

Assessing The Impact of Skill Development Programs on Employment Outcomes in the Field of Plastics Technology: A Longitudinal Study

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Abstract

The article presents a longitudinal study that explored the effects of skill development programs on employment in the plastics technology field. They picked a sample of 250 trainees and response by 75 employers at three periods (immediately after training, 6 months, and one year later). The use of structured assessments and surveys was used to gather data on employment status, skill proficiency, and workplace performance. Results showed that the number of full-time employment (46 to 72 percent) and the number of full-time unemployment (26 to 4 percent) went down significantly. There was also a significant improvement in skill proficiency in terms of technical knowledge, practical use, and problem-solving skills, and a continued improvement at the follow-up assessments. Employers stated that they had a high degree of satisfaction with the performance, flexibility, and productivity of the trainees, which substantiates the applicability of training programs to the needs of an industry. The researched result emphasizes the impact of effective skill development programmes on improving employability, technical skills, and workforce readiness in the plastics industry, and this offers the evidence to the policymakers, training institutions and the industry stakeholders.

Keywords: Skill Development, Employment Outcomes, Plastics Technology, Longitudinal Study, Technical Competence, Workforce Readiness, Employer Satisfaction, Vocational Training.

Introduction

The increasing rate of development within the plastics sector has resulted in a high demand of skilled workforce which will address the transforming technological and production characteristics. Due to the high specialization and dynamism of the plastics technology, the individuals working in such industry need to have technical knowledge with the additional expertise in the field to make the manufacturing process efficient, quality, and more innovative. Even though more opportunities are being created in this industry, there is still a mismatch between competencies in the market and the positions of job seekers, which can lead to poor underemployment or bad placements. The development of skills programs have been considered as one of the most important approaches to eliminate this gap and prepare the trainees with relevant skills, problem solving skills, and workplace capabilities that can increase his/her employability and long-term career opportunities. This is especially true when it comes to developing economies, whereby the systematic training of vocations could be used as a driver in to sustainable employment and industrial development.

Plastics technology major skill development courses include the theoretical and practical fields including Injection Moulding, Blow Moulding, Extrusion Technology, CNC Lathe Operations, CAD/CAM Design and Polymer Processing Techniques. Taught by training centres such as CIPET and accredited according to the NSDC, these courses are meant to instil the skills in the working of machines, mould design, and computer-aided manufacturing. These modular programs help fulfil the skill shortage in the plastics industry by providing the connections between technical education and the requirements of the contemporary production systems.

The knowledge of how these skill development programmes can influence the employment outcomes is a necessary thing to the policymakers, training institutes and the industry players. Longitudinal studies also offer an overall program in order to test not only short-term betterment in skills and employment of the participants but also the endurance of these results throughout the time. Monitoring the trainees at several points, immediately after training, six months after training, and one year after training, the researchers will be able to learn more about the quality of the training interventions, their suitability to the industry demands, and the degree to which they help trainees advance their careers. The purpose of this study is, therefore, to evaluate the effectiveness of skill development schemes in plastics technology through assessing their impacts on the employment status, skill competency and employer satisfaction at the end of the day with a view to continuing to provide recommendation to the need to improve the workforce development in this industry.

The plastics industry is among the high-growth manufacturing sectors whereby over 10 lakh skilled technicians are required by 2030 (National Skill Development Corporation, NSDC, 2023). CIPET (2024) offers structured training modules on mould design, polymer processing and CNC-based production systems under its Skill Development and Technology Support programmes to increase employability. On the same note, the All-India Plastics Manufacturers Association (AIPMA) insists on the necessity of continuous up skilling to address Industry 4.0 requirements in the manufacturing of plastics.

1.1 Research Objectives

- To assess the impact of skill development programs on trainees' employment outcomes over time.
- To evaluate improvements in technical, practical, and problem-solving skills after training.
- To analyze employer satisfaction with the performance and competence of trained employees.

