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Enhancing Research Competence in Distance Education through Scientific Workshops: Integrating Ergo-Iconic Learning Design

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Abstract

Distance education has expanded rapidly with the increasing use of digital technologies. It often presents challenges related to learner engagement, interaction, and the development of practical competencies. Integrating scientific workshops and ergonomic learning design may provide a more interactive and supportive learning environment. This study aims to examine the effectiveness of integrating scientific workshops into distance education to enhance students' competencies, particularly in supporting the preparation of final research projects. A mixed-methods approach was employed, combining descriptive quantitative analysis with qualitative insights from semi-structured interviews. The study involved 197 participants and data were collected using structured questionnaires and follow-up interviews with selected informants. The quantitative results show that 91.3% of participants gained new knowledge related to TAPM and TAPD, 98.9% reported that the materials supported their final project writing, and 99.5% found the practical training in research tools and output interpretation beneficial. Qualitative findings further indicate that the workshops improved participants' understanding of research methods and fostered collaborative learning, although some participants experienced difficulties in independently applying the research tools. These findings suggest that integrating scientific workshops with ergo-iconic instructional design can improve engagement, strengthen research competencies, and support more effective learning experiences in distance education environments.

Keywords

Active Engagement, Distance Education, Ergo-Iconic Learning Design, Learners' Competence, Scientific Workshops.

1. Introduction

The rapid expansion of distance education has accelerated the adoption of Information and Communication Technology (ICT) in higher education institutions (Chatterjee & Chakraborty, 2021; Andriyansah et al., 2025). Distance education offers significant flexibility for learners, however, it also presents challenges related to engagement and motivation(Hodges et al., 2020; Turan et al., 2022). The OECD (2020) report notes that despite many educational institutions introducing digital platforms for distance learning, numerous students still feel lonely and disconnected from their learning communities. Distance education often fails to provide sufficient opportunities for social interaction, which are vital for students' academic progress and personal development (Zaheer & Munir, 2020; Hasanov et al., 2021). Although the academic literature on distance education has evolved, a gap remains in research regarding the effectiveness of these practices in fostering professional competencies among learners (Okolie et al., 2020; Brenner, 2022; Eden et al., 2024). Nearly all studies have focused on academic outcomes without highlighting the development of professional skills and soft skills that are crucial in the workplace (Succi & Canovi, 2020; Ivaldi et al., 2022)

Effective instructional design is strongly associated with the concept of ergo-iconic values, which emphasize the integration of ergonomic comfort and visual elements to create learning environments that are both supportive and effective for students. Despite its relevance, limited research has examined the application of ergo-iconic values, referring to comfort and visual appeal embedded within educational experiences, particularly in the context of distance education and scientific workshops. These elements play an important role in shaping meaningful learning environments by improving students' learning experiences and strengthening their involvement in the educational process. In digital learning settings, where interaction is often mediated through technology, the presence of ergonomically designed and visually engaging materials can help address issues of isolation while encouraging more active learner participation (Andriyansah et al., 2025).

Government policies for educational providers must support the enhancement of distance education quality by ensuring equal access for all learners and providing training for educators to utilize technology efficiently (Selvaraj et al., 2021; Chan, 2023). Current policies in Indonesia indicate the need for the adaptation of teaching methods that respond to learners' needs and integrate ergo-iconic values as essential elements in the development of educational policies (Andriyansah et al., 2025). Research conducted by Bonfield et al., (2020) demonstrates that educational organizations must continually innovate to meet the requirements of learners in this digital age. This includes using interactive platforms that promote collaboration among students to create a constructive learning environment (Behnagh & Yasrebi, 2021; Hidayat et al., 2024; Aldi et al., 2025).

Enhancing learners' competencies in the context of distance education necessitates a bridge between formal education and scientific workshops that integrate ergo-iconic values (Andriyansah et al., 2024). By understanding the phenomena of distance education, existing research gaps, and the needs of educational policies, it is hoped that this research can make a significant contribution to the development of effective strategies for improving learning quality and student engagement in the digital era.

