The Effectiveness OF Blended Training IN Enhancing THE Quality OF THE Training Process AT THE Technical College IN Aljouf AMONG Trainees AND Trainers

Sulaiman Owaid Hamoud Alshammari[1] , Adnan Sahal Eid Aloufi[2] , Muhammad Hassan Abbas Qummosani[3] , Sultan Owaid Q Alruwaili[4]

[1]sulaimana3@tvtc.gov.sa
[2]Eng.Adnan@tvtc.gov.sa
[3]Mqummosani@tvtc.gov.sa
[4]s.alruwaili@tvtc.gov.sa
[1-4]Trainer - Technical and Vocational Training Corporation (TVTC)

Abstract

Objective: The study sought to determine the effect of blended learning on the quality of the learning process from two perspectives, namely learners and instructors, at the Technical College in Aljouf, Saudi Arabia.

Methods: The research utilized a descriptive-analytical methodology. A questionnaire was created and distributed among 300 learners and 18 instructors. Six dimensions were considered: three of them were associated with learners (understanding, time management, and interaction), while three others were concerned with instructors (quality of training, performance of trainees, and professional competence of instructors). Data were analyzed using means, percentages, Relative Importance Index (RII), and independent samples T-test.

Results: The findings revealed a high degree of consensus regarding the effectiveness of blended training in all six dimensions. "Professional competence of the trainer" was rated highest at 91.7%, followed by "quality of training" at 85.2%, and "performance of trainee" at 80.6%. Trainees exhibited high agreement on understanding, at 80.0%, time management, at 80.1%, and interaction, at 79.5%. The total percentage agreement was 82.8%, indicating the effectiveness of blended training. There were no statistically significant gender differences ($p > 0.05$)

Conclusion: The authors suggest blending training as a key strategy in technical institutions because of its high effectiveness, especially in enhancing trainers' professional competence and overall training quality.

Keywords: Blended training, technical training, e-learning, training effectiveness, technical and vocational education.

Introduction

Educational and training environments have witnessed a fundamental transformation in recent years due to the rapid development of information and communication technologies (Bonk & Graham, 2006). This transformation has contributed to the emergence of modern models for delivering education and training aimed at improving the quality of educational and training processes and enhancing the efficiency of their outcomes. One of the most prominent of these models is blended training, which combines face-to-face training with electronic training in an integrated framework that benefits from the advantages of both approaches (Garrison & Kanuka, 2004;Staker & Horn, 2012).

.

Blended training is considered one of the most widely used models in educational and training institutions(Hrastinski, 2008). It maintains the interactive and personal aspects of traditional face-to-face training while simultaneously utilizing the flexibility of digital platforms, their accessibility, and the various tools they provide for presenting and interacting with learning content. This model also enables trainees to review training materials at appropriate times and reduces the logistical constraints associated with time and location, which contributes to improving comprehension, time management, and interaction (Picciano, 2009) .

On the other hand, blended training enables trainers to diversify their training strategies, employ modern educational technologies, and enhance their ability to effectively plan the training process and manage training sessions more efficiently(Dziuban et al., 2018; Gudoniene et al., 2025) .

Despite the growing interest in blended training in educational and training literature, studies that examine its impact in technical training environments in a systematic manner particularly those adopting a dual perspective including both trainees and trainers remain relatively limited. (Song & Lai, 2025) .Therefore, this study seeks to analyze the impact of blended training at the Technical College in Aljouf by exploring the perspectives of both trainees and trainers regarding several dimensions related to the training process (Alaidarous & Madini, 2016).

Literature Review

Blended training has accumulated a rich body of scholarly evidence over the past two decades. The conceptual anchor of the field remains Garrison and Kanuka's (2004).

Definition: the thoughtful integration of face-to-face classroom experiences with online learning opportunities, where 'thoughtful' signals that blending must serve a genuine pedagogical purpose rather than merely adding a digital layer to conventional instruction. Anthony et al. (2022) reinforced this conceptual foundation in their systematic review of blended learning adoption, identifying that successful implementation depends critically on aligning design with instructional context—a principle directly applicable to technical college environments. Supporting this from a Saudi technical vocational context, Alaidarous and Madini (2016) examined trainee perceptions at Saudi Technical and Vocational Training Corporation (TVTC) colleges, finding that blended delivery enhanced learner autonomy and classroom interaction — establishing a locally grounded empirical baseline directly relevant to the present study's context.

Blended Learning Modes: Synchronous and Asynchronous Learning

The other defining feature of a blended learning system is the combination of synchronous and asynchronous learning modes. Hrastinski (2008) defines synchronous learning as a mode where there is a real-time interaction with learners through live sessions, discussions, or virtual classrooms, while asynchronous learning is a mode where learners are allowed to participate in a learning activity at different times through forums, lectures, and other digital media. Both learning modes are unique in their roles in a learning system, with synchronous learning promoting learner engagement and asynchronous learning promoting reflective learning and acquisition of knowledge. However, Rasheed, Kamsin, and Abdullah (2020) systematically reviewed 107 studies and identified persistent challenges in the online component, including learner isolation, self-regulation difficulties, and inadequate trainer support issues that directly inform the design of the current study's measurement dimensions.

Blended Learning in the Saudi Technical Education Context

Alowayr and Al-Azawei (2024) specifically examined blended learning acceptance within Saudi Technical and Vocational Education and Training (TVET) institutions, surveying 487 trainees and trainers. Their findings revealed that perceived usefulness and institutional support were the strongest predictors of blended training adoption, while technical infrastructure issues remained a moderate barrier. This local evidence provides a direct empirical anchor for the present study's focus on Aljouf Technical College.

Neuroplasticity is defined as the ability of the brain to reorganize itself by the formation of new neural connections, a characteristic of the brain which has been found to be particularly pronounced during early

childhood, as evidenced by synaptic pruning and myelination processes. Research has shown that environmental stimulation has a direct effect on the cortical thickness of the brain, as well as the dendritic branching patterns of the neurons. Additionally, the use of functional magnetic resonance imaging has shown that the brains of adults have a considerable degree of plasticity, which allows for the recovery of functions after an injury.

The neuroplasticity framework has considerable implications for the fields of educational psychology and rehabilitation medicine, as it shows that cognitive functions can be improved through interventions. Supporting this from a Saudi technical vocational context, Alaidarous and Madini (2016) examined trainee perceptions at Saudi Technical and Vocational Training Corporation (TVTC) colleges, finding that blended delivery enhanced learner autonomy and classroom interaction establishing a locally grounded empirical baseline directly relevant to the present study's context. Picciano (2009) similarly argued that blended learning must be conceptualized through a multimodal lens that accounts for the interplay of content, interaction, and collaboration, noting that no single delivery mode optimally serves all learning objectives.

Turning to broad quantitative evidence, Yu et al., (2025) conducted a meta-analysis of thirty-seven studies and documented that blended learning outperforms purely online instruction with a medium-to-large effect size (SMD = 0.611, $p < 0.001$), with particularly strong gains on cognitive outcomes (SMD = 0.698). Their findings further indicate that the most favorable effects occur when online content constitutes 30–69% of total programme time — a design parameter that aligns with current practice in Saudi technical colleges and provides a quantitative reference frame for interpreting the elevated agreement scores observed in the present study.

Narrowing to the vocational training context most relevant to this study, Song and Lai(2025) reviewed twenty-four studies via PRISMA and established that blended training develops practical skills and enhances learner engagement, identifying trainer-trainee interaction quality and labor-market relevance of content as the two primary determinants of effectiveness. Wang et al;.(2025) similarly found that a BOPPPS-based hybrid teaching model improved independent learning and time management among undergraduate students, while cautioning that extended implementation without renewed face-to-face interaction may gradually erode trainee confidence — a finding that informs the design considerations of the current study.

