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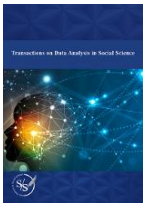

The Effect of E-Learning on Farmers' Attitudes Toward Alternative Crops

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ABSTRACT

This study was conducted in 2022–2023 in Nazarabad village, Alborz Province, to examine the effect of e-learning on farmers' attitudes toward adopting alternative crops. The statistical population included all farmers residing in provinces suitable for saffron cultivation. Using purposive cluster sampling, 60 farmers from rural areas of Nazarabad County were selected and invited to participate in the training program. Participants were randomly assigned to three groups of 20 each (n = 20): Experimental Group 1 (instruction through educational videos), Experimental Group 2 (web-based instruction), and a control group (traditional training). The research followed a quasi-experimental design using pre-test and post-test with two experimental groups and one control group. The inclusion of two experimental groups allowed for comparison between video-based and web-based training methods. To ensure content validity, the questionnaire was reviewed by faculty members from the Universities of Tehran, Isfahan, and Kharazmi. Reliability was confirmed using Cronbach's alpha (α = 0.74). Data analysis included descriptive statistics (mean, frequency, percentage) and inferential analysis using the Mann–Whitney U test to examine hypotheses across the three types of attitudes. Findings indicated that web-based training significantly enhanced farmers' knowledge and information, whereas video-based training had a stronger influence on their affective beliefs. Moreover, both methods had nearly equal effects in motivating farmers to adopt saffron cultivation as an alternative to water-intensive crops.

1. INTRODUCTION

The agricultural sector is undergoing significant transformations due to technological advancements, with e-learning emerging as a powerful tool to enhance knowledge dissemination and influence farmers' decision-making processes [1]. E-learning, defined as the delivery of educational content through digital platforms, offers farmers

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access to flexible, cost-effective, and scalable training opportunities, particularly in rural and resource-constrained areas [2]. As global agricultural systems face challenges such as climate change, market volatility, and the need for sustainable practices, farmers are increasingly encouraged to adopt alternative crops non-traditional or underutilized crops that can enhance resilience, diversify income, and improve soil health [3]. However, farmers' attitudes toward adopting these crops are often shaped by their knowledge, access to information, and perceived risks, which e-learning can address by providing targeted education [4].

The adoption of alternative crops, such as quinoa, amaranth, or cover crops, is critical for sustainable agriculture, as these crops can mitigate environmental degradation and improve food security [5]. Traditional extension services, while effective in some contexts, often face limitations in reach, frequency, and adaptability to farmers' specific needs [6]. E-learning platforms overcome these barriers by offering accessible, on-demand content that can be tailored to local agricultural challenges and include multimedia resources to enhance engagement [7]. Studies have shown that e-learning can positively influence farmers' attitudes by increasing their awareness of innovative practices and reducing resistance to change [8]. For instance, a study by Mishra et al. (2018) found that digital training programs significantly improved farmers' willingness to adopt sustainable farming techniques in India [9].

Despite its potential, the impact of e-learning on farmers' attitudes toward alternative crops remains underexplored, particularly in developing countries where digital literacy and internet access may pose challenges [10]. Factors such as user-friendly platform design, content relevance, and cultural appropriateness are critical to the success of e-learning interventions [11]. Furthermore, understanding how e-learning influences psychological factors, such as perceived self-efficacy and risk perception, is essential for designing effective programs that encourage the adoption of alternative crops [12]. This study aims to investigate the effect of e-learning on farmers' attitudes toward alternative crops, assessing whether digital training can foster positive behavioral changes and promote sustainable agricultural practices.

2. STATEMENT OF THE PROBLEM

In order to shift the perspective of farmers in Alborz Province toward increasing their willingness and practical engagement in saffron cultivation which not only aligns well with the region's climate but can also contribute to greater export potential worldwide and simultaneously improve the welfare and economic status of farmers it is necessary to provide targeted training through the use of modern technologies in the field of e-learning. Accordingly, there is a clear need to identify the most effective instructional approach, an issue examined in the present study.

