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Enhancing Competency and Skills Through Industrial Training Programs and Knowledge Management: A Comprehensive Analysis

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Abstract

Purpose: This study examines the impact of industrial training programs on enhancing workforce competency and bridging the gap between theoretical knowledge and practical application. By analyzing employer and employee perspectives, the study highlights the role of structured training initiatives in fostering industry-relevant skills, professional development, and effective knowledge transfer.

Methods: A comprehensive statistical analysis using predictive modeling techniques was employed to assess training effectiveness. Data were collected from employees, students, and supervisors to evaluate skill acquisition, industry preparedness, workplace adaptability, and training outcomes.

Results: The findings indicate that industrial training significantly improves communication skills, problem-solving abilities, research orientation, and self-confidence. Employers report enhanced workforce readiness, while trainees acknowledge greater adaptability, continuous learning orientation, and improved understanding of real-world work environments.

Conclusions: The study underscores the transformative impact of industrial training on workforce competency, emphasizing its role in aligning academic curricula with industry demands. Structured mentorship, effective feedback systems, and strengthened industry–academia collaboration are essential for optimizing training effectiveness.

Limitations: The study is limited to a specific geographic context (Iran) and sector (polytechnic institutions), which may restrict generalizability. In addition, reliance on self-reported data may introduce response bias. Future studies should apply longitudinal designs and examine diverse industrial settings.

Contributions: This study contributes to the literature on workforce development and knowledge management by providing empirical evidence on how industrial training bridges theory–practice gaps, strengthens competency development, and supports sustainable industry–academia partnerships.

Keywords: *Academia-Industry Collaboration, Industrial Training, Knowledge Transfer, Skill Development, Workforce Competency*

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1. Introduction

The process of training is a structured method by which individuals acquire specialized knowledge or skills for a specific purpose, aimed at developing expertise, competencies, and proficiencies necessary for specific job roles or within an organizational setting (Hatami, Seyednaghavi, Alvani, & Hoseinpour, 2021; M. R. Zahedi & Naghdi Khanachah, 2020). Industrial training refers to a well-organized program that offers pre-professional work experiences with specific assignments and responsibilities (Lam &

Hassan, 2018; Obasi, 2015), designed to provide practical experience within a set timeframe, supervised and conducted in both public and private sector organizations (Srinivasan & Ravi, 2017; Thangaru & Kinyua, 2017; Vrabcová & Urbancová, 2022; M. Zahedi & Khanachah, 2024). These programs cater to individuals with theoretical knowledge, exposing them to real-world experiences to bridge the gap between theoretical classroom instruction and practical experiences encountered in higher education to achieve organizational competitiveness and a knowledge-based structure (De Wit-de Vries, Dolfsma, van der Windt, & Gerkema, 2019).

Industrial training is an essential part of academic development implemented in many countries globally and is known by various names such as internships, cooperative education, and work-study programs (Amegayibor & Korankye, 2021; M. R. Zahedi & Khanachah, 2020), most effective when aligned with students' career aspirations, interests, and academic fields (Ghorbani & Khanachah, 2020b) to facilitate the transition from theory to practical application, offering exposure to real-world work environments (Spöttl & Windelband, 2021).

In Iran, the federal government established the Industrial Training Fund (ITF) in 1971 to oversee the industrial training program, operating under Decree 47 of 1971, which was later amended in the 2011 ITF Act. This initiative also led to the establishment of the Students' Industrial Work Experience Scheme (SIWES) in 1973 (ITF, 2003), aiming to produce graduates with academic proficiency, technological competence, and practical orientation (Adler, 2012; Aroh, 2000; M. R. Zahedi & Naghdi Khanachah, 2020). The program equips employees with practical skills, preparing them for real-world scenarios and building confidence when they resume their academic pursuits (Ghorbani & Khanachah, 2021).

Despite various training programs, a significant gap persists between academia and industry in terms of skill enhancement and performance improvement (DeCenzo, Robbins, & Verhulst, 2016; Fazli, Mazaheri, Ja'fari, Jaworski, & Zarch, 2024, 2025; M. R. Zahedi, Naghdi Khanachah, & Papoli, 2024), with challenges such as securing placements, inadequate supervision, poor working conditions, safety concerns, accommodation shortages, communication gaps, lack of training materials, transportation issues, geographical distance, limited opportunities, weak academia-industry collaboration, and attitudes of host organizations (Afonja, Sraku-Lart, & Oni, 2005; Hajizadeh, Jajarmizadeh, & Mohtashami, 2022; Lengmang, Dakung, & Auta, 2024).

Effective training benefits academic activities by reducing the need to explain terms or ambiguities to employees, as they have encountered and applied these terms during their training programs M. R. Zahedi and Naghdi Khanachah (2019) fitting the construction industry, employ, the ITF, and the nation by providing trained employees with prior knowledge of and tasks, promoting professionalism within the industry (Ghorbani & Khanachah, 2020a). Industrial training enhances employees' skills and academic performance to enhance their abilities (Hamouche, 2023; M. R. Zahedi & Khanachah, 2020; M. R. Zahedi, Naghdi Khanachah, & Zahedi, 2024).

Recent studies on industrial training cover various countries and educational institutions, including case studies on polytechnics in Ghana (Nduro, Anderson, Peprah, & Twenefour, 2015), and industrial challenges at Gweru Polytechnic College in Zimbabwe (Wilson, 2016; M. R. Zahedi, 2021), technical and vocational education in Bangladesh (Haolader, Foysol, & Clement, 2017), female participation in vocational training in Kenya (Ngugi & Muthima, 2017), effects of internship programs in Malaysia (Yaakob, Ail, & Radzi, 2018), vocational training in Uganda (Okumu & Bbaale, 2019), industrial training in Indian institutes (Ajithkumar & Pilz, 2019), and vocational education in Zimbabwe (Shereni, 2020) and Cambodia (Bamdad Sufi, Taghavifard, Dehghanan, & Dehghan Najmabadi, 2021; Bupo & Okiridu, 2018; Miller, 2020).

Other studies have focused on vocational training in Mumbai (Neroorkar & Gopinath, 2020), training graduates in Iran (Okolie et al., 2020), and practical training trends among college employees (Ichdan, 2024; Nazarova, Kubrushko, Alipichev, & Gryazneva, 2021; Sonnentag et al., 2021), providing valuable insights into industrial training in diverse contexts. This study integrates theoretical insights

into competency development and knowledge management with empirical data collected from trainees, supervisors, and employers. Previous research has highlighted the significance of industry-academia partnerships in enhancing employability M. R. Zahedi, Naghdi Khanachah, and Zahedi (2024) shown that hands-on experience during training improves both cognitive and practical skills (Rodzalan & Saat, 2012).