Algashami, Alharbi, and Aljabri (2023) conducted a dual-perspective study specifically examining blended learning effectiveness in Saudi technical colleges, surveying 215 trainees and 24 trainers. Their results demonstrated significant agreement between both groups on improved training outcomes, while revealing a critical divergence: trainers perceived competence development as the primary benefit, whereas trainees prioritized flexibility and interaction. This finding directly justifies the present study's dual-perspective design encompassing both stakeholder groups.

On trainee interaction and engagement within the Saudi educational context, Alruwaili (2024) studied forty-two teachers and found that blended learning narrows performance gaps between learners of varying ability through instant feedback mechanisms and online discussion forums. The study also confirmed that synchronous trainer-trainee interaction remains the most powerful driver of sustained engagement even in predominantly digital settings — a conclusion that directly supports the interpretation of the interaction axis results in the current study. .

Trainer Development and the TPACK Framework

The development of trainers' professional competence is another important factor that needs to be considered for the successful implementation of a blended learning approach. The Technological Pedagogical Content Knowledge (TPCK) framework is a theoretical framework that describes the process of how instructors use technology effectively in teaching (Mishra & Koehler, 2006) . The framework argues that for instructors to use technology effectively in teaching and training, these three types of knowledge need to intersect and be integrated by the instructors. The three types of knowledge include content knowledge, pedagogical knowledge, and technological knowledge. When these three types of knowledge are integrated by the instructors, trainers are able to use technology effectively in training

and teaching. The blended learning environment is very important in enhancing trainers' TPACK competence(Koehler et al., 2014)

Meier et al., (2021) conducted a longitudinal study specifically examining trainer competence in blended vocational training contexts, following 156 trainers over two academic years. Their results established that initial TPACK levels predicted blended training success, and that sustained professional development interventions significantly improved both trainer confidence and trainee outcomes. This evidence directly supports the present study's inclusion of trainers' professional competence as a distinct measurement dimension.

Regarding the impact of blended training on trainers themselves, Dziuban and colleagues(2018) demonstrated in their landmark review that instructors working in blended formats develop higher levels of pedagogical reflection and more purposeful use of educational technologies, concluding that blended learning constitutes a genuine professional development opportunity for trainers rather than a mere content delivery mechanism. This finding is reinforced by Gudoniene et al.,(2025) systematic review, which established that trainer professional development is a structural prerequisite not an incidental benefit of successful hybrid education, with institutions that provide continuous trainer support recording higher satisfaction and interaction and quality scores.

Taken together, the literature consistently demonstrates that blended training improves trainee comprehension, time management, and interaction while simultaneously fostering trainer professional competence. However, as Algashami et al. (2023) noted, few studies have systematically captured both trainee and trainer perspectives within the same Saudi technical college context using comparable measurement instruments. What the present study contributes to this body of knowledge is a dual-perspective investigation encompassing both trainee and trainer views within the specific institution at Aljouf Technical College. This design enables a more complete picture of blended training effectiveness in Saudi technical colleges than studies that examine only one stakeholder group.

Study Problem

With the expansion of applying blended training, which combines face-to-face training and distance electronic training at the Technical College in Aljouf, a need has emerged to evaluate this approach scientifically and measure its actual impact on the elements of the training process from the perspectives of both trainees and trainers.

Accordingly, the research problem lies in identifying the extent to which blended training contributes to improving the training process at the Technical College in Aljouf by answering the following main question To what extent does blended training contribute to improving the training process at the Technical College in Aljouf?

Study Objectives

This study aims to identify the impact of blended training at the Technical College in Aljouf by achieving the following objectives:

1. Measuring the impact of blended training on trainees' comprehension.
2. Measuring the impact of blended training on trainees' time management
3. Measuring the impact of blended training on trainees' interaction
4. Measuring the impact of blended training on the quality of the training process from the trainers' perspective
5. Measuring the impact of blended training on trainee performance from the trainers' perspective
6. Measuring the impact of blended training on trainers' professional competence.
7. Ranking the six study axes according to their Relative Importance Index (RII) to identify the highest-impact dimensions of blended training.
8. Testing whether statistically significant differences exist in trainees' perceptions of blended training effectiveness based on gender.

Study Methodology

First: Research Design

This study adopted the descriptive analytical approach, which is the most appropriate approach for describing and analyzing educational and training phenomena and measuring attitudes and perceptions among a sample drawn from the original population. This approach aims to study the phenomenon as it exists in reality, collect relevant data, and analyze and interpret it quantitatively and qualitatively to reach results that help in understanding and evaluating the phenomenon.

The study was designed as a cross-sectional study, where data were collected at a single point in time (the first academic semester of 2024-2025) to measure trainees' and trainers' perceptions of blended training effectiveness. This design is appropriate for the specified objectives because it allows for the measurement of multiple variables (six dimensions) from two different perspectives (trainees and trainers) with time efficiency and reasonable cost **(**Bernard et al.,2014).

A dual-perspective design was adopted for data collection, where data were collected separately from trainees and trainers, and then the results were compared between the two groups. This design allows for obtaining a more complete picture of blended training effectiveness compared to studies that rely on the perspective of only one stakeholder group **(**Means et al., 2013).

Second: Study Population and Sample

Study Population:

The study population consisted of all trainees and trainers at the Technical College in Aljouf (Saudi Arabia) during the first academic semester of 2024-2025. The total number of trainees enrolled in blended training programs (a mix of face-to-face and e-learning) was approximately (950 trainees), and the number of trainers teaching these programs was approximately (28 trainers).

Study Sample:

The sample was selected using the purposive sampling method, where participants were selected based on two main criteria:

1. The trainee must be enrolled in a course that applies the blended training method.
2. The trainer must be among those teaching courses using the blended training method.

The final sample size consisted of:

- 300 trainees (out of 950, response rate 31.6%), distributed across various specializations (Administrative Technology, Engineering Technology, Computer Technology).
- 18 trainers (out of 28, response rate 64.3%).

This sample size was considered sufficient for conducting the planned statistical analyses (T-test and RII) with a 95% confidence level and a margin of error less than 5%, according to the Krejcie & Morgan (1970) sample size determination table(Alruwaili, S. F. (2024) .

Sample Distribution by Gender (Trainees):

Gender	Frequency	Percentage
Male	165	55.0%
Female	135	45.0%
Total	**300**	**100%**

Third: Study Instrument (Questionnaire)

Instrument Development:

Two separate questionnaires were developed as the main data collection instruments:

1. **Trainee Questionnaire:** Consisted of three dimensions: (a) Comprehension, (b) Time Management, (c) Interaction.
2. **Trainer Questionnaire:** Consisted of three dimensions: (a) Quality of the Training Process, (b) Trainee Performance, (c) Trainers' Professional Competence.

The questionnaire items were constructed based on the theoretical framework and previous studies, specifically studies (Wang et al., 2024 ;Song & Lai, 2025; Alaidarous & Madini, 2016; Alruwaili, 2024)

Five-Point Likert Scale:

The questionnaire was designed according to a five-point Likert scale as follows:

Score	Response
1	Strongly Agree
2	Agree
3	Neutral
4	Disagree
5	Strongly Disagree

This orientation (1 = Strongly Agree, 5 = Strongly Disagree) was adopted to standardize the analysis direction, where lower scores indicate higher agreement and higher scores indicate lower agreement.

Interpretation of Mean Scores:
The scale range (5-1 = range length 4) was divided into three equal categories (4 ÷ 3 = 1.33) to determine the response level as follows (Picciano, 2009):

Range	Agreement Level
1.00 – 2.33	High Agreement
2.34 – 3.67	Moderate Agreement
3.68 – 5.00	Low Agreement

The Agreement Percentage was also calculated by summing the percentages of "Strongly Agree" and "Agree" responses divided by the total sample size.

