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Assessment of Power Station Training Through E-Learning Platforms: Basis for a Technology Management Framework

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ABSTRACT: This study assessed the effectiveness of power station training through e-learning platforms as the basis for developing a technology management framework. The research utilized the Input–Process–Output (IPO) model and adopted a descriptive-correlational research design to determine the level of assessment of e-learning platforms and their relationship with training effectiveness. The respondents were composed of 100 personnel, including engineers and technicians, selected through purposive sampling. Data were gathered using a structured questionnaire and analysed using weighted mean, percentage, standard deviation, and Pearson correlation coefficient. Findings revealed that the e-learning platform was generally rated as highly effective in terms of system quality, information quality, service quality, accessibility, usability, and user satisfaction. Respondents also demonstrated high levels of training effectiveness in areas such as knowledge acquisition, skills development, employee engagement, learning flexibility, and training performance outcomes. However, challenges were identified in technological infrastructure, learner readiness, instructional design, management support, and system sustainability, which were all rated as highly affected factors. Correlation analysis showed a highly significant relationship between e-learning platform assessment and training effectiveness ($r = 0.81$, $p < 0.05$), indicating that improvements in e-learning system quality directly enhance training outcomes in power station operations. The study concludes that effective e-learning systems significantly contribute to improved workforce competence and operational efficiency. It is recommended that organisations strengthen their technological infrastructure, enhance instructional design, and provide continuous management support to sustain effective e-learning implementation. The proposed technology management framework may serve as a guide for optimising digital training systems in industrial environments.

KEYWORDS: Technology Management, E-Learning Platforms, Power Station Training, Training Effectiveness, Technology Management Framework, System Quality, Instructional Design, CTU-Main Campus, Cebu, Philippines

INTRODUCTION

Technology has become an essential component of organizational operations, workforce development, and management in industrial environments. Digital technologies have transformed training into learning systems that support workforce development. In power generation, employee competence is important because operational efficiency, workplace safety, environmental compliance, and sustainable performance depend on adequately trained personnel. As power stations adopt digital technologies, training approaches must evolve to address technological requirements and industry standards.

E-learning platforms provide an alternative to face-to-face training by allowing employees to access instructional materials, assessments, simulations, and learning resources with fewer geographical and time constraints. These platforms support development while reducing operational disruptions caused by employee absences. These tools strengthen knowledge retention, learner engagement, and practical skill development. However, e-learning effectiveness depends on technological quality, information quality, design, user satisfaction, management support, and sustainability.

This study focuses on assessing power station training delivered through e-learning platforms and for technology management. Specifically, it examines the effectiveness, accessibility, usability, and acceptability of e-learning systems used in training programs. It also identifies the strengths, challenges, and opportunities of digital learning technologies in power generation facilities. The assessment will provide evidence for a technology management framework guiding decision-makers in improving training delivery, workforce competency, technology utilization, and performance.

Although e-learning has been studied in educational institutions and corporate settings, limited research has examined its application to the training requirements of power stations. Evidence remains limited regarding how digital learning systems affect employee skills, knowledge

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transfer, operational readiness, and learning in technical environments. Furthermore, few studies have integrated training assessment findings into a framework addressing planning, implementation, monitoring, evaluation, and continuous improvement.

The study benefits power station administrators, technology managers, training officers, instructors, employees, and policymakers. Its findings may help organizations identify practices, address implementation challenges, and improve training quality. The proposed framework may support alignment between technology investments, workforce development, and operational objectives. From a technology management perspective, the study contributes to digital transformation, learning, and innovation management by emphasizing the importance of using technology to maximize organizational value.

Ultimately, the study seeks to bridge e-learning implementation and technology management in power station training. Through systematic assessment and framework development, it aims to promote continuous learning, improve workforce readiness, strengthen adaptability, and support power stations in addressing operational challenges within a digitalized industrial environment. The findings may also inform policy development, training standards, resource allocation, technology selection, and continuous evaluation, ensuring that digital learning initiatives remain relevant, sustainable, and responsive to evolving operational demands and workforce needs in the future.