By aligning these findings with new empirical data, this study not only supports the existing literature but also extends the understanding of how industrial training can be optimized to better meet the needs of both academia and industry. This linkage offers a deeper understanding of how theoretical frameworks on skill development and knowledge sharing can be effectively applied to real-world training environments. Building on these insights, we evaluated employees' experiences in an industrial training program, focusing on the polytechnic sector in Iran. The subsequent sections are structured as follows: Section 2 outlines the methodology, Section 3 presents the findings, Section 4 discusses the results, and Section 5 provides concluding remarks.

2. Literature Review and Hypothesis Development

Industrial training programs serve as a critical mechanism for bridging the gap between academic knowledge and industry practice, offering participants the opportunity to apply theoretical concepts in real-world settings (Obasi, 2015; Srinivasan & Ravi, 2017). The effectiveness of these programs is contingent on the interplay of several key variables, including skill development, knowledge transfer, industry-academia collaboration, and workforce adaptability. Understanding how these elements are interconnected is crucial for designing training programs that yield maximum benefits for individuals and organizations.

2.1 Skill Development and Workforce Readiness

The primary objective of industrial training is to enhance skill acquisition and equip trainees with the competencies required to meet industry standards (Nazarova et al., 2021). Studies have indicated that industrial training improves both technical and soft skills, including problem-solving, teamwork, and communication (Spöttl & Windelband, 2021; Yaakob et al., 2018). The effectiveness of skill development is further influenced by supervision quality and training structure, as inadequate oversight can hinder the learning outcomes (Hajizadeh et al., 2022). Research suggests a bidirectional relationship between skill development and workforce readiness: employees who gain practical exposure demonstrate higher employability and productivity, while organizations benefit from a prepared and adaptable workforce (Ajithkumar & Pilz, 2019). However, gaps in industry-academia coordination can lead to mismatched skills, highlighting the need for dynamic curriculum updates aligned with industry trends (Nson, 2025; Rodzalan & Saat, 2012).

2.2 Knowledge Transfer and Industrial Training

Knowledge management plays a fundamental role in the success of industrial-training programs. The flow of explicit and tacit knowledge from experienced professionals to trainees determines the depth of learning and practical application (De Wit-de Vries et al., 2019; M. R. Zahedi & Naghdi Khanachah, 2019). Effective knowledge transfer mechanisms, such as mentorship, structured feedback, and industry collaboration, significantly enhance training outcomes (Ghorbani & Khanachah, 2020a). The literature also highlights the role of digital transformation in knowledge dissemination, where e-learning platforms and virtual training modules supplement hands-on experiences (Nazarova et al., 2021). Organizations that foster a culture of continuous learning and feedback facilitate higher retention and practical application of knowledge post-training, ultimately improving employee performance and organizational efficiency (M. R. Zahedi, Naghdi Khanachah, & Zahedi, 2024).

2.3 Industry-Academia Collaboration and Training Effectiveness

A critical factor influencing the success of industrial training is the degree of collaboration between academic institutions and industry partners (Ikwuo, Nwite, Nworie, & Nworie, 2025; Tanha et al., 2025). Strong partnerships ensure that training curricula remain relevant by aligning educational outcomes with workforce demands (Okolie et al., 2020). Research in various countries, including Malaysia and India, underscores the benefits of dual education models, in which institutions actively

engage with industry stakeholders to co-design training programs (Ajithkumar & Pilz, 2019; Neroorkar & Gopinath, 2020).

However, a lack of structured collaboration can create disconnects in skill expectations, resulting in under-prepared graduates (Okumu & Bbaale, 2019). Challenges such as inconsistent employer engagement, lack of training incentives, and limited resource allocation further hinder the effectiveness of such partnerships (M. R. Zahedi, Naghdi Khanachah, & Zahedi, 2024). Strengthening industry-academia linkages through policy reforms, internship funding, and employer-driven curriculum updates can help mitigate these issues.

2.4 Workforce Adaptability and Career Progression

The adaptability of employees post-training is a key measure of program effectiveness. Studies suggest that industrial training enhances long-term career prospects, with trainees demonstrating higher job satisfaction, retention rates, and career progression opportunities (Ghorbani & Khanachah, 2021; Shereni, 2020). A well-structured training experience fosters confidence in problem-solving, decision-making, and independent work**,** which are crucial for career advancement (Aroh, 2000). Moreover, organizations that integrate structured onboarding and mentorship programs post-training observe greater employee retention and performance (Mabhanda & Masukume, 2025; Pilz & Regel, 2021). Companies that invest in longitudinal training assessments and competency-based evaluations benefit from sustained workforce development, contributing to innovation and competitiveness (DeCenzo et al., 2016).

The interplay between skill development, knowledge transfer, industry-academia collaboration, and workforce adaptability highlight the systemic nature of industrial training. Effective knowledge transfer strengthens skill development, which enhances workforce adaptability. Simultaneously, strong industry-academia collaboration ensures training relevance, thereby improving career outcomes and organizational efficiency. However, misalignment in any of these variables can undermine the effectiveness of the training programs. For instance, limited collaboration between academia and industry may result in skills that are not industry relevant, reducing workforce adaptability. Similarly, poor knowledge transfer mechanisms can weaken the link between theoretical learning and practical application, thereby diminishing training effectiveness.

This interconnected framework underscores the need for a comprehensive and dynamic approach to industrial training that integrates real-time industry insights, structured supervision, and continuous feedback mechanisms to optimize skill development and workforce readiness.

- *H1:* Industrial training programs significantly enhance workforce competency by bridging the gap between theoretical knowledge and practical application of that knowledge.
- *H1a:* Employees who undergo industrial training demonstrate higher levels of skill development and industry preparedness than those who do not undergo training.
- *H1b:* Effective knowledge transfer during industrial training positively influences employees' problem-solving abilities and workplace adaptability.
- *H1c:* The degree of industry-academia collaboration affects the effectiveness of industrial training programs in preparing employees for real-world job roles.
- *H1d:* Employees with prior industrial training experience exhibit greater confidence and adaptability in workplace environments than those without such experience.

