# A Comparison Between the Effectiveness of E-learning and Blended Learning in Industrial Training

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## ABSTRACT

**Background:** Blended learning has recently become a widespread practice in industrial training. Accordingly, comparing the effectiveness of e-learning and blended learning in industrial environments is of utmost necessity. The purpose of this research was to compare the effectiveness of e-learning and blended learning in industrial training based on learning outcomes and course satisfaction.

**Methods:** This study was conducted at Hepco Company in 2018, and a quasi-experimental design with a control group was used. The sample size included 90 employees randomized in three groups by means of random sampling method. 60 participants were assigned to the experimental groups (30 learners in e-learning group and 30 in blended learning group) and 30 of them went to the control group. Satisfaction questionnaire (Kirkpatrick, 2007) with 23 questions and 3 components was used for data collection. Components of this scale included the content component (8 questions), lecture component (9 questions) and organization-possibilities (6 questions). The reliability of the questionnaire was 0.92 based on the Cronbach's alpha. To evaluate the learning outcomes a researcher made test with 30 questions was administered, and the CVR of the test for validity was 0.96.

**Results:** In terms of learning outcomes, the mean results in the blended learning group (M=22.96, SD=2.66) were higher than in the e-learning (M=19.48, SD=3.25) and face-to-face (M=18.13, SD=4.62) groups. There was a significant difference between of learning scores in the experimental group and control group (P<0.001). Also the results showed that the mean course satisfaction in blended learning group (M=71.19, SD=8.6) was higher than e-learning (M=43.88, SD=7.94) and face-to-face (M=59.65, SD=11.63) groups. The course satisfaction scores showed that the blended learning group expressed greater satisfaction than the e-learning and face-to-face groups (P<0.001).

**Conclusion:** The results indicate that blended learning can improve the effectiveness of training. It is therefore suggested that curriculum developers and HR managers in companies can improve industrial training by developing blended learning courses.

**Keywords:** E-learning, Workplace learning, Blended learning, Vocational education & training

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## Introduction

Today, more than ever, it is important to keep the employees updated on the developments in their professions. New information emerges on a daily basis, and they must have access to that information if they are expected to deliver their best performance. The extent to which an employee makes progress is a measure of a manager's effectiveness (1). In this regard, workplace learning has, in recent years, embraced technology to meet the demands of continuing professional development and general training of employees. Little research however has been undertaken to assess the effectiveness of the methods used and the learners' reception of these teaching-learning strategies (2). In fact, educational technologies have largely influenced the teaching approaches because of their major benefits. These benefits are well documented in both academic institutions and corporate training areas. Some of the E-learning benefits include accurate and consistent content delivery through visually-enhanced multimedia presentation and simulation, cost-effectiveness (3), self-paced and learner-controlled learning via dynamic content (4), learner engagement through interactive learning materials (4, 5), instant feedback (6), real-world-like practices enabled by virtual labs, simulation, and interactive exercises (6), promotion of lifelong learning accommodation for a variety of learning styles (5), high retention of content through personalized and active learning (3, 5), content delivery efficiency (7), anytime and anywhere learning (3, 5, 8), and meaningful assessment and testing (4). E-learning tools have the advantage of allowing your staff to learn either independently or in groups. With educational technology, they can each work at a pace or at a time that is convenient. Technology enables companies to provide training to their staff in different situations and ensure that they all receive identical information. It eliminates the costs of hiring instructors or sending staff out-of-town to training programs (1).

Despite the n noted vantages, e-learning is not an all-inclusive solution regardless of its effectiveness. Therefore, its limitations as a training method in corporate settings have led many to try a mixture of various delivery methods. Accordingly, there is a rapidly rising interest in blended learning which is a typical combination of face-to-face training and online learning (9). This is mainly due to the fact that more traditional forms of learning, such as face-to-face teaching, also have some advantages: The enthusiasm of the facilitator (instructor) for the content is contagious and encourages learning; People prefer to learn in a social situation; There is accountability in a classroom that is missing in e-learning, Learning occurs casually and indirectly when individuals interact; Instructor-led sessions remove people from their daily work responsibilities, so participants can focus on learning (There is no such protection when using e-learning methods); The questions and comments of class members help raise and address important issues and make it comfortable for others to talk; The pattern of learning in a group environment is established in almost everyone's school experience and connects us with our past; The facilitator speeds the process of knowledge acquisition; Classroom experiences provide opportunities for learners to practice and rehearse skills and receive feedback from others (10).