LITERATURE REVIEW

The evaluation of power station training via e-learning platforms is based on numerous theories that explain technology adoption, online learning, knowledge management, and organizational efficiency. As companies continue to embrace digital transformation, incorporating e-learning technology has become a critical strategy for worker development and ongoing learning. Theories like the Technology Acceptance Model (Davis, 1989), Diffusion of Innovation Theory (Rogers, 2003), Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003), and Technology Management Theory (Burgelman et al., 2009) lay the groundwork for understanding how employees adopt and use e-learning systems in technical training settings. Similarly, learning theories such as Constructivist Learning Theory (Piaget, 1972), Adult Learning Theory (Knowles, 1984), and the Community of Inquiry Framework (Garrison et al., 2000) explain how digital learning environments promote knowledge acquisition, collaboration, and skill development. Collectively, these theories assist the evaluation of e-learning platforms in power station training and serve as the foundation for the creation of a Technology Management Framework that improves training effectiveness, organizational learning, and technical innovation.

Technology Acceptance Model (TAM). The Technology Acceptance Model describes how people learn to accept and use technology. The concept proposes that perceived utility and simplicity of use impact consumers' attitudes toward technology adoption. TAM is pertinent to this study since it assesses the adoption and use of e-learning platforms among power station trainees and trainers.

Diffusion of Innovation Theory. This theory describes how new ideas get embraced and disseminated within organizations and societal systems. It is useful for investigating how e-learning technologies are introduced, accepted, and maintained in power station training contexts.

Technology-Organization-Environment (TOE) Framework. The TOE Framework proposes that technical, organizational, and environmental aspects drive technology adoption. This theory allows the assessment of variables influencing e-learning deployment in power plants, as well as the creation of a technology management framework.

Unified Theory of Acceptance and Use of Technology (UTAUT). UTAUT defines technology adoption in terms of performance, effort, social impact, and enabling circumstances. This hypothesis is beneficial for understanding the characteristics that influence employees' adoption of e-learning platforms.

Constructivist learning theory. Constructivism emphasizes how learners actively create knowledge through their experiences and interactions. E-learning platforms provide self-directed and experiential learning, making this idea applicable to power station training.

Adult Learning Theory (andragogy). Adult learning theory asserts that adult learners are self-directed, goal-oriented, and motivated by practical applications. Because power station staff are adult learners, this idea lends assistance to the development and evaluation of e-learning programs.

Community of Inquiry (CoI) Framework. The CoI Framework emphasizes cognitive, social, and teaching presence in online learning settings. It provides a foundation for assessing the efficacy of virtual learning experiences in power station training.

Knowledge Management Theory. Knowledge management theory focuses on the production, sharing, and use of organizational knowledge. E-learning platforms are tools for capturing and transmitting technical information in power plant operations.

System Theory. It defines an organization as an integrated system made up of interdependent components. This idea is applied in the research, which looks at how technology, people, processes, and training systems interact in power plant operations.

Technological Management Theory. It focuses on the strategic planning, execution, assessment, and management of technical resources to fulfill organizational goals. This theory directly promotes the creation of a technology management framework based on the evaluation outcomes of e-learning platforms.

Republic Act No. 10929, the Free Internet Access in Public Places Act. This regulation encourages access to information and communication technology by allowing free internet connections in public spaces. It promotes the use of digital learning initiatives and improves access to e-learning platforms for workforce development and training programs.

Republic Act No. 10173: Data Privacy Act of 2012. The Data Privacy Act protects personal information gathered, processed, and stored via digital technologies. Because e-learning platforms collect employee and trainee data, adherence to data privacy standards is critical for administering online training systems and preserving user information.

Republic Act No. 8792—The Electronic Commerce Act of 2000. The E-Commerce Act recognizes the legality of electronic documents, digital transactions, and electronic communications. This law establishes legal backing for online learning systems, electronic assessments, digital certificates, and technology-enabled training management procedures used in power plant training.

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OBJECTIVES

1. Evaluate power station training using e-learning platforms.
2. Evaluate e-learning systems' efficacy for power station training.
3. Identify problems when implementing e-learning platforms for power station training.
4. Evaluate the impact of e-learning platforms on power station training efficacy.
5. Create a technology management framework using research findings to improve power station training thru e-learning platforms.

MATERIALS AND METHODS

Design

The study employed a descriptive-correlational research design. The descriptive component was used to determine the respondents' profile, assess the quality and acceptability of e-learning platforms, measure the effectiveness of power station training, and identify implementation challenges. The correlational component was used to determine whether a significant relationship existed between the assessment of e-learning platforms and the effectiveness of power station training. The findings served as the basis for developing a technology management framework.

Environment

The study was conducted at Global Business Power Corporation during Fiscal Year 2021–2022. The organization was selected because of its power generation operations and the implementation of e-learning platforms for employee training and development. The research focused on personnel who had direct experience with or exposure to the organization's power station training programs delivered through digital learning platforms.