3. Methodology

Our research targeted three specific groups of respondents: ND2 students, HND1 students, and IT supervisors. Respondents were selected using a stratified random sampling technique, which ensures equal representation of every item within the population (Taherdoost, 2016). This method was chosen to provide all ND2 and HND1 students with a fair opportunity to participate in this study. The stratified random sampling process involved several steps. Initially, we identified the total populations of ND2 and HND1 students and divided them into their respective groups. Subsequently, we calculated the sample size as a percentage of the total population, following guidelines by (Taherdoost, 2016).

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$$\boldsymbol{n = \frac{N}{1+\alpha^2 N}} \quad (1)$$

Where:
n = Sample size
N= No of population
α= 0.10

3.1 Data Collection Tool

During industrial training, data collection is essential for students in the built environment to gain hands-on experience and apply their theoretical knowledge in real-world scenarios. This process involves collecting, analyzing, and interpreting data specific to their discipline, allowing students to develop data management, research, and problem-solving skills. In architectural technology, students gather information on building materials, construction techniques, and design standards to inform their project plans and ensure compliance with the regulations. Building technology students collect data on structural integrity, construction methods, and building codes to monitor the progress and quality of construction projects.

Estate management students acquire data on property values, market trends, and lease agreements to make informed decisions regarding property management and investment strategies. Surveying students collect data through land surveys, mapping, and boundary determination to provide accurate information for land development projects. Geo-informatics students gather geospatial data, satellite imagery, and environmental data to analyze and visualize geographic information for environmental planning and resource management. Quantity surveying students collect data on project costs, material quantities, and procurement processes to ensure financial efficiency and the viability of construction projects. Overall, the data collection process during industrial training allows students to gain practical experience, enhance their critical thinking skills, and deepen their understanding of their chosen discipline. By engaging in hands-on data collection activities, students can effectively apply their knowledge in real-world settings and prepare for successful careers in built environments.

Table 1. Internship program in built environment

Department	Obligations relating to the industrial training program
Building	Tasks include understanding and implementing project drawings, creating detailed working drawings for medium-sized buildings, preparing accurate cost estimates for building projects, and conducting surveys to compile repair schedules for existing structures.
Surveying and Geo-Informatics	The responsibilities included drafting and maintaining survey documents, verifying survey accuracy, supervising boundary surveys, computing geospatial data, and calibrating surveying instruments. The drafting and Maintenance of Survey Documents involve creating and updating sketches, maps, reports, and legally valid descriptions of surveys to delineate and certify completed work. Survey Accuracy verification ensures precision in survey data, including measurements and calculations. Supervision of Boundary Surveys oversees surveys to establish legal property boundaries in the United States. The computation of Geospatial Data involves calculating elevations, depths, positions, property boundaries, and terrain characteristics. Calibration of Surveying Instruments includes regularly calibrating instruments to ensure accuracy.
Quantity Surveying	In the construction field, various tasks are performed to ensure the successful completion of projects. These tasks include conducting measurements and preparing bills of quantities and contract documents, compiling and preparing final accounts, measuring and documenting constructed works, interpreting

	contract documents for different types of projects, and developing cost estimates. Each of these tasks is essential for the proper management and execution of construction projects in the UAE. By paying attention to detail and following established procedures, professionals in the construction industry can effectively carry out these tasks and contribute to the overall success of their projects.
Architecture	To ensure zero scientific plagiarism, it is essential to conduct feasibility studies and appraise options in the initial stage. Subsequently, design concepts should be developed creatively and originally. Tender documents must be prepared to reflect new ideas and innovative solutions. During the construction phase, work should be inspected thoroughly to ensure quality and adherence to standards. Finally, production information should be prepared meticulously, focusing on originality and authenticity.
Estate Management.	Monitoring tenancy agreements is an essential aspect of this position, ensuring that all agreements are managed effectively. Rent assessment is also an important task, as it involves evaluating rental values to ensure fair pricing for tenants and property owners. Additionally, managing budgeting and administrative systems is crucial for maintaining the property's financial health. Contract negotiation skills are necessary for effective communication and collaboration with tenants, property owners, and stakeholders.

In this study, 430 questionnaires were distributed to evaluate students' participation in the Iranian Industrial Training Program. Of these, 210 questionnaires adhering to the British Standard BS 8210 were completed and returned, indicating an 84% response rate.

4. Result and Discussions

Table 2. Category of the respondents

S/N	Category	Frequency	Percentage of Participant
1	Staff	10	4.8
2	Employee	190	95.2
	Total	**200**	**100.0**

According to Table 2, the data show that the majority of respondents, totaling 95.2%, were students, amounting to 200 individuals. In contrast, staff members constituted a smaller group, comprising only 10 respondents, accounting for 4.8% of the total participation.

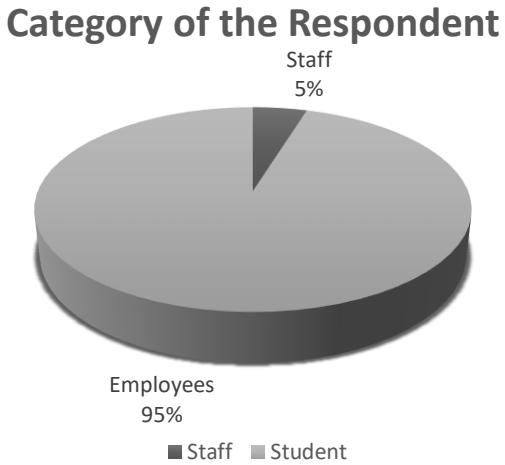

Figure 1. The demographic characteristics of the respondent's staff are categorized as follows

Table 3. Year of experience of the staff

S/N	Year range	Frequency	Percentage	Upper Class Boundaries
1	Less than 1 year	0	0	1.5
2	2 - 5 years	5	37.0	5.5
3	6 - 9 years	20	73.0	9.5
4	Above 10 years	0	0	10.5 Above
	Total	**25**	**100.0**	

Table 3 presents a breakdown of the staff experience. The largest percentage of staff members, at 70.0%, had between 6-9 years of experience, which amounts to seven respondents. Those with 2-5 years of experience accounted for 30.0% of the sample. Notably, there were no participants with less than 1 year or more than 10 years of experience in this study.

