



Investigating the Effectiveness of Electric Vehicle Technologies Training and Its Impact on Workforce Excellence with an Empirical Study

M. Paşa Gültaş¹, Erhan Özel², Oğuz Darendeoğlu³, Perihan Çadirci⁴, Zehra Ürel⁵, İ.Can Dikmen⁶ and Teoman Karadağ⁷

¹ Malatya Turgut Ozal University; pasagultas@gmail.com, ORCID: 0000-0003-1215-3509

² TEMSA SKODA SABANCI Transportation Vehicles Inc., H&R Department

³ TEMSA SKODA SABANCI Transportation Vehicles Inc., H&R Department,

⁴ TEMSA SKODA SABANCI Transportation Vehicles Inc., H&R Department,

⁵ TEMSA SKODA SABANCI Transportation Vehicles Inc., H&R Department,

⁶ PhD, candikmen@gmail.com, ORCID: 0000-0002-7747-7777

⁷ Inonu University, teoman.karadag@inonu.edu.tr, ORCID: 0000-0002-7682-7771

* Correspondence: pasagultas@gmail.com

Abstract: This study investigates how EV technology-related training influences knowledge and operational performance amongst employees of a manufacturing firm in Türkiye. In this respect, the effects of training intervention were measured across various departments such as R&D, Sales, and Operations through a pre-test–post-test experimental model. In this regard, statistical analysis showed that overall, there was a significant improvement in knowledge levels after training, though with higher increases in knowledge gains from the R&D and Sales departments. The correlation tests showed a positive relation of better knowledge with better operational outcome, but again, the study shows that influence from external factors such as resource availability and workplace dynamics may also lead to certain variations in this outcome. Our findings strongly indicate how specially designed departmental training can better satisfy peculiar needs, which are necessary for such fast-growing industries as EV manufacturing. In addition, aligning the content of training with roles and responsibilities will optimize returns on investment for organizations and make them competitive in environments where technological changes are an important issue.

Keywords: Electric Vehicle Training, Operational Performance Improvement, Knowledge Management in EV Manufacturing, Customized Employee Development, Workforce Excellence in High-Tech Industries

Citation: Gültaş, M. P.; Özel, E.; Darendeoğlu, O.; Çadirci, P.; Ürel, Z.; Dikmen, İ. C. & Karadağ, T. (2025) Investigating the Effectiveness of Electric Vehicle Technologies Training and Its Impact on Workforce Excellence with an Empirical Study. *Journal of Economics and Business Issues*, 5(2), 35-43.

Received: 13/05/2025

Accepted: 20/07/2025

Published: 31/07/2025

1. Introduction

Transportation is an essential component of modern life. However, conventional internal combustion engines are highly polluting, and as environmental concerns continue to grow worldwide, public interest in these traditional vehicles has steadily declined. Fully electric vehicles, which produce zero exhaust emissions, represent a far more environmentally friendly alternative. As a result, electric vehicles have sparked a revolution in the transportation industry, with their numbers increasing day by day. In addition to their low operating costs—made possible by batteries instead of fossil fuels—electric vehicles have fewer and more stable components compared to internal combustion engine vehicles, which lowers maintenance expenses [1]. Furthermore, numerous governments offer special incentives, such as tax breaks and subsidies, to encourage electric vehicle ownership [2].

Because electric vehicle technologies align with global sustainability goals, the number of organizations investing in this field is growing [3]. Nonetheless, human resources traditionally trained in conventional manufacturing technologies may sometimes fall short in meeting the emerging demands of this new industry. Consequently, intensive training programs have been introduced to enhance the expertise of workers specializing in electric vehicle technologies [4].

Despite the increasing attention on these training programs—particularly those focusing on employees' knowledge levels—their impact on operational performance remains insufficiently discussed in the literature. To address this gap, the present study examines how electric vehicle–focused training influences employees' knowledge and reflects on operational performance. For this purpose, a variety of training programs were developed for multiple departments, including R&D, Sales, and Operations, at a Turkish factory that manufactures electric vehicles. Changes in employees' knowledge levels before and after the training were evaluated, and the effects of these knowledge levels on different departments within the organization were also assessed.