2. Literature Review

Didier (2022) evaluated the job training program efficacy in Chile with a longitudinal study. The researchers monitored the participants throughout a long duration to analyze how employment result and acquisition of skills have changed. The results indicated that the technical and work place skills of the participants were greatly enhanced, the job placement rates were very high due to the structured training programs. The study placed special focus on continuous follow-up and training intervention through continuous monitoring and follow-up to assess the effects of training interventions on long-term stability of employment and career advancement.

Hughes et al. (2023) investigated the effect of industrial placement years on the gain of competencies by students by using three cohorts of study. In their study, they have revealed that under the industrial placements, students improved significantly in terms of technical skills, solving problems and professional flexibility than those students who had not gone through the placements. The paper has highlighted that on-the-job exposure in the industry had a significant positive influence on employability and equipped graduates to effectively handle demands of the real-life situations at work.

Sahayararaj et al. (2024) surveyed the fire-retardant capability of natural fiber reinforced polymer composites, the characteristics of materials, processing method, and industrial applications. The research was based on the field of the materials science in question; however, the growing necessity of the specific nature of the skills in the plastics and polymer technology with references to the understanding of the composite materials, testing methods, and production processes was indirectly mentioned in the course of the research. The research highlighted the importance of technical training and skill development courses to prepare professionals to handle hi-tech polymer composite materials and conform to the key development in the industry.

3. Research Methodology

The longitudinal design was applied in the research to assess the effect of skill development programs on employment and skills and employer satisfaction in 250 trainees in plastics technology. The measurement of program effectiveness was done by collecting data, at various periods through assessments and surveys and analyzing it in terms of descriptive, trend and qualitative tools.

3.1 Research Design

The research design used in this study was longitudinal research design to determine the effect of skill development programs on employment prospects in the area of plastics technology. The longitudinal design provided the possibility to trace the response variables; employment of the participants, skill competency, and employer satisfaction at three points in time; immediately after training, six months post-training and one year follow-up. This design also enabled the assessment of the effectiveness of the training programs in the long and short term.

3.2 Population and Sample

The sample of this study was those people who attended the skill development programs concerning the plastics technology in various training centers. Purposive sampling was adopted where the participants to be sampled were selected who had gone through the training program. The sample used was 250 trainees, a mix of different age, education background and previous working experience. Moreover, the results were evaluated on an industry-level by gathering feedback on 75 employers of the trained participants.

3.3 Tools and Instruments

Those tools, which were used in the study, are quantitative and qualitative:

1. **Employment Tracking Questionnaire:** This information obtained the employment status, type of employment (full-time, part-time, self-employed), and variation of income levels at each period.
2. **Skill Assessment Test:** Both scale and problem-solving competence on 0-100 on technical knowledge, practical performance and problem solving. The evaluation was done prior to training, right after training, 6 months and one year.
3. **Employer Satisfaction Survey:** A questionnaire survey conducted as a structured questionnaire tested how well trainees performed in their jobs based on job performance, technical competence, adaptability and productivity. The responding was by rating on a 4-point Likert scale (Highly Satisfied, Satisfied, Neutral, Dissatisfied).

The method of validation was expert review and pilot test in order to validate the instruments and their relevance to plastics technology industry.

3.4 Data Collection Procedure

The collection of data was done in several stages in order to assess the effectiveness of skill development programs. The baseline proficiency on using the skills and employment condition was documented in a pre-training test. The post-training outcomes were measured in the immediate skills and employment improvements. Employment status, income as well as skill application were followed up at six months and one year. The follow-ups also involved the employer feedback to evaluate the performance, adaptability, and productivity. Ethical concerns, such as informed consent and other confidentiality were carefully considered during the process.

3.5 Data Analysis

Statistical data analysis was done using descriptive and inferential statistics to determine the effectiveness of skill development programs. Employment status, proficiency in skills, and employer satisfaction were summarized using

descriptive analysis which comprised of frequencies, percentages and mean scores. Trend analysis was used to follow-up longitudinal changes that occurred on three time point, right after training, six months, and at one year follow-up. The trends were presented in graphs, the qualitative feedback of the employers was added to the quantitative data to present a full picture of the program performance, and the relationship between the program training, learning of skills, and employment results is identified.