Figure 2. Experience of staff

Table 4. Demographic characteristic of the Employees

Department	Frequency	Percentage (%)
Architecture	2	20.0
Building	1	20.0
Estate Management	3	20.0
Quantity Surveying	2	30.0
Urban and regional planning	0	0.0
Surveying and Geo – informatics	2	10.0
Others	0	0.0
Total	10	100.0
Gender		
Male	130	65.0
Female	70	35.0
Total	**200**	**100.0**
Course		
Architecture	25	12.5
Building	40	20.0
Estate Management	50	25.0
Quantity Surveying	25	12.5
Urban and regional planning	30	15.0
Surveying and Geo – informatics	30	15.0
Others	0	0.0
Total	**200**	**100.0**

Place of Industrial Training		
Consultant	65	32.5
Contractor	54	27.0
Ministry	76	38.0
Others	5	2.5
Total	**200**	**100.0**

The demographic profiles of the participants are shown in Table 4. Estate management was the most represented field, with 30% of participants (three respondents). Architecture, quantity surveying, surveying, and geo-informatics each contributed 20%, with two respondents from each discipline. The building department represented 10% of the participants, with one respondent. Urban and regional planning and other fields were not included in this study. Gender diversity is reflected in the study, with males making up 65% and females 35% of respondents.

Estate management was the predominant field, with 25% of students (50 respondents), followed by building management with 20% (40 respondents). Urban and regional planning, surveying, and geo-informatics each contributed 15% (30 respondents each). Architecture and quantity surveying had 25 students each, representing 12.5% in each field. In terms of industrial training placements, the ministry sector had the highest rate at 38% (76 respondents), followed by consultants at 32.5% (65 respondents) and contractors at 27% (54 respondents). The other categories collectively accounted for 2.5% of the respondents. Figure 2 showcases the demographic characteristics of the participants in this study.

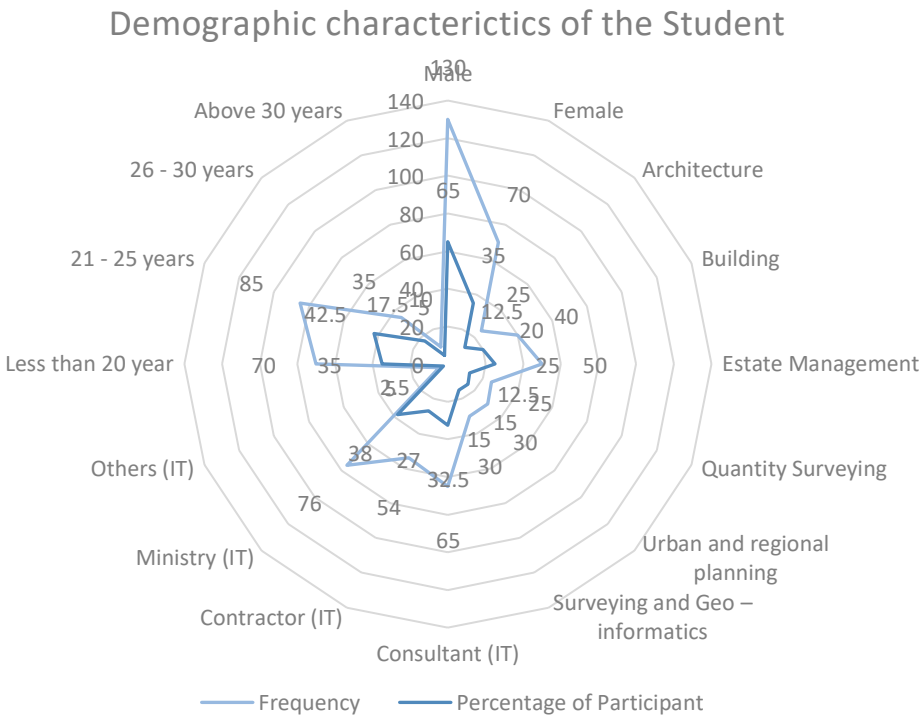

Figure 3. Demographic characteristic of the Employees

Table 5. Age of the respondent

S/N	Age	Cumulative Frequency	Frequency	Percentage	Upper Class Boundaries
1	Less than 20 years	70	70	35.0	20.5
2	21 - 25 years	155	85	42.5	25.5
3	26 - 30 years	190	35	17.5	30.5
4	Above 30 years	200	10	5.0	30.5 Above
	Total		**200**	**100.0**	

According to Table 5, the largest group of students (42.5 %) fell within the age range of 21-25 years. Following them, 35.0% of the respondents were under 20 years old. Participants aged 26-30 years make up 17.5% of the total, with 35 respondents. However, those over 30 years old accounted for the smallest percentage, making up only 5% of the respondents. This is illustrated in Figure 4.

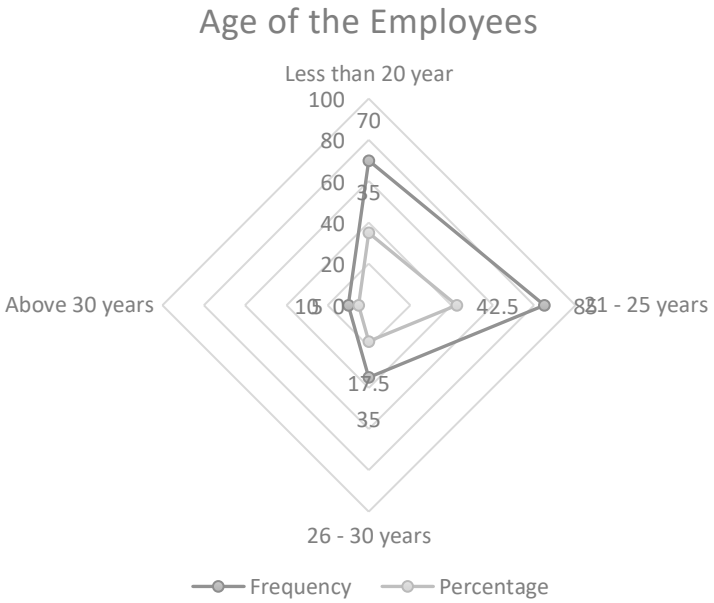

Figure 4. Demographic characteristic of the Employees

4.1 Findings

4.1.1 Impact of IT on Employees (Staff Perspective)

Table 6 provides insights into the staff's perceptions of the impact of Industrial Training (IT) on students. It is evident that IT plays a crucial role in guiding students towards identifying research areas for their final-year projects, which is the most important aspect, with a relative importance index (RII) of 0.92. Additionally, IT serves as a platform for exposing students to real-world experiences beyond academia, ranked second, with an RII of 0.88. It also helps students understand industry culture and technological advancements, promoting continuous learning and securing a third rank with an RII of 0.88.