Respondents

The respondents consisted of selected employees involved in or exposed to power station training through e-learning platforms. They were described according to age and gender, educational attainment, position or designation, and years of service. Respondents were selected based on their relevance to the training program and their actual experience using or participating in the e-learning system.

Table 1: Distribution of Respondents
N=100

Respondents	Population Size (N)	Percentage (%)
Engineers (Mixed)	20	20
Technicians (College, Technical Vocational and High School Graduates)	80	80
TOTAL	100	100

Instrument

A structured questionnaire was used as the primary data-gathering instrument. It consisted of sections covering the respondents' profile, assessment of e-learning platforms, effectiveness of power station training, and challenges encountered during implementation. The assessment of e-learning platforms covered system quality, information quality, service quality, accessibility, usability, and user satisfaction. Training effectiveness covered knowledge acquisition, skills development, employee engagement, learning flexibility, and training performance outcomes. Implementation challenges covered technological infrastructure, learner readiness, instructional design, management support, and system sustainability.

The questionnaire items were measured using a five-point Likert scale ranging from 1 to 5. Higher ratings indicated more favorable assessments, greater effectiveness, or more pronounced conditions, depending on the specific indicator. The instrument was reviewed for content validity by qualified experts and subjected to reliability testing before administration.

Data Gathering Procedure

Permission to conduct the study was secured from the appropriate authorities of Global Business Power Corporation. After approval, the researcher coordinated with designated personnel to identify qualified respondents and schedule the administration of the questionnaire. The purpose of the study, voluntary participation, confidentiality, and appropriate use of information were explained to the respondents. The accomplished questionnaires were collected, checked for completeness, encoded, tabulated, and prepared for statistical analysis.

Statistical Treatment of Data

Frequency and percentage were used to summarize the respondents' profile. Weighted mean and standard deviation were used to determine the level of assessment of the e-learning platforms, training effectiveness, and implementation challenges. Pearson product-moment correlation was used to examine the relationship between e-learning platform assessment and training effectiveness. The level of significance was set at 0.05. The statistical results were interpreted according to the research objectives and used to identify areas requiring improvement and framework development.

Ethical Considerations

The study observed ethical principles concerning voluntary participation, informed consent, confidentiality, privacy, and responsible handling of research data. Respondents were informed that participation was voluntary and that they could decline or withdraw without penalty. No personally identifiable information was unnecessarily disclosed in the presentation of findings. All collected data were used solely for academic research purposes.

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Development of the Technology Management Framework

The proposed Technology Management Framework was developed from the empirical findings of the study. Results concerning e-learning quality, accessibility, usability, satisfaction, training effectiveness, and implementation challenges were synthesized to identify priority areas for technology management intervention. The framework was designed to provide strategic guidance for planning, implementing, monitoring, evaluating, and continuously improving e-learning-supported power station training.

RESULTS AND DISCUSSIONS

Table 6. System Quality

The findings show that the e-learning platform was **highly effective** in terms of system quality. Respondents perceived the system as reliable, stable, efficient, and capable of minimizing technical errors. The mean scores ranged from **3.92 to 4.02**, indicating that the platform adequately supported uninterrupted training activities.

Table 7. Information Quality

The results indicate that the platform provided **high-quality information** that was accurate, updated, relevant, complete, and aligned with training objectives. The mean scores ranged from **3.98 to 4.03**, suggesting that the information supported knowledge acquisition and technical training requirements.

Table 8. Service Quality

The findings reveal that the e-learning platform provided **highly effective support services**. Respondents recognized the availability, responsiveness, and timeliness of technical assistance. The mean scores ranged from **3.93 to 3.96**, demonstrating that support services helped minimize training disruptions and encouraged continued system use.

Table 9. Accessibility

The results demonstrate that the e-learning platform was **highly accessible** to power station personnel. Respondents indicated that training resources could be accessed conveniently, including through different devices and locations. The mean scores ranged from **4.06 to 4.10**, showing that accessibility supported flexible and continuous learning.

Table 10. Usability

The findings show that the e-learning platform was **highly usable and user-friendly**. Respondents found the interface easy to navigate, the features understandable, and the instructions clear. Mean scores ranged from **4.02 to 4.08**, indicating that usability contributed to efficient participation in training activities.