4. Data Analysis and Interpretation

The study was longitudinal research to determine the effect of skill development interventions on the employment outcomes of trainees in the plastics technology field. The data were measured at three points, tracking the changes of the employment, income level and the skills of the professionals at the same time jointly immediately after training, six months after training and a year after the training. Quantitative and qualitative measures were situated to find out the efficacy of these programs in the long-term perspective.

4.1 Employment Outcomes Post Skill Development

The findings showed that there was significant enhancement of the employment rates of the participants after they had attended skill development programs. The percentage of working people grew continuously with the term of observation as indicated in Table 1.

Table 1: Employment Status of Trainees Over Time

Employment Status	Immediately After Training (%)	After 6 Months (%)	After 1 Year (%)
Employed (Full-time)	46	64	72
Employed (Part-time)	18	14	10
Self-employed	10	12	14
Unemployed	26	10	4

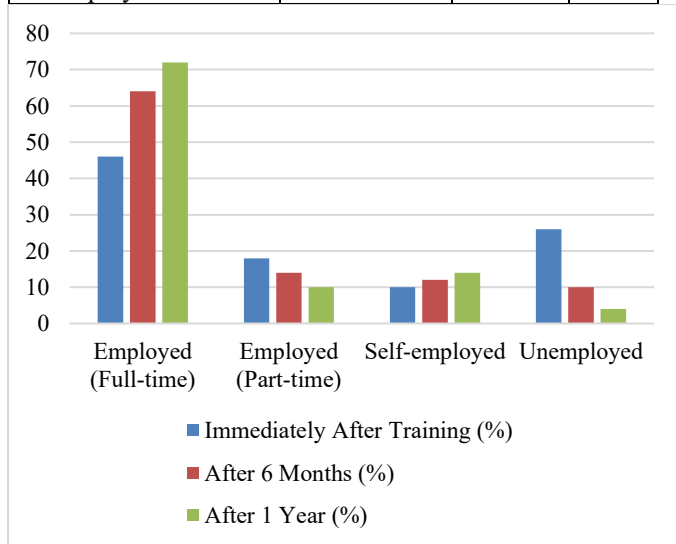


Figure 1: Graphical Representation of Employment Status of Trainees Over Time

46 % of the participants were able to get full-time employment immediately after training and went up to 72 % after a year. The level of unemployment reduced tremendously by 26% down to 4%. This gradual enhancement highlights the favorable and enduring impact of structured skill building programs in increasing job preparedness and employability in the plastics industry.

4.2 Changes in Skill Proficiency Levels

At each stage, skill assessment tests were conducted to test the improvement in the technical, analytical and problem-solving competencies. Table 2 shows the results of the questionnaires (the mean scores out of 100) in three main areas of skills.

Table 2: Average Skill Proficiency Scores Before and After Training

Skill Domain	Before Training	After Training	After 6 Months	After 1 Year
Technical Knowledge	52.6	78.4	81.7	84.2
Practical Application	49.2	75.1	79.3	82.8
Problem-Solving Ability	55.8	73.2	77.6	80.5

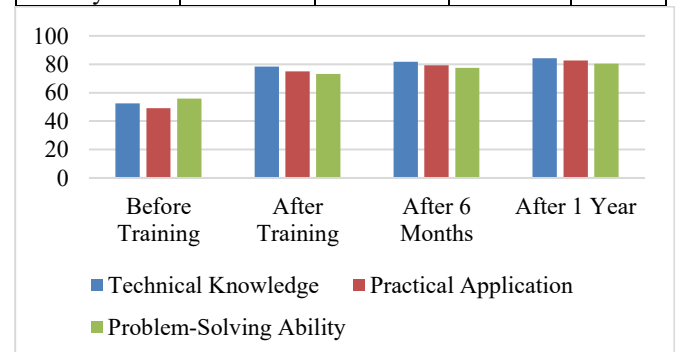


Figure 2: Graphical Representation Average Skill Proficiency Scores Before and After Training

The level of skill was markedly improved as soon as the training was over, especially in technical knowledge (the improvement was 25.8 points). The fact that incremental gains were made at the checkpoints of 6 months and 1 year indicates that exposure on the job and further practice strengthened the competencies learned during the training period. This confirms that the program has the longitudinal effect of contributing to sustained professional development of the participants.