The table also presents the diverse skills that students acquired during their IT experiences. IT significantly enhances students' proficiency in formal and informal written communication, achieving the highest ranking, with an RII of 0.94. It also improves students' ability to plan and execute tasks effectively, holding the second-place position with an RII of 0.92. IT fosters problem-solving skills and collaboration with diverse groups, ranking third, with an RII of 0.88. Furthermore, IT boosts creativity, ranking sixth with an RII of 0.86. Finally, IT enhances students' self-confidence in tackling challenges, earning the seventh position with an RII of 0.82. These findings highlight the various benefits of IT, including academic and practical skill development.

Table 6. Impacts of IT on the Employees (staff perspective)

		Variables	5	4	3	2	1	RII	Ranking
Knowledge	1	Industrial training improved Employees' knowledge and intellectual capability	2	8	0	0	0	0.84	5th
	2	Industrial training improved Employees' understanding of course of study	2	8	0	0	0	0.92	5th
	3	Industrial training assisted Employees' in finding a research area for their final year project	6	4	0	0	0	0.92	1st
	4	Industrial training exposed Employees' to having an idea of life after school	6	4	1	0	0	0.92	1st
	5	Industrial training exposed Employees to the changing industry culture and developments in technology	4	6	0	0	0	0.84	3rd
	6	Industrial training exposed Employees to the need for continuous learning	5	4	1	0	0	0.88	3rd
Skills	1	Industrial training improved Employees' creativity ability	4	5	1	0	0	0.86	6th
	2	Industrial training developed Employees' ability to identify problems and proffer solution	4	6	0	0	0	0.88	3rd
	3	Industrial training developed Employees' ability to plan and complete any assigned task	6	4	0	0	0	0.92	2nd
	4	Industrial training developed Employees' ability to work effectively with different groups	4	6	0	0	0	0.88	3rd
	5	Industrial training improved Employees' skills in formal and informal written communication	4	6	0	0	0	0.88	3rd
	6	Training improved Employees' skills in formal and informal written communication	8	1	1	0	0	0.94	1st
	7	Industrial training improved Employees' self confidence in tackling problems	2	7	1	0	0	0.82	7th
Attitude	1	Industrial training developed Employees' ability to socialize and sustain the relationship	5	5	0	0	0	0.90	1st
	2	Industrial training improved Employees' self-control and motivation	3	7	0	0	0	0.86	2nd
	3	Industrial training improved Employees' success consciousness	5	2	3	0	0	0.84	5th
	4	Industrial training increased Employees' confident on employment prospects	3	5	2	0	0	0.76	7th
	5	Industrial training improved Employees' perseverance in challenging situations	1	6	3	0	0	0.82	6th
	6	Industrial training improved Employees' time keeping ability	3	7	0	0	0	0.86	2nd
	7	Industrial training improved Employees' ability to work independently	3	7	0	0	0	0.86	2nd

Table 6 presents the positive attitudes that employees developed during their Industrial Training (IT) experiences. This shows that IT plays a significant role in improving employees' interpersonal relationships, self-discipline, motivation, punctuality, self-reliance, independence, success-oriented mindset, perseverance, and confidence in employment prospects. These findings highlight the holistic development of positive attitudes through IT, including skills in interpersonal communication, self-motivation, time management, self-reliance, and emotional resilience.

The findings also emphasize the impact of IT on employees' knowledge, skills, and attitudes. In terms of knowledge, IT helps employees identify research areas for their final-year projects and gain insights into post-graduation life. These aspects are crucial for selecting relevant project topics and

understanding career opportunities. In terms of skills, IT enhances employees' written communication abilities, boosting their confidence in expressing themselves effectively in professional contexts. In terms of attitudes, IT improves employees' socialization skills, enabling them to build meaningful relationships with colleagues and enhance their social interactions with employers and peers.

Overall, this study showcases the transformative impact of IT on employees' knowledge, skills, and attitudes, underscoring the importance of experiential learning in cultivating well-rounded professional development.

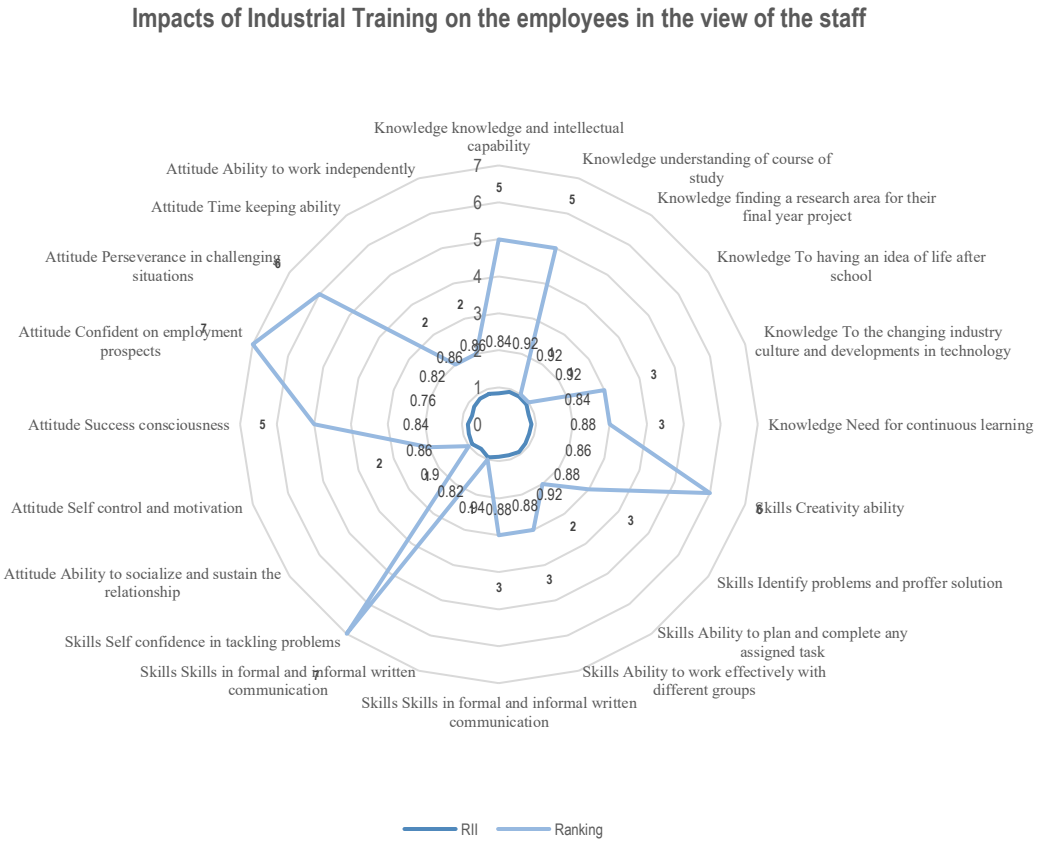

Figure 5. Impacts of IT (staff perspective)