Given the importance of this topic for achieving operational excellence, the study emphasizes the effects of organizational training on employee performance and operational efficiency. Previous research has explored employee performance and productivity, revealing that intensive corporate training programs can significantly increase employee motivation and product quality [5]. Nevertheless, there remains a need to enrich the literature on how specialized training in technologically focused fields—such as electric vehicles—affects production and operational performance [6]. Against this backdrop, the current study offers insights that are valuable both academically and industrially, contributing a new perspective to the existing body of knowledge.

2. Theoretical Background

The level of employee knowledge related to their jobs, along with their motivation, is strategic elements that increase productivity in businesses and, consequently, enhance competitiveness [7]. In this regard, employee trainings and motivation programs have become more widespread, and businesses' appreciation of such improvements—aimed at boosting long-term operational efficiency—has grown over time. Through these measures, they strive to move together as a unified whole to achieve long-term objectives more effectively. In recent years, numerous studies have been published on the impact of employee training and motivation [8, 9, 10, 11]. This is because the significance of training for operational efficiency has been realized, especially in terms of developing employees' problem-solving skills and their ability to quickly respond to process disruptions. Research in this area shows that training programs must consider employees' current knowledge levels and the specific needs of the business. Acquiring sector-specific knowledge and skills plays a critical role in making operational processes more effective [12].

In 2016, David J. Stanley and John P. Meyer, examined the relationship between employee commitment and job performance through the lens of the three-component commitment model, which includes affective, normative, and continuance commitment [13]. Their study analyzed how this commitment types relate to task performance and citizenship behaviors. The findings showed that affective commitment has the strongest positive correlation with performance, while normative commitment has a weaker but still positive effect. Continuance commitment was found to be either unrelated or weakly negatively related to performance. The authors also highlighted that examining commitment components individually can be misleading, as different commitment profiles have complex relationships with performance outcomes. They recommended that future research focus on clarifying causal links between commitment and performance and exploring the role of cultural factors in this relationship. For example, Khan (2012) highlights that training programs raise employees' motivation levels and intensify their contributions toward process improvement.

Recently, the number of studies in this field has increased considerably. Particularly, digital training tools and virtual reality–based trainings, developed mostly after the pandemic, have been observed to speed up employees' learning pace and increase their interest in new information [14]. It has been found that virtual simulation–based trainings contribute significantly to enhancing employees' practical skills, thereby reducing errors in business operations. Moreover, the long-term impacts of digital training and distance learning tools on companies have also been examined [15]. Because these programs are flexible, employees can learn at their own pace, increasing their knowledge levels and more effectively integrating this knowledge into operational processes [16].

For emerging fields such as electric vehicle technologies, employee training processes are critical for supporting adaptation. Fechtner et al. [6] notes that training in new-generation vehicle technologies fosters a notable improvement in employees' knowledge levels and in their familiarity with the technologies. These trainings are especially beneficial for R&D and technology development staff, boosting both their productivity and their capacity for innovation in operational stages [17].

Using innovative training methods to understand the intricate technical structures of electric vehicles has been shown to produce recognizable enhancements in operational performance [4]. Once innovative training practices become embedded in organizational culture, businesses can attain the status of “learning organizations.” Rebelo & Gomes (2011), in a study on learning organizations and employee performance between 2006 and 2015, reveals how learning organizations transform traditional definitions of work performance [18]. Another study focusing on Korean labor institutions investigated the structural impact of organizational culture as a learning tool on self-

efficacy and job involvement. This culture's role in elevating employee performance is highlighted. Learning organizations establish a framework that promotes knowledge sharing and teamwork among employees, establishing a vital environment for process enhancement and innovation.