Given the widespread access to the internet in contemporary society and the abundance of websites dedicated to saffron, web-based education can serve as a valuable tool for agricultural extension specialists in promoting saffron cultivation. Nevertheless, the role of educational videos should not be underestimated, as they facilitate group learning and can be beneficial for the broader community of farmers with diverse characteristics.

This research therefore investigates the impact of these two instructional approaches web-based training and educational videos in comparison with traditional methods within Alborz Province, with an emphasis on their effectiveness in altering farmers' attitudes toward adopting saffron as an alternative crop.

3. LITERATURE REVIEW

Based on the conducted reviews and the examination of previous studies, it was found that a substantial body of research has been carried out on information and communication technology (ICT) and its applications across various fields. However, to date, no study has specifically addressed the impact of e-learning programs on farmers, particularly in terms of changing their attitudes toward adopting alternative crops and promoting sustainable agriculture, either in Iran or internationally. Therefore, in this section, several studies most relevant to the present research are reviewed and categorized by topic:

Experts' Perspectives on the Design and Implementation of Web-Based Agricultural Extension Services in Iran [13]. The results of factor analysis indicated that designers and planners of agricultural service websites should pay attention to aspects such as "user-centeredness and interactivity," "accessibility and content transparency," "flexibility to adjust structure according to audience needs," "content accuracy and timeliness," "uniqueness of

content," and "content comprehensiveness." Furthermore, the activities of agricultural service websites should cover six dimensions: "providing banking facilities and interactive services," "offering comprehensive and specialized services," "online marketing and introduction of exemplary farmers and villages," "providing extension and information services," "creating social networks," and "presenting successful models and addressing farmers' needs."

Farmers' Attitudes in Gachsaran County Toward the Formation of Water Cooperatives [14]. In this study, 48.4% of farmers held a positive attitude, while 51.6% exhibited a negative attitude toward membership in water cooperatives. Correlation analysis showed no statistically significant relationship between farmers' awareness of cooperative principles, the size of their agricultural land, age, or educational level and their attitude toward water cooperatives. However, the number of land plots, farming experience, and family size were positively and significantly associated with attitudes toward water cooperatives.

Farmers' Attitudes Toward Modern Agricultural Practices: A Study in Mehriz and Khatam Counties [15]. This study found that the use of specialized publications and attention to the recommendations of agricultural extension agents and experts had the strongest positive correlation with farmers' attitudes toward modern agricultural practices, whereas 29% of farmers held negative attitudes. Variables such as attention to extension agents' recommendations, willingness to support children's continued education, use of new agricultural technologies, engagement with specialized agricultural publications, participation in extension and training programs, family involvement in household and farming decisions, and age were significant predictors, collectively explaining 44% of the variance in farmers' attitudes toward modern agricultural teachings.

Factors Affecting Wheat Farmers' Attitudes Toward Wheat Waste Management: A Case Study of Hashtgerd Farmers [16]. The results indicated that farmers' attitudes toward reducing wheat waste were significantly associated with age, cultivated area, distance from service centers, and participation in extension training programs related to wheat.

E-learning platforms provide farmers with access to critical educational resources, which can enhance their understanding of alternative crops. Chavas and Nauges (2020) emphasize the role of uncertainty and learning in technology adoption within agriculture, suggesting that e-learning can effectively reduce uncertainties faced by farmers regarding new practices. By delivering targeted educational content, e-learning can address farmers' questions and concerns, fostering a more positive attitude toward alternative crops [17].

Additionally, the integration of machine learning into agriculture highlights the potential for e-learning to disseminate knowledge about innovative technologies. Elbasi et al. (2023) discuss how machine learning algorithms can optimize crop production, presenting a compelling case for farmers to consider alternative crops [18]. E-learning can bridge the knowledge gap, allowing farmers to understand and utilize these technologies effectively, which may positively influence their attitudes towards alternative cultivation methods.

