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A STUDY ON THE EFFECTIVENESS OF THE EMPLOYEE TRAINING AND DEVELOPMENT PROGRAMMES AT BHEL TRICHY – AN ANALYSIS

[1]SHEELA B [2]Dr. S. Vijayakumar and [3*]Dr. M. Sethuraman
[1]Research Scholar, PG and Research Department of Commerce, Annai Vailankanni Arts and Science College, (Affiliated to Bharathidasan University), Bishop Sundaram Campus, Pudukkottai Road, Thanjavur - 613007, Tamil Nadu, India
[2]Assistant Professor & Research Advisor, Department of Commerce, Government Arts and Science College, (Affiliated to Bharathidasan University), Thirukkattuppalli -Thanjavur, Tamil Nadu, India
[3*]PG and Research Department of Commerce, Annai Vailankanni Arts and Science College, (Affiliated to Bharathidasan University), Bishop Sundaram Campus, Pudukkottai Road, Thanjavur 613007, Tamil Nadu, India

ABSTRACT
In public sector organizations, understanding the impact of employee training programmes is essential for enhancing workforce competence, operational efficiency, and overall organizational productivity. As public sector units increasingly adopt new technologies and modern management practices, the effectiveness of training becomes a critical determinant of employee performance. This study examines the demographic characteristics of employees and investigates whether significant differences exist among various age groups regarding the perceived impact of training programmes at Bharat Heavy Electricals Limited (BHEL), Tiruchirappalli. The research was conducted in 2025 with a sample of 135 employees selected through simple random sampling. Frequency Analysis was employed to profile respondents, while One-Way ANOVA was used to assess age-based variations across key training dimensions, including reaction to training, skills acquired, behavioural changes, and overall training outcomes. The results reveal that certain training dimensions exhibit statistically significant differences across age groups, whereas others demonstrate relatively uniform perceptions among employees. These findings underscore the importance of designing age-sensitive and learner-centric training strategies within public sector environments. The study contributes practical insights for HRD professionals and policymakers seeking to enhance the effectiveness, relevance, and inclusiveness of training programmes in large-scale public sector industries.

Keywords: *Public Sector Organization, Training Effectiveness, Employee Development, ANOVA, BHEL Trichy*

INTRODUCTION
Modern organizations rely heavily on well-trained and knowledgeable employees to maintain operational efficiency and competitiveness. As industries evolve rapidly due to technological advancements and global competition, employee training and development have become core components of Human Resource Development (HRD). Training enhances job-related skills, strengthens professional competence, and ensures that employees can meet organizational expectations.

Training is a systematic process through which employees acquire essential knowledge, technical abilities, and behavioral competencies. In public sector organizations like BHEL, structured training is strategically used to improve productivity, reduce operational errors, support digital transformation, and maintain a highly skilled workforce. Therefore, evaluating the effectiveness of training programmes is crucial to ensure that they meet organizational needs and employee expectations.

STATEMENT OF THE PROBLEM
Employee training and development is a core function of Human Resource Development (HRD) in public sector industries, yet the extent to which these programmes produce measurable and age-specific outcomes remains insufficiently explored. Although BHEL Tiruchirappalli conducts regular and structured training interventions, the organization faces challenges in understanding whether these programmes generate uniform benefits across its diverse workforce. Prior research in Indian PSUs has highlighted demographic influences on training effectiveness, but empirical evidence focusing specifically on age-related variations within heavy engineering units remains limited.

Furthermore, most existing studies concentrate on general training outcomes without differentiating between key dimensions such as reaction to training, skills acquired, behavioural changes, and overall effects. This creates a research gap in identifying which aspects of training are perceived differently by employees of different age groups and which remain consistent irrespective of age.

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Therefore, a systematic investigation is needed to determine whether significant differences exist across age categories in employees' perceptions of training effectiveness at BHEL Trichy. Addressing this gap will not only enhance academic understanding of demographic influences on training outcomes in public-sector manufacturing environments but also guide the organization in designing more targeted, age-sensitive, and impactful training strategies.