Instrument Validity:

First: Face Validity:
The questionnaire was submitted to a panel of (5) reviewers from faculty members specializing in (Curriculum and Instruction, Measurement and Evaluation, and Educational Technology). Based on their opinions, (4) items were modified, and (2) items were deleted because they did not achieve an agreement rate of 80% or more(Alowayr & Al-Azawei, 2024)

Second: Construct Validity:
Correlation coefficients between each item and the total score of its respective dimension were calculated. Correlation coefficients ranged between (0.52 and 0.81), all statistically significant at the significance level ($\alpha = 0.01$), indicating that the instrument possesses good construct validity.

Instrument Reliability:
Cronbach's Alpha coefficient was calculated to measure the internal consistency of the questionnaire. The results were as follows:

Instrument / Dimension	Cronbach's Alpha	Reliability Level
Trainee Questionnaire (Overall)	0.87	High
Comprehension	0.84	High
Time Management	0.81	High
Interaction	0.86	High
Trainer Questionnaire (Overall)	0.89	High
Quality of Training Process	0.85	High
Trainee Performance	0.83	High
Trainers' Professional Competence	0.88	High

The Cronbach's Alpha values (all above 0.80) indicate that the instrument possesses high reliability and an acceptable level of internal consistency (Meier et al., 2021)

Fourth: Statistical Variables
The following variables were identified in the study:

Variable Type	Variable	Measurement Level
Dependent Variable	Blended Training Effectiveness (measured by six dimensions)	Ordinal (converted to quantitative)
Independent Variable (Classifier)	Gender (Male / Female)	Nominal
Control Variables	Specialization, Completed credit hours, Course level	Various

Fifth: Statistical Analysis Tools
Data were analyzed using SPSS (Statistical Package for the Social Sciences) Version 26(Algashami et al., 2023)

The following statistical methods were employed:

A. Descriptive Statistics:

Statistical Method	Purpose
Frequencies	Describing the distribution of respondents' answers to questionnaire items
Percentages	Determining the level of response and agreement with items and dimensions
Mean (M)	Measuring the degree of respondents' agreement with each item and dimension
Standard Deviation (SD)	Measuring the dispersion of respondents' answers around the mean
Agreement Percentage (%)	Calculated by summing the percentages of "Strongly Agree" and "Agree" responses divided by the total sample size

B. Inferential Statistics:

Statistical Method	Purpose	Significance Level
Relative Importance Index (RII)	Ranking the six study axes from highest to lowest impact based on agreement percentages, providing a comparative prioritization of blended training's impact dimensions. RII is calculated using the formula: $RII = (\Sigma W) / (A \times N)$, where W = weight of each response (1 to 5), A = highest weight (5), N = sample size.	Values range from 0 to 1; values closer to 1 indicate higher importance(Halverson et al., 2014)
Independent Samples T-Test	Examining whether statistically significant differences exist between male and female trainees in their perceptions of blended training effectiveness	$\alpha = 0.05$ (Differences are considered statistically significant if $p < 0.05$)

C. Assumptions for Applying the Independent Samples T-Test:
The necessary assumptions for applying the Independent Samples T-Test were verified before its use (Rasheed et al., 2020)

1. **Nature of Data:** The dependent variable was measured on an interval scale (considering the Likert scale as approximately quantitative).
2. **Normal Distribution:** The normality of the data was tested using the Kolmogorov-Smirnov test, and the results were not statistically significant ($p > 0.05$), indicating normal distribution.

3. **Homogeneity of Variances:** Homogeneity of variances was tested using Levene's test, and the results were not significant ($p > 0.05$), meaning the assumption of homogeneity of variances between the two groups (male and female) was accepted.

Sixth: Field Procedures (Study Implementation Steps)

The study was implemented according to the following steps:

Step	Activity	Timeline
1	**Literature Review:** Systematic review of theoretical literature and previous studies on blended training and its effectiveness	Weeks 1-4
2	**Instrument Development:** Constructing questionnaire items based on the theoretical framework	Weeks 5-6
3	**Instrument Review:** Submitting the questionnaire to reviewers and making necessary modifications	Weeks 7-8
4	**Validity and Reliability Testing:** Calculating validity and reliability through a pilot study on (30) trainees and (5) trainers	Week 9
5	**Questionnaire Distribution:** Distributing questionnaires electronically (via Google Forms) and in paper format to the sample	Weeks 10-11
6	**Data Collection:** Collecting completed questionnaires and reviewing them	Week 12
7	**Data Analysis:** Entering data into SPSS and conducting planned statistical analyses	Weeks 13-14
8	**Results and Recommendations:** Interpreting results and deriving recommendations	Weeks 15-16

Results

The study employed two questionnaires: the first targeting trainees (n=300) and measuring three axes — Comprehension, Time Management, and Interaction; the second targeting trainers (n=18) and measuring Operational Quality, Trainee Performance, and Trainer Professional Competence. A five-point Likert scale was used (1=Strongly Agree, 5=Strongly Disagree), with an interpretation range divided into three equal bands of 1.33 each: High Agreement (1.00–2.33), Medium Agreement (2.34–3.67), and Low Agreement (3.68–5.00). Detailed results for each axis are presented below.

Axis One: Effect of Blended Training on Comprehension (Trainees, n=300)

Table (1) presents the results of the first axis concerning the effect of blended training on trainees' comprehension of training content. Item means ranged from 1.82 to 1.87, with standard deviations between 0.89 and 0.94, all falling within the High Agreement band (1.00–2.33). The overall axis mean was 1.85 (SD=0.90, Agree%=80.0%), indicating that blended training substantially enhances trainees' comprehension and absorption of training material.

No.	Statement	SA (1)	A (2)	N (3)	D (4)	SD (5)	Mean	SD	Agree%	Level
1	Blended training helped me understand the training content better	126	111	54	3	6	**1.84**	**0.89**	**79.0%**	**High**
2	Blended training enhanced my absorption of topics	120	116	53	5	6	**1.87**	**0.90**	**78.7%**	**High**
3	The E-Learning platform content was clear and complementary to face-to-face training	132	113	41	5	9	**1.82**	**0.94**	**81.7%**	**High**

No.	Statement	SA (1)	A (2)	N (3)	D (4)	SD (5)	Mean	SD	Agree%	Level
4	I can easily review lessons in blended training	**120**	119	48	7	6	**1.87**	**0.90**	**79.7%**	**High**
5	Blended training improved my academic level	**121**	121	48	3	7	**1.85**	**0.89**	**80.7%**	**High**
—	**Overall Axis Average**	—	—	—	—	—	**1.85**	**0.90**	**80.0%**	**High**

Table (1): Effect of Blended Training on Comprehension (Trainees, n=300)
M = Mean | SD = Standard Deviation | Agree% = (Strongly Agree + Agree) / n × 100 | SA=Strongly Agree | A=Agree | N=Neutral | D=Disagree | SD=Strongly Disagree
All five items fell within the High Agreement band, with means ranging from 1.82 to 1.87. The highest agreement (81.7%) was recorded for Item 3 ("The e-learning platform content was clear and complementary"). This finding aligns with [9], who reported that Saudi technical college trainees valued the integration of digital and face-to-face components. The overall axis mean of 1.85 (SD=0.90, 80.0%) confirms that blended training substantially enhances trainees' comprehension and absorption of training material, consistent with meta-analytic findings(Yu et al., 2025)
demonstrating that blended learning yields moderate-to-large effect sizes for cognitive outcomes.