The concept of climate-smart agriculture (CSA) is increasingly relevant as farmers face the impacts of climate change. Nyasimi et al. (2017) identify the importance of educational programs in promoting CSA practices, which often include alternative crops that can better withstand climate variability [19]. E-learning can serve as a vital tool in this context, enabling farmers to access information about CSA practices and the benefits of alternative crops. By enhancing farmers' knowledge and skills through e-learning, there is a greater likelihood of improved agricultural resilience and sustainability.

Understanding farmers' perceptions is critical for promoting the adoption of alternative crops. Paulrud and Laitila (2010) highlight that farmers' attitudes toward energy crops are influenced by various factors, including perceived usefulness and ease of use [20]. This aligns with the Technology Acceptance Model (TAM), which Jimenez et al. (2020) apply to e-learning in agriculture. Their findings suggest that tailoring e-learning platforms to address farmers' specific needs can significantly enhance their acceptance of alternative crops. By focusing on perceived value and usability, e-learning initiatives can foster positive attitudes towards new agricultural practices [21].

Moreover, the extended model of TAM indicates that social influences and peer feedback play a crucial role in technology acceptance. Positive experiences shared among farmers can enhance the perceived benefits of e-learning, further encouraging the adoption of alternative crops (Jimenez et al., 2020). This suggests that e-learning platforms

should foster community engagement, allowing farmers to share successes and challenges related to alternative crop adoption.

The motivations and barriers to e-learning usage are also essential considerations. Rezk et al. (2020) highlight that engaging and relevant content can motivate farmers to explore new practices, including alternative crops. Understanding the challenges farmers face in self-directed learning can help design supportive e-learning environments that encourage exploration and adoption [22]. Addressing these motivational factors can lead to a significant shift in farmers' attitudes towards alternative crops.

Despite the promising findings, several knowledge gaps remain in the literature. First, there is limited research focusing specifically on the long-term effects of e-learning on farmers' attitudes towards alternative crops. Future studies could investigate how sustained engagement with e-learning platforms influences not only immediate attitudes but also long-term adoption rates.

Second, the role of socio-economic factors in shaping farmers' responses to e-learning interventions is underexplored. Research could delve into how different demographics, such as age, education level, and economic status, affect the effectiveness of e-learning in promoting alternative crop adoption.

Finally, there is a need for more research on the integration of e-learning with traditional agricultural practices. Understanding how e-learning can complement existing methods may provide insights into enhancing overall adoption rates of alternative crops.

This literature review underscores the potential of e-learning to positively influence farmers' attitudes towards alternative crops. By addressing uncertainties, providing relevant educational content, and fostering community engagement, e-learning can serve as an effective tool for promoting agricultural innovation. However, further research is necessary to fully understand the long-term impacts and socio-economic factors that influence this relationship, paving the way for more effective e-learning strategies in agriculture.

4. RESEARCH METHOD

Social phenomena are inherently complex and multidimensional. To address this complexity, research methods must also be diverse and carefully adapted to the characteristics of the phenomenon under study. The validity and effectiveness of any research depend largely on the appropriateness of its methodology. While multiple research approaches exist, each contributes to the discovery of scientific principles to some degree. In the social and behavioral sciences in particular, selecting suitable methods and applying them with precision is especially critical.

For the purposes of this study, purposive cluster sampling was employed to select 60 farmers from villages in Nazarabad County, who were then invited to participate in the training program. Ultimately, participants were divided into three groups of 20 (n = 20) as follows:

- **Experimental Group 1:** Training through educational videos
- **Experimental Group 2:** Web-based training
- **Control Group:** Traditional instruction (no intervention)

After group allocation, all participants attended an introductory session, during which a pre-test was administered to all three groups. Subsequently, members of Experimental Group 1 received DVDs containing educational videos, while Experimental Group 2 was provided with a list of websites selected by the researchers. The control group did not receive any form of training.