The research emphasizes the importance of designing engaging, interactive, and ergonomic learning materials to enhance student comfort and learning experience, aligning with modern trends in digital education. Scientific workshops serve as collaborative platforms where students can share ideas, interact directly, and receive feedback, thereby increasing their sense of belonging and engagement. Encouraging

students to apply theory through hands-on experiences ensures the skills acquired are more relevant and applicable in real-world situations. Therefore, this research aims to examine the effectiveness of integrating scientific workshops in enhancing students' competencies in distance education. The novelty offered as a solution that impacts educational institutions is the introduction of a new approach focusing on scientific workshops as a bridge between formal education and distance learning.

2. Literature Review

2.1. Scientific Workshops and Practical Training

Integrating scientific workshops has increasingly been recognized as an effective strategy for bridging the gap between theoretical knowledge and practical application in higher education. Previous studies indicate that participatory and practice-oriented approaches, such as virtual laboratories and interactive workshops, can significantly enhance student engagement in online learning environments. For instance, Kebande (2024) demonstrated that the use of virtual laboratories in a distance cybersecurity course promoted active learning and increased student participation, showing that well-designed practical components can enrich learning experiences even without physical laboratory access. Similarly, Davidaviciene et al. (2021) found that creative workshops can be effectively organized in remote settings through the use of appropriate digital tools and distance learning techniques, enabling study programs to achieve their learning objectives while also fostering students' creativity.

Furthermore, Nuzuludin et al. (2025), in a systematic review of self-paced learning, highlighted that self-paced learning accompanied by interactive activities plays a crucial role in developing students' competencies in the digital age, particularly their ability to apply theoretical knowledge to real-world assignments or projects. In the context of scientific workshops, this approach is relevant because it provides students with a space to practice research skills and use research tools directly, which are the primary focus of their research. Thus, scientific workshops serve not only as a source of content but also as an active learning tool that helps students strengthen conceptual understanding and technical skills through hands-on practice.

2.2. Instructional Design and Ergonomic Learning Materials

Instructional design literature emphasizes the importance of developing learning materials that are not only informative but also visually appealing and comfortable for students. Effective instructional design considers content organization, ease of navigation, and interactivity, thereby increasing learner engagement and motivation in e-learning environments. Sherzodovna (2025) emphasized that user-centered design principles, interactivity, and adaptive features are essential components of an effective e-learning platform because they help maintain attention and improve knowledge retention. Furthermore, Lu and Hanim (2024) found in their study that interactive visual communication design positively impacts the online learning experience by strengthening student engagement and information retention. This suggests that visual elements are not merely aesthetic but also pedagogical strategies that improve students' cognitive and affective processes.

Good instructional design is closely related to the concept of ergo-iconic values, which emphasize the integration of ergonomic and visual elements to create learning environments that are both comfortable and effective for students. This approach is consistent with the principles of Universal Design for Learning (UDL), as highlighted by Utami et al. (2025), who explain that inclusive instructional design improves accessibility and supports more meaningful learning experiences for diverse learners in online environments. In addition, research by Todorova et al. (2017) indicates that ergonomic quality in e-learning, measured through factors such

as effectiveness, user satisfaction, and overall ergonomic performance, has a significant influence on learning assessment outcomes. Furthermore, combining appropriate teaching methodologies in blended learning with the visual and interactive capabilities of computer modeling and visualization can further enhance the effectiveness of the learning process, enabling students to understand complex concepts more clearly and engage more actively in their studies.

2.3. Student Engagement, Motivation, and Isolation in Distance Learning

Student engagement is a crucial issue in distance learning due to the nature of digital platforms, which often create social and emotional distance between students and instructors and fellow students. A systematic study by Leong (2025) found that technology integration, student-centered learning methods, and the use of interactive activities such as gamification significantly increased student engagement and motivation in digital learning environments, positively impacting learning outcomes.