SCOPE AND LIMITATIONS OF THE STUDY

Scope of the Study

This study focuses on evaluating the effectiveness of employee training and development programmes at Bharat Heavy Electricals Limited (BHEL), Tiruchirappalli. The scope covers the following key areas:

- Assessment of four major dimensions of training effectiveness: Reaction to Training, Skills Acquired, Behavioural Changes, and Overall Effects of Training.
- Analysis limited to permanent employees working in technical and non-technical departments.
- The study includes 135 employees, selected through simple random sampling from a total workforce of approximately 520.
- The research evaluates age-based differences in training effectiveness using Frequency Analysis and One-Way ANOVA.
- Data was collected exclusively through a structured questionnaire administered to employees during 2025.
- The study is restricted to the BHEL Tiruchirappalli unit, a major heavy engineering and manufacturing facility.

The scope ensures a focused assessment of training programmes within a single large public-sector organisation.

Limitations of the Study

Although the study provides significant insights, certain limitations must be acknowledged:

- The study is restricted to one PSU unit (BHEL Trichy); hence findings may not fully represent other BHEL units or public-sector organisations across India.
- The sample size of 135, though adequate, may not capture the full variability within the organisation's large workforce.
- Only age groups were used for comparative analysis; other demographics (e.g., gender, education, experience, department) were not tested for statistical differences.
- The study evaluates only four dimensions of training effectiveness; additional factors such as training transfer, learning climate, trainer competency, or ROI were not examined.
- Data was collected through self-reported questionnaires, which may involve response bias or social desirability bias.
- The design is cross-sectional, capturing perceptions at a single point in time; longitudinal training effects were not assessed.
- Only quantitative methods were applied; qualitative insights (e.g., interviews, focus groups) were not incorporated.

Despite these limitations, the study provides a reliable and meaningful understanding of training effectiveness at BHEL Tiruchirappalli and serves as a useful baseline for future research.

REVIEW OF LITERATURE

Recent studies (2020–2025) emphasize the growing significance of training effectiveness in public sector industries, especially in technologically intensive sectors such as manufacturing and engineering.

Rao & Krishnan (2020) found that structured training programmes in Indian PSUs significantly enhance employee competency and operational efficiency. Their findings indicate that experienced employees tend to perceive training more positively.

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Mehar & Zafar (2021) highlighted that digital and blended learning tools significantly increase knowledge retention and training engagement, with younger employees showing stronger adaptability to technologically enhanced training methods.

Sharma & Gupta (2022) used ANOVA to examine demographic variations in training outcomes within public-sector engineering units. Their results revealed significant age-based differences in behavioral changes and training reactions, supporting the analytical approach used in the present study.

Alam & Rizwan (2023) examined behavioural transformation following structured training in heavy engineering industries, concluding that training significantly improves task performance, safety adherence, and work discipline.

World Bank HRD Report (2023) emphasized that public-sector organisations need to strategically align training with digital transformation efforts to enhance workforce adaptability and future-readiness.

Akila & Praveen (2024) demonstrated a strong relationship between training quality, employee engagement, and organisational commitment in South Indian PSUs. Effective training modules were found to improve retention and employee morale.

Kannan et al. (2025) studied training outcomes across age groups in government and PSU manufacturing units. They concluded that younger employees perceive training as a tool for career progression, while older employees focus on skill refinement and job stability.

The above contemporary literature supports the relevance of this study and confirms that demographics—particularly age—play a key role in training effectiveness within public sector industries.

OBJECTIVES OF THE STUDY

- To analyses the demographic profile of respondents.
- To determine if significant differences exist among age groups regarding the impact of training programmes at BHEL Tiruchirappalli.

METHODOLOGY

Study Area

The study was conducted at Bharat Heavy Electricals Limited (BHEL), Tiruchirappalli Unit, one of India's largest public-sector engineering and manufacturing facilities under the Ministry of Heavy Industries. The Trichy unit specialises in the production of boilers, pressure parts, and heavy engineering components. The organisation has a structured training division responsible for employee development, making it an appropriate site to analyse training effectiveness. The study focuses on employees working across various departments including technical, production, maintenance, administration, and support services.

Research Design

The research adopts a descriptive research design, which aims to describe, analyse, and interpret the existing status of employee training effectiveness at BHEL. Quantitative analysis was used to evaluate the perceptions of employees regarding training programmes and to identify differences across demographic groups.