Three months later, a post-test was conducted with all participants, during which the required data were collected. The three-month interval was chosen deliberately to ensure that the saffron planting season had passed, thereby allowing the researchers to assess performance outcomes an important component of farmers’ attitudes toward cultivation.

This study employed a quasi-experimental design using a pre-test and post-test with two experimental groups and one control group.

Table 1. Pre-test/Post-test Design with Two Experimental Groups

Study Group	Number	Pre-test	Independent Variable	Post-test
Experimental Group 1	20	T2	X (Video-based training)	T1
Experimental Group 2	20	T2	Y (Web-based training)	T1
Control Group	20	T2	(No intervention)	T1

The rationale for including two experimental groups was to compare the effectiveness of video-based training with that of web-based training. The statistical population consisted of all farmers in provinces where saffron cultivation is feasible. The final sample included 60 farmers, divided into three groups of 20 each. Sampling was carried out using purposive cluster sampling, selecting farmers from Nazarabad County who were then randomly assigned to the groups.

Data required for this study were collected through both fieldwork and documentary research. Initially, documentary methods were employed to review books, theses, articles, prior research in the field, as well as databases and relevant websites. In the next phase, data were gathered from the target population using a researcher-designed questionnaire.

To establish content validity, the questionnaire was developed based on a review of related literature and then evaluated by subject-matter experts. Following expert feedback and revisions, the instrument was finalized. To ensure reliability, 30 finalized questionnaires were administered as a pilot study to farmers in Isfahan a population comparable to the main sample from Nazarabad. The completed questionnaires were collected and analyzed; several items were revised, merged, or eliminated. Using SPSSwin22, Cronbach's alpha coefficients were calculated, yielding a reliability score of 0.74 across the different sections of the questionnaire, indicating an acceptable level of internal consistency for data collection.

Table 2. Cronbach's Alpha Coefficient

Variable	Cronbach's Alpha
Knowledge and information about saffron cultivation	0.75
Affective beliefs regarding saffron cultivation	0.73
Behavioral intention toward saffron cultivation	0.76

Cronbach's Alpha coefficient is interpreted as follows: ≥ 0.9 = Excellent, ≥ 0.8 = Good, ≥ 0.7 = Acceptable, ≥ 0.6 = Questionable, ≥ 0.5 = Poor, and < 0.5 = Unacceptable.

5. FINDINGS AND DISCUSSION

Data analysis is regarded as one of the core components of scientific research methodology. In this chapter, data are analyzed in two sections: descriptive statistics and inferential statistics. The descriptive section provides an overview of the sample population. Given the violation of assumptions required for parametric tests, such as the normal distribution of scores, the non-parametric Mann–Whitney U test was employed to examine the research questions.

5.1. Descriptive Data

To investigate the role of e-learning in changing the attitudes of participants, the following steps were undertaken:

- Separate comparisons of pre-test and post-test results on the **knowledge scale** for both experimental groups versus the control group.
- Separate comparisons of pre-test and post-test results on the **affective beliefs scale** for both experimental groups versus the control group.
- Separate comparisons of pre-test and post-test results on the **behavioral intention scale** for both experimental groups versus the control group.
- Comparisons of pre-test and post-test scores within both experimental groups, using the Mann–Whitney U test, to determine the magnitude of differences across all three attitude dimensions.

Table 3. Mean and Standard Deviation of Pre-test and Post-test Scores on the Knowledge and Information Scale Regarding Saffron Cultivation Across the Three Groups

	Group	N	Pre-test Mean	Pre-test SD	N	Post-test Mean	Post-test SD
Variable: Knowledge and Information	Experimental (1)	20	11.360	15.01	20	373.88	14.06
	Experimental (2)	20	11.329	25.14	20	362.88	21.25
	Control	20	333.66	25.20	20	332.66	25.15