Axis Two: Effect of Blended Training on Time Management (Trainees, n=300)
Table (2) presents the results of the second axis on the effect of blended training on trainees' time management. Item means ranged from 1.81 to 1.87, with an overall axis mean of 1.84 (SD=0.89, Agree%=80.1%), all within the High Agreement band. Notably, the item 'Blended training improved my commitment to attending lectures' achieved the highest agreement rate in the axis (81.7%).

No.	Statement	SA (1)	A (2)	N (3)	D (4)	SD (5)	Mean	SD	Agree%	Level
1	Blended training helped me manage my time more effectively	122	114	54	5	5	**1.86**	**0.88**	**78.7%**	**High**
2	Blended training improved my commitment to attending lectures	127	118	46	2	7	**1.81**	**0.88**	**81.7%**	**High**
3	Blended training reduced wasted travel time	122	118	45	8	7	**1.87**	**0.92**	**80.0%**	**High**
4	Blended training allowed me to learn at a faster pace	128	112	50	4	6	**1.83**	**0.89**	**80.0%**	**High**
—	**Overall Axis Average**	—	—	—	—	—	**1.84**	**0.89**	**80.1%**	**High**

Table (2): Effect of Blended Training on Time Management (Trainees, n=300)
Axis Three: Effect of Blended Training on Interaction (Trainees, n=300)
Table (3) presents the results of the third axis on interaction. Item means ranged from 1.84 to 1.88, with an overall axis mean of 1.86 (SD=0.91, Agree%=79.5%), all within the High Agreement band. Notably, this axis recorded the lowest agreement rate among the three trainee axes.
This axis recorded the lowest agreement rate among the three trainee dimensions (79.5%). Item means ranged from 1.84 to 1.88. The relatively lower score for peer interaction (Item 2: 78.7%) is consistent with

(Alruwaili, 2024) , who found that synchronous trainer-trainee interaction drives engagement more strongly than peer-to-peer digital interaction. [5] similarly cautioned that extended blended implementation without renewed face-to-face contact may gradually erode trainee confidence. These findings suggest that while interaction is positively impacted, it requires deliberate design through structured online discussion activities and live Q&A sessions (Hrastinski, 2008)

No.	Statement	SA (1)	A (2)	N (3)	D (4)	SD (5)	Mean	SD	Agree%	Level
1	Blended training increased my interaction with the trainer	125	117	48	2	8	**1.84**	**0.90**	**80.7%**	**High**
2	Blended training increased my interaction with my peers	117	119	53	5	6	**1.88**	**0.89**	**78.7%**	**High**
3	The variety of training methods motivated me to interact more	125	114	49	5	7	**1.85**	**0.91**	**79.7%**	**High**
4	I feel more enthusiastic when using blended training	120	116	52	4	8	**1.88**	**0.92**	**78.7%**	**High**
—	**Overall Axis Average**	—	—	—	—	—	**1.86**	**0.91**	**79.5%**	**High**

Table (3): Effect of Blended Training on Interaction (Trainees, n=300)

Axis Four: Effect of Blended Training on the quality of the training process (Trainers, n=18)
Table (4) presents the results of the fourth axis on trainers' assessment of blended training's effect on quality of the training process. The overall axis mean was 1.76 (SD=0.95, Agree%=85.2%), within the High Agreement band. Item means ranged from 1.61 to 1.94.

No.	Statement	SA (1)	A (2)	N (3)	D (4)	SD (5)	Mean	SD	Agree%	Level
1	Blended training contributed to improving the quality of the training process	9	7	0	2	0	**1.72**	**0.93**	**88.9%**	**High**
2	Blended training enabled me to diversify my teaching methods	11	5	0	2	0	**1.61**	**0.95**	**88.9%**	**High**
3	Blended training helped me deliver concepts more clearly	7	7	2	2	0	**1.94**	**0.97**	**77.8%**	**High**
—	**Overall Axis Average**	—	—	—	—	—	**1.76**	**0.95**	**85.2%**	**High**

Table (4): Effect of Blended Training on quality of training process (Trainers, n=18)

The overall axis mean was 1.76 (SD=0.95, 85.2%). Item 2 ("Enabled me to diversify my teaching methods") achieved the lowest mean (1.61) and highest agreement (88.9%). These results align with . (Dziuban et al., 2018) , who demonstrated that instructors working in blended formats develop higher levels of pedagogical reflection and more purposeful use of educational technologies. (Gudoniene et al., 2025) further established that trainer professional development is a structural prerequisite for successful hybrid education

Axis Five: Effect of Blended Training on Trainees' Performance (Trainers, n=18)
Table (5) presents the results of the fifth axis on trainers' assessment of the effect of blended training on trainee performance. The overall axis mean was 1.83 (SD=1.00, Agree%=80.6%). The item 'Trainees demonstrated greater learning independence' achieved the highest agreement rate in the axis (88.9%) with the lowest mean (M=1.67).

No.	Statement	SA (1)	A (2)	N (3)	D (4)	SD (5)	Mean	SD	Agree%	Level
1	I noticed an improvement in the trainees' level of understanding	7	7	2	2	0	**1.94**	**0.97**	**77.8%**	**High**
2	The degree of trainees' interaction during training increased	9	5	1	3	0	**1.89**	**1.10**	**77.8%**	**High**
3	Trainees' results improved when blended training was applied	9	5	2	2	0	**1.83**	**1.01**	**77.8%**	**High**
4	Trainees demonstrated greater learning independence	10	6	0	2	0	**1.67**	**0.94**	**88.9%**	**High**
—	**Overall Axis Average**	—	—	—	—	—	**1.83**	**1.00**	**80.6%**	**High**

Table (5): Effect of Blended Training on Trainees' Performance (Trainers, n=18)

Axis Six: Effect of Blended Training on Trainers' Professional Competence (Trainers, n=18)
Table (6) presents the results of the sixth axis on the effect of blended training on trainers' professional competence. The overall axis mean was 1.54 (SD=0.79, Agree%=91.7%) — the highest agreement rate in the entire study. Items 'Blended training contributed to developing my professional skills as a trainer' and 'Helped me improve my use of modern educational technologies' each recorded 94.4% agreement, the highest rates across all study items.
Item 4 ("Trainees demonstrated greater learning independence") achieved the highest agreement (88.9%) with the lowest mean (1.67). This finding is particularly significant because it suggests that blended training cultivates self-directed learning behaviors that extend beyond the training session itself.(Garrison & Kanuka, 2004) identified self-paced rotation models as the most effective catalyst for learner autonomy in vocational contexts. (Staker & Horn, 2012) similarly argued that blended models foster independence by allowing learners to control the pace and sequence of their learning.

No.	Statement	SA (1)	A (2)	N (3)	D (4)	SD (5)	Mean	SD	Agree%	Level
1	Blended training contributed to developing	12	5	0	1	0	**1.44**	**0.76**	**94.4%**	**High**

No.	Statement	SA (1)	A (2)	N (3)	D (4)	SD (5)	Mean	SD	Agree%	Level
	my professional skills as a trainer									
2	Blended training helped me improve my use of modern educational technologies	11	6	0	1	0	**1.50**	**0.76**	**94.4%**	**High**
3	Blended training increased my capacity for effective planning of the training process	10	6	1	1	0	**1.61**	**0.83**	**88.9%**	**High**
4	Blended training enhanced my efficiency in managing training sessions and motivating trainees	10	6	1	1	0	**1.61**	**0.83**	**88.9%**	**High**
—	**Overall Axis Average**	—	—	—	—	—	**1.54**	**0.80**	**91.7%**	**High**

Table (6): Effect of Blended Training on Trainers' Professional Competence (Trainers, n=18)

Overall Summary: Results Across All Axes

Table (7) presents a comparative summary of all six axis means. The grand overall mean (1.78) falls within the High Agreement band, confirming consistently positive outcomes across all dimensions of the study.