Furthermore, empirical studies on synchronous online learning show that live interaction in virtual classrooms can strengthen student engagement, with students feeling more motivated to actively participate in discussions and learning activities than when studying independently without real-time interaction (Jarrah et al., 2025). Other literature also shows that strategies such as rapid feedback, clear course structures, and opportunities for collaboration among students enhance the overall learning experience, indirectly reducing feelings of isolation one of the main challenges of distance learning (Kerimbayev et al., 2023). The success of scientific workshops in increasing student engagement in your research (e.g., >98% of respondents found the material useful and were actively engaged) aligns with these findings, suggesting that the combination of interactive content and practical experience in a digital environment can mitigate isolation and increase overall learning motivation.

3. Methods

This study employed a mixed-methods design, combining quantitative and qualitative approaches to examine the effectiveness of integrating scientific workshops in enhancing students' competencies in distance education. The quantitative component served as the primary method to describe participants' perceptions and responses to the workshop using a descriptive design, while the qualitative component provided deeper insights into participants' experiences and interpretations of the workshop outcomes. This approach enabled the researcher to present factual findings based on participants' actual experiences after attending the workshop.

The study involved 197 participants who had previously attended the scientific workshop program. The respondents were categorized based on gender and institutional background to provide a comprehensive demographic overview. In addition, participants were drawn from two main categories of higher education institutions, namely Universitas Terbuka and other universities. This distribution allowed the research to capture perspectives from students who are primarily engaged in distance education as well as those from conventional higher education environments.

Data for the quantitative phase were collected using a structured questionnaire distributed to all participants after the completion of the workshop. The instrument consisted of several sections designed to measure: (1) demographic characteristics, (2) perceptions of the workshop materials, (3) perceived benefits related to final project preparation (TAPM and TAPD), (4) usefulness of research tools and interpretation of outputs, and (5) evaluation of implementation aspects such as timing and duration. The questionnaire items were measured using closed-ended

questions with percentage-based response calculations to facilitate quantitative analysis.

Prior to analysis, responses were tabulated and coded. The data were then analyzed using descriptive statistical techniques, including frequency distribution and percentage analysis, to provide a clear overview of participant responses. This approach allowed the researcher to identify trends in perceived material relevance, practical usefulness, and satisfaction with workshop implementation. Through descriptive quantitative analysis, the study aims to provide an empirical overview of how scientific workshops contribute to students' learning experiences in distance education settings, highlighting patterns of satisfaction and perceived competency improvement among participants.

To complement the quantitative findings, a qualitative phase was conducted through semi-structured interviews with a small number of selected participants who had previously attended the workshop. The interview participants were selected purposively to represent diverse perspectives, including participants from different institutional backgrounds and varying levels of perceived workshop usefulness. The interviews aimed to explore participants' experiences during the workshop, their perceptions of the workshop materials, the extent to which the workshop supported their research preparation, and suggestions for improving future workshop implementation. The qualitative data obtained from the interviews were analyzed using thematic analysis. Interview responses were transcribed, coded, and organized into themes that reflected participants' experiences and perceptions of the workshop. These qualitative insights were used to enrich and clarify the quantitative findings, providing a more comprehensive understanding of how scientific workshops support competency development among students in distance education environments.

4. Results

4.1. Quantitative Findings

This study involved a total of 197 participants, with a breakdown of gender as follows. The results in Table 1 show that participants, both male and female, benefited from the scientific workshops, with a tendency for female participants to provide more positive evaluations regarding the effectiveness of the materials taught, especially in the context of utilizing research tools. This aligns with previous research findings Korlat et al. (2021) that indicate females tend to be more proactive in seeking assistance and integrating technology into their learning, possibly due to their positive attitudes towards social learning experiences. Research by Keramati and Gillies (2023) also found that females often experience an increase in motivation when engaged in collaborative learning environments, which may explain why they responded more positively to this workshop. Nevertheless, male respondents exhibited a high percentage in their evaluation of the materials, indicating that they also felt a significant impact from the workshop, albeit slightly lower than that of female participants. This suggests a need to consider the differing learning styles between the two genders when designing content and training approaches in the future.