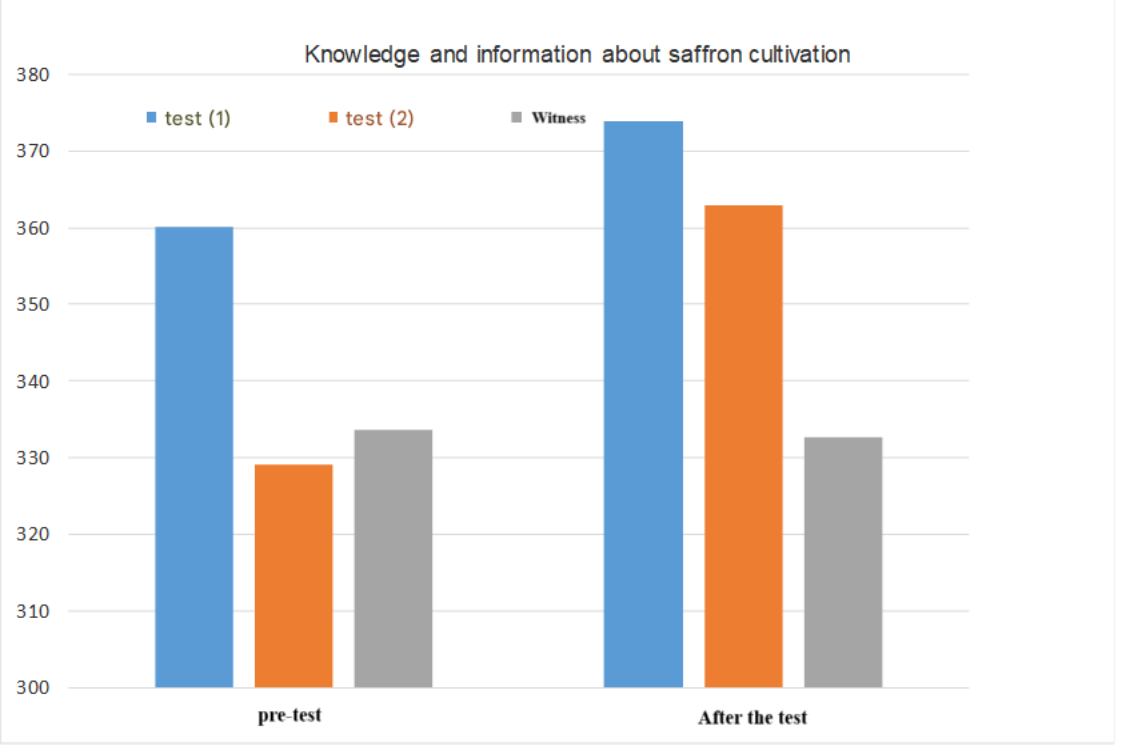

Fig. 1. Mean Pretest and Posttest Scores of Knowledge and Information Regarding Saffron Cultivation

As illustrated in Figure1, the levels of knowledge and information related to saffron cultivation (including planting, maintenance, harvesting, as well as marketing and export) increased in the posttest for both experimental groups compared to the control group. This improvement was particularly more pronounced in Experimental Group

2. The means and standard deviations of the pretest and posttest scores on the Emotional Beliefs Scale for the two experimental groups and the control group are presented in the following table:

Table 4. Means and Standard Deviations of Pretest and Posttest Scores on the Emotional Beliefs Scale Regarding Saffron Cultivation in Three Groups

Group		Pretest			Posttest		
Emotional Beliefs Regarding Saffron Cultivation		N	Mean	SD	N	Mean	SD
	Experimental 1	20	49.77	1.73	20	56.88	2.6
	Experimental 2	20	44.77	1.32	20	48.66	1.52
	Control	20	49.22	2.17	20	47.66	2.66