Table 11. User Satisfaction

The results indicate a **high level of user satisfaction** with the e-learning platform. Respondents expressed satisfaction with the system, believed that the training met their expectations, and showed willingness to recommend the platform. Mean scores ranged from **4.02 to 4.07**, reflecting a positive overall learning experience.

Table 12. Knowledge Acquisition

The findings indicate that e-learning platforms effectively supported **knowledge acquisition** among power station personnel. Digital learning resources improved comprehension and retention of technical concepts by providing structured and accessible learning experiences.

Table 13. Skills Development

The results demonstrate that e-learning contributed positively to **skills development**. The platform supported the acquisition of technical competencies and provided opportunities for employees to connect theoretical knowledge with practical workplace applications.

Table 14. Employee Engagement

The findings suggest that e-learning promoted **employee engagement** in training activities. Interactive and flexible learning opportunities encouraged participation and supported learner motivation and involvement in professional development.

Table 15. Learning Flexibility

The results show that e-learning provided **flexible learning opportunities** by allowing employees greater control over the time, pace, and place of learning. This flexibility helped employees participate in training while managing their operational responsibilities.

Table 16. Training Performance Outcomes

The findings indicate that e-learning contributed to **improved workplace performance**. Digital training enhanced employees' skills, efficiency, competency, and ability to apply acquired knowledge to power station operations.

Table 17. Technological Infrastructure

The findings reveal that **technological infrastructure remains a significant implementation challenge**. Unstable internet connectivity, limited device availability, and system downtime can interrupt training delivery and reduce learning efficiency.

Table 18. Learner Readiness

The results indicate that **learner readiness is an important challenge** in implementing e-learning. Some employees experience limited digital skills, difficulty adapting to online learning, and reduced motivation for self-directed training.

Table 19. Instructional Design

The findings show that **instructional design requires improvement**. Poorly structured materials, limited interactive activities, and inadequate alignment with learning objectives may reduce the effectiveness of digital training.

Table 20. Management Support

The results indicate that **management support is essential** to the successful implementation and sustainability of e-learning. Leadership commitment, adequate resources, policy support, and investment are necessary to maintain effective digital training programs.

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Table 21. System Sustainability

The findings suggest that **system sustainability requires continuous organizational and technological support**. Long-term implementation depends on adequate resources, regular system improvement, updated training content, technical maintenance, and sustained management commitment.

Table 22. Relationship Between E-Learning Assessment and Training Effectiveness

The findings establish a **strong and statistically significant relationship** between the dimensions of e-learning platform assessment and power station training effectiveness. Correlation coefficients ranged from **0.76 to 0.84**, with **p = 0.000**, indicating that improvements in system quality, information quality, service quality, accessibility, usability, and user satisfaction are associated with higher training effectiveness.

Overall Summary

Overall, the tables demonstrate that the e-learning platform was **highly effective, accessible, usable, and satisfactory** for power station training. It supported knowledge acquisition, skills development, engagement, flexibility, and workplace performance. However, technological infrastructure, learner readiness, instructional design, management support, and sustainability require continued improvement. The significant relationships identified in Table 22 provide a strong empirical basis for the proposed **Technology Management Framework**.

