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# Transforming Employee Training in Saudi Companies: Using Extended Reality for Enhanced Employee Performance

Sheikha M Alotaibi [1] Othman I Alsalloum [2]

1. Department of Human Resources Management, College of Business Administration, Prince Sattam bin Abdulaziz University, P.O. Box 165, Akharj 11942, Saudi Arabia
2. Department of Information Management Systems, College of Business Administration, King Saud University, P.O. Box 71115, Riyadh 11587, Saudi Arabia

**Abstract**

In today's rapidly evolving professional environment, organizations are increasingly focused on improving employee skills and performance, which are crucial for organizational success. However, traditional training methods often fall short in bridging the gap between theoretical knowledge and practical application. This study investigates the use of Extended Reality (XR) technologies in employee training programs within Saudi companies and examines their impact on employee performance. Data was collected through structured questionnaires from 163 employees and analyzed using SPSS. The findings indicate that while XR technologies are not yet widely adopted, employees perceive them as beneficial for enhancing learning experiences and improving job performance. Employee views on XR's engagement compared to traditional methods are mixed. Technical difficulties are a concern for some, highlighting the need for support.

**Keywords:** Employee Training, Extended Reality, Employee Performance

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## 1. Introduction

In today's dynamic environment, organizations are concerned with ways to improve employee skills and performance since employee performance plays a critical role in organizational success (Siddiqui, 2014). However, traditional training approaches usually struggle to bridge the gap between theoretical and practical training. Extended Reality (XR) includes virtual reality (VR), augmented reality (AR), and mixed reality (MR). XR technologies simulate workplace scenarios, giving risk-free training environments and supporting digital transformation in areas such as production, maintenance, and marketing (Ortega-Gras et al., 2023). Moreover, organizations using XR technologies are likely to enhance both work efficiency and productivity. (Kaplan et al., 2021)

Saudi Arabia is currently at a transformational stage driven by global trends and its ambitious Vision 2030, which seeks to achieve a diversified, sustainable economy that will provide employment opportunities for its population. To this end, the government has been investing heavily in employee training and development programs to prepare its public sector workforce and improve their performance in the new economic dispensation. Reports including the KPMG report for 2020 indicate that Saudi Arabia faces substantial human resource challenges, pointing to a dire need for practical training to align the workforce to changes envisioned in its Vision 2030 (Othayman, Meshari, Mulyata & Debrah, 2020).

This research aims to discover to what extent investigates how Extended Reality (XR) technologies improve employee training in Saudi companies, and clarifies how this impacts employee performance.

## 2. Literature Review

Research has shown that traditional training approaches in the public sector face challenges such as a lack of practical application skills and low engagement, which hinders their effectiveness in imparting the relevant practical skills for improved performance. Research has also pointed to increasing adoption of immersive technologies such as Virtual Reality (VR) and augmented Reality (AR) to facilitate delivery training programs owing to their ability to offer immersive experiences replicating real-world situations, thereby improving skill uptake, knowledge retention, and application. However, the application of these immersive technologies is

mainly witnessed in the professional setups in the private sector, mainly in developed countries (Kaplan, & Jessica, 2020).

Its adoption is even more limited in developing countries due to challenges such as inadequate technological infrastructure and low levels of awareness. This is compounded by a lack of localized studies on the effectiveness of such immersive technologies in the delivery of training. Therefore, this study recommends the adoption of Extended Reality (XR) in the delivery of training to address the limitations of the traditional training approaches and increase skill uptake and application in the dynamic public service, particularly Saudi governance envisioned in the Saudi Vision 2030 (Othayman et al., 2020).

Extended Reality (XR) is an umbrella term comprising a collection of immersive technologies including Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) that integrate digital elements into the physical environment, creating virtual environments. The conceptualization of XR revolves around the virtuality continuum, whereby in Virtual Reality, the observer is immersed in a synthetic, digitally simulated world, while in Augmented Reality, the real environment is augmented with virtual objects that have been digitally produced or a fully virtual created environment is augmented with aspects from the real environment Therefore, AR supplements the real environment rather than replacing it completely. Mixed Reality (MR) is achieved by combining elements of VR and AR (Vasarainen, Paavola & Vetoshkina, 2021).