Table 1. Participants in the Scientific Workshop

Characteristics	Category	Quantity	Percentage (%)
Gender	Male	75	38.1%
	Female	122	61.9%
Institution	Universitas Terbuka	102	51.8
	Other Higher Education Institutions	95	48.2

Based on Table 1, most participants were from Universitas Terbuka (51.8%), while 48.2% came from other higher education institutions, indicating that the dataset is relevant for examining distance education contexts (Andriyansah et al., 2025). The higher proportion of Universitas Terbuka students reflects participants who are more familiar with distance learning, self-directed study, and technology-based education, which may influence their perspectives on the scientific workshops. Meanwhile, participants from other institutions provide additional viewpoints that enrich the analysis across different academic contexts. Participants commonly reported that the workshop materials were "very important" or "beneficial," suggesting a positive perception of the program.

Table 2. Responses Related to Implementation

Question Item	Quantity of Responses	Percentage (%)
New materials acquired related to TAPM and TAPD	180	91.3
Materials assist in writing TAPM and TAPD	195	98.9
Practical materials for utilizing research tools	196	99.5
Materials for reading output from research tools	196	99.5

Based on Table 2, the research findings indicate that the majority of participants felt they acquired significant new knowledge related to the Final Project for the Master's Programme (*Tugas Akhir Program Magister*/TAPM) and the Final Project for the Diploma Programme (*Tugas Akhir Program Diploma*/TAPD). With 180 respondents (91.3%) stating that they obtained new materials, it is evident that the scientific workshop successfully met the fundamental needs of students for the theoretical knowledge required in preparing their final projects. Mastery of this material is critical, as TAPM and TAPD represent crucial stages in higher education that directly impact graduation and readiness for the workforce.

Another notable advantage is reflected in the assessment that 195 participants (98.9%) reported that the materials taught were extremely helpful in writing TAPM and TAPD. This demonstrates that not only was theoretical knowledge presented, but also practical skills that were effectively integrated into the education process. The ability to apply theory in practice is central to effective education. When students feel supported by relevant materials and directed practices, they are more likely to be confident in producing high-quality written work.

Furthermore, the results indicate that 196 participants (99.5%) found the materials on the practical use of research tools to be highly beneficial for conducting their research. Awareness and proficiency in utilizing modern research tools are essential in today's digital age, where data and technology play a dominant role. Research by Busetto et al. (2020) suggests that understanding and applying appropriate research tools can enhance both the quality of the research and the relevance of the findings obtained.

Lastly, 196 participants (99.5%) also reported feeling supported in reading the output generated by the research tools used. This shows that the workshop successfully taught participants not only how to use the tools but also how to analyze and interpret the data produced. The ability to read and comprehend research findings is a crucial skill for students, particularly in an academic context that demands critical analysis and accurate synthesis of information. The results of this study support the notion that distance education, coupled with hands-on workshops and the use of modern tools, can significantly enhance students' learning experiences. Therefore, it is essential for educational institutions to continually

develop and update their teaching materials and methods to meet the evolving needs of students in this ever-changing era.

The timing of the workshop was well-received, with 177 respondents indicating that it was scheduled appropriately, avoiding weekends and taking place after the break, specifically between 2:00 PM and 4:00 PM WIB. The duration for theoretical instruction ranged from 30 to 45 minutes, with the remainder of the time allocated for practical application of the tools and reading the processed results.

Table 3. Responses to the Implementation of the Workshop

Question Item	Quantity of Responses	Percentage (%)
Timing of Implementation	177	89.8
Duration of Implementation Responses	179	90.8

Table 3 shows that the research findings indicate that 177 participants (89.8%) felt that the timing of the scientific workshop was appropriately scheduled, while 179 participants (90.8%) expressed satisfaction with the duration of the implementation. These findings highlight the importance of effective time management in the delivery of distance education, as it significantly impacts participants' learning experiences.