FIGURES 14



Figure 1. Location Map of the Research Environment

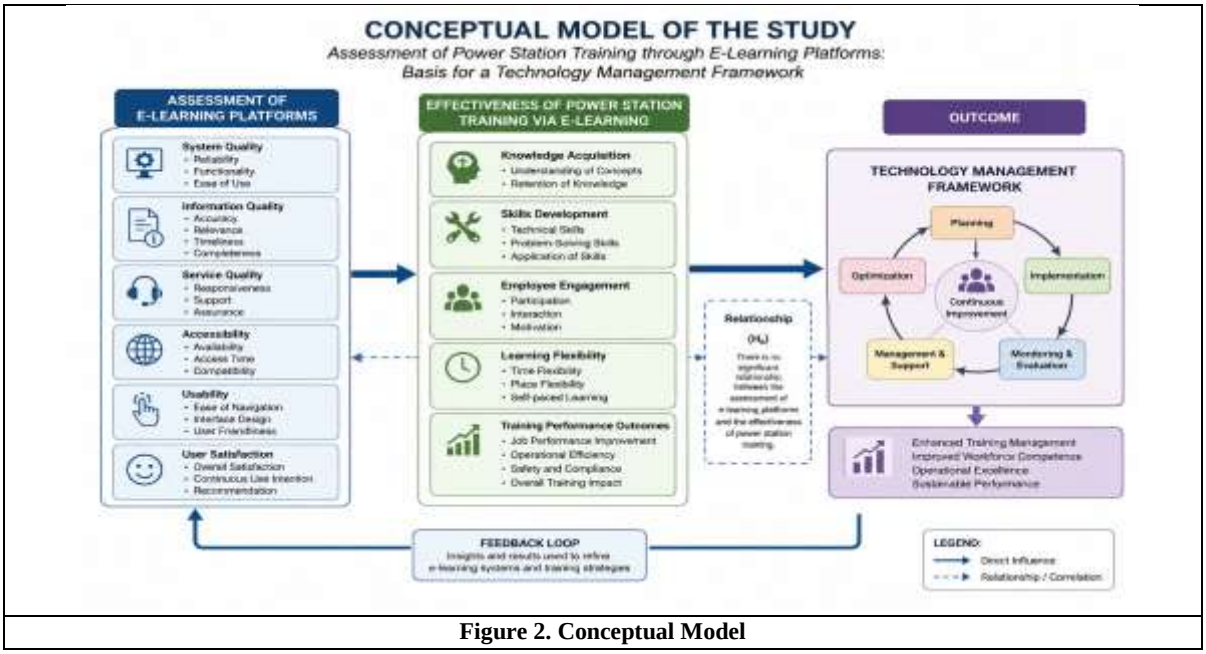


Figure 2. Conceptual Model

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Table 2 System Quality
N=100

Indicators	5	4	3	2	1	Mean	%	SD	Interpretation
System is reliable and stable	40	35	15	7	3	4.02	80.4%	0.89	Highly Effective
System loads quickly and efficiently	38	34	18	6	4	3.96	79.2%	0.91	Highly Effective
System minimizes technical errors	36	36	16	8	4	3.92	78.4%	0.93	Highly Effective

Table 3: Information Quality
N=100

Indicators	5	4	3	2	1	Mean	%	SD	Interpretation
Content is accurate and updated	42	33	15	6	4	4.03	80.6%	0.88	Highly Effective
Information is relevant to training	40	35	14	7	4	4.00	80.0%	0.90	Highly Effective
Content supports learning objectives	39	36	15	6	4	3.98	79.6%	0.91	Highly Effective

Table 4: Service Quality
N=100

Indicators	5	4	3	2	1	Mean	%	SD	Interpretation
Technical support is responsive	37	35	17	7	4	3.95	79.0%	0.92	Highly Effective
Assistance is available when needed	38	34	16	8	4	3.96	79.2%	0.91	Highly Effective
Users receive timely help	36	36	15	9	4	3.93	78.6%	0.93	Highly Effective

Table 5: Accessibility
N=100

Indicators	5	4	3	2	1	Mean	%	SD	Interpretation
Platform is accessible anytime	45	32	14	6	3	4.10	82.0%	0.85	Highly Effective
Accessible via multiple devices	44	33	14	6	3	4.09	81.8%	0.86	Highly Effective
Easy login and navigation access	42	35	13	7	3	4.06	81.2%	0.87	Highly Effective

Table 6: Usability
N=100

Indicators	5	4	3	2	1	Mean	%	SD	Interpretation
Interface is user-friendly	43	34	14	6	3	4.08	81.6%	0.86	Highly Effective
Easy to navigate system features	41	35	15	6	3	4.04	80.8%	0.88	Highly Effective
Instructions are clear and simple	40	36	14	7	3	4.02	80.4%	0.89	Highly Effective

Table 7: User Satisfaction
N=100

Indicators	5	4	3	2	1	Mean	%	SD	Interpretation
Users are satisfied with the system	42	35	14	6	3	4.07	81.4%	0.87	Highly Effective
Training meets user expectations	41	34	15	7	3	4.03	80.6%	0.88	Highly Effective
Users recommend the platform	40	36	14	7	3	4.02	80.4%	0.89	Highly Effective

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Table 8: Knowledge Acquisition
N = 100

Indicators	5	4	3	2	1	Mean	%	SD	Interpretation
E-learning improves understanding of concepts	44	35	13	5	3	4.12	82.4%	0.85	Highly Effective
E-learning enhances retention of lessons	43	34	15	5	3	4.08	81.6%	0.86	Highly Effective
E-learning makes learning easier to understand	41	36	14	6	3	4.05	81.0%	0.88	Highly Effective
Grand Mean						4.08	81.7%	0.86	Highly Effective