It is evident that the usage as well as referential relationships of these immersive technologies is overlapping and continues to evolve with the advancement and application of technology (Kaplan, & Jessica, 2020). A review of the literature regarding the capabilities and application of XR identifies two central features of XR i.e. immersion and interactivity. Immersion refers to the sensation of being in an environment or space usually achieved through mental or physical state by the use of technology (Sherman and Craig, 2019). As Vasarainen et al. (2021) note, the immersive experience is usually close to that of real presence. Interactivity refers to the interaction of the user with the medium, it also refers to the interaction of various users facilitated by a medium. Quite often, it speaks to the navigational capabilities offered by the medium (Berg and Vance, 2017).

XR has emerged as an effective way of delivering employee training in various fields. These immersive technologies facilitate employee training in different ways. For instance, VR training is done using a headset and controllers enabling trainees to be fully immersed in a computer-generated 3D environment that builds the required simulations in real-time (Xie et al., 2021). Virtual Reality enables users to interact with the virtual environment as they could in the natural environment helping trainees to learn most practically. As Lindner et al. (2019) note, the immersive experiences generated in VR help to improve the engagement of the trainees and help them to apply the skills they learn in real-life situations.

Various studies have been undertaken to assess the effectiveness of VR training. For instance, a study involving medical trainees found that incorporating immersive VR technologies, Mao et al. (2021) established that the use of VR improves the accuracy, procedural times as well as task completion of the medical trainees. The study established that the trainees that used VR were up to 43% better than the control group that did not use VR. In another study, Howard, Gutworth, and Jacobs (2021) found that training programs that incorporate VR produce better outcomes than the other options.

A recent study by Jordan, Singh, and Stumpf (2024) proposed a structured taxonomy for evaluating the effectiveness of Virtual Reality (VR) training in industrial environments. The taxonomy categorizes VR outcomes across three core dimensions: learning effectiveness, usability and user experience, and organizational impact. Their findings underscore that VR-based training programs enhance knowledge retention, procedural performance, and worker engagement. This structured framework aligns with the present study's emphasis on not only introducing XR tools but also assessing their practical impact in measurable ways.

Using AR and MR in training involves utilizing these technologies to complement and improve the training experience. The use of MR and AR allows employees to observe the instructions in detail, allowing them to ask questions, make suggestions, etc. Studies on the effectiveness of MR in training have shown greater effectiveness in skill acquisition and knowledge retention compared to training in virtual environments without AR (Eldokhny & Drwish 2021).

Generally, research has shown that XR technologies are increasingly being used in the delivery of training owing to their immersive and interactive capabilities that allow for realistic simulations, which in turn enable employees to acquire practical skills in a controlled environment (Zwoliński et al., 2022). Studies also indicate that the deployment of XR technologies improves employee engagement, which enhances both training outcomes and employee performance (Yu et al., 2021).

## 3. Methodology

### 3.1 Research design

This study employs a quantitative research approach to examine employee perceptions of Extended Reality (XR) technologies in training programs within Saudi companies (Saudi employees in Riyadh). Data were collected through structured questionnaire using a survey instrument with Likert-type scale questions. The survey was designed to assess various aspects of XR adoption, including its perceived benefits, engagement levels, potential technical challenges, and its impact on job performance. The study targeted experienced employees actively involved in training processes, ensuring insights were drawn from individuals with relevant expertise.

A total of 163 employees participated in the study, providing diverse perspectives based on their demographic and professional backgrounds. The collected data were analysed using SPSS, where reliability analysis (Cronbach's alpha) was conducted to ensure consistency in responses. Descriptive statistics, frequency distributions, and inferential analyses were applied to address the research questions. The findings offer empirical insights into the current state of XR training adoption and employee attitudes, aiding organizations in understanding potential barriers and opportunities for implementing XR technologies in workplace training.

### 3.2 Research Objectives and questions

1. To assess the extent of Extended Reality (XR) technologies within employee training programs in Saudi companies.
2. To investigate the extent to which Extended Reality (XR) technologies improve employee training in Saudi companies.
3. To propose a solution for addressing training issues and enhancing the training process using XR.
4. To clarify the impact of XR-based training on employee performance.