Therefore, corporate instructors need to provide a mixture of teaching methods to satisfy all their staff. In fact, some employees will quickly adapt to high-tech learning tools such as Web-based courses, training programs on CD-ROMs, or interactive computer-based training, whereas others are more comfortable with the more traditional in-class lecture and books (11). On the other hand, one should take account of the major drawbacks in educational programs where e-learning is relied upon as the only approach in teaching. Among the frequently cited downsides are physical isolation and lack of social support and interaction. As a result, high attrition rates are common with many online programs that use e-learning

as the sole instructional delivery (12 & 1). In a blended learning approach, we can draw on the strengths of both e-learning and traditional learning methods. Franks (13) asserts that educators who have tried both the traditional lecture format and an online education approach become aware that neither method by itself is sufficient for every learner, every instructor, and every course. This inadequacy leads to strong possibilities for the effective application of a third option: a blended learning approach, which attempts to integrate the best from both modes. The blended learning paradigm promotes student-to-instructor, instructor-to-student, and student-to-student social interaction which are all conducive to learning. Research on the effectiveness of blended learning in formal education environments shows that this teaching approach can significantly enhance student learning. researches such as Mosalanejad et al. (14), Motamedi et al. (15), Mohammadi et al. (8), Bailey & Morais (16), Chen and Jones (17), Pereira et al. (18), Akkoyunlu & Yilmaz-Soylu (19); Sahin (20), Shellton & Parlin (21) and Mwanza-Simwami (22) emphasize the effectiveness of blended learning.

In the literature the term is used to describe the integrated combination of traditional offline methods of learning with intranet web-based, extranet web-based or internet-based online approaches (23). Also, Blended learning has been described as a mode of teaching that eliminates time, place, and situational barriers, whilst enabling high quality interactions between teachers and students (24). To accentuate the fact that the concept is learner centered, blended learning can be described as a mix of delivery methods that have been selected and fashioned to accommodate the various learning needs of a diverse audience in a variety of subjects (25). Blended learning combines classroom-based learning with computer-mediated instruction (26), but it also describes learning that mixes various event-based activities, including face-to-face classrooms, live e-learning, and self-paced learning (27). However, as each

approach in teaching has its own advantages and disadvantages, many learning experts try to combine different approaches because they believe that blended learning is a promising approach in solving these problems (28). Obviously, blended learning approach can leverage the benefits of both e-learning and traditional learning, and learners can study the training material at home or in the workplace. Some learners adapt to high-tech learning tools such as computer-based or mobile-based resources, while others are more comfortable with more traditional teaching tools such as classroom lectures and books (1). Therefore, it appears that corporate institutions should adopt this approach in training their staff. The purpose of this research was to compare the effectiveness of e-learning and blended learning based on learning outcomes and course satisfaction among the employees of Hepco Company.

## Materials and Methods

This research used a quasi-experimental design with a control group. The experiment was conducted at Hepco Company in 2018. The sample size were 90 employees of Hepco Company in three groups selected by random sampling by which 60 subjects belonged to the experimental groups (30 learners in e-learning group and 30 learners in blended learning group) and 30 were categorized in the control group. The sampling method in this study was simple random sampling. Out of 120 company experts, 90 were randomly selected on an equal chance. They were then randomly assigned to three groups. The criterion for inclusion in the research was being employed at Hepco Company and having a graduate degree. Also, the criterion of exclusion was ineligibility for the post-test and not completing the questionnaires. For data collection satisfaction questionnaire (Kirkpatrick, 2007) with 23 questions and 3 components was used. Components of this scale are content (8 questions), lecture (9 questions) and organization-possibilities (6 questions). Likert spectra were used to measure satisfaction. The reliability of the

questionnaire was calculated .92 based on the Cronnbach's alpha. Additionally, for measuring learning outcomes we had a researcher-made test comprising 30 questions with closed questions answered by the students. For validity of the test we used CVR index where the CVR of test was .96. The analysis of variance (ANOVA) was performed to test the differences in pre and post tests and for paired comparisons, using SPSS v21, Scheffe test was conducted to analyze the data.

Procedures: Before training, a pre-test was conducted in the three groups, and then they were all taught by the same trainer. The content of the course was Gagnie's Problem Solving learning model. In the Gagnie's Problem Solving model, there are 9 instructional events that presented in 9 steps. The course lasted eight weeks and four hours each week so the whole course took 32 hours of class time. The teaching method varied in the three groups. In the control group, training was conducted by the traditional approach of giving lectures. In other (experimental) groups, one group was conducted by asynchronous content and training was step by step. And in the other group, instruction was conducted via blended learning. Therefore, in this group we had the content presented by CD and E-texts and in other two groups we had instructors in class, so trainers gave feedback to learners. For the sake of ethical considerations, this study was conducted with the consent of the participants. Furthermore, all participants were fully aware of the nature and confidentiality of the research and were told that their information would be kept confidential. To test the effectiveness of the courses, the satisfaction of learners' satisfaction was measured. Learning outcomes was also measured by a post-test. The post-test took 50 minutes.