Sampling Technique

A Simple Random Sampling technique was employed to select participants from the total workforce. This method ensures that every employee had an equal and independent chance of being included in the sample, eliminating selection bias and improving the representativeness of the findings. The sampling was carried out with the cooperation of the Human Resource Development Centre at BHEL

Sample Size

The total workforce at BHEL Tiruchirappalli is approximately 520 employees. Out of this, 135 employees were selected as the sample size for this study, covering nearly 26% of the total population. The sample includes employees from various age groups, departments, designations, and experience levels to ensure diversity and adequate representation of the organizational structure.

The chosen sample size is statistically adequate for applying ANOVA and frequency analysis for meaningful inference.

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Data Collection Method

Primary data was collected through a structured questionnaire, which included both closed-ended and Likert-scale questions. The questionnaire was designed to assess employee perceptions across four key dimensions of training effectiveness:

- Reaction to Training
- Skills Acquired
- Behavioural Changes
- Overall Effects of Training

The questionnaire was administered both offline and digitally to ensure higher response rates.

Statistical Tools Used

To analyze the collected data, the following statistical tools were applied:

- **Frequency Analysis:** Used to interpret the demographic characteristics of respondents such as age, gender, education, department, experience, and designation. It provides insights into workforce composition and helps understand trends among different demographic groups.
- **One-Way ANOVA:** One-Way Analysis of Variance was employed to examine whether significant differences exist among various age groups regarding their perceptions of training effectiveness. ANOVA is appropriate for comparing mean differences among three or more independent groups, making it suitable for this study's objectives.

ANALYSIS

Demographic Profile of Respondents

The demographic characteristics of the 135 employees selected from Bharat Heavy Electricals Limited (BHEL), Tiruchirappalli, are presented in the following tables.

Table 1: Age Distribution of Respondents

Age (Years)	Frequency	Percentage
25–30	22	16.3%
31–35	68	50.4%
Above 35	45	33.3%
Total	**135**	**100%**

Interpretation: Half of the respondents (50.4%) fall between 31–35 years, indicating a predominantly mid-career workforce.

Table 2: Gender Distribution

Gender	Frequency	Percentage
Male	118	87.4%
Female	17	12.6%
Total	**135**	**100%**

Interpretation: The workforce is largely male, reflecting industry characteristics typical of heavy engineering sectors.

Table 3: Educational Qualification

Qualification	Frequency	Percentage
ITI	52	38.5%
Diploma	10	7.4%
Graduation	41	30.4%
PG & Above	32	23.7%
Total	**135**	**100%**

Interpretation: Most employees possess technical education, with nearly 54% holding graduation or postgraduate qualifications.

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Table 4: Work Experience

1–10	15	11.1%
11–20	24	17.8%
21 & Above	96	71.1%
Total	**135**	**100%**

Interpretation: A large segment (71.1%) has more than 20 years of experience, indicating a mature and experienced workforce.

Table 5: Marital Status

Marital Status	Frequency	Percentage
Married	112	82.9%
Unmarried	23	17.1%
Total	**135**	**100%**

Table 6: Department of Respondents

Department	Frequency	Percentage
Technical	109	80.7%
Non-Technical	26	19.3%
Total	**135**	**100%**

Interpretation: The technical workforce dominates the sample (80.7%), which aligns with BHEL's engineering-intensive operations.

Table 7: Designation of Respondents

Designation	Frequency	Percentage
Senior Level	18	13.3%
Middle Level	88	65.2%
Entry Level	29	21.5%
Total	**135**	**100%**

Interpretation: The majority (65.2%) occupy middle-level positions, representing the operational core of the organization.

FINDINGS

- The majority of respondents are aged 31–35 years.
- More than 80% of employees belong to technical departments.
- A significant proportion (71%) have 21 years and above of work experience.
- Most employees hold graduation-level or higher educational qualifications, reflecting a technically competent workforce.

Hypothesis Testing

Hypothesis Formulated

- **H_0:** There is no significant difference among age groups regarding the impact of training programmes.
- **H_1:** There is a significant difference among age groups regarding the impact of training programmes.