Following are the research questions that align with each of the above research objectives.

1. To what extent are XR technologies (VR, AR, MR) currently utilized in employee training programs in Saudi companies?
2. Do employees perceive XR-based training as more engaging than traditional methods?

3. To what extent Employees are concerned about potential technical difficulties with XR equipment.

4. Does XR-based training improve perceived job performance?

### 3.3 Ethical considerations

This study adhered to ethical research principles to ensure the rights and privacy of participants were protected. Participation in the survey was entirely voluntary, and respondents were informed about the purpose of the research before providing their responses. Informed consent was obtained, ensuring that participants understood their rights, including their ability to withdraw at any time without consequences. No personally identifiable information was collected, maintaining confidentiality and anonymity throughout the study. Additionally, the data was handled with strict confidentiality and used solely for academic purposes. The study followed ethical guidelines by ensuring that responses were reported in aggregate form to prevent the identification of individual participants. Furthermore, the research complied with ethical standards related to survey-based studies, avoiding any potential risks or harm to participants. The study was conducted in accordance with institutional research ethics protocols and adhered to relevant ethical guidelines applicable to social science research.

## 4. Results and Analysis

4.1 Cronbach alpha of data

Cronbach's alpha is used for calculating reliability coefficients for survey instruments that use Likert-type response sets. Cronbach's alpha coefficient ranges from 0 to 1.0 with higher values denoting increased reliability. The criterion for an acceptable Cronbach's alpha coefficient is debated in the literature, but to be conservative, any alpha coefficient below .75 is a cause for concern.

Table 1: Reliability Statistics

| Cronbach's Alpha | N of Items |
|---|---|
| .912 | 10 |

Since the value of Cronbach alpha is 0.912 which is close to the 1. It shows that the conducted survey is reliable and the questionnaires related to Extended Reality (XR) technologies have been collected by respondents by keeping reliable standards of Likert type responses.

Item Statistics:
Following table shows the Descriptive statistics of the Likert scale questions.

Table 2: Item Statistics

| Items | Mean | Std. Deviation | N |
|---|---|---|---|
| 1. To what extent has your organization utilized Extended Reality (XR) technologies (VR, AR, MR) in employee training programs? | 2.15 | .995 | 163 |
| 2. I believe XR technologies could offer unique learning experiences compared to traditional methods. | 4.12 | .899 | 163 |
| 3. I believe XR-based training would be more engaging than traditional training methods. | 3.24 | 1.076 | 163 |
| 4. I believe XR training could reduce the need for costly and time-consuming in-person training sessions. | 4.26 | .815 | 163 |
| 5. I am concerned about potential technical difficulties with XR equipment. | 3.64 | 1.251 | 163 |
| 6. I believe adequate technical support is crucial for successful XR training implementation. | 4.12 | .827 | 163 |
| 7. I believe XR training could positively impact my job performance. | 3.99 | .899 | 163 |
| 8. I believe XR training could make me more efficient and productive in my role. | 3.88 | .901 | 163 |
| 9. I believe XR training could contribute to my professional growth and advancement within the organization. | 3.64 | .894 | 163 |
| 10. I am confident that I can successfully integrate the knowledge and skills gained through XR training into my daily work. | 3.49 | .856 | 163 |

The results indicate that the use of Extended Reality (XR) technologies in employee training programs is currently limited, as shown by a low mean score (2.15) on the extent of XR utilization. However, employees strongly believe in the potential benefits of XR, with high agreement that it can provide unique learning experiences (M = 4.12) and reduce costly in-person training (M = 4.26). There is moderate agreement that XR-based training would be more engaging than traditional methods (M = 3.24), and employees acknowledge its potential to improve job performance (M = 3.99) and efficiency (M = 3.88). Concerns about technical difficulties (M = 3.64) suggest that implementation challenges exist, reinforcing the importance of technical support (M = 4.12). While employees see XR training as beneficial for professional growth (M = 3.64) and skill application (M = 3.49), the variation in responses (indicated by standard deviations) suggests differing levels of confidence and experience with XR.