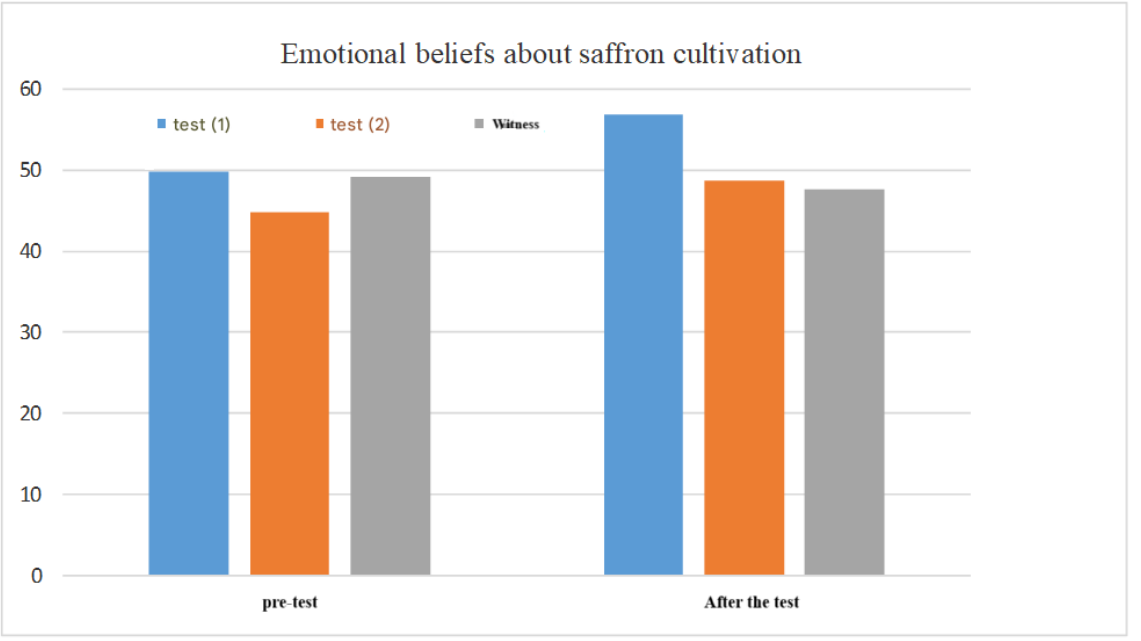

Fig. 2. Comparison of Mean and Standard Deviation of Pretest and Posttest Scores on the Emotional Beliefs Scale Regarding Saffron Cultivation

As shown in Figure 2, posttest scores for emotional beliefs regarding saffron cultivation increased in both experimental groups compared to the control group, with the difference being more pronounced in Experimental Group 1. The means and standard deviations of the pretest and posttest scores on the Behavioral Intention Scale for the two experimental groups and the control group are presented in the following table:

Table 5. Means and Standard Deviations of Pretest and Posttest Scores on the Behavioral Intention Scale Regarding Saffron Cultivation in Three Groups

Group		Pretest			Posttest		
Emotional Beliefs Regarding Saffron Cultivation		N	Mean	SD	N	Mean	SD
	Experimental 1	20	105.888	4.127	20	113.777	4.982
	Experimental 2	20	106.777	4.421	20	113.777	4.358
	Control	20	109.555	5.918	20	110.222	5.966