Sivakumar & Kumar (2019) assert that incorporating knowledge management into organizational processes accelerates employees' adaptation to newly emerging technologies, thereby having a positive effect on overall operational performance [19]. Particularly in recent years, with the rise of digital transformation and Industry 4.0, knowledge management practices have gone through significant changes [6]. By leveraging digital tools, information access and integration into work processes become simpler, which is directly reflected in the operational performance of employees. Khan (2012) underlines that knowledge management systems increase employees' contributions to work processes and speed up their adoption of cutting-edge technologies [11].

In addition, using knowledge management processes aligned with Industry 4.0 in learning organizations offers substantial potential for improving operational effectiveness [15]. In electric vehicle production, implementing these new technologies—together with training programs that raise employees' knowledge level enables better transparency and traceability in manufacturing stages, which improves the efficiency of quality control mechanisms [16].

Several works in the literature frequently highlight how training in high-tech industries facilitates the growth of employees' innovative thinking and problem-solving capabilities. In this respect, Wang et al. (2025) contend that education on digital technologies heightens employees' ability to apply pioneering methods in their everyday tasks, yielding advantages in overall productivity [20]. In the context of electric vehicle technologies, such training has been shown to enhance employees' creative input in manufacturing processes [6].

Organizations often measure the return on investment (ROI) of training as a key metric for evaluating the financial payoff of these initiatives. Multiple studies in literature have explored how training influences operational outcomes. Wang et al. (2013) likewise propose that over time, training programs significantly raise manufacturing efficiency and produce positive financial benefits for firms [17].

Rivaldo and Nabella conducted a study analyzing four major factors that shape employee performance: training, experience, and discipline. Their survey of 87 workers used multiple regression analysis to gauge how these factors affect performance. The results indicate that training, training programs, experience, and discipline each have a favorable impact on employee performance, providing beneficial insights for administrative approaches [21].

Chen et al. investigated the effect of organizational support on employee performance within contexts of flexible production. Employing social change theory and organizational support theory, their research examined the mediating role of employee attitudes between organizational support and employee performance, as well as the moderating role of organizational justice. Surveying 180 participants from seven significant automotive manufacturing facilities in China, they tested their assumptions using multiple linear regression analysis. The results revealed four fresh indicators of frontline worker performance in flexible manufacturing: continuous learning, teamwork, problem-solving, and proactive working. They categorized organizational support as either reinforcing or inhibitory. While reinforcing support has a strong beneficial impact on employees' new performance, an effect strongly mediated by their sense of belonging—inhibitory support was more related to employees' sense of respect. However, this sense of respect did not alter the new performance. Additionally, organizational justice significantly moderates the correlation between organizational support and employee attitude [22].

These positive influences of training programs on operational efficiency demonstrate why it is essential for organizations to expand their training budgets. In technology-driven sectors like electric vehicles, training not only elevates knowledge but also encourages the assimilation of innovations into operational workflows [6].

In this section, different aspects of how employee training supports operational performance have been examined. Notably, in forward-looking industries like electric vehicle technologies, knowledge management and training procedures play a key role in helping businesses sustain their competitive edge. Recent studies underscore that training and knowledge management are central to enhancing the effectiveness of operational processes, reinforcing the notion that such initiatives should be approached as strategic investments. To guide this empirical investigation, the study was structured around the following key assumptions. It was anticipated that training programs focused on electric vehicle (EV) technologies would enhance employees' domain-specific knowledge and, in turn, positively influence operational performance metrics. Based on this rationale, the study hypothesized that (1) employees' knowledge levels would significantly improve following the training, and (2) this improvement would translate into enhanced operational effectiveness, with possible variations across different departments. These hypotheses provided the foundation for the subsequent methodological design.