4.2 Demographic Characteristics:

Following frequency distribution table shows the demographic characteristic of the survey participants.

Table 3: Demographic Characteristics

| Variable | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| Gender | | | | |
| Male | 61 | 37.4 | 37.4 | 37.4 |
| Female | 102 | 62.6 | 62.6 | 100.0 |
| Age | | | | |
| 22 - 28 Years | 44 | 27.0 | 27.0 | 27.0 |
| 29 - 35 Years | 51 | 31.3 | 31.3 | 58.3 |
| 36 - 42 Years | 44 | 27.0 | 27.0 | 85.3 |
| 43 - 49 Years | 24 | 14.7 | 14.7 | 100.0 |
| Years of Experience | | | | |
| Less than a Year | 16 | 9.8 | 9.8 | 9.8 |
| 1 - 3 Years | 27 | 16.6 | 16.6 | 26.4 |
| 4 - 7 Years | 52 | 31.9 | 31.9 | 58.3 |
| 8 - 10 Years | 36 | 22.1 | 22.1 | 80.4 |
| 10+ Years | 32 | 19.6 | 19.6 | 100.0 |

The demographic analysis of the participants reveals a diverse group in terms of gender, age, and work experience. The majority of respondents are female (62.6%), while males make up 37.4% of the sample. In terms of age, most participants fall within the 29–35 years (31.3%) and 22–28 years (27.0%) age groups, indicating a relatively young workforce. A similar proportion (27.0%) belongs to the 36–42 years category, while a smaller group (14.7%) is aged 43–49 years.

Regarding work experience, the largest segment (31.9%) has 4–7 years of experience, followed by 22.1% with 8–10 years, and 19.6% with over 10 years in the workforce. Fewer participants (16.6%) have 1–3 years of experience, and only 9.8% have worked for less than a year. These findings suggest that the majority of participants have moderate to extensive experience, which may influence their perspectives on XR training adoption.

4.3 Testing the research questions

RQ1: To what extent are XR technologies (VR, AR, MR) currently utilized in employee training programs in Saudi companies?

The frequency distributions on the responses to the survey question, "To what extent has your organization utilized XR technologies in training?" are obtained to answer this research question.

Following are the results of the analysis.

Table 4: To what extent has your organization utilized Extended Reality (XR) technologies (VR, AR, MR) in employee training programs?

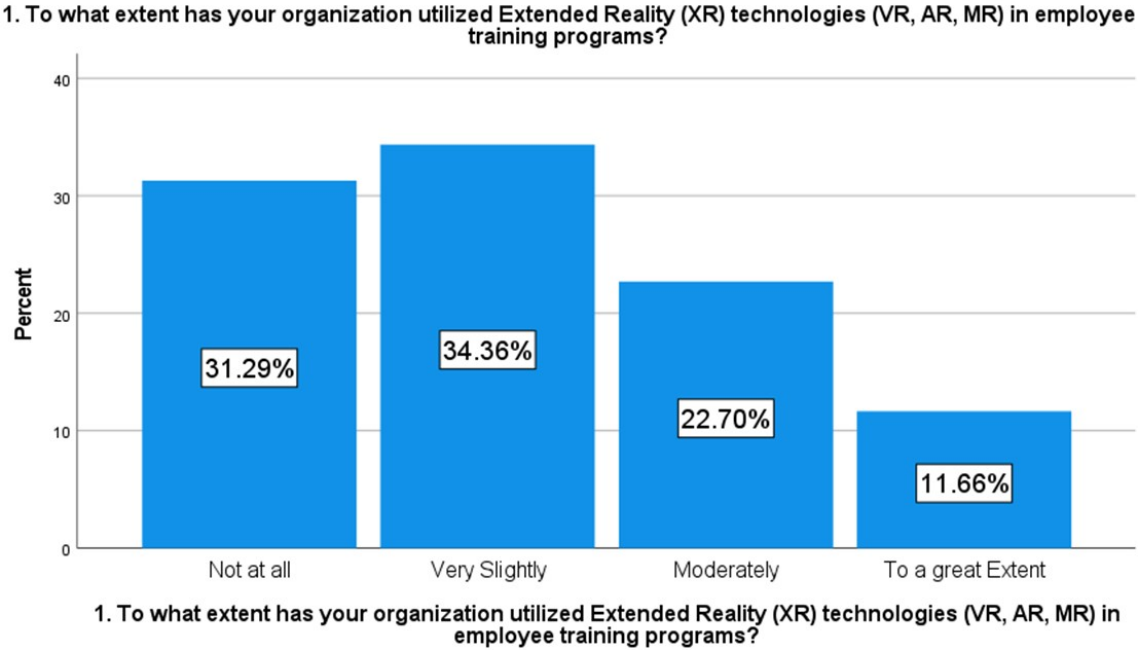
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Not at all | 51 | 31.3 | 31.3 | 31.3 |
| | Very Slightly | 56 | 34.4 | 34.4 | 65.6 |
| | Moderately | 37 | 22.7 | 22.7 | 88.3 |
| | To a great Extent | 19 | 11.7 | 11.7 | 100.0 |
| | Total | 163 | 100.0 | 100.0 | |