4.4 Employer Satisfaction and Industry Response

To evaluate the results at the industry levels, employers of the workers trained were surveyed on the performance in job, adaptability and productivity of the new recruits. The summary of the results is in Table 3.

Table 3: Employer Satisfaction with Trained Employees

Parameter	Highly Satisfied (%)	Satisfied (%)	Neutral (%)	Dissatisfied (%)
Job Performance	58	34	6	2
Technical Competence	62	30	6	2
Adaptability to Workplace	55	37	6	2
Productivity Improvement	60	32	6	2

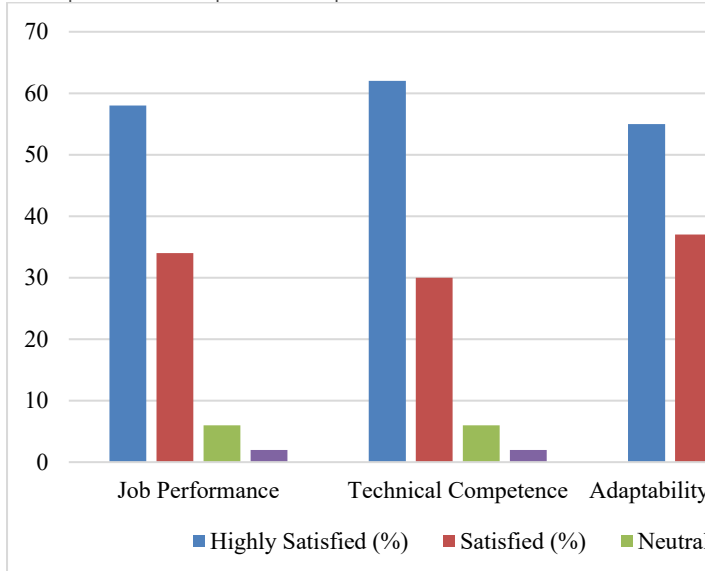


Figure 3: Graphical Representation of Employer Satisfaction with Trained Employees

The general satisfaction levels of most employers were high especially on the technical competence and productivity of trainees. In a study done by employers over 90 % in the employers stated that the post training candidates provided improved worker quality and efficiency because they were skill trained, which implies the program has indeed narrowed the gap between the industry and training curricula.

4.4 Discussion

The findings of the study show that skill development programs have a strong positive effect on employment in the industry of plastics technology. These increased rates of full-time jobs and decreased unemployment levels are revealing in the success of this program to match the participants with market demands.

The enhancement of proficiency in skills especially those in the technical and applied fields underscores the fact that experiential and practice-based learning modules played a key role in enhancing employability. The progressive improvement in the post-training scores in skills over time shows that constant exposure of professions to a professional environment only enhances competencies gained.

These results are supported by the findings of employer feedback, which proves that the program participants comply with the industry performance levels and can adjust to the new manufacturing conditions. These results also correspond with national goals of increasing work efficiency and creating sustainable and lasting employment on the basis of specific skills development programs.

5. Conclusion

The results of this longitudinal research illustrate that the influence of skill development programs in plastics technology is both diverse and profound and long-lasting regarding their effect on the employment status, technical expertise, and job preparedness. The trainees demonstrated significant changes to full-time employment, skill competencies in terms of knowledge of technical knowledge, practical application, and problem-solving skills, flexibility and productivity according to employers. The observed cumulative improvements in a year are the results of the viability of the structured training program in reducing the

gap between the needs of the industry and the capabilities of the workforce in the long term. These findings highlight the need to institute specific vocational training programs to improve employability, career progression and adhesion to the dynamic requirements of the plastics industry. These findings can be used by policymakers, training centers, and industry players to identify and support evidence-based training and development programs that end up creating a skilled, competent and industry relevant workforce.