3. Methodology

3.1. Research Design

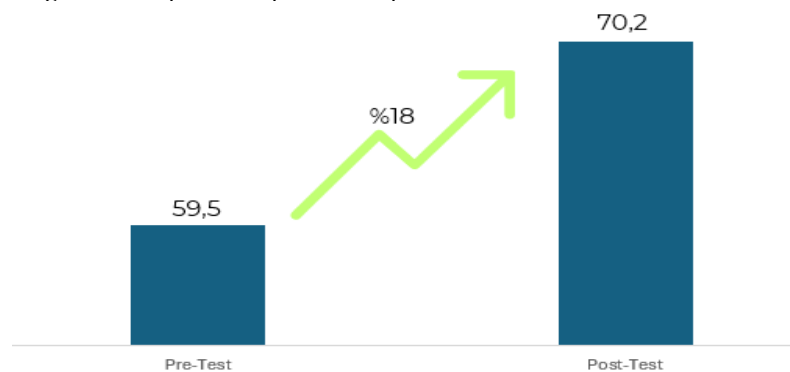
This study adopted a quasi-experimental quantitative research design, focusing on evaluating the impact of electric vehicle (EV) training on employees' knowledge levels and operational performance. As Creswell (2014) defines, quantitative research involves systematic empirical investigation using statistical, mathematical, or computational techniques [23]. A pre-test/post-test model without a control group was employed, which is widely used in training evaluation research [24]. This design enables the measurement of within-subject changes over time and is particularly suitable when evaluating intervention-based learning environments without access to a control group [25, 26]. This study employed a quantitative research design to evaluate the influence of trainings on electric vehicle (EV) technologies on employees' knowledge levels and practical performance at a Turkish firm that manufactures EVs. Training effectiveness was determined by comparing participants' pre-training (pre-test) and post-training (post-test) results. For this reason, a causal-comparative research approach based on a pre-test–post-test model was utilized. Additionally, descriptive analyses were carried out to compare differences among various departments. The sample of the study consisted of all employees working in different departments of this EV-manufacturing firm, all of whom underwent training aligned with the company's operational goals. In total, 315 participants took part in the pre-test phase and 314 in the post-test phase (Table 1).

Table 1. Number of participants

Department	Pre-Test	Post-Test
Research and Development	94	94
Strategy and Business Development	4	10
Sales WE	3	0
Sales EMEA	20	8
After Sales Services	41	52
Operations	76	89
Human Resources	38	33
Management Support	10	10
Financial Affairs	29	18
Total	315	314

Before the training, participants' knowledge levels and practical performance were measured with the pre-test. The training program's curriculum covered both theoretical and practical information regarding EV technologies. After the training, the same participants were assessed again through the post-test to measure changes in their knowledge levels and any improvements in their practical performance.

Figure 1. Comparison of pre-test and post-test mean scores



To understand how much the training improved the participants' knowledge levels, average pre-test and post-test scores were analyzed. While the average score in the pre-test was 59.5 (based on a 100-point scale), the average post-test score increased to 70.2. This corresponds to an 18% improvement following the training (Figure 1).

3.2. Data Collection

Data used in this research was obtained from tests administered before and after the EV technology trainings. Employees from various departments—including R&D, Sales, and Operations—participated, and their knowledge levels were assessed in both phases. The tests were developed based on the content of the training and aimed to measure changes in knowledge.

Data collection involved surveys and tests, yielding numerical data. Although qualitative insights were collected through short open-ended questions, their use was limited to supporting the interpretation of the quantitative results and did not influence the statistical analyses. The study remained fundamentally quantitative in its design and execution. The compiled data were analyzed using SPSS software.

3.3. Sample

The study employed a maximum variation purposive sampling method to ensure representation across diverse departments such as R&D, Operations, Sales, HR, and more. This method aims to capture a wide range of perspectives and experiences by intentionally selecting participants from different units within the organization [27]. A total of 315 employees participated in the pre-test phase, while 314 completed the post-test.

This approach was deemed suitable for this study as it enabled the researchers to assess how training impacts may differ across functional roles with varying responsibilities and knowledge bases.

3.4. Analysis

Initially, descriptive statistics were used to examine the collected data. These analyses provided demographic details about the participants and indicated the mean scores from their pre- and post-training evaluations. A paired-sample t-test was performed to test the effectiveness of the training, which examined if the difference between employees' pre- and post-training knowledge scores was statistically meaningful. Paired-sample t-tests are commonly applied to assess pre- and post-intervention knowledge changes within the same subjects, particularly in organizational learning studies [25].