The results show that the adoption of Extended Reality (XR) technologies in employee training programs within Saudi companies remains relatively low. A significant portion of respondents (31.3%) reported that XR is not used at all in their organizations, while an additional 34.4% indicated that it is used very slightly. This means that over 65% of respondents work in companies where XR technologies have little to no presence in training programs. Only 22.7% stated that XR is used moderately, and a small proportion (11.7%) reported that their organizations use XR to a great extent. These findings suggest that while XR has the potential to enhance training, its implementation is still in the early stages, with most companies yet to adopt it extensively.

Following figure shows the bar chart of the participants' responses.

Figure 1: Bar chart for the utilized XR technologies




RQ2: Do employees perceive XR-based training as more engaging than traditional methods?

The frequency distributions on the responses to the survey question, "I believe XR-based training would be more engaging than traditional training methods" are obtained to answer this research question.
Following are the results of the analysis.

Table 5: I believe XR-based training would be more engaging than traditional training methods.

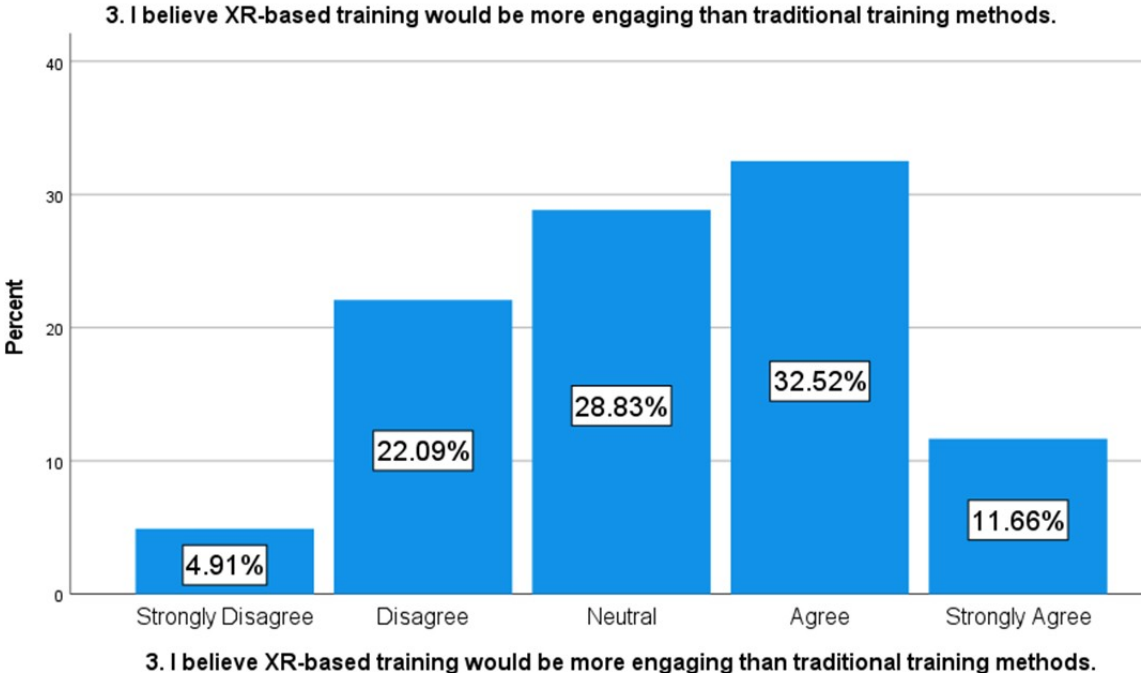
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Strongly Disagree | 8 | 4.9 | 4.9 | 4.9 |
| | Disagree | 36 | 22.1 | 22.1 | 27.0 |
| | Neutral | 47 | 28.8 | 28.8 | 55.8 |
| | Agree | 53 | 32.5 | 32.5 | 88.3 |
| | Strongly Agree | 19 | 11.7 | 11.7 | 100.0 |
| | Total | 163 | 100.0 | 100.0 | |

