Effects of Hands-on AI Training on Educational Administrators' Digital Competence and Implementation Intention

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***Abstract*—This study empirically examined the effects of a hands-on Artificial Intelligence (AI) training program on educational administrators' digital competence and intention to implement AI in schools. To evaluate its effectiveness in fostering digital leadership, 49 educational administrators in South Korea were purposively recruited. Conducted between June and July 2025, the study used a single-group pretest–posttest design, with participants enrolled in both basic and advanced courses. Data were analyzed using paired-samples t-tests, and Cohen's d was calculated to assess the effect sizes of the training. The results indicate that participants in the basic course showed a significant increase in their awareness of the need for AI education, from 4.2 to 4.8 ($p < 0.001$), and their competency in using AI tools also improved substantially from 2.63 to 4.5 ($p < 0.001$). In the advanced course, AI competency significantly increased from 3.9 to 4.49 ($p < 0.001$). Notably, practical skills such as AI-based document writing, content generation, and the use of the Hi-Learning platform showed meaningful improvement. In addition, participants' intention to apply and share AI practices in school settings significantly increased in both courses ($p < 0.01$). These findings suggest that hands-on AI training may be associated with gains in individual competencies and may strengthen administrators' intention to implement and share AI practices, which could serve as a precursor to—rather than direct evidence of—organizational-level diffusion.**

***Keywords*—educational administrator training, Artificial Intelligence (AI) education, digital competence, experiential learning theory, intention to implement**

I. Introduction

The rapid advancement of emerging technologies such as Artificial Intelligence (AI), big data, and cloud computing has placed digital transformation at the center of educational innovation [1, 2]. This transformation extends beyond changes in teaching and learning practices, requiring comprehensive innovation in school management and administrative systems. Recent studies have emphasized that generative AI is rapidly reshaping educational systems by influencing instructional design, administrative decision-making, and school leadership practices [3, 4].

In this context, educational administrators, who lead school organizations, are expected to move beyond passive policy implementation and demonstrate proactive digital leadership that fosters the digital competence of all school members and drives educational innovation [5–7]. Digital leadership is recognized as a core competency that facilitates transformation across school operations and curricula, and can be broadly categorized into two dimensions: administrative leadership that enhances organizational efficiency, and pedagogical leadership that supports innovation in curriculum and instruction [8].

However, such digital leadership can only be effectively realized when supported by practical competencies that can be directly applied in real school settings. Accordingly, there is a growing need for hands-on training programs that enable administrators to apply AI and EdTech tools to both administrative tasks and instructional practices. Yet existing AI training programs for educational administrators have largely focused on theoretical understanding, with limited empirical evidence regarding their effectiveness in enhancing practical competencies or supporting their real-world application. In particular, few empirical studies have examined whether hands-on AI training can enhance not only administrators' technical competency but also their readiness to implement and diffuse AI practices within school organizations.

This study examined whether a hands-on training model could overcome the limitations of traditional, theory-based training to enhance educational administrators' AI competency and strengthen their intention to implement and diffuse AI practices in their schools. In this study, digital leadership is conceptualized as a broader organizational capability that may be strengthened through improvements in individual AI competency. This study applies Experiential Learning Theory (ELT) as a design framework in two specific ways. First, whereas ELT has predominantly been applied to learner- or teacher-centered skill acquisition, the present study repositions Kolb's four-stage cycle as a mechanism foe leadership capacity-building, in which the "active experimentation" stage is reconceptualized as organizational application intention—the self-reported readiness to transfer individual learning into school-wide practice. Second, the study illustrates how the cycle appears to operate differently across competency levels: for low-baseline learners, gains concentrate in the concrete-experience and conceptualization stages, whereas for high-baseline learners, value shifts toward reflective refinement and contextual transfer, where change is qualitative rather than numerical. By addressing this gap, the study provides practical implications for designing effective AI training programs that support sustainable digital transformation in education.

In response to this need, the present study designed a practice-oriented training program aimed at strengthening administrators' competencies by enabling them to directly experience AI tools and apply them to real-world tasks. It

comprised a basic course on foundational competencies and an advanced course on applied skills and school-management strategies, and was implemented flexibly according to participants' levels and needs.