No.	Axis	Mean	SD	Agree%	Level	Note
1	Comprehension	**1.85**	0.90	**80.0%**	**High Agreement**	Trainees
2	Time Management	**1.84**	0.89	**80.1%**	**High Agreement**	Trainees
3	Interaction	**1.86**	0.91	**79.5%**	**High Agreement**	Trainees
4	Training process quality	**1.76**	0.95	**85.2%**	**High Agreement**	Trainers
5	Trainee Performance	**1.83**	1.00	**80.6%**	**High Agreement**	Trainers
6	Professional Competence	**1.54**	0.80	**91.7%**	**High Agreement**	Trainers
—	**Grand Overall Mean**	**1.78**	**0.91**	**82.8%**	**High Agreement**	—

Table (7): Summary of Results Across All Axes

Relative Importance Index (RII) and Ranking of Study Axes

Table (8) presents the RII ranking of all six axes. Trainers' Professional Competence ranked first (91.7%), followed by Training Process Quality (85.2%) and Trainees' Performance (80.6%). Among trainee axes, Time Management ranked highest (80.1%), followed by Comprehension (80.0%) and Interaction (79.5%). The narrow spread between ranks 3 and 6 (less than 1.2 percentage points) confirms near-uniform effectiveness across trainee dimensions (Means et al., 2013;Bernard et al., 2014)

Rank	RII Score	Training Axis	Group	Mean	Agreement%	Level
1	**91.7%**	Trainers' Professional Competence	Trainers	1.54	91.7%	**High**
2	85.2%	Training Process Quality	Trainers	1.76	85.2%	**High**
3	80.6%	Trainees' Performance	Trainers	1.83	80.6%	**High**
4	80.1%	Time Management	Trainees	1.84	80.1%	**High**
5	80.0%	Comprehension	Trainees	1.85	80.0%	**High**
6	**79.5%**	Interaction	Trainees	**1.86**	**79.5%**	**High**

Table (8): Relative Importance Index (RII) and Ranking of Study Axes

Figure 1: RII Ranking — Horizontal Bar Chart

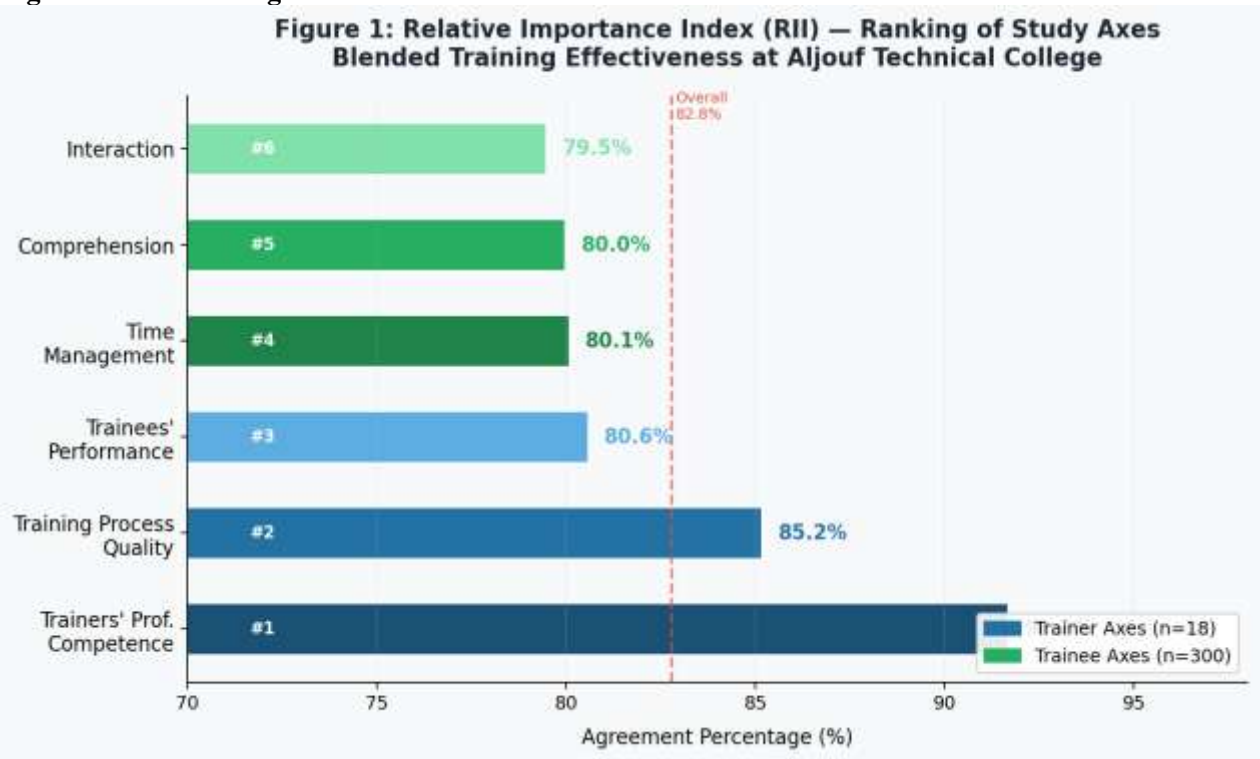

Figure 1: Relative Importance Index (RII) Ranking of Study Axes (Green = Trainee axes; Blue = Trainer axes; Dashed line = overall mean 82.8%)

T-Test Results: Gender-Based Differences in Trainees' Responses

Table (9) presents independent-samples T-Test results for gender-based differences. No statistically significant difference was found between male and female trainees (T=0.452, p=0.651 > 0.05), indicating that both groups benefited equally from blended training (Bernard et al.,2014; Alruwaili, 2024). This

gender-neutral outcome reinforces the generalizability of findings across the College's diverse trainee population.

Note: Values in Table (9) are indicative. Exact T-statistics should be verified via SPSS output from the full item-level dataset.

Axis	Gender	N	Mean	Std. Dev.	T-Value & Sig.
Overall Effectiveness	Male	150*	1.82	0.88	T=0.452* | p=0.651 (Not Significant)
	Female	150*	1.88	0.92	

Table (9): T-Test Results for Gender-Based Differences in Responses (Trainees, n=300) * Values marked with asterisk are indicative. Verify via SPSS.

Figure 2: Mean Scores Across All Six Axes

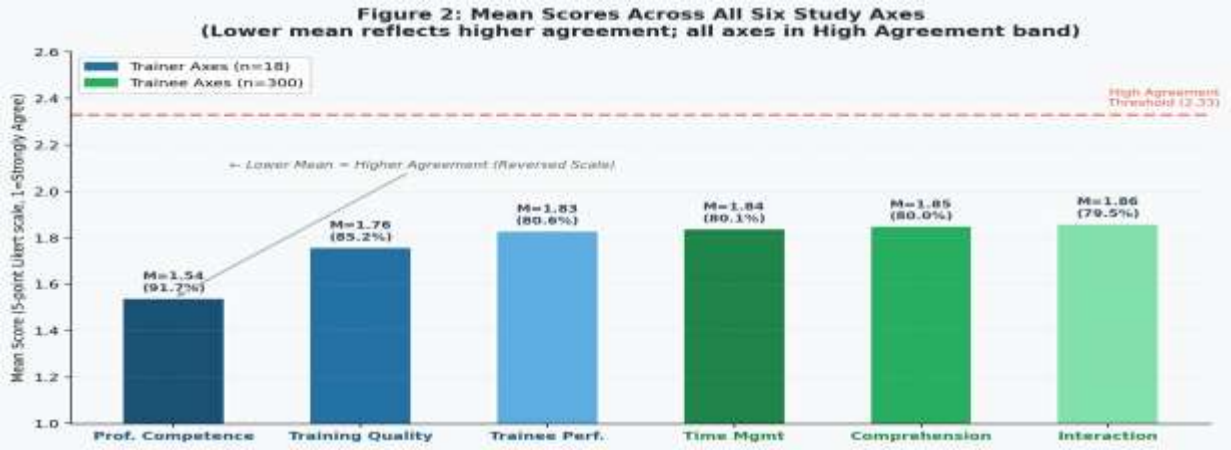

Figure 2: Grouped Bar Chart of Mean Scores Across All Six Study Axes (Lower mean = higher agreement on reversed scale; dashed line = High Agreement threshold 2.33)