The results indicate that employee perceptions of XR-based training being more engaging than traditional methods are mixed, with a slight tendency toward agreement. While 44.2% of respondents (Agree: 32.5%, Strongly Agree: 11.7%) believe XR-based training would be more engaging, a notable 28.8% remain neutral, suggesting uncertainty or a lack of experience with XR technologies. On the other hand, 27% (Disagree: 22.1%, Strongly Disagree: 4.9%) do not find XR training more engaging than traditional methods.
These findings suggest that while many employees see potential in XR training, a significant portion remains either unconvinced or unsure. Organizations may need to provide more exposure to XR training or address concerns to improve employee confidence in its effectiveness.

Following figure shows the bar chart of the participants' responses.

Figure 2: Bar chart for the XR-based training to be more engaging.




RQ3: To what extent Employees are concerned about potential technical difficulties with XR equipment.

The frequency distributions on the responses to the survey question, " I am concerned about potential technical difficulties with XR equipment." are obtained to answer this research question.

Following are the results of the analysis.

Table 6: I am concerned about potential technical difficulties with XR equipment.

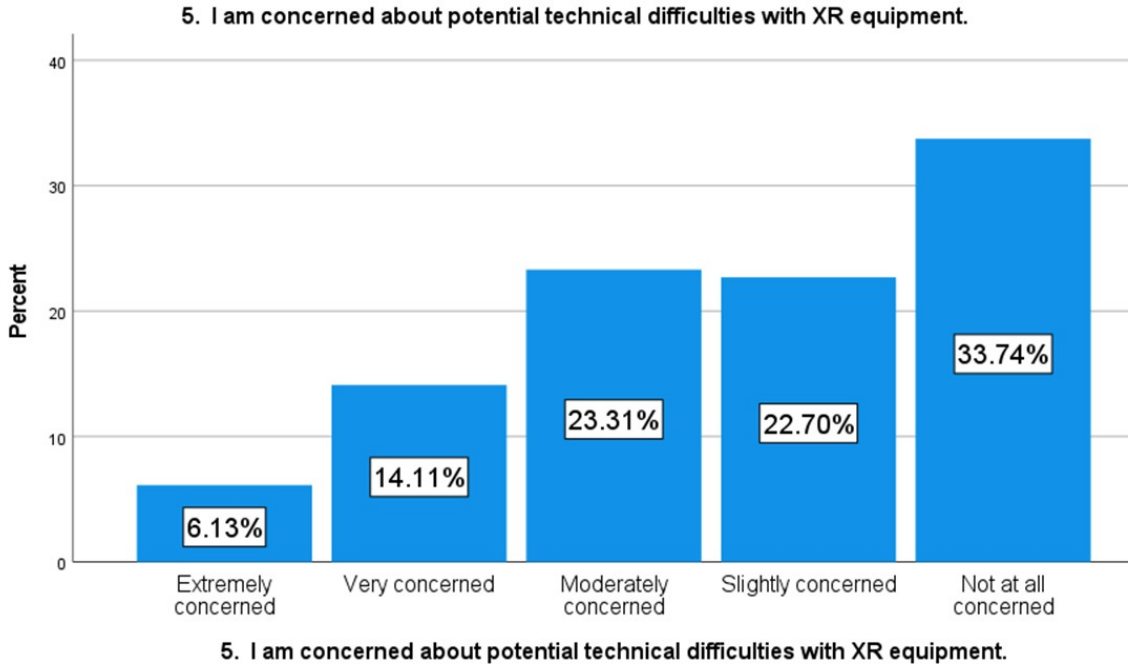
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Extremely concerned | 10 | 6.1 | 6.1 | 6.1 |
| | Very concerned | 23 | 14.1 | 14.1 | 20.2 |
| | Moderately concerned | 38 | 23.3 | 23.3 | 43.6 |
| | Slightly concerned | 37 | 22.7 | 22.7 | 66.3 |
| | Not at all concerned | 55 | 33.7 | 33.7 | 100.0 |
| | Total | 163 | 100.0 | 100.0 | |