Accordingly, the following research questions were formulated:

(1) How does hands-on training influence educational administrators' awareness of and perceptions toward AI education?
(2) How does experiential AI training affect administrators' practical competencies in using AI tools?
(3) How does hands-on training influence administrators' intention to apply and share AI practices in school settings?

II. Literature Review

A. Digital Leadership of Educational Administrators

In the era of digital transformation, educational administrators must possess multifaceted competencies that extend beyond technological proficiency. These include the ability to redesign educational visions based on digital foundations, foster innovative organizational cultures, and promote collaboration among school members. These competencies collectively constitute digital leadership, a critical form of leadership that enables school innovation in digitally transformed environments. Digital leadership emphasizes action-oriented practices that respond flexibly to technological changes and reconstruct school culture and learning structures [9, 10].

Previous studies have emphasized that digital leadership in school principals is defined not by technical proficiency alone, but by their capacity to create conditions that enable organizational members to use technology effectively for educational purposes and to support its practical implementation. Various frameworks and terminologies have been proposed to conceptualize this leadership, including strategies, competencies, components, and standards [11–14].

The International Society for Technology in Education (ISTE) has further operationalized this concept by presenting standards for digital-age education leaders. ISTE categorizes the role of school leaders into five domains and highlights their responsibility to intentionally design and facilitate the continuous process of technology adoption, diffusion, and institutionalization [15].

Synthesizing prior research, digital leadership can be understood as an integrated construct comprising three interrelated dimensions: strategic leadership, pedagogical leadership, and technological leadership. Strategic leadership involves establishing a vision for digital transformation and guiding organizational change through data-driven decision-making. Pedagogical leadership focuses on supporting teachers' digital competence development and fostering instructional innovation and collaborative school cultures. Technological leadership entails understanding AI and EdTech tools, applying them effectively to school operations and curricula, and ensuring a stable digital infrastructure.

In particular, digital leadership in education emphasizes the ability to utilize technology effectively to support learner-centered education, personalized learning, and digital citizenship, while also engaging in critical reflection on its use. Based on this integrated perspective, the present study designed a training program to cultivate administrators' competencies to lead school innovation through a systematic understanding of AI-based educational environments.

Recent research has distinguished AI literacy from broader digital competence, arguing that effective AI use requires not only technical skills but also critical understanding, ethical awareness, and implementation readiness [16, 17]. This distinction suggests that hands-on AI training should focus not only on general digital leadership but also on the development of AI-specific competency among educational administrators.

In this study, AI competency refers to the practical ability to apply AI tools effectively in educational administration, whereas digital leadership is treated as a broader organizational capability that may be strengthened through enhanced individual AI competency.

B. Experiential Learning Theory and Hands-on Training

According to adult learning theories, particularly Kolb's experiential learning theory, learning is most effective when individuals engage in direct experience and active experimentation. The effectiveness of adult training programs cannot be achieved through passive knowledge transmission alone [18]. Instead, the degree to which learners are able to experience, reflect upon, and transfer their learning into practice plays a critical role in determining learning outcomes. From this perspective, Kolb's experiential learning theory has been widely adopted as a key theoretical foundation for designing adult training programs [19].

As illustrated in Fig. 1, experiential learning is not a simple process of information acquisition but a cyclical process involving four stages: (1) concrete experience, (2) reflective observation, (3) abstract conceptualization, and (4) active experimentation. This iterative cycle deepens learning over time. For adult learners, learning outcomes are maximized when their prior experiences and real-world tasks are used as the starting point for learning, thereby increasing the likelihood of transferring learning outcomes to actual work and organizational contexts.

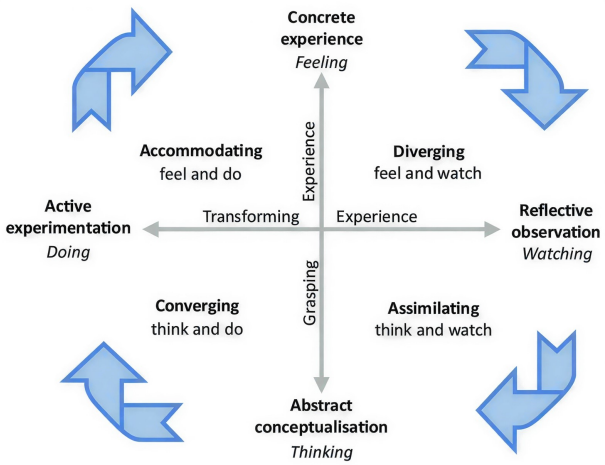


Fig. 1. Kolb's experiential learning cycle.