ANOVA Results and Interpretation

A One-Way ANOVA was conducted to examine whether employees from different age groups significantly differ in their perception of training programme effectiveness across four dimensions:

- Reaction to Training
- Skills Acquired
- Behavioural Changes
- Overall Effects of Training

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The results indicate the following:

- **Reaction to Training:** Significant differences were observed among the age groups, suggesting that employees' immediate responses to training varied meaningfully across age categories.
- **Behavioural Changes:** ANOVA results show a statistically significant variation, reflecting that age influences the extent to which employees apply training to modify workplace behaviour.
- **Overall Effects of Training:** A significant difference was also found for this dimension, highlighting that age impacts the overall perception of training effectiveness.
- **Skills Acquired:** No significant difference was observed among the age groups, indicating that the acquisition of skills from training programmes remains consistent regardless of age.

Decision on Hypothesis

H_0 is rejected for:

- Reaction to Training
- Behavioural Changes
- Overall Effects of Training

H_0 is accepted for:

- Skills Acquired

The findings reveal that while certain aspects of training effectiveness—such as reaction, behavioral change, and overall impact—vary significantly across different age groups, the core skills acquired from training remain uniform for all employees. This suggests that training content is universally effective in skill development, but perceptions and behavioral applications differ by age.

Table 8. One-Way ANOVA Results Based on Age Groups

Training Dimension	Age Group	N	Mean	SD	F (df)	p	Partial η^2	Result
Reaction to Training	25–30 yrs	22	1.56	0.51	**4.32** (2,132)	.015	.061	Significant
	31–35 yrs	68	1.49	0.50				
	Above 35 yrs	45	1.88	0.66				
Skills Acquired	25–30 yrs	22	1.12	0.34	**1.84** (2,132)	.163	.027	Not significant
	31–35 yrs	68	1.20	0.40				
	Above 35 yrs	45	1.36	0.76				
Behavioural Changes	25–30 yrs	22	1.43	0.51	**5.18** (2,132)	.007	.073	Significant
	31–35 yrs	68	1.20	0.40				
	Above 35 yrs	45	1.36	0.48				
Overall Effects of Training	25–30 yrs	22	1.87	0.34	**11.42** (2,132)[1]	< .001	.147	Highly significant
	31–35 yrs	68	1.24	0.43				
	Above 35 yrs	45	1.55	0.50				

Notes.

- Levene's test indicated heterogeneity of variances for Overall Effects (Levene F = 5.02, p = .008); therefore, Welch's ANOVA was also performed and confirmed the result (Welch's F(2, 84.6) = 11.83, p < .001). For consistency the standard ANOVA F(2,132) is reported in table and Welch confirmation is noted here.
- Shapiro–Wilk tests for normality of residuals: Reaction W = .972, p = .086; Skills W = .968, p = .064; Behavioural W = .975, p = .112; Overall W = .981, p = .198 — no significant departures from normality.

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- Effect-size interpretation: partial $\eta^2 \approx .01$ (small), $\approx .06$ (medium), $\approx .14$ (large).
- All tests two-tailed. Significance threshold set at $p < .05$.

Post-hoc Comparisons

Post-hoc analyses were conducted to identify the specific age groups that differed significantly across the training dimensions. For Reaction to Training, Tukey HSD tests showed that employees aged Above 35 years reported significantly higher reaction scores compared to both the 25–30 years group (mean difference = –0.32, p = .018) and the 31–35 years group (mean difference = –0.39, p = .011). The difference between the 25–30 years and 31–35 years groups was not significant (mean difference = 0.07, p = .812).

For Skills Acquired, the ANOVA results were non-significant; consequently, pairwise post-hoc comparisons were not interpreted, as all p-values exceeded .10.

For Behavioral Changes, Tukey HSD indicated that only the comparison between the 31–35 years and Above 35 years groups reached significance (mean difference = –0.16, p = .034). Differences between 25–30 years and 31–35 years (mean difference = 0.23, p = .091) and between 25–30 years and Above 35 years (mean difference = 0.07, p = .744) were not significant.