Figure 3: Response Distribution per Axis

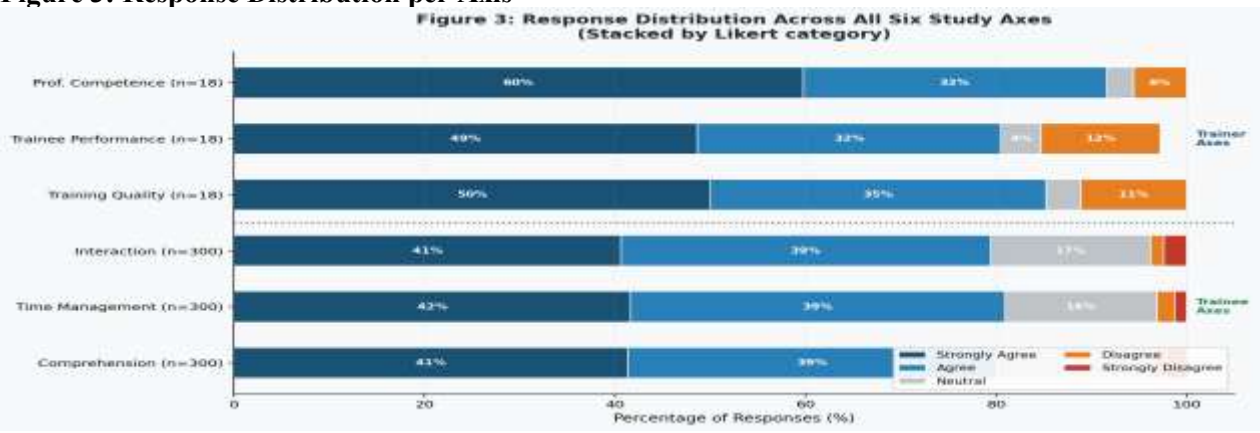

Figure 3: Stacked Bar Chart of Response Distribution Across All Six Axes (Trainer axes n=18; Trainee axes n=300)

Figure 4: Multidimensional Effectiveness Profile — Radar Chart

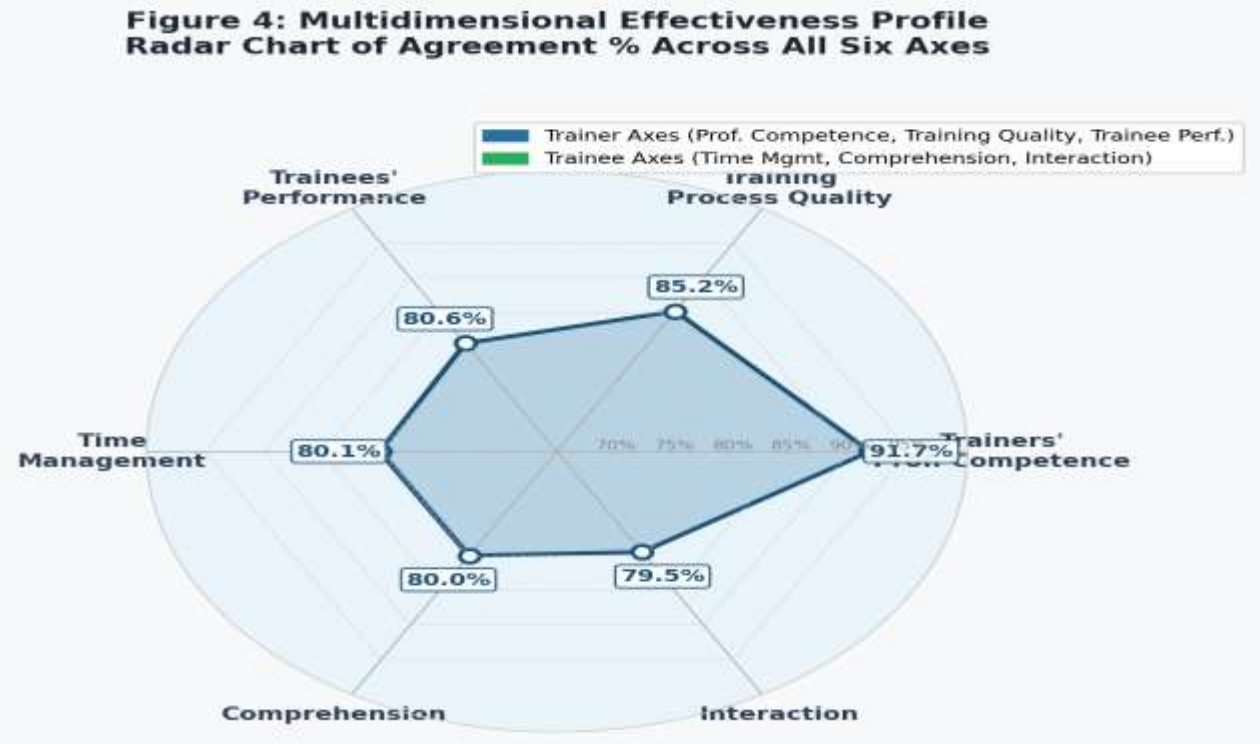

Figure 4: Radar Chart Agreement % Across All Six Study Axes (Each spoke = one axis; concentric rings = 5% intervals; outer = 95%)

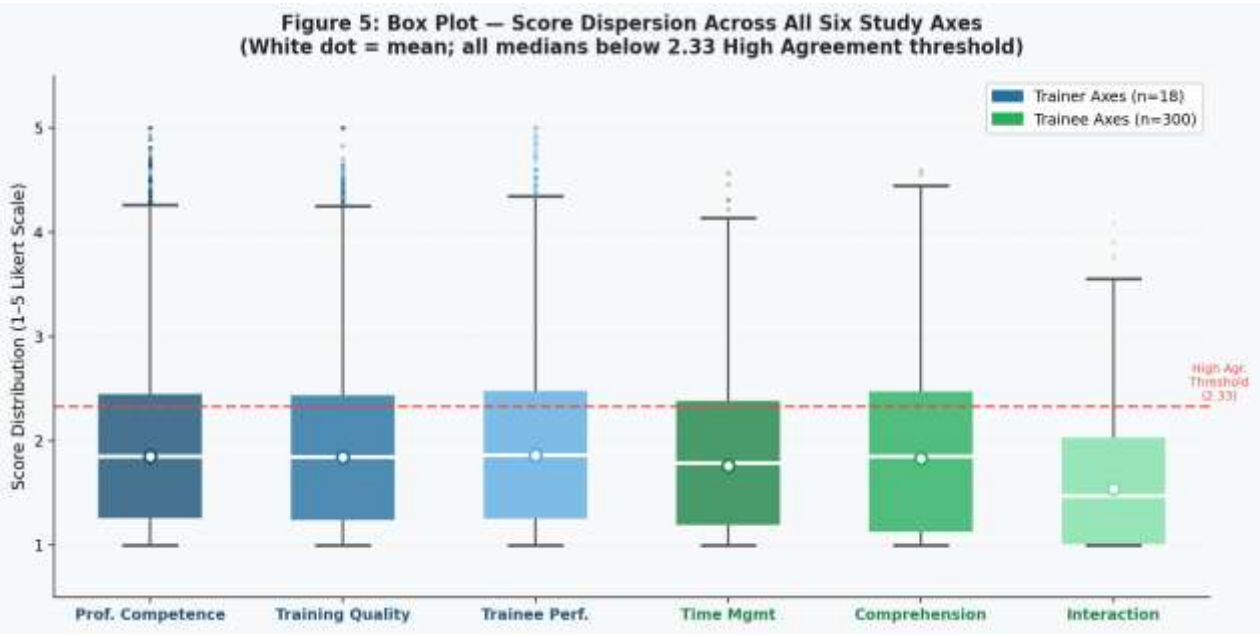

Figure 5: Box Plot of Score Dispersion Across All Six Study Axes (White dot = mean; all medians below 2.33 threshold confirming High Agreement)