The hands-on training model, grounded in this theoretical

framework, emphasizes strengthening practical competencies by engaging learners in performing concrete tasks, reflecting on their experiences, and conceptualizing their learning. This approach extends beyond technical skill practice, integrating reflection and conceptualization to enhance learning.

Through reflection on experiences formed during hands-on activities and reinterpretation within broader contexts, learners are able to transform individual experiences into generalized principles. Such processes enable learning outcomes to extend beyond individual competence development and facilitate transfer to administrative practice and organizational-level change.

C. Effectiveness of Hands-on Training Models and the Contribution of This Study

Previous studies have demonstrated that hands-on training programs grounded in experiential learning theory have a positive impact on teachers' professional development, significantly enhancing problem-solving abilities, self-efficacy, and their willingness to implement instructional improvements [20–22]. These findings suggest that hands-on training is an effective approach that goes beyond the acquisition of technical skills, facilitating changes in teachers' perceptions and promoting the transfer of learning into actual educational practices.

However, a considerable number of prior studies have treated experiential learning theory primarily as a conceptual background for training design, with limited efforts to systematically structure and analyze the entire training process based on the cyclical framework of experiential learning [6]. Moreover, most existing studies have focused on teachers' instructional improvement and professional development, with relatively few studies targeting school administrators as the primary subjects of investigation [6, 21, 23].

In addition, traditional administrator training programs have largely emphasized policy delivery or administrative capacity building, which limits their ability to provide structured opportunities for participants to actively experience generative AI and digital technologies and apply them to real-world school management contexts.

To address these gaps, the training program analyzed in this study was designed as a hands-on model aligned with experiential learning theory. The program emphasizes practical, task-oriented activities directly connected to real-world administrative work, such as building AI-based assistants, generating school documents using generative AI, and designing curricula using EdTech platforms. Through these activities, administrators are provided with a learning environment in which they can directly solve problems and immediately observe outcomes.

This design was intended to enhance participant engagement and immersion during the stages of concrete experience and active experimentation, while also structuring the stages of reflective observation and abstract conceptualization by encouraging participants to reinterpret their hands-on experiences within broader contexts such as school management and curriculum innovation.

By positioning school administrators as the primary agents of change and enabling them to utilize, reflect on, and conceptualize the use of generative AI, Hi-Learning, and other digital tools in decision-making and school operations, this study highlights the critical role of administrators in leading school transformation in the era of digital transition.

Accordingly, this study contributes to the literature by extending hands-on training research beyond teacher-centered perspectives and proposing a digital leadership training model tailored for educational administrators. Theoretically, it advances ELT by explicitly modeling the "active experimentation" stage not merely as in-session task performance but as organizational application intention—the bridge through which individual experiential learning is hypothesized to transfer to school-level practice—a transfer-to-organization step that prior teacher-focused ELT studies have rarely operationalized. Furthermore, it provides theoretical and practical implications by demonstrating how experiential learning-based AI training can facilitate individual competency development and increase administrators' intention to diffuse AI practices-a hypothesized precursor to, but not direct evidence of, organizational-level change.

III. Materials and Methods

A. Research Design and Participants

This study employed a single-group pretest-posttest design to examine the effectiveness of the training program. In addition, a longitudinal analysis focused on participants who completed both courses, enabling an in-depth investigation of the cumulative effects of the stepwise training process. A one-group pretest–posttest design is widely used in educational intervention research to examine changes following a targeted program when random assignment is not feasible [24]. However, because this design lacks a control group, observed pre–post changes cannot be attributed solely to the training and are therefore interpreted throughout as pre–post associations rather than as causal effects.