The results indicate that employee concerns about potential technical difficulties with XR equipment vary. While 43.5% of respondents (Extremely concerned: 6.1%, Very concerned: 14.1%, Moderately concerned: 23.3%) express a moderate to high level of concern, a similar proportion (22.7%) are slightly concerned. However, the largest group (33.7%) is not at all concerned, indicating that many employees do not see technical issues as a major challenge.

Overall, while some employees are worried about potential technical difficulties, a substantial number either have minimal concerns or feel confident in handling XR technology. This suggests that organizations implementing XR training should provide adequate technical support and user training to address concerns and ensure smooth adoption.

Figure 3: Employees' Concern about difficulties




Q4: To what extent employees believe that XR training could positively impact their job performance.

The frequency distributions on the responses to the survey question, "I believe XR training could positively impact my job performance." are obtained to answer this research question.

Following are the results of the analysis.

Table 7: I believe XR training could positively impact my job performance.

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Strongly Disagree | 3 | 1.8 | 1.8 | 1.8 |
| | Disagree | 7 | 4.3 | 4.3 | 6.1 |
| | Neutral | 27 | 16.6 | 16.6 | 22.7 |
| | Agree | 77 | 47.2 | 47.2 | 69.9 |
| | Strongly Agree | 49 | 30.1 | 30.1 | 100.0 |
| | Total | 163 | 100.0 | 100.0 | |

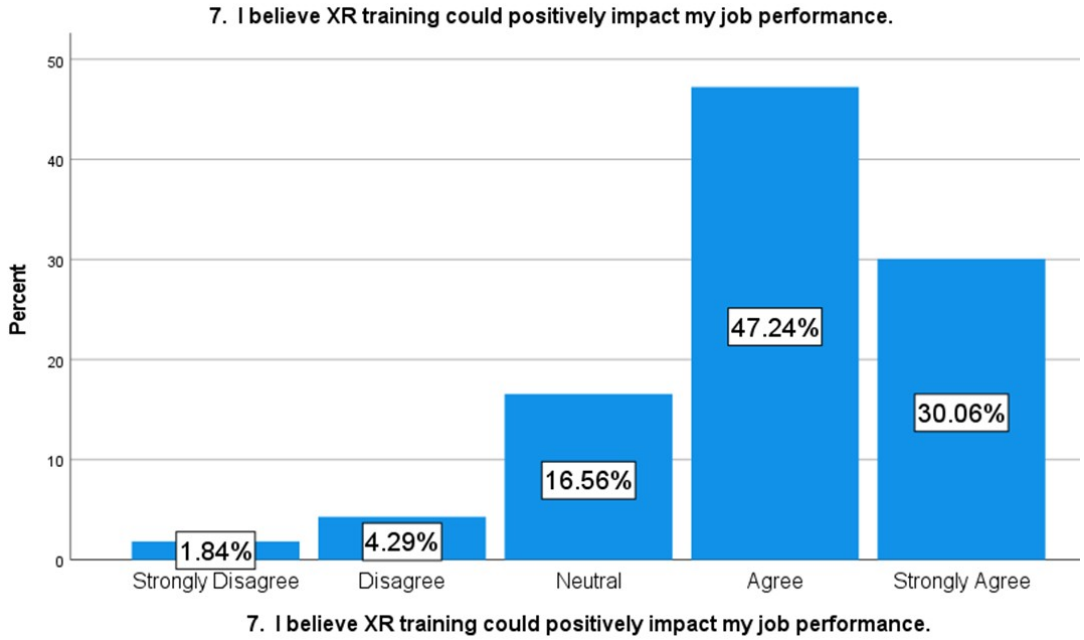
The results show that the majority of employees believe XR training could positively impact their job performance. Nearly 77.3% of respondents (Agree: 47.2%, Strongly Agree: 30.1%) express a positive outlook on the effectiveness of XR training in enhancing job performance. A smaller group (16.6%) remains neutral, while only 6.1% (Disagree: 4.3%, Strongly Disagree: 1.8%) do not believe XR training would improve their performance.