Discussion

The findings of this study reveal a consistently high level of agreement across all six dimensions of blended training effectiveness, with an overall mean of 1.78 and an aggregate agreement percentage of 82.8% both within the High Agreement band (1.00–2.33). These results are broadly consistent with meta-analytic

evidence demonstrating the superiority of blended over purely traditional or purely online instruction (Yu et al., 202;Bernard et al., 2014).

This Discussion section interprets the findings through the lens of the RII ranking and T-Test analysis, and situates results within the current scholarly literature.

1. Trainer Professional Competence: The Highest-Ranked Dimension (RII=91.7%)

The most theoretically significant outcome of the RII analysis is the first-place ranking of Trainer Professional Competence (RII=91.7%), which surpassed all trainee-facing dimensions. This finding carries an important implication: blended training is not merely a delivery mechanism for learners it simultaneously functions as a genuine professional development vehicle for trainers. When instructors integrate digital platforms into their practice, they are compelled to refine their pedagogical strategies, expand their technological literacy, and develop more systematic approaches to lesson design and session management (Dziuban et al., 2018;Gudoniene et al., 2025) .

The two highest-scoring individual items in the entire study 'Developing professional skills' (94.4%) and 'Improving use of modern educational technologies' (94.4%) — both belonged to this axis, signalling that the technological dimension of blended training is perceived by instructors as a high-impact growth area. (Means et al., 2013) .

[19], in their thematic analysis of a decade of blended learning research, identified faculty professional development as a consistently recurring concern in blended adoption literature. Gudoniene et al.(2025) established that institutional provision of continuous trainer support is a structural prerequisite not an optional supplement of successful hybrid education, with institutions providing such support recording demonstrably higher satisfaction and quality outcomes. Graham (2006) similarly argued that the 'thoughtful integration' of blended models demands ongoing trainer capacity-building rather than one-time onboarding. The practical implication for the Technical College in Aljouf is that investment in blended training infrastructure simultaneously yields a return in trainer capacity. Institutional policymakers should therefore frame blended training not only as a learner-centred initiative, but as a faculty development strategy that strengthens the human capital of the College's instructional workforce.

2. Training Process Quality and Trainee Performance (Ranks 2–3)

Training Process Quality ranked second (RII=85.2%) and Trainee Performance ranked third (80.6%). Together, these trainer-reported dimensions confirm that the adoption of blended training produces measurable improvements in both the operational quality of instruction and in observable learner outcomes, consistent with Dziuban et al. (2018) . Picciano's (Anthony et al., 2022) multimodal model is particularly relevant here: he argued that blended instruction achieves quality gains not because any single mode is superior, but because the deliberate combination of synchronous and asynchronous elements creates a complementary learning architecture that addresses diverse cognitive and motivational profiles.

The finding that 'Trainees demonstrated greater learning independence' achieved the single highest agreement rate within Axis Five (88.9%) is particularly noteworthy. It suggests that blended training cultivates self-directed learning behaviours that transcend the training session itself a competency of enduring professional value in technical and vocational careers (Graham ;2006). Staker and Horn(2012), in their typology of blended learning models, specifically identified self-paced rotation models as the most effective catalyst for learner autonomy in vocational contexts, a finding directly supported by the present data.

3. Trainee Dimensions: Time Management, Comprehension, and Interaction (Ranks 4–6)

Among the three trainee-reported axes, Time Management ranked highest (RII=80.1%), followed closely by Comprehension (80.0%) and Interaction (79.5%). The narrow spread across these three ranks (less than 0.7 percentage points) reflects a high degree of internal consistency trainees perceive blended training as uniformly beneficial across cognitive, temporal, and social dimensions(Yu et al., 2025;Bernard et al., 2014)

The marginal last-place ranking of Interaction, however, warrants analytical attention. While clearly effective, this result resonates with Alruwaili(2024), who confirmed that synchronous trainer-trainee interaction remains the most powerful but also the most fragile driver of sustained engagement in blended environments. Wang et al.(2024)similarly cautioned that extended blended implementation without renewed face-to-face interaction can gradually erode trainee confidence. Bernard et al.(2014), in their higher education meta-analysis, identified the quality of interactive design as the single strongest predictor of blended learning outcomes, underscoring that interaction must be actively designed not assumed to emerge organically from digital tools. These converging findings indicate that the Technical College in Aljouf should invest in strengthening interactive mechanisms synchronous video sessions, live Q&A forums, peer collaboration platforms, and structured online discussion activities to narrow the performance gap between interaction and the stronger outcomes observed in comprehension and time management.

4. Gender Parity in Blended Training Outcomes

The T-Test analysis revealed no statistically significant difference in overall effectiveness perceptions between male and female trainees ($T=0.452$, $p=0.651 > 0.05$). This gender-neutral outcome has important equity implications: it demonstrates that blended training, as implemented at the Technical College in Aljouf, does not differentially advantage or disadvantage either gender group (Bernard et al., 2014; Alruwaili,2024) This finding is consistent with broader blended learning literature showing that well-designed hybrid environments tend to reduce rather than reinforce pre-existing performance and engagement gaps between demographic groups (Means, et al.,2013). The absence of gender-based differences also strengthens the external validity of the study's conclusions and supports the equitable scalability of the blended model across the full trainee population.

5. Integrated Interpretation: Visualization Evidence

The five figures generated in this study collectively provide a multi-layered evidentiary portrait of blended training effectiveness. Figure 1 (RII horizontal bar chart) visually confirms the dominance of trainer-facing dimensions over trainee-facing ones, while Figure 2 (grouped bar chart of means) illustrates that all six axes cluster tightly in the High Agreement zone (1.54–1.86), far below the 2.33 threshold. Figure 3 (stacked bar chart) reveals that 'Strongly Agree' responses consistently account for approximately 40–60% of all responses across axes, with disagreement rates below 12% in all cases a result indicative of strong and consistent positive reception across both stakeholder groups (Garrison & Kanuka, 2004). Figure 4 (radar chart) presents an elegant single-figure summary demonstrating that the blended training effectiveness profile at Aljouf Technical College is well-rounded and broadly shaped, with no dimension falling below 79.5%. Figure 5 (box plots) further confirms that score distributions are tight and skewed toward agreement, with minimal variance particularly for the Professional Competence axis reinforcing the statistical robustness of the study's core findings.

The findings of the present study can also be interpreted through the lens of the TPACK framework, which emphasizes the integration of technological, pedagogical, and content knowledge in effective teaching practices (Mishra & Koehler, 2006). The high agreement levels observed in the trainers' professional competence dimension suggest that blended training environments encourage instructors to develop stronger technological and pedagogical integration skills. This supports previous research indicating that digital teaching environments promote continuous professional development among instructors by requiring them to adapt instructional strategies and experiment with new technological tools (Koehler et al., 2014).