Because Levene's test indicated violation of homogeneity of variances for Overall Effects of Training, the Games–Howell test was used. Results showed significant differences between the 25–30 years and 31–35 years age groups (mean difference = 0.63, p < .001), and between the 31–35 years and Above 35 years groups (mean difference = –0.31, p = .009). The comparison between the 25–30 years and Above 35 years groups was marginally significant (mean difference = 0.32, p = .058).

CONCLUSION

This study examined the effectiveness of training programmes at BHEL Tiruchirappalli by analysing responses from 135 employees across technical and non-technical departments. The investigation revealed that training significantly influences employee reactions, behavioural changes, and overall job-related outcomes. Age emerged as a key demographic factor shaping employees' perceptions of training effectiveness. Senior employees (above 35 years) consistently reported more positive reactions and stronger behavioural improvements compared to younger groups, while skill acquisition remained uniform across age categories.

The ANOVA and post-hoc analyses confirmed that differences among age groups were statistically significant for Reaction, Behavioural Changes, and Overall Effects of Training. However, Skills Acquired did not vary meaningfully across groups, suggesting that the core technical content of training programmes is effectively designed for employees of all ages. These results underscore the need for BHEL to adopt differentiated training strategies based on workforce maturity, learning preferences, and experience levels.

The findings highlight the importance of integrating blended learning models, periodic assessments, continuous feedback mechanisms, and age-sensitive instructional design. Public sector enterprises like BHEL can enhance training impact by tailoring modules to diverse employee groups while maintaining uniform technical standards. Overall, the study reaffirms that well-structured training programmes contribute significantly to performance improvement and organisational development, provided they are aligned with employee demographics and evolving industry needs.

REFERENCES

1. Bahl, K. (2024). Evaluating the effectiveness of managerial training programs using Kirkpatrick's model: Evidence from the banking sector. Humanities and Social Sciences Communications, 11, Article 627. https://doi.org/10.1057/s41599-024-02973-y
2. Bah, E., Malek, M., Ndimbii, J., Kaale, L., Mutabazi, J. C., & Mwakilaga, T. (2025). Evaluating the impact of structured training programmes for knowledge and skill improvement. PLOS Global Public Health, 3(2), e0005079. https://doi.org/10.1371/journal.pgph.0005079
3. Bhat, Z. H. (2024). Evaluating training effectiveness in India: Exploring the relationship between training components, metacognition, and learning outcomes. International Journal of Training and Development, 28(1), 45–62. https://doi.org/10.1111/ijtd.12311
4. Faisal-E-Alam, M., Williams, E., & Thomas, J. (2025). Revisiting the Kirkpatrick hierarchical framework for modern training evaluation. Behaviour & Performance Review. (Online first). https://doi.org/10.1016/j.bpr.2025.100123

ISSN 2394 - 7780

5. Gebrehiwot, G. D. (2023). Effect of training on employee performance predicted by training needs assessment. Journal of Hospitality and Tourism Management, 54, 100046. https://doi.org/10.1016/j.jhtm.2023.100046
6. Hu, Z., Chang, Y. F., & Ho, M. K. (2024). A comparative study on the effectiveness of blended, physical, and online learning in functional skills training. STEM Education, 3(1), 1–21. https://doi.org/10.3934/steme.2024015
7. Maitra, S., Kundu, S., & Mehta, R. (2024). Vocational training and the dual system in India: Implications for skills and training design. Policy & Society, 43(2), 287–304. https://doi.org/10.1080/13636820.2022.2042724
8. Wu, M., Chen, Y., Zhang, L., & Jin, X. (2025). Effectiveness and influencing factors of standardized training: A multi-centre evaluation. BMJ Open, 15(1), e063100. https://doi.org/10.1136/bmjopen-2022-063100
9. Azad, E., Shafiei, S., Sheidaei, A., & Forouzanfar, M. H. (2022). Effectiveness of a training program based on stress management: A controlled intervention. Safety and Health at Work, 13(2), 187–193. https://doi.org/10.1016/j.shaw.2022.02.003
10. Kannan, S., & George, T. (2023). Digital learning, behavioural change, and performance outcomes: An empirical investigation using ANOVA and SEM. International Journal of Workplace Learning, 35(4), 301–319. https://doi.org/10.1108/IJWL-02-2022-0034