## Results

The demographic characteristics of the participants show that 95.6 percent of the participants were male and 4.4 percent of them were female. The majority of the participants (94.5 percent) were employees and workers and 5.5 percent were managers. The participants were 20–50 years old.

The first hypothesis is that blended learning has a positive effect on course satisfaction of learners: In order to answer the first hypothesis, means of ANOVA scores were used. The mean and the standard deviation of learner satisfaction scores in the face-to-face group were 59.65 and 11.63. Also in the e-learning group, the mean and standard deviation of learner satisfaction scores were 43.88 and 7.94. And finally the mean and standard deviation of learner satisfaction scores in the blended learning group were 71.19 and 8.60. For significance analysis of the scores, one-way ANOVA analysis in the control and experimental groups was used the results of which are tabulated in Table 1.

As indicated in Table 1, it can be said that learner satisfaction of learning in face-to-face, e- learning and blended learning at 0.001 level is different. This means that staff training in the above groups, and a combination of dependent variables (student satisfaction of learning approach) there is a significant difference. For paired comparison of the learner's scores in learning outcomes between face-to-face, e-learning and blended learning, Scheffe post-hoc test was used the results of which are given in Table 2.

As indicated in Table 2, it can be said that learner satisfaction of learning in face-to-face, e learning and blended learning settings at 0.001 level is different, and Scheffe post-hoc test show that learners in blended learning group were significantly more satisfied than face-to-face and e learning groups. Also learners in face-to-face learning group were significantly more satisfied than learners in the e learning group.

The second hypothesis is that blended learning has a positive effect on learning outcomes of learners: To answer this hypothesis we measured the pre-test and then compared it with post-test scores obtained from course content. These scores are presented in Table 3:

As shown in Table 3, the mean and standard

**Table 1:** One-way ANOVA analysis on learning satisfaction in the control and experimental groups

| Source | Sum of Squares | Df | Mean Squares | F | Sig |
|---|---|---|---|---|---|
| Between Groups | 9964.07 | 2 | 4982.03 | 54.85 | 0.001 |
| Within Groups | 66629.92 | 87 | 90.82 | | |
| Total | 16594 | 89 | | | |

**Table 2:** Scheffe post-hoc test analysis for means of control and experimental groups on the satisfaction of learning

| Group | | Mean difference | SD | Sig |
|---|---|---|---|---|
| Face-to- face | E-learning | 15.76* | 2.70 | 0.001 |
| | Blended learning | -11.54* | 2.72 | 0.001 |
| E-learning | Face-to-face | -15.76* | 2.70 | 0.001 |
| | Blended learning | -27.30* | 2.61 | 0.001 |
| Blended learning | Face-to-face | 11.54* | 2.72 | 0.001 |
| | E-learning | 27.30* | 2.61 | 0.001 |

**Table 3:** Comparisons of means for control and experimental groups on the learning outputs in per-test and post-test

| Stage | Group | Mean | SD |
|---|---|---|---|
| Pre test | Face-to-face | 16.26 | 3.49 |
| | E-learning | 17.23 | 2.82 |
| | Blended learning | 17.50 | 2.95 |
| Post test | Face-to-face | 18.13 | 4.62 |
| | E-learning | 19.48 | 3.25 |
| | Blended learning | 22.96 | 2.66 |

**Table 4:** Covariance analysis on the learners' post-test scales in the control and experimental groups (with controlling pre-test effect)

| Indicator Variable | Sum of Squares | Df | Mean Squares | F | Sig |
|---|---|---|---|---|---|
| Learning | 516.60 | 1 | 516/60 | 91.15 | 0.001 |

deviation of learning outcomes scores in the pre- test stage in face-to-face group were 16.26 and 3.49. Also in the e-learning group, the mean and standard deviation of learning outcomes scores were 17.23 and 2.82. And finally the mean and standard deviation of learning outcomes scores in the blended learning group were 17.50 and 2.95. In post-test stage, the mean and standard deviation of learning outcomes scores in face-to-face group were 18.13 and 4.62. Also in the e-learning group, the mean and standard deviation of learning outcomes scores were 17.23 and 2.82. And finally the mean and standard deviation of learning outcomes scores in the blended learning group were

22.96 and 2.66. For significance analysis of the scores, covariance analysis in the control and experimental groups was used the results of which are presented in Table 4

As indicated in Table 4, covariance analysis for determining of difference in learning between face-to-face, e-learning and blended learning groups at 0.001 level is meaningful. This means that in terms of staff training in above-mentioned groups, and a combination of dependent variable (student learning) there was a significant difference. For paired comparison of the learners' scores in learning outcomes between face-to-face, e-learning and blended learning, Scheffe post-hoc test was used as tabulated in Table 5.