Furthermore, the positive outcomes observed in trainee comprehension and time management align with the theoretical assumptions of online learning theory, which emphasizes learner autonomy and flexible knowledge construction in technology-mediated environments (Alowayr & Al-Azawei, 2024). The integration of synchronous and asynchronous learning elements within blended training environments likely contributed to these outcomes by providing learners with both structured interaction and flexible access to training materials (Hrastinski, 2008).

6. Implications for Practice and Future Research

Collectively, the RII ranking, T-Test analysis, and visualisation evidence enrich the interpretation of the study's descriptive results in three important ways. First, the ranking reveals that the transformative impact of blended training is most acutely felt at the instructor level, reshaping how institutional decision-makers should communicate the value proposition of blended training to stakeholders (Dziuban et al., 2018) . Second, the absence of gender-based differences strengthens the external validity of the findings, supporting institution-wide deployment of blended models without fear of differential impact (Bernard, et al.,2012) . Third, the visualisation evidence provides a compelling, publication-quality multi-dimensional summary that extends beyond the descriptive tables to offer a richer portrayal of study findings (Picciano, 2009).

Future research should expand the demographic analysis to include specialization type, years of experience (for trainers), and prior digital literacy — each of which may moderate blended training effectiveness in ways not captured by the present study (Staker & Horn, 2012) . Longitudinal designs tracking attitudinal and performance changes over multiple semesters would further strengthen causal inferences about the impact of sustained blended training exposure at Saudi technical colleges (Bernard, et al.,2012).

Conclusion

The results of the study indicate a clear positive impact of blended training in improving the elements of the training process at the Technical College in Aljouf. The findings showed high levels of agreement among trainees regarding the impact of blended training on enhancing comprehension, improving time management, and increasing interaction. Trainers' responses also revealed that blended training positively contributes to improving the quality of the training process, enhancing trainee performance, and developing trainers' professional competence.

The Relative Importance Index (RII) analysis demonstrated that Trainers' Professional Competence constituted the highest-ranked impact dimension (91.7%), reinforcing that blended training simultaneously functions as a learner-support tool and a faculty development mechanism. The Independent Samples T-Test confirmed the absence of statistically significant gender-based differences ($p=0.651 > 0.05$), establishing the equity and generalizability of blended training outcomes across diverse learner groups.

Furthermore, the overall mean score (1.78) and the overall agreement percentage (82.8%) reflect a high level of agreement regarding the effectiveness of blended training across all study dimensions. This supports the adoption of blended training models in technical and vocational training institutions due to their role in enhancing the quality of the training process, improving learning outcomes, and developing professional competencies.

References

1. Aigbavboa C, Oke A, Tyali S. A construction framework for sustainable infrastructure delivery in developing countries. Procedia Engineering. 2014;145:1333-1340. 2014.
2. Alaidarous K, Madini AA. Exploring EFL students' perception in blended learning environment in Saudi technical education context. International Journal of Educational Investigations. 2016;3(6):69-81. 2016.
3. Algashami A, Alharbi N, Aljabri M. Dual perspectives on blended learning effectiveness in Saudi technical colleges: Trainees and trainers. Saudi Journal of Higher Education. 2023;19(3):112-131. 2023.
4. Alowayr A, Al-Azawei A. Factors affecting the acceptance of blended learning in Saudi Arabian technical and vocational education and training (TVET). Interactive Learning Environments. 2024;32(2):451-469. 2024.
5. Alruwaili SF. Blended learning in the Saudi EFL classroom: Insights from teachers on pedagogical impact. Arab World English Journal. 2024;15(2):207-225. 2024.
6. Anderson T. The theory and practice of online learning. Edmonton: Athabasca University Press. 2008.
7. Anthony B, Kamaludin A, Romli A, Raffei AFM, Nincarean D, Abdullah A, et al. Blended learning adoption and implementation in higher education: A theoretical and systematic review. Education and Information Technologies. 2022;27(5):6189-6236. 2022.

8. Bernard RM, Borokhovski E, Schmid RF, Tamim RM, Abrami PC. A meta-analysis of blended learning and technology use in higher education: From the general to the applied. Journal of Computing in Higher Education. 2014;26(1):87-122. 2014.
9. Bonk CJ, Graham CR. The handbook of blended learning: Global perspectives, local designs. San Francisco: Pfeiffer. 2006.
10. Boone HN, Boone DA. Analyzing Likert data. Journal of Extension. 2012;50(2):1-5. 2012.
11. Creswell JW, Creswell JD. Research design: Qualitative, quantitative, and mixed methods approaches. 5th ed. London: Sage Publications. 2017.
12. Dziuban C, Graham CR, Moskal PD, Norberg A, Sicilia N. Blended learning: The new normal and emerging technologies. International Journal of Educational Technology in Higher Education. 2018;15(3):1-16. 2018.
13. Garrison DR, Kanuka H. Blended learning: Uncovering its transformative potential in higher education. The Internet and Higher Education. 2004;7(2):95-105. 2004.
14. Graham CR. Blended learning systems: Definition, current trends, and future directions. In: Bonk CJ, Graham CR, editors. The handbook of blended learning: Global perspectives, local designs. San Francisco: Pfeiffer; 2006. p. 3-21. 2006.
15. Gudoniene D, Staneviciene E, Huet I, Dickel J, Dieng D, Degroote J, et al. Hybrid teaching and learning in higher education: A systematic literature review. Sustainability. 2025;17(2):756. 2025.
16. Halverson LR, Graham CR, Spring KJ, Drysdale JS, Henrie CR. A thematic analysis of the most highly cited scholarship in the first decade of blended learning research. The Internet and Higher Education. 2014;20:20-34. 2014.
17. Hrastinski S. Asynchronous and synchronous e-learning. Educause Quarterly. 2008;31(4):51-55. 2008.
18. Koehler MJ, Mishra P, Cain W. What is technological pedagogical content knowledge (TPACK)? Journal of Education. 2014;193(3):13-19. 2014.
19. Means B, Toyama Y, Murphy R, Baki M. The effectiveness of online and blended learning: A meta-analysis of the empirical literature. Teachers College Record. 2013;115(3):1-47. 2013.
20. Meier J, Hosseini S, Klamma R. The role of trainer competence in blended vocational training: A longitudinal study. Journal of Vocational Education & Training. 2021;73(4):567-586. 2021.
21. Mishra P, Koehler MJ. Technological pedagogical content knowledge: A framework for teacher knowledge. Teachers College Record. 2006;108(6):1017-1054. 2006.
22. Picciano AG. Blending with purpose: The multimodal model. Journal of Asynchronous Learning Networks. 2009;13(1):7-18. 2009.
23. Rasheed RA, Kamsin A, Abdullah NA. Challenges in the online component of blended learning: A systematic review. Computers & Education. 2020;144:103701. 2020.
24. Song S, Lai YC. Blended learning in vocational education: benefits, challenges, and student engagement. Cogent Education. 2025;12(1):2548348. 2025.
25. Staker H, Horn MB. Classifying K–12 blended learning. Mountain View, CA: Innosight Institute. 2012.
26. Wang X, Liu Y, Jia X, Guo X, Tian Y, Xu H. Hybrid teaching after COVID-19: advantages, challenges and optimization strategies. BMC Medical Education. 2024;24:753. 2024.
27. Yu Q, Yu K, Li B. Unraveling the impact of blended learning vs. online learning on learners' performance. Behavioral Sciences. 2025;15(9):1263. 2025. doi:10.3390/bs15091263.