Table 9: Skills Development
N = 100

Indicators	5	4	3	2	1	Mean	%	SD	Interpretation
E-learning improves technical skills	46	33	13	5	3	4.14	82.8%	0.85	Highly Effective
E-learning supports hands-on application	42	36	14	5	3	4.09	81.8%	0.86	Highly Effective
E-learning enhances problem-solving skills	41	35	15	6	3	4.05	81.0%	0.88	Highly Effective
Grand Mean						4.09	81.9%	0.86	Highly Effective

Table 10: Employee Engagement
N = 100

Indicators	5	4	3	2	1	Mean	%	SD	Interpretation
Employees actively participate in e-learning training activities	43	35	14	5	3	4.10	82.0%	0.86	Highly Effective
Employees show interest and motivation in online training	42	36	14	5	3	4.09	81.8%	0.86	Highly Effective
Employees complete training modules on time	41	35	15	6	3	4.05	81.0%	0.88	Highly Effective
Grand Mean	42.00	35.33	14.33	5.33	3.00	4.08	81.6%	0.87	Highly Effective

Table 11: Learning Flexibility
N = 100

Indicators	5	4	3	2	1	Mean	%	SD	Interpretation
E-learning provides positive learning experience	44	35	13	5	3	4.12	82.4%	0.85	Highly Effective
Learners are engaged during training	42	36	14	5	3	4.09	81.8%	0.86	Highly Effective
Training motivates continuous learning	41	35	15	6	3	4.05	81.0%	0.88	Highly Effective
Grand Mean						4.09	81.7%	0.86	Highly Effective

Table 12: Training Performance Outcomes
N = 100

Indicators	5	4	3	2	1	Mean	%	SD	Interpretation
E-learning improves work efficiency and productivity	44	34	13	6	3	4.10	82.0%	0.86	Highly Effective
E-learning enhances job-related competencies	42	35	14	6	3	4.08	81.6%	0.87	Highly Effective
E-learning contributes to better task performance accuracy	41	36	14	6	3	4.07	81.4%	0.87	Highly Effective
Grand Mean	42.33	35.00	3.67	6.00	3.00	4.08	81.7%	0.87	Highly Effective

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Table 13: Technological Infrastructure
N=100

Indicators	5	4	3	2	1	Mean	%	SD	Interpretation
Unstable internet connection affects training	38	34	15	8	5	3.92	78.4%	0.92	Highly Affected
Limited access to devices/hardware	36	35	16	8	5	3.89	77.8%	0.93	Highly Affected
System downtime interrupts learning sessions	37	33	17	8	5	3.90	78.0%	0.92	Highly Affected
Grand Mean	37.00	34.00	16.00	8.00	5.00	3.90			Highly Affected

Table 14: Learner Readiness
N=100

Indicators	5	4	3	2	1	Mean	%	SD	Interpretation
Lack of digital skills among users	35	34	18	8	5	3.86	77.2%	0.94	Highly Affected
Difficulty adapting to online learning	34	36	17	8	5	3.87	77.4%	0.93	Highly Affected
Low motivation for self-paced learning	33	35	18	9	5	3.83	76.6%	0.95	Highly Affected
Grand Mean						3.85	77.1%	0.94	Highly Affected

Table 15: Instructional Design
N=100

Indicators	5	4	3	2	1	Mean	%	SD	Interpretation
Learning materials are not well-structured	34	35	18	8	5	3.84	76.8%	0.94	Highly Affected
Lack of interactive content in modules	33	36	17	9	5	3.83	76.6%	0.95	Highly Affected
Poor alignment of content with objectives	32	35	18	10	5	3.79	75.8%	0.96	Highly Affected
Grand Mean						3.82	76.4%	0.95	Highly Affected

Table 16: Management Support
N=100

Indicators	5	4	3	2	1	Mean	%	SD	Interpretation
Insufficient support from management	36	34	16	8	6	3.86	77.2%	0.94	Highly Affected
Lack of funding for e-learning implementation	35	33	17	9	6	3.82	76.4%	0.95	Highly Affected
Limited training policies and guidelines	34	34	18	8	6	3.83	76.6%	0.95	Highly Affected
Grand Mean						3.84	76.7%	0.95	Highly Affected

Table 17: System Sustainability
N=100

Indicators	5	4	3	2	1	Mean	%	SD	Interpretation
High cost of maintaining the system	37	34	16	8	5	3.88	77.6%	0.93	Highly Affected
Lack of long-term technical support	35	35	17	8	5	3.86	77.2%	0.94	Highly Affected
Difficulty upgrading system features	34	34	18	9	5	3.83	76.6%	0.95	Highly Affected
Grand Mean						3.86	77.1%	0.94	Highly Affected