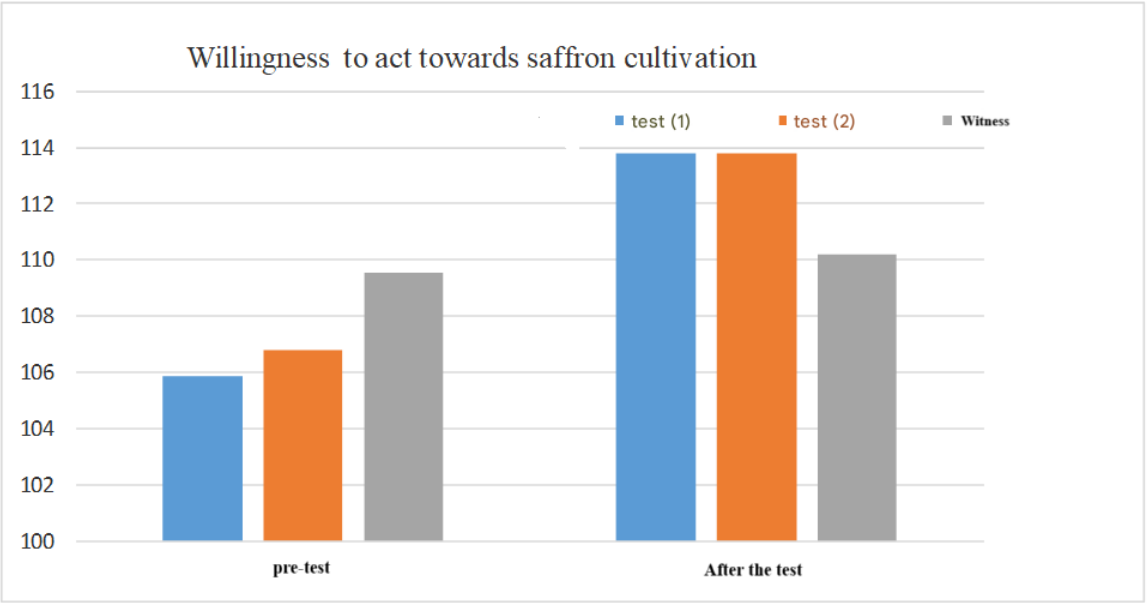

Fig. 3. Comparison of Mean and Standard Deviation of Pretest and Posttest Scores on the Behavioral Intention Scale Regarding Saffron Cultivation

As shown in Figure 3, the posttest scores for behavioral intention toward saffron cultivation increased in both experimental groups compared to the control group.

5.2. Inferential Analysis of the Data

In this study, inferential analysis was conducted using analysis of covariance (ANCOVA). The independent variable was farmers' attitudes toward saffron cultivation, which was applied across three groups: 1) web-based training, 2) video-based training, and 3) no training. The dependent variables included: 1) knowledge and information regarding saffron cultivation, 2) emotional beliefs regarding saffron cultivation, and 3) behavioral intention toward saffron cultivation.

6. CONCLUSION

*T*his study revealed a significant difference in the impact of training type on changing farmers' attitudes. The evidence suggests that, given the widespread access to the internet and computers or smartphones today, this potential should be fully leveraged to advance educational goals in agricultural extension. Although various official and unofficial websites provide information on saffron cultivation and can partially meet farmers' needs, these platforms are not sufficient to provide comprehensive and specialized guidance. Therefore, it is recommended to establish an official website that offers information in multiple formats including text, book references, documentaries, and instructional videos and includes sections dedicated to saffron market introduction, high-quality cultivation methods, government support programs, and other essential resources for farmers.

Declaration

We acknowledge that we used ChatGPT to enhance the academic writing of our manuscript while ensuring the originality and integrity of our work.

Transparency Statement

The data supporting this study are available upon reasonable request to the corresponding author, subject to ethical and confidentiality considerations.

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Declaration of Interest

The authors declare that they have no competing interests.

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REFERENCES

[1] Anderson, J. R., & Feder, G. (2004). Agricultural extension: Good intentions and hard realities. The World Bank Research Observer, 19(1), 41–60. https://doi.org/10.1093/wbro/lkh013

[2] Bates, A. W. (Tony). (2019). Teaching in a Digital Age – Second Edition: Guidelines for designing teaching and learning. Vancouver, B.C.: Tony Bates Associates Ltd. Retrieved from https://pressbooks.bccampus.ca/teachinginadigitalagev2/

[3] Pretty, J., & Bharucha, Z. P. (2014). Sustainable intensification in agricultural systems. Annals of Botany, 114(8), 1571–1596. https://doi.org/10.1093/aob/mcu205

[4] Rogers, E. M. (2003). Diffusion of Innovations (5th ed.). Free Press.

[5] Altieri, M. A., & Nicholls, C. I. (2017). The adaptation and mitigation potential of traditional agriculture in a changing climate. Climatic Change, 140(1), 33–45. https://doi.org/10.1007/s10584-013-0909-y

[6] Swanson, B. E., & Rajalahti, R. (2010). (As above already cited; please ensure not duplicated).