4.2 The Influence of Industrial Training (IT) on Employees

Table 7 outlines the influence of Industrial Training (IT) on employees from their perspective. The impacts can be categorized into three components: knowledge, skill, and attitude. In terms of knowledge, IT emphasizes the importance of continuous learning, enhances intellectual capabilities, improves course understanding, provides insights into industry culture, offers a realistic post-graduation perspective, and helps identify research areas for projects. These aspects were ranked based on their Relative Importance Index (RII), with continuous learning securing the top position.

When it comes to skills, IT significantly boosts self-confidence in problem-solving, develops problem-solving skills, hones task planning and execution abilities, sparks creativity, improves written communication, and cultivates effective collaboration skills. These skills contribute to the overall professional and personal development of the employees. Furthermore, employees' attitudes are positively influenced by IT, improving their time-keeping ability, self-control, motivation, socialization and relationship skills, success consciousness, ability to work independently, confidence in employment prospects, and perseverance in challenging situations. Overall, these insights highlight the holistic impact of IT on employees' knowledge, skills, and attitudes, contributing to their growth and development in both personal and professional domains

Table 7. Impacts of IT on Employees' (Employees' perspective)

Variables			5	4	3	2	1	RII	Ranking
Knowledge	1	Industrial training improved my knowledge and intellectual capability	94	100	0	6	0	0.88	2nd
	2	Industrial training improved the understanding of my course of study	83	113	0	4	0	0.88	2nd
	3	Industrial training assisted me in finding a research area for my project	55	120	25	0	0	0.83	6th
	4	Industrial training exposed me to having an idea of life after school	77	111	8	4	0	0.86	5th
	5	Industrial training exposed me to the changing industry culture and developments in technology	86	100	8	6	0	0.87	4th
	6	Industrial training exposed me to the need for continuous learning	97	95	8	0	0	0.89	1st
Skills	1	Industrial training improved my creativity ability	72	101	23	4	0	0.84	4th
	2	Industrial training developed my ability to identify problems and proffer solution	91	79	30	0	0	0.86	2nd
	3	Industrial training developed my ability to plan and complete any assigned task	80	98	22	0	0	0.86	3rd
	4	Industrial training developed my ability to work effectively with different groups	43	132	21	4	0	0.81	6th
	5	Industrial training improved my skills in formal and informal written communication	56	110	30	4	0	0.82	5th
	6	Training improved my skills in formal and informal written communication	50	111	31	8	0	0.80	7th
	7	Industrial, Industrial training improved my self-confidence tackling problems	84	104	31	8	0	0.87	1st
Attitude	1	Industrial training developed my ability to socialize and sustain the relationship	58	115	21	6	0	0.83	3rd
	2	Industrial training improved my self-control and motivation	56	117	25	2	0	0.83	2nd
	3	Industrial training improved my success consciousness	60	104	36	0	0	0.82	4th
	4	Industrial training improved my success consciousness	60	104	36	0	0	0.82	4th
	5	Industrial training increased my confident on employment prospects	52	114	30	4	0	0.81	6th
	6	Industrial training improved my perseverance in challenging situations	38	126	26	10	0	0.79	7th
	7	Industrial training improved my ability to work independently	37	144	19	0	0	0.82	4th

Table 7 shows in terms of knowledge, IT plays a crucial role in encouraging employees to engage in ongoing learning. Respondents noted that IT has broadened their perspectives and critical thinking abilities, fostering a deeper interest in their fields of study and improving their grasp of academic concepts. They appreciate how IT has enriched their understanding of educational objectives. Regarding skills, IT has boosted employees' confidence in solving problems. Participation in IT programs has equipped them with the necessary skills to navigate potential challenges after graduation and succeed in their professional endeavors. By providing them with a comprehensive view of the industry, IT has empowered them to identify their strengths and areas for improvement to excel in their chosen roles.

On the attitude front, IT has substantially improved employees' time management skills, which is a key priority for respondents. They acknowledge IT's role in teaching them the value of effective time management, which not only enhances their academic performance but also underscores the importance

of the program. IT has underscored the significance of timely task completion in both academic and professional contexts. Overall, these findings emphasize the diverse benefits of IT in expanding knowledge, honing skills, and fostering positive attitudes towards continuous learning, problem-solving, and time management.