Table 18: Relationship Between E-Learning Assessment and Training Effectiveness
N = 100

Variables	r-value	p-value	Decision on Ho	Interpretation
System Quality vs Training Effectiveness	0.78	0.000	Reject Ho	Significant Relationship
Information Quality vs Training Effectiveness	0.81	0.000	Reject Ho	Significant Relationship

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Variables	r-value	p-value	Decision on Ho	Interpretation
Service Quality vs Training Effectiveness	0.76	0.000	Reject Ho	Significant Relationship
Accessibility vs Training Effectiveness	0.83	0.000	Reject Ho	Significant Relationship
Usability vs Training Effectiveness	0.80	0.000	Reject Ho	Significant Relationship
User Satisfaction vs Training Effectiveness	0.84	0.000	Reject Ho	Significant Relationship

CONCLUSION

Based on the findings of the study, the e-learning platform used for power station training at Global Business Power Corporation was generally assessed as highly effective in terms of system quality, information quality, service quality, accessibility, usability, and user satisfaction. The results indicate that the platform provides a reliable, accessible, user-friendly, and technically supportive environment for delivering training to power station personnel. The system quality indicators, for example, obtained mean scores ranging from 3.92 to 4.02, while information quality was similarly rated highly.

The effectiveness of power station training was likewise rated highly in terms of knowledge acquisition, skills development, employee engagement, learning flexibility, and training performance outcomes. These findings demonstrate that e-learning can effectively support workforce competency development and provide flexible learning opportunities without substantially disrupting operational responsibilities. The study's overall findings confirm that effective digital training contributes to improved workforce competence and operational efficiency.

Despite these positive results, significant implementation challenges were identified. Technological infrastructure, learner readiness, instructional design, management support, and system sustainability remain important concerns. Unstable internet connectivity, limited device availability, inadequate digital skills, difficulties in adapting to self-directed learning, insufficiently interactive instructional materials, and organizational support issues may limit the full potential of e-learning.

Furthermore, the findings established a strong and statistically significant relationship between e-learning platform assessment and training effectiveness. Correlation coefficients ranging from 0.76 to 0.84, with a reported significance value of $p = 0.000$, demonstrate that improvements in system quality, information quality, service quality, accessibility, usability, and user satisfaction are associated with improved training outcomes. The overall correlation of $r = 0.81$ ($p < 0.05$) further supports this relationship.

Therefore, the study concludes that e-learning is a viable strategic mechanism for power station training, provided that technological, instructional, human, and organizational requirements are systematically managed. The findings provide an empirical basis for the development and implementation of a Technology Management Framework for planning, implementing, monitoring, evaluating, and continuously improving e-learning-supported power station training.

RECOMMENDATIONS

Based on the findings and conclusions, the following recommendations are proposed:

1. Strengthen technological infrastructure. The organization should improve internet connectivity, network reliability, device availability, system capacity, and technical maintenance to minimize interruptions and ensure continuous access to e-learning resources.

2. Enhance learner readiness. Regular digital literacy orientations and user training should be provided to employees, particularly those who experience difficulty using online learning technologies or adapting to self-directed learning.

3. Improve instructional design. Training developers should create interactive, competency-based, and power-station-specific learning materials incorporating videos, simulations, case studies, demonstrations, assessments, and practical applications.

4. Maintain high-quality learning content. Digital training materials should be regularly reviewed and updated to ensure accuracy, relevance, completeness, and alignment with current operational procedures, safety requirements, and industry standards.

5. Strengthen technical and user support. Dedicated technical assistance should be available to respond promptly to login problems, system errors, connectivity concerns, and other issues affecting training participation.

6. Increase management support. Power station administrators should provide adequate funding, personnel, equipment, time, policies, and incentives to sustain e-learning implementation and continuous employee development.

7. Implement continuous monitoring and evaluation. The organization should regularly assess system quality, user satisfaction, training effectiveness, learner performance, and implementation challenges to identify areas requiring improvement.

8. Adopt the proposed Technology Management Framework. The framework should be used as a strategic guide for integrating technology, people, processes, and training objectives. Its implementation should follow a continuous cycle of planning, implementation, monitoring, evaluation, and improvement.