[7] Garrison, D. R. (2011). E-Learning in the 21st Century: A Framework for Research and Practice (2nd ed.). Routledge.

[8] Charatsari, C., Lioutas, E. D., & Koutsouris, A. (2020). Farmer intentions to adopt sustainable practices: The role of knowledge and information technologies. Journal of Rural Studies, 78, 378–388. https://doi.org/10.1016/j.jrurstud.2020.06.031

[9] Mishra, A. K., Kumar, A., & Joshi, P. K. (2018). Impact of digital agricultural extension on farm productivity: Evidence from India. Agricultural Economics Research Review, 31(2), 187–196. https://doi.org/10.5958/0974-0279.2018.00016.4

[10] Mwantimwa, K. (2021). ICT access and use in agriculture: Evidence from smallholder farmers in Tanzania. Technology in Society, 67, Article 101730. https://doi.org/10.1016/j.techsoc.2021.101730

[11] Moore, M. G., & Kearsley, G. (2012). Distance Education: A Systems View of Online Learning (3rd ed.). Wadsworth Cengage Learning.

[12] Bandura, A. (1997). Self-Efficacy: The Exercise of Control. W.H. Freeman and Company.

[13] Esmaeili Aval, M. (2014). *Experts' perspectives on the design and implementation of web-based agricultural*

extension services in Iran (Master's thesis). Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran.

[14] Taghipour, M., Abbasi, E., Chizari, M., & Heydari, A. Q. (2013). Analysis of farmers' attitudes in Gachsaran County toward the formation of water cooperatives. *Cooperation and Agriculture*, 6, 1–21.

[15] Alibeigi, A. H., Darre Zershki, M., & Khaki, M. R. (2011). Farmers' attitudes toward modern agricultural practices: A study in Mehriz and Khatam counties. *Iranian Journal of Agricultural Economics and Development Research*, 42(2), 4.

[16] Mirtorabi, M. S., Hosseini, S. M., & Alizadeh, N. (2011). Factors influencing wheat farmers' attitudes toward wheat waste management: A case study of Hashtgerd farmers. *Journal of Agricultural Extension and Education Research*, 3(4).

[17] Chavas, J., & Nauges, C. (2020). Uncertainty, learning, and technology adoption in agriculture. Applied Economic Perspectives and Policy, 42, 42–53. https://doi.org/10.1002/aepp.13003

[18] Elbasi, E., Zaki, C., Topcu, A., Abdelbaki, W., Zreikat, A., Cina, E., Shdefat, A., & Saker, L. (2023). Crop prediction model using machine learning algorithms. Applied Sciences. https://doi.org/10.3390/app13169288

[19] Nyasimi, M., Kimeli, P., Sayula, G., Radeny, M., Kinyangi, J., & Mungai, C. (2017). Adoption and dissemination pathways for climate-smart agriculture technologies and practices for climate-resilient livelihoods in Lushoto, Northeast Tanzania. Climate, 5, Article 63. https://doi.org/10.3390/cli5030063

[20] Paulrud, S., & Laitila, T. (2010). Farmers' attitudes about growing energy crops: A choice experiment approach. Biomass & Bioenergy, 34, 1770–1779. https://doi.org/10.1016/j.biombioe.2010.07.007

[21] Jimenez, I. A. C., García, L., Violante, M., Marcolin, F., & Vezzetti, E. (2020). Commonly used external TAM variables in e-learning, agriculture and virtual reality applications. Future Internet, 13, Article 7. https://doi.org/10.3390/fi13010007

[22] Rezk, N. G., Hemdan, E. E., Attia, A., El-Sayed, A., & El-Rashidy, M. A. (2020). An efficient IoT-based smart farming system using machine learning algorithms. Multimedia Tools and Applications, 80, 773–797. https://doi.org/10.1007/s11042-020-09740-6