actual employment outcomes and employer satisfaction.

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