9. Integrate e-learning with practical training. Digital learning should complement, rather than completely replace, hands-on activities, simulations, supervised workplace training, and other practical experiences essential to power station operations.

10. Conduct further research. Future studies should examine larger and more diverse samples, compare different power stations or e-learning platforms, and investigate the long-term effects of digital training on employee competency, safety performance, productivity, and organizational outcomes.

DEFINITION OF TERMS

To help readers understand the study, the following terms are operationally defined and arranged alphabetically:

Accessibility – Refers to the extent to which e-learning course content can be accessed and used by learners with varying abilities, including those who may require assistive technologies to complete training activities.

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Active Learning – Refers to a learner-centered training strategy that encourages participants to actively engage in reading, discussion, problem-solving, and practical activities to understand and apply course content.

Agile Learning – Refers to an iterative approach to designing learning content in which training materials are developed rapidly, evaluated, refined, and improved through successive cycles.

Analysis, Design, Development, Implementation, and Evaluation (ADDIE) – Refers to a five-phase instructional design framework consisting of analysis, design, development, implementation, and evaluation, used as a guide for developing effective training programs and learning resources.

Assessment – Refers to the systematic process of evaluating learner knowledge, skills, understanding, and performance through tests, activities, or other evaluation methods aligned with training objectives.

Assimilation – Refers to the process of incorporating new ideas, concepts, experiences, or information into existing knowledge structures or mental schemas.

Asynchronous Learning – Refers to a learning approach that allows participants to complete training activities independently at a convenient time, place, and pace without requiring simultaneous interaction with an instructor.

Blended Learning – Refers to an instructional approach that combines face-to-face classroom instruction with online learning activities to provide an integrated learning experience.

Certification – Refers to an official document or recognition confirming that a learner has successfully completed a training program or achieved predetermined competency standards.

Classroom-Based Training – Refers to traditional face-to-face instruction in which an instructor facilitates training activities in a physical classroom, meeting room, or similar learning environment.

Compliance Training – Refers to employee training required by laws, regulations, organizational policies, or industry standards to ensure that personnel understand and follow applicable requirements.

Computer-Based Training (CBT) – Refers to training delivered through computer-based technologies that allow learners to access instructional materials and activities electronically, typically on demand.

Continuing Professional Development (CPD) – Refers to structured, informal, or self-directed learning activities undertaken by professionals to maintain and improve their knowledge, skills, and competencies throughout their careers.

Corporate Training – Refers to organizational programs designed to develop employees' knowledge, skills, competencies, and performance in support of organizational goals.

Course Management System (CMS) – Refers to a collection of digital tools used to create, organize, manage, and deliver online courses and learning materials, including multimedia resources.

Distance Learning – Refers to an educational approach in which learners receive instruction and complete learning activities without regular face-to-face interaction with instructors, using various communication and instructional methods.

E-Learning – Refers to learning facilitated and supported through information and communication technologies, including Internet-based platforms, digital materials, electronic applications, and other technology-enabled learning resources.

Educational Technology (EdTech) – Refers to the application of digital tools, technologies, and instructional resources to facilitate, support, manage, and improve teaching and learning processes.

Employee Training – Refers to organized learning activities provided to employees to develop job-related knowledge, skills, competencies, compliance awareness, and performance.

Gamification – Refers to the integration of game-based elements, such as points, badges, levels, and leaderboards, into non-game learning activities to increase learner motivation and engagement.

Kirkpatrick Model – Refers to a training evaluation model that examines training outcomes through four levels: reaction, learning, behavior, and results.

Knowledge Base – Refers to an organized digital repository containing information, instructional resources, technical knowledge, and other materials used to support learning and training activities.

Learning and Development (L&D) – Refers to organizational activities designed to improve the knowledge, skills, competencies, and performance of individuals and teams through training and professional development.

Learning Management System (LMS) – Refers to a software application used to create, deliver, manage, monitor, assess, and track online training and learning activities.

Massive Open Online Course (MOOC) – Refers to a web-based course designed for large numbers of participants that commonly provides video lectures, online discussions, assessments, quizzes, and other digital learning activities.

Mobile Learning – Refers to the delivery and access of learning content through mobile devices such as smartphones, tablets, and other portable digital technologies.

Online Learning – Refers to a form of learning in which instructional activities, resources, communication, and assessments are primarily delivered through the Internet.

Virtual Learning Environment (VLE) – Refers to an integrated digital environment that facilitates online learning through multimedia resources, communication tools, assignments, assessments, and management functions.

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