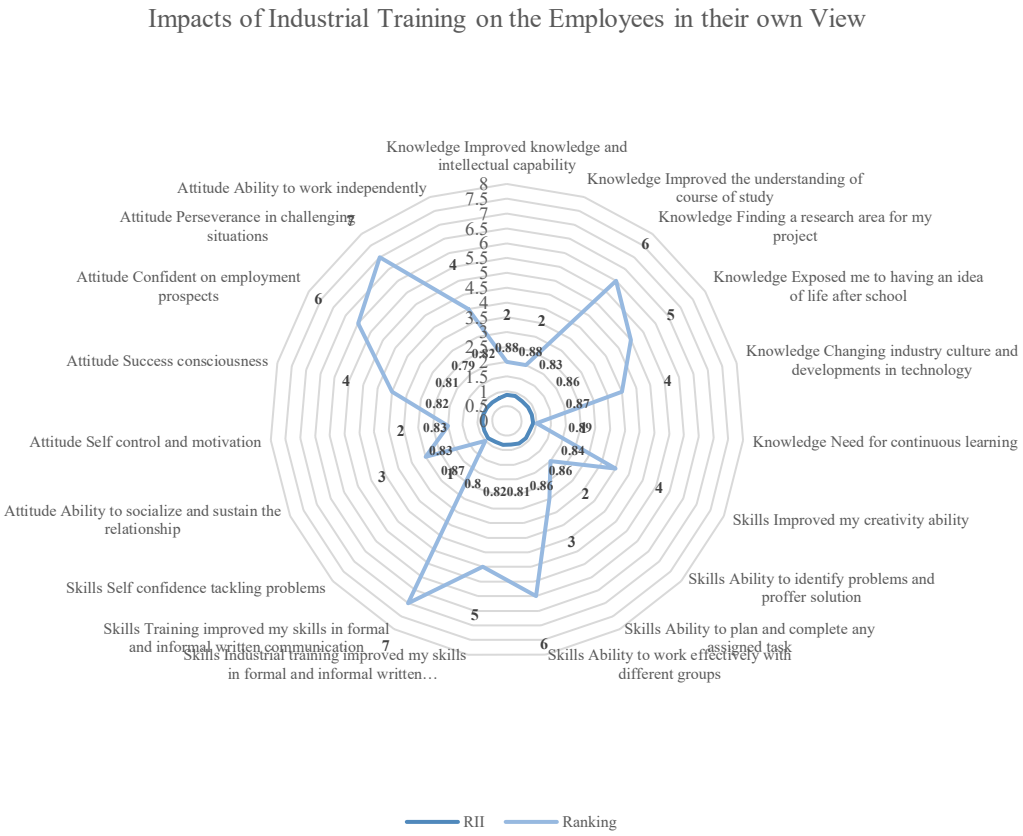

Figure 6. Impacts of IT on Employees (Employees' perspectives)

4.3 Challenges during IT

During their Industrial Training (IT) experiences, the respondents faced various challenges, as detailed in Table 8. The top challenges identified included safety, supervisor commitment, distance from residence to training location, polytechnic policies and transportation. Safety, the most significant challenge, highlighted workplace hazards due to the lack of safety measures. The second major challenge, supervisor Commitment, emphasized the importance of effective supervision for task completion.

The distance between the residence and workplace ranked third, underscoring the challenge of long commutes. The fourth challenge, polytechnic policies, included issues such as program duration and assessment methods. Transportation, the fifth challenge, was identified as a significant barrier for students because of the lack of stipends. Conversely, issues such as trainees being assigned menial tasks and poor partnerships between academia and industry were considered less significant challenges. Addressing these challenges is crucial for enhancing the quality of IT experience for students.

Table 8. Challenges Employees' face during IT

S/N	Variables	5	4	3	2	1	RII	Ranking
1	Distance from residence to place of training	33	40	121	16	0	0.695	3rd
2	Duration of industrial training	9	77	110	14	0	0.685	7th
3	Attitude of host organization	7	89	94	20	0	0.685	7th
4	Remuneration during industrial training	7	78	89	32	4	0.655	10th
5	Commitment of supervisor	23	71	105	6	5	0.705	2nd

6	Polytechnic policies	18	71	100	21	0	0.685	6th
7	Transportation	20	66	103	21	0	0.685	7th
8	Safety	27	84	88	11	0	0.725	1st
9	Accommodation	26	48	97	35	4	0.655	9th
10	Lack of social activities	20	56	101	30	3	0.66	8th
11	Inadequate training opportunity	20	34	137	0	19	0.63	12th
12	Ambiguous program grading system	20	37	125	24	4	0.64	11th
13	Lack of communication	14	25	128	43	0	0.61	17th
14	Uncomfortable working environment	4	42	137	24	3	0.62	14th
15	Limited opportunity and lack of responsibility	4	35	145	23	3	0.61	17th
16	Documentation with the Industrial Training Fund (ITF)	6	51	123	27	3	0.63	13th
17	Time spent in getting a place for industrial training	9	39	131	24	7	0.62	15th
18	Poor supervision by supervisors	8	26	120	46	10	0.58	23rd
19	Lack of training materials	0	44	109	44	13	0.58	24th
20	Gender inequality	4	43	126	28	9	0.61	19th
21	Poor partnership between academia and industry	0	7	163	27	13	0.56	26th
22	Employees in host organizations feel endangered due to the presence of interns	4	59	95	42	10	0.61	19th
23	Supervisors from school request that interns to bring their logbooks for assessment rather than visiting the intern's workplace	13	30	109	50	8	0.60	21st
24	Sexual harassment and intimidation of Employees	3	44	114	33	16	0.59	22nd
25	Trainees are made to do menial jobs	3	12	144	40	11	0.56	25th
26	High industrial expectation	7	46	112	45	0	0.61	16th

4.4 Strategies to Overcome Challenges during IT

Insights into overcoming challenges during Industrial Training (IT) are provided in Table 9. The Relative Importance Index (RII) ranking analysis highlighted key strategies for effectively addressing these challenges. The top three strategies, ranked by RII, are

1. The highest-ranking strategy (RII=0.88) was providing Certificates/Recommendation Letters to trainees. This recognition can boost job prospects and demonstrate skills.
2. Viewing Trainees as Prospective Assets (RII=0.876) emphasizes the importance of perceiving trainees as valuable assets for collaborative and organizational goals.
3. Timely and Adequate Compensation (RII=0.87) is crucial for motivating trainees and easing financial burdens. On the other hand, the least ranked strategies include:
4. Providing Orientation for Supervisors (RII=0.83) to ensure effective oversight of trainees.
5. Sharing Host Responses with trainees (RII=0.82) can improve communication and address challenges.
6. Adjusting the Timing of IT programs (RII=0.80) to accommodate students' needs. Overall, the RII rankings showed no significant differences among the strategies. Effective communication, recognition, fair compensation, and a positive perspective towards trainees are emphasized for successful IT experiences. By implementing these approaches, students can have rewarding IT experiences