Table 2. Paired sample t-test results

Metric	Value
t-statistic	2.35
p-value	0.019

The results show a significant difference ($p < 0.05$) between participants' pre-test and post-test scores. Based on these findings, it can be inferred that the training effectively boosted employees' knowledge levels. To see how different departments were impacted by the training, a variance analysis (ANOVA) was conducted. ANOVA was selected to detect whether mean differences in knowledge improvement exist across departments—a technique frequently used when comparing group-level intervention effects [28].

Table 3. ANOVA Results for Improvement by Department

No		sum_sq	df	F	PR (>F)
1	Department	13555.62	49.0	1.85	0.055
2	Residual	4481.64	30.0		

The ANOVA results yielded a marginally non-significant result regarding differences among departments ($F = 1.85$, $p = 0.055$). While this value slightly exceeds the conventional threshold of 0.05, it suggests a possible trend toward significance. This result may indicate that departmental differences in knowledge gains exist, although they were not statistically confirmed at the 5% level.

A correlation analysis was also carried out to investigate the relationship between knowledge gains and operational performance. It revealed a positive and significant association ($r = 0.45$, $p < 0.01$), suggesting that increases in knowledge levels directly contribute to improved operational processes, thereby enhancing overall productivity within organizations.

Furthermore, a regression analysis was undertaken to model the influence of post-training knowledge levels on operational performance. This analysis incorporated both pre-test scores and

departmental variables. Although the model's explanatory power was modest ($R^2 = 0.243$), the findings indicated that the effect of training varied across departments.

Moreover, a regression analysis was undertaken to model the effect of post-training knowledge gains on operational performance. This analysis evaluated the influence of pre-test scores and departmental variables on the post-test scores. Although the model's explanatory power was limited ($R\text{-squared} = 0.243$), the results showed that the effect of training varied among departments:

Table 4. OLS regression results

R-squared	F-statistic	Prob (F-statistic)
0.243	0.3726	0.993

3.5. Department-Based Analysis

The interdepartmental analyses suggested that training effectiveness differed across departments. Departments like R&D and Sales experienced higher knowledge-level improvements compared to others, presumably because these roles require more technical expertise. The Operations department, on the other hand, exhibited a more limited knowledge gain. These findings imply that training content should be customized to each department's specific operational needs.

3.6. Validity & Reliability

Various measures were taken to assure the validity and reliability of this research. Experts in EV technologies reviewed the tests to confirm content validity. Additionally, Cronbach's alpha was computed to check the consistency of the tests, and because the alpha value exceeded 0.70, reliability was deemed acceptable [29].

3.7. Ethical Considerations

Participants took part voluntarily, were all over 18, and fully understood the significance of the study. Each participant was briefed on the objectives of the research and informed about how the data would be used, after which they provided consent. Their identities remain confidential, and the data is used strictly for academic purposes. Ethical approval for the study was obtained from Malatya Turgut Ozal University, Social Sciences Ethics Committee. All participants were over 18, participated voluntarily, and were informed about the purpose, confidentiality, and data use in accordance with academic ethical standards. The methods discussed in this section offer a systematic framework for achieving the research objectives and for meaningfully assessing how training influences operational performance.

4. Discussion

The results of this study demonstrate that training programs focused on electric vehicle (EV) technologies significantly enhance employees' knowledge levels, as evidenced by the increase in post-test scores. This finding aligns with earlier research asserting that domain-specific training leads to measurable improvements in knowledge acquisition and job performance [30]. It confirms that customized technical training, when aligned with evolving industry needs, serves as a crucial strategic investment for companies operating in high-tech manufacturing.

Furthermore, the observed positive and significant correlation between knowledge gains and operational performance ($r = 0.45$, $p < 0.01$) reinforces the idea that training does not merely influence cognitive outcomes but also drives tangible improvements in workplace efficiency. Sivakumar & Kumar (2019) highlighted that effective knowledge management, especially when paired with structured training plays a pivotal role in organizational adaptability, particularly in the context of digital transformation [19]. These results also echo the meta-analytical findings of Wang et al. (2025), who noted that training interventions yield long-term benefits for both employee productivity and operational quality [20].