References

1. Didier, N. (2022). Assessing job training effectiveness in Chile: A longitudinal approach. *Latin American Policy*, 13(2), 354-372.
2. Felix Sahayaraj, A. M. T. S., M. T. S., Sasi Kumar, M., Sathish, S., Gokulkumar, S., Jenish, I., & Makeshkumar, M. (2024). Fire retardant potential of natural fiber reinforced polymer composites: a review. *Polymer-Plastics Technology and Materials*, 63(7), 771-797.
3. Hughes, H. P. N., Mouratidou, M., & Donald, W. E. (2023). Exploring the impact of an industrial placement year on students' competency development: a three-cohort, longitudinal study. *Higher Education, Skills and Work-Based Learning*, 13(6), 1218-1233.
4. Kulkarni, A. V., Joseph, S., & Patil, K. P. (2024). Artificial intelligence technology readiness for social sustainability and business ethics: Evidence from MSMEs in developing nations. *International Journal of Information Management Data Insights*, 4(2), 100250.
5. Lukmanova, I., Saini, N., Singh, P. P., Mohan, C., & Kumar, Y. (2024). Quantifying the impact of digital transformation on Economic growth: A Longitudinal analysis. In *BIO Web of Conferences* (Vol. 86, p. 01079). EDP Sciences.
6. Mitrano, D. M., Bigalke, M., Booth, A. M., Carteny, C. C., Coffin, S., Egger, M., ... & Wagner, S. (2023). Training the next generation of plastics pollution researchers: tools, skills and career perspectives in an interdisciplinary and transdisciplinary field. *Microplastics and Nanoplastics*, 3(1), 24.
7. Ramli, A. H. M., Abd Manaf, L., Zulkeflee, Z., & Andriyono, S. (2024). Advancing circular economy approaches in plastic waste management: A systematic literature review in developing economies. *Sustainable Production and Consumption*, 51, 420-431.
8. Valeriya, G., Kirola, M., Gupta, M., Bharathi, P., & Acharya, P. (2024). Evaluating the Impact of AI-Based Sustainability Measures in Industry 5.0: A Longitudinal Study. In *BIO Web of Conferences* (Vol. 86, p. 01058). EDP Sciences.
9. Venkat, M. V. V., Khan, S. R. K., Gorkhe, M. D., Reddy, M. K. S., & Rao, S. P. (2023). Fostering talent stability: a study on evaluating the influence of competency management on employee retention in the automotive industry. *Remittances Review*, 8(4), 2300-2328.
10. Wamba, S. F., Fotso, M., Mosconi, E., & Chai, J. (2023). Assessing the potential of plastic waste management in the circular economy: A longitudinal case study in an emerging economy. *Annals of Operations Research*, 1-23.
11. National Skill Development Corporation (NSDC). (2023). Sector Skill Council for Plastics: Skill Gap Report. New Delhi: NSDC.
12. Central Institute of Petrochemicals Engineering & Technology (CIPET). (2024). Skill Development and Technical Training Programs in Plastics Technology. Ministry of Chemicals and Fertilizers, Government of India.

13. *All India Plastics Manufacturers' Association (AIPMA). (2023). Skill Development and Industry Readiness Initiatives in Indian Plastics Sector. Mumbai: AIPMA Publications.*
14. *National Skill Development Corporation (NSDC). (2022). Annual Report on Skill India Mission: Advancing Workforce Development in the Manufacturing Sector. New Delhi: NSDC Publications.*
15. *Central Institute of Petrochemicals Engineering & Technology (CIPET). (2023). Annual Review on Skill Enhancement and Industrial Collaboration in Plastics Sector. Government of India, Ministry of Chemicals and Fertilizers.*