Table 9. Ways to overcome challenges during IT

S/N	Variables	5	4	3	2	1	RII	Ranking
1	Employees should be well paid regularly and early	104	88	14	0	4	0.87	3rd
2	Employees on training should be viewed as prospective assets and not threats	110	73	23	4	0	0.87	2nd
3	Relevant stakeholders meeting should be organized regularly	76	123	11	0	0	0.86	9th
4	Outstanding Employees should be identified, and their progress should be monitored	88	83	39	0	0	0.84	13th
5	Industrial Training Fund should assist Employees in getting placement	92	100	10	8	0	0.86	5th
6	Adequate monitoring and supervision of Employees by the industry and academia	95	96	15	4	0	0.86	6th
7	Supervisors in the industry should be given adequate orientation regarding student's supervision	67	109	30	4	0	0.83	16th
8	Responses from student's host should be disclosed and discussed with Employees	51	130	29	0	0	0.82	17th
9	Supervisors in the industry should be monitored	68	122	20	0	0	0.84	14th
10	Employees should be monitored early and regularly	86	117	4	3	0	0.87	4th
11	There should be synergy and cooperation between industry and academia	83	108	19	0	0	0.86	10th
12	Industrial training should be a major requirement for graduation	101	75	34	0	0	0.86	7th
13	The duration of industrial training should be adjusted	92	81	28	9	0	0.84	15th
14	Time of industrial training should be changed	75	74	51	4	6	0.80	18th
15	The academia should recommend places where Employees should go for industrial training	93	83	31	3	0	0.85	12th
16	Employees should defend their reports when they complete industrial training	92	94	24	0	0	0.86	6th
17	Host should issue a certificates/ recommendation letters to deserving Employees after completing training	106	86	18	0	0	0.8	1sh
18	Employees with outstanding course(s) should be allowed to register such course(s) during industrial training	104	71	28	7	0	0.85	11th

4.5 Study Summary and Insights on IT Impact and Challenges

This study aims to summarize the key issues and focus areas, assessing the impact of Industrial Training (IT) on employees from both staff and employee perspectives, with a primary focus on knowledge, skills, and attitudes. Additionally, this study examines the challenges faced by IT employees during their training and explores strategies to overcome these challenges.

4.6 Key Findings

The discussion sparked by the findings of this study has intrigued both the staff and employees. The IT staff, as seen in Table 6, agree that IT exposes students to life beyond academia and helps them identify research areas for their final-year projects. However, the students had a slightly different perspective, as shown in Table 7. Despite this, both groups acknowledged the transformative impact of IT, recognizing its role in promoting continuous learning, improving their understanding of their courses, and enhancing their intellectual capabilities.

It is interesting to note the convergence of opinions between the staff and students regarding the influence of culture and technological advancements in the industry. These findings are in line with the observations of (Al Ahad, Khan, & Rahman, 2020), who emphasized the increasing importance of work experience in conjunction with academic qualifications in the job market. Consequently, industrial training has become a prerequisite for higher education institutions. This training period, typically lasting around six months, aims to equip individuals with the necessary industry skills and plays a

crucial role in shaping a skilled and professional workforce. However, the development of general skills remains a challenge in this context.

From the staff's perspective, IT significantly enhances formal and informal communication skills, boosting confidence in problem-solving. Employees believe that IT extends beyond academic activities, influencing various aspects of life, such as social relationships, self-control, motivation, and task completion within deadlines. Financial support is a critical concern, with regular and timely stipends essential for employee sustenance during internships. Inadequate financial support can lead to difficulties for employees, resulting in reduced motivation, increased absenteeism, and higher dropout rates. Offering early and regular stipends is crucial for maintaining employee motivation. To ensure effective employee development, comprehensive monitoring and supervision involving industry-based supervisors, the Industrial Training Fund, and academia should be implemented in the future. This monitoring system enables a close evaluation of employee progress and ensures that the skills acquired during internships are valuable and relevant. Research Objectives:

1. Summarized key issues and focus areas related to Industrial Training (IT) and its impact on employees.
2. Assess the challenges faced by employees during IT and explore strategies to overcome them.
3. Examine the perspectives of staff and employees on the impact of IT on knowledge, skills, and attitudes.

Theory or Research Finding: This study aligns with the observations of (Al Ahad et al., 2020), highlighting the importance of industrial training as a prerequisite in higher education institutions due to the job market's emphasis on work experience alongside academic qualifications. Developing general skills remains a challenge, underscoring the need to equip individuals with industry-relevant skills during their IT tenure. Research Findings: The study findings indicate that IT exposure enhances communication, self-confidence, problem-solving, and time management skills. It also promotes continuous learning, intellectual development, and the importance of financial support through regular stipends to sustain motivation during the internship. Recommendations for effective IT programs include comprehensive monitoring and supervision involving industry supervisors, the ITF, and academia to ensure employee development.

5. Conclusions

5.1 Conclusion

This study assessed the experiences of ND2 and HND1 students after completing the industrial training (IT) program to evaluate their hands-on exposure and how the program bridges the gap between theoretical knowledge and practical application. The findings confirm that industrial training supports students in identifying research areas for final-year projects, improves their problem-solving skills, and strengthens their continuous learning, knowledge, and intellectual capability. Overall, the results indicate that industrial training significantly improves competencies in communication, adaptability, and workplace readiness, particularly when knowledge transfer is supported by structured mentoring and feedback.

Despite these benefits, the study also identified persistent challenges that limit program effectiveness, including safety concerns, supervisor commitment, distance to training sites, transportation, accommodation, and limited industry–academia interactions. Strengthening collaboration between educational institutions and industry partners, improving trainee support mechanisms, and enhancing supervision and training structures are critical to maximizing outcomes. These findings emphasize that industrial training should remain a vital component of the curriculum to prepare students for real-world work environments and to foster stronger links between education and industry.

5.2 Research Limitations

This study had several limitations that may affect the generalizability of the findings. First, the research was conducted within a specific geographic context Iran and focused on polytechnic institutions, which limits the ability to apply the results to other regions or educational settings. Additionally, the study relied on self-reported data from employees, students, and supervisors, which may have introduced

response bias. The use of cross-sectional data also means that causal inferences cannot be drawn. Furthermore, the scope of this study was limited to industrial training programs in specific sectors; future studies should examine a wider range of industries to better understand the broader impact of industrial training programs.

5.3 Suggestions and Directions for Future Research

Future research should consider several avenues to build on the findings of this study. Longitudinal studies could provide a more comprehensive understanding of the long-term effects of industrial training on workforce competency, particularly how skills develop over time and translate into career progression. Expanding research to include diverse industrial settings and regions will enhance the generalizability of the findings. Moreover, studies incorporating a larger sample size, including both trainees and employers, could offer more nuanced insights into the training's impact on both parties'satisfaction.

To address the limitations of self-reported data, future studies should incorporate objective performance measures to assess the effectiveness of industrial training programs. Additionally, exploring the role of digital tools and online training platforms in enhancing industrial training could provide valuable insights into workforce development in the digital age. Finally, examining the impact of industry-academia collaboration on the success of training programs could help optimize these partnerships and improve training outcomes.

Author Contributions

MP contributed to conceptualization, handled data collection and analysis. MP and MA jointly drafted and revised the manuscript. MA supervised the research process. All authors approved the final version of the manuscript.

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