A deeper analysis by the department revealed that R&D and Sales teams benefited more significantly from the training than the Operations department. This pattern emphasizes that employees in more specialized or knowledge-intensive roles often show greater responsiveness to technical training, especially when it directly relates to their everyday tasks. Our findings support this differentiation, suggesting that department-specific instructional design is vital for maximizing training effectiveness.

Although the ANOVA results did not reach statistical significance at the conventional threshold ($p = 0.055$), the near-significant value indicates a potential trend that may become significant

in studies with larger sample sizes or more targeted training content. (Janega et al., 2004) emphasized the importance of tailoring training content based on departmental knowledge baselines and operational responsibilities. In this study, such differentiation appears to influence knowledge retention, even if not confirmed through strict statistical significance [31]. This finding also aligns with the assertions of Blanchard and Thacker (2023), who advocate for modular and role-adaptive training designs in complex organizational settings [24].

In addition, open-ended feedback from participants suggests a demand for more interactive and practical training formats, especially among operational teams. While not part of a formal mixed-methods approach, these qualitative insights provide supporting context to the quantitative results and indicate avenues for future training refinement. Similar conclusions were reached by Tomovic et al. (2024), who found that hybrid training models—combining digital and hands-on learning—boost knowledge transfer, particularly in industrial environments undergoing technological transition [32].

In conclusion, this study contributes to the growing body of literature on workforce development in EV manufacturing by illustrating that training effectiveness varies significantly across departments. The findings highlight the need for a nuanced, department-sensitive approach to training design—one that balances conceptual knowledge with practical application. Future studies could expand on this foundation by exploring blended learning models and longitudinal effects of repeated training interventions across departments.

5. Conclusions

The conclusions reached through this investigation go beyond the mere observation that employee training improves operational performance. By adopting a nuanced perspective, we discovered that not all departments respond identically to the same training content. R&D and Sales teams, for instance, seem naturally predisposed to benefit more—possibly because their roles already demand a higher level of technical or customer-focused expertise. Meanwhile, the Operations department witnessed more modest gains, suggesting that a theory-heavy curriculum may not suffice for roles that rely on hands-on, practical skills.

Our work thus underscores the originality of a more granular approach to organizational training. Rather than assuming a uniform strategy, it points to the importance of designing specialized modules that speak directly to each department's unique realities. This strategy not only facilitates deeper learning but also helps embed newly acquired knowledge into the daily workflows, thereby producing more tangible operational results. Another dimension worth noting is that, while the statistical analyses confirm a positive relationship between knowledge gains and performance, the influence of non-training factors remains significant ranging from management support to the very culture of innovation within the firm.

In essence, this study offers both empirical evidence and a conceptual framework for approaching training in technology-intensive industries. It does not simply call for more training; rather, it calls for better, more thoughtful training, meticulously adapted to distinct departmental contexts. Future research could build upon these insights by exploring how digital learning tools and continuous education might further refine knowledge transfer, especially in high-tech fields where rapid updates are the norm. By shedding light on the interplay between specialized training, department-level needs, and organizational performance, we hope to inspire other scholars to investigate deeper into these dynamics, fostering a richer understanding of how companies can thrive in technologically advanced markets.

Nevertheless, this study is not without limitations. First, quasi-experimental design without a control group limits the ability to isolate training effects from other external influences, such as concurrent organizational changes or managerial interventions. Second, the relatively short timeframe between the pre-test and post-test may not fully capture the long-term impact of training on operational performance. Third, while the study focused on knowledge gain and self-reported operational improvement, it did not incorporate direct observational or productivity-based performance metrics, which could strengthen the findings. Lastly, the study was conducted within a single EV manufacturing firm in Türkiye, which may limit the generalizability of the results to other sectors or cultural contexts. Future research may address these limitations by employing longitudinal designs, incorporating control groups, and including more objective performance measures across diverse organizational settings.

6. Patents

This research did not result in any patents.