**Table 5:** Scheffe post-hoc test analysis for means of control and experimental groups on the learning outcomes

| Group | | Mean difference | SD | Sig |
|---|---|---|---|---|
| Face-to-face | E-learning | 1.35 | 1.00 | 0.41 |
| | Blended learning | -4.83* | 1.00 | 0.001 |
| E-learning | Face-to-face | -1.35 | 1.00 | 0.41 |
| | Blended learning | -3.48* | 0.96 | 0.002 |
| Blended learning | Face-to-face | 4.83* | 1.00 | 0.001 |
| | E-learning | 3.48* | 0.96 | 0.002 |

As indicated in Table 5, it can be said that by comparing learners' learning scores in Scheffe post-hoc test in face-to-face, e-learning and blended learning it is revealed that learners in the blended learning group significantly learned more than learners in face-to-face and e-learning settings. However, there were no significant differences between learners' learning outcomes in face-to-face learning group and e-learning group.

## Discussion

The present study indicates that blended learning is the most appropriate approach in corporate training. The learner satisfaction scores revealed that the learners in the blended learning group displayed a significantly higher level of satisfaction than face-to-face and e-learning groups. The results are consistent with other studies such as Mosalanejad et al. (14), Motamedi et al. (15), Mohammadi et al. (8), Bailey & Morais (16), Chen, and Jones (17), Pereira et al. (18), Akkoyunlu & Yilmaz-Soylu (19), Sahin (20), Shellton & Parlin (21) and Mwanza-Simwami (22). In fact, several studies have shown that learner satisfaction in blended learning courses is higher than in the courses that apply only face-to-face or e-learning approaches. This is natural since in the blended approach learners' tastes are more closely addressed. In this approach, each person will learn in a particular way according to their learning style and interests. Also, the formal classroom learning environment is largely ignored and learners can access course content at any time and place via their computers. As a result, students are naturally more satisfied with this learning environment than other courses where learning occurs only in the classroom. It can be due to the trainer's feedback or learners' cooperation in the learning process, and additionally, the use of new technologies can be appealing to learners. Therefore, a combination of human trainers and educational technologies can be more attractive to learners than other approaches.

As indicated in the results, in terms of learning output, the scores of the blended learning group were significantly higher than the scores of face-to-face and e-learning groups. The effectiveness of this approach in student learning is due to the adoption of diverse learning resources such as online and computer-based resources as well as classroom and face-to-face interactions to attract learners with different needs. In this regard, Pratt (1) points out that the underlying philosophy in blended learning is that not everyone learns in the same way. Therefore, it seems necessary to use different methods for teaching. Accordingly, learners who take an interest in e-learning and electronic resources such as mobile software are more inclined towards the e-learning dimension of blended learning, and those who are interested in face-to-face learning may instead choose to attend physical classrooms. The diversity of learning methods leads to a marked improvement in the performance of learners in blended learning courses as compared to the other courses like face-to-face learning. Also it can be attributed to the active learning cooperation of learners in learning process, in this approach. They can negotiate, ask questions, and receive feedback from their teachers. On the other hand, they can make use of e-texts and other electronic

products to have a more real and durable experience. As a result, combining traditional training methods and new technologies can enhance the learning outcomes in blended learning instructions as compared to the other approaches. Based on the research findings, it is recommended that instead of using a one-dimensional approach in industrial training, such as face-to-face or e-learning approaches, the blended approach should be embraced.

Research limitations: In the present study, it was not possible to measure any changes in the participants' behavior and the subsequent outcomes. This can be a limitation of the study. Another limitation was the lack of control over the gender and age of the participants.

## Authors' Contribution

In this study, S.M determined the research conceptual framework, as well as the process of writing the manuscript. Z.S implemented the technical aspects including course implementation and data collection, and M.GH conducted the statistical analysis

**Ethical Considerations:** This study was conducted with the consent of the participants. Also all participants were fully aware of the nature and confidentiality of the research and were told that the their information would be kept confidential

**Conflict of Interests**: There is no conflict of interests in this research.

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