High satisfaction with the workshop timing indicates that participants felt the schedule aligned well with their other responsibilities, which is particularly important in distance education where learners often balance work and family commitments. Flexible scheduling can improve engagement and reduce learner stress (Bekiroglu et al., 2022). In addition, 90.8% of participants expressed satisfaction with the workshop duration, suggesting that the allocated time allowed them to understand the material adequately without feeling rushed. Adequate instructional time supports deeper comprehension, interaction, and better academic outcomes (Lauermann & Ten Hagen, 2021). Positive perceptions of both timing and duration also contribute to overall learning satisfaction, highlighting that the effectiveness of distance education depends not only on content and technology but also on well-managed time organization (Hodges et al., 2020). Therefore, careful time management and regular evaluation of program scheduling are essential to ensure effective learning experiences.

4.2. Qualitative Findings

The qualitative findings obtained from semi-structured interviews provide additional insights that support the quantitative results presented in Table 2. Most informants confirmed that the workshop provided new knowledge and practical guidance related to the preparation of TAPM and TAPD. Informant AR (Informant 1) explained that the workshop helped clarify several aspects of research preparation that had previously been difficult to understand, particularly in structuring research proposals and selecting appropriate research methods. Similarly, DS (Informant 3) stated that the materials delivered during the workshop provided a clearer overview of the stages involved in completing the final project. These responses align with the survey results showing that 91.3% of participants reported gaining new materials related to TAPM and TAPD, indicating that the workshop successfully addressed students' needs for additional academic guidance in preparing their final research projects.

Another theme emerging from the interviews concerns the practical usefulness of the workshop materials in supporting the writing process of TAPM and TAPD. Several informants emphasized that the workshop not only provided theoretical explanations but also offered applicable strategies that could be directly implemented in their research work. For example, NF (Informant 2) noted that the explanations regarding research design and data analysis helped her revise sections of her

research proposal, while MR (Informant 5) reported that the practical exercises improved his confidence in conducting data analysis independently. These experiences reinforce the quantitative finding that 98.9% of participants considered the workshop materials helpful in writing their final projects, suggesting that the program effectively bridged theoretical knowledge with practical research application.

Despite these positive outcomes, the interviews also revealed several challenges faced by participants, particularly in relation to the practical use and interpretation of research tools. While most informants acknowledged that the workshop introduced useful analytical tools, some participants indicated that they still required additional practice to fully master these tools after the workshop. LN (Informant 6) explained that although the training provided a helpful introduction to research software, limited time for hands-on exercises made it difficult to apply the procedures independently. This finding provides important context for the survey results, where 99.5% of participants reported that the practical materials on research tools and output interpretation were beneficial. The qualitative responses suggest that although the materials were perceived as useful, some participants still experienced challenges related to independent application, which is often observed in distance education settings where opportunities for interaction and immediate feedback are limited (Hasanov et al., 2021; Taghizadeh & Hajhosseini, 2021). In this regard, the workshop functioned as a collaborative learning platform where participants could exchange ideas and receive guidance, supporting the argument that collaborative learning environments can enhance both academic skills and professional readiness (Pojani & Rocco, 2023).

5. Discussion

Previous research suggests that women often demonstrate more positive attitudes toward learning and tend to be more proactive in seeking academic support during their studies (Elbes & Oktaviani, 2022). The demographic composition of the present study reflects a similar pattern, with female participants representing 61.9% of the sample, while male participants accounted for 38.1%. This distribution indicates a higher level of female participation in the scientific workshop and may reflect broader trends in higher education participation, particularly within distance education contexts where flexible learning systems allow individuals to balance academic, professional, and personal responsibilities. Previous survey findings by Akram and Majid (2024) similarly indicate that women are more likely to utilize online learning platforms and digital resources to support their studies.

The findings of this study demonstrate that scientific workshops can contribute significantly to the development of learners' competencies in distance education settings. Quantitative results indicate that 91.3% of participants reported acquiring new knowledge related to the Final Project for the Master's Programme (TAPM) and the Final Project for the Diploma Programme (TAPD), while 98.9% indicated that the workshop materials assisted them in writing their final projects. In addition, 99.5% of respondents perceived the practical use of research tools and the interpretation of analytical outputs as highly beneficial. These results suggest that the workshops effectively combined theoretical explanations with practical applications that are relevant to students' academic needs. Such findings are consistent with previous studies emphasizing the importance of active engagement and structured learning support in distance education environments (Martin & Borup, 2022; Akram & Majid, 2024). Practical and application-oriented learning approaches are particularly important for strengthening students' research competencies, as highlighted by Gürses et al. (2023) and Ubhe et al. (2024), who note that experiential learning activities help learners apply theoretical knowledge to real research tasks.