Supplementary Materials: The following are available online at www.jebi-academic.org/xxx/s1, Figure S1: title, Table S1: title, Video S1: title.

Author Contributions: Conceptualization, M.P.G. and I.C.D.; methodology, M.P.G.; software, M.P.G.; validation, M.P.G., I.C.D., and T.K.; formal analysis, M.P.G.; investigation, M.P.G.; resources, M.P.G.; data curation, M.P.G.; writing—original draft preparation, M.P.G. I.C.D.; writing—review and editing, M.P.G., T.K., I.C.D.; visualization, M.P.G.; supervision, I.C.D.; project administration, E.Ö.; training program development and implementation, E.Ö., O.D., P.Ç., Z.Ü.; funding acquisition, none. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Acknowledgments: The authors gratefully acknowledge the support of the Human Resources Department at TEMSA Skoda Sabancı Transportation Vehicles Inc. for coordinating training logistics and facilitating access to participants. Special thanks to the data entry and teams for their assistance in pre-test and post-test administration.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

Appendix A

Appendix A1. Sample Questions from the EV Knowledge Assessment

Appendix A2. Overview of EV Training Curriculum by Department

Appendix A3. Cronbach's Alpha Reliability Statistics by Department.

Appendix B

Figure A1. Change in Average Knowledge Scores across Departments

Table A1. Participant Demographics by Department and Seniority

Figure A2. Correlation Plot: Knowledge Gain vs. Performance Self-Report.

References

- Liu, Z., Song, J., Kubal, J., Susarla, N., Knehr, K. W., Islam, E., ... & Ahmed, S. (2021). Comparing total cost of ownership of battery electric vehicles and internal combustion engine vehicles. *Energy Policy*, 158, 112564. <https://doi.org/10.1016/j.enpol.2021.112564>.
- Javazi, L., linaghian, M., Khosroshahi, H. (2025), Evaluating government policies promoting electric vehicles, considering battery technology, energy saving, and charging infrastructure development: A game theoretic approach, *Applied Energy*, 290, 125799, ISSN 0306-2619, <https://doi.org/10.1016/j.apenergy.2025.125799>.
- Udendhran, R., Mohan, T. R., Uthra, R. A., Selvakumarasamy, S., Dinesh, G., Mukhopadhyay, M., ... & Chakraborty, P. (2025). Transitioning to sustainable E-vehicle systems—Global perspectives on the challenges, policies, and opportunities. *Journal of Hazardous Materials Advances*, 17, 100619. <https://doi.org/10.1016/j.hazadv.2025.100619>.
- Aggeri, F., Elmquist, M., & Pohl, H. (2009). Managing learning in the automotive industry—the innovation race for electric vehicles. *International Journal of Automotive Technology and Management*, 9(2), 123-147.
- Herjuna, S., Marhaeni, V., Alvira, M., Putri, F. & Anastasya, F. (2024). Impact of Training and Development Programs on Employee Performance in the Manufacturing Sector. *Acta Psychologia*. 3. 140-151. 10.35335/psychologia.v3i3.68.
- Fechtner, H., Fechtner, E., Schmuelling, B., & Saes, K. H. (2015). A new challenge for the training sector: Further education for working on electric vehicles. In 2015 IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE) (pp. 88-95). IEEE.
- Kamboj, J., & Eronimus, A. (2023). Unwrap the roles of green human resource management practices with the mediating role of green innovation. In *Handbook of evidence based management practices in business* (pp. 204–213). Routledge.
- Wambura, J. C. (2025). A Literature Review on the Influence of Training on Improving Employee Performance. *African Journal of Empirical Research*, 6(1), 554-559.
- He, H., Ye, Y., & Huo, B. (2024). Can employee training facilitate production repurposing in crises? An ability-motivation-opportunity perspective. *International Journal of Production Economics*, 278, 109444.
- Ozkesen, Banu (2019). Impact of training on employee motivation in human resources management, *Procedia science direct*, 158(2019), 802-810. <https://doi.org/10.1016/j.procs.2019.09.117>
- Khan, M. I. (2012). The impact of training and motivation on performance of employees. *Business review*, 7(2), 84-95.
- Malerba, F. (2005). Sectoral systems of innovation: a framework for linking innovation to the knowledge base, structure and dynamics of sectors. *Economics of innovation and New Technology*, 14(1-2), 63-82.
- Stanley, D. J., & Meyer, J. P. (2016). Employee commitment and performance. In *The SAGE handbook of organizational behavior: Volume 1 - Micro approaches* (pp. 208–221). SAGE Publications. <https://doi.org/10.4337/9781784711740.00027>
- Ertiö, T., Eriksson, T., Rowan, W., & McCarthy, S. (2024). The role of digital leaders' emotional intelligence in mitigating employee tech-nostress. *Business Horizons*, 67(4), 399-409.
- Hiremath, N. V., Mohapatra, A. K., & Paila, A. S. (2021). A study on digital learning, learning and development interventions and learnability of working executives in corporates. *American Journal of Business*, 36(1), 35-61.
- Garcia, L., & Lopez, A. (2022). Transparency in production processes: A case study in electric vehicle manufacturing. *Journal of Supply Chain Management*, 58(1), 77–94.
- Wang, C. H., Lu, Y. H., Huang, C. W., & Lee, J. Y. (2013). R&D, productivity, and market value: An empirical study from high-technology firms. *Omega*, 41(1), 143-155.