These findings suggest that employees are generally optimistic about the potential benefits of XR-based training. Organizations looking to implement XR training can leverage this positive perception to drive adoption and engagement, ensuring that training programs align with employee expectations and job performance goals.

Following figure shows the bar chart of the participants' responses.

Figure 2: XR-based impact on employees' performance




**5. Discussion**

The findings of this study are consistent with Alnajdi's (2023) research, which demonstrated that integrating AR into training environments led to significant improvements in trainee performance and satisfaction. While our study confirms that XR technologies are still in early adoption stages in Saudi companies, Alnajdi's work presents concrete evidence of AR's effectiveness in a real-world Saudi training context. This suggests that barriers to adoption are more likely due to infrastructure and awareness rather than technology efficacy. His findings also underline the motivational impact immersive technologies can have when implemented thoughtfully, reinforcing the importance of user-centered design and support.

This study explored the extent to which Extended Reality (XR) technologies are utilized in employee training programs in Riyadh (Saudi Arabia) and examined employees' perceptions of their effectiveness. The findings revealed that XR adoption in training is still in its early stages, with the majority of participants reporting little to no use of XR in their organizations. However, employees expressed strong agreement on the potential benefits of XR, particularly in enhancing learning experiences and reducing the need for costly in-person training. These results align with previous research indicating that while emerging technologies hold promise, widespread implementation often faces barriers such as technical challenges and organizational readiness.

Employee perceptions of XR-based training were mixed, with many agreeing that XR can improve engagement compared to traditional methods, but a significant portion remaining neutral. This suggests that while XR technologies have the potential to enhance training, employees may need more exposure and hands-on experience to fully appreciate their benefits. Additionally, concerns regarding technical difficulties highlight the importance of adequate technical support in ensuring a smooth transition to XR-based training. Despite these concerns, employees generally believed that XR training could improve job performance and efficiency, indicating a positive outlook on its future role in workplace learning. Organizations looking to adopt XR in training should focus on addressing technical challenges, providing proper support, and gradually integrating the technology to enhance employee confidence and acceptance.

5.1 Recommendations

To enhance the adoption of XR technologies in employee training, organizations should focus on increasing awareness and providing hands-on experience with these tools. Offering pilot programs, training workshops, and technical support can help employees become more comfortable with XR-based learning. Addressing concerns about technical difficulties by ensuring reliable infrastructure and IT support will also be crucial for successful implementation. Additionally, organizations should tailor training approaches to different employee groups, considering factors like work experience and familiarity with technology.

## 6. Conclusion

This study provides valuable insights into the current state of XR adoption in employee training programs in Saudi Arabia. The findings indicate that while XR technologies are not widely utilized, employees recognize their potential to enhance training effectiveness and job performance. However, concerns about technical difficulties and limited engagement highlight the need for strategic implementation, technical support, and increased awareness to ensure successful adoption.

The study underscores the importance of preparing organizations and employees for technological advancements in training. Companies should focus on structured implementation strategies, invest in technical infrastructure, and provide employees with adequate training on XR tools. Future research could explore industry-specific challenges and best practices for integrating XR into corporate training programs. By addressing these areas, organizations can maximize the benefits of XR technologies and create more effective, engaging, and future-ready learning environments.

Future research should explore the long-term impact of XR training on employee performance and skill development. Studies could also examine the cost-effectiveness of XR training compared to traditional methods and identify best practices for implementation. Further investigation into employee resistance to XR adoption and strategies to overcome these challenges would provide valuable insights for organizations looking to integrate XR technologies into their training programs.

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