The qualitative findings further reinforce these results by illustrating how participants perceived the workshop as a meaningful learning platform. Interview responses indicated that participants gained clearer guidance in structuring research proposals, selecting appropriate methodologies, and interpreting analytical outputs. Several informants also highlighted the value of hands-on practice sessions that allowed them to apply research tools directly to their own academic work. At the same time, some participants reported challenges related to the independent application of research tools after the workshop had concluded. Limited opportunities for extended practice and the absence of immediate guidance were identified as factors that sometimes hindered participants from fully mastering the analytical procedures. These challenges are frequently reported in distance education environments, where learners may experience reduced opportunities for direct interaction and feedback from instructors and peers (Hasanov et al., 2021; Taghizadeh & Hajhosseini, 2021).

In response to these challenges, the scientific workshop functioned as a collaborative learning platform that helped address some of the limitations commonly associated with distance education. Through discussion sessions and opportunities for interaction, participants were able to exchange ideas, clarify methodological issues, and receive feedback on their research work. This collaborative dimension supports the argument presented by Pojani and Rocco (2023), who emphasize that learning environments that encourage collaboration and role-based engagement can enhance social competencies and professional readiness. In addition, the effectiveness of such workshops may also be influenced by the quality of instructional design used in delivering learning materials. Instructional design literature highlights that well-organized, interactive, and visually engaging learning materials can significantly improve learner engagement and motivation in e-learning environments (Sherzodovna, 2025; Lu & Hanim, 2024). The concept of ergo-iconic values, which integrates ergonomic comfort and visual appeal in educational experiences, further suggests that thoughtfully designed learning environments can reduce feelings of isolation and enhance students' active participation in distance education (Andriyansah et al., 2025). Although female participants in this study tended to report slightly higher levels of satisfaction, male participants also expressed positive perceptions of the workshop materials, indicating that the benefits of the program were experienced across gender groups. Therefore, future workshop designs may benefit from adopting more inclusive instructional approaches that integrate ergonomic and visually engaging learning materials to accommodate diverse learning preferences and further strengthen engagement in distance education settings.

6. Conclusion

This study confirms that the integration of scientific workshops into distance education significantly enhances students' competencies and learning experiences. Involving 197 respondents from various universities, predominantly from the Open University, the findings indicate that participants gained substantial new knowledge related to TAPM and TAPD while also experiencing increased engagement and motivation. Notably, approximately 99.5% of respondents reported that the practical utilization of research tools was highly beneficial, highlighting the effectiveness of hands-on and application-based approaches in distance learning environments. These results demonstrate that combining theoretical instruction with practical activities can meaningfully strengthen students' academic preparedness.

The study also contributes to the literature by emphasizing the importance of ergo-iconic values, focusing on comfort and visual appeal in learning material design, which are often overlooked in previous research. While earlier studies primarily concentrate on academic performance or technological challenges in online learning,

this research underscores the role of well-designed and visually engaging materials in improving student satisfaction and participation. Furthermore, although female respondents showed slightly more positive evaluations, male participants also reported substantial benefits, reinforcing the importance of inclusive training design that accommodates diverse learner characteristics.

In terms of implications, the findings suggest that educational institutions should integrate structured scientific workshops into distance education programs and continuously improve material design to enhance learner engagement. Policymakers and administrators can use these insights to develop adaptive, student-centered strategies that align with the demands of digital education. However, this study has limitations. The sample is dominated by participants from a single institution, which may limit generalizability. Additionally, the research relies on self-reported perceptions rather than objective performance measures. Future research should involve broader and more diverse stakeholders, incorporate mixed methods approaches, and examine the long-term impact of workshop-based learning and ergo-iconic design on academic outcomes and professional skill development.

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