18. Rebelo, T. M., & Duarte Gomes, A. (2011). Conditioning factors of an organizational learning culture. *Journal of workplace learning*, 23(3), 173-194.
19. Sivakumar, R., & Kumar, L. (2019). Unlocking organizational potential: The synergy of performance management and knowledge management. *Journal of Business and Economic Options*, 2(4), 159-165.
20. Wang, Y., Park, J., & Gao, Q. (2025). Digital leadership and employee innovative performance: The role of job crafting and person-job fit. *Frontiers in Psychology*, 16, 1492264. Doi: 10.3389/fpsyg.2025.1492264.
21. Rivaldo, Y., & Nabella, S. D. (2023). Employee performance: Education, training, experience and work discipline. *QAS Journal*, 24(193), 20. <https://doi.org/10.47750/QAS/24.193.20>
22. Chen, T., Hao, S., Ding, K., Feng, X., Li, G., & Liang, X. (2020). The impact of organizational support on employee performance. *Employee Relations*, 42(1), 166–179. <https://doi.org/10.1108/ER-01-2019-0079>
23. Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). SAGE Publications.
24. Blanchard, P. N., & Thacker, J. W. (2023). *Effective training: Systems, strategies, and practices*. SAGE Publications.
25. Budiningsih, I., Soehari, T. D., & Ahmad, M. (2017). Increase competency through training interventions. *International Journal of Applied Business and Economic Research*, 15(6), 249–266.
26. Williams, G. (2012). Operational training and knowledge management strategy and realisation at EUMETSAT. In *SpaceOps 2012* (p. 1275132).
27. Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: SAGE Publications.
28. Alessandri, G., Zuffianò, A., & Perinelli, E. (2017). Evaluating intervention programs with a pretest-posttest design: A structural equation modeling approach. *Frontiers in psychology*, 8, 223.
29. George, D., & Mallery, P. (2003). *SPSS for Windows step by step: A simple guide and reference* (4th ed.). Boston: Allyn & Bacon.
30. Ibojo, B. O., & Mobolade, G. O. (2023). Effect of Knowledge Acquisition on Organizational Performance. *International Journal of Economics and Business Management*, 9(8), 10-25.
31. Janega, J. B., Murray, D. M., Varnell, S. P., Blitstein, J. L., Birnbaum, A. S., & Lytle, L. A. (2004). Assessing intervention effects in a school-based nutrition intervention trial: Which analytic model is most powerful?. *Health Education & Behavior*, 31(6), 756-774.
32. Tomovic, M., Tomovic, C., & Bawab, S. (2024). A hybrid approach to engineering education: Integrating online and in-person learning. In *INTED2024 Proceedings* (pp. 1233-1239). IATED.