The participants of this study were educational administrators—including those from kindergarten, elementary, secondary, and special education settings—who participated in the "Administrator Training for Future Education" program conducted between June and July 2025.

Matched pretest and posttest responses from 49 participants were included in the final analysis based on matched pretest and posttest responses using participant identifiers. Specifically, 20 participants were included in the basic course analysis, and 29 participants were included in the advanced course analysis. Educational administrators were selected because they play a critical role in school-level decision-making, digital transformation, and the institutional implementation of emerging technologies such as AI. It should be noted that these subgroup sizes are small, which has implications for statistical power and for the feasibility of factor-analytic validation.

The training program was systematically designed as a 12-session curriculum (12 instructional hours) consisting of two levels: a basic course aimed at developing foundational competencies and an advanced course focusing on applied skills and strategic school management. This stepwise structure enabled participants to progressively build competencies aligned with their learning levels and professional needs.

Given the practical constraints of real-world training environments, the study adopted a single-group design; however, to enhance the robustness of the analysis, longitudinal comparisons and multiple outcome variables were employed to capture changes in awareness, competency, and implementation intention across training stages. Some participants completed both the basic and advanced courses, whereas others participated in only one course. To account for this structure, pretest and posttest analyses were conducted separately for each course.

B. Measurement Instruments

The effectiveness of the training program was assessed using a researcher-developed questionnaire designed to measure changes in participants' individual competencies. The questionnaire items were adapted from previously validated instruments related to digital competence, AI literacy, and technology acceptance [25], and were modified to reflect the objectives and context of the present hands-on AI training program for educational administrators.

The instrument consisted of 15 items across three domains: (1) awareness of and perceived need for AI education (5 items), (2) understanding and practical competency in using AI tools and the Hi-Learning platform (5 items), and (3) intention to apply and share learned content in school settings (5 items). All items were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

To establish content validity, the instrument was reviewed by seven experts in educational technology and AI education, and several items were revised to improve clarity and contextual appropriateness. Internal consistency reliability was assessed using Cronbach's alpha; the overall reliability of the instrument was high (α = 0.95), indicating strong internal consistency across the measured domains. It is important to note, however, that content validity and internal consistency do not establish construct validity, as no Exploratory Factor Analysis or Confirmatory Factor Analysis (EFA/CFA) was conducted to verify the hypothesized three-domain structure.

As presented in Table 1, all constructs demonstrated acceptable internal consistency, with Cronbach's alpha values exceeding the recommended threshold of 0.70.

Table 1. Reliability analysis of measurement instruments

Group	Variable	Num. of Items	Cronbach's α	
			Pre	Post
Basic Course	AI Education Needs	5	0.79	0.83
	Digital Competency	5	0.89	0.92
	Implementation Intention	5	0.84	0.83
Advanced Course	AI Education Needs	5	0.74	0.90
	Digital Competency	5	0.85	0.93
	Implementation Intention	5	0.83	0.93

C. Training Program

The training program was designed with the primary objective of enhancing educational administrators' digital leadership competencies. As illustrated in Table 2, the program adopts a stepwise structure consisting of basic and advanced levels. Grounded in Kolb's experiential learning theory, the program was structured to ensure that the cyclical process of concrete experience, reflective observation, abstract conceptualization, and active experimentation was continuously implemented across both levels of training. This design enabled participants to engage in iterative learning processes that connect experience with reflection and application.

Table 2. Training program structure based on Kolb's experiential learning cycle

Phase	Course Title	Key Training Content	Kolb's Stage
Basic	AI as a Partner in Work: Insights through Real-world Cases and Tools	• Leadership cases in the Digital Transformation era • Hands-on experience with AI-assisted administrative tasks	Concrete Experience
	Understanding Digital Education Policy and Future Directions	• Reflection on the changing roles of schools and teachers in DX • Discussion on future education cases	Reflective Observation
	Fundamentals of Generative AI and Educational Application	• Understanding Digital Literacy and AI Literacy concepts • Establishing principles for the educational use of Generative AI	Abstract Conceptualization
	Overview and Basic Experience of the Hi-Learning Platform	• Hands-on experience with Hi-Learning features • Understanding the structure of AI-based customized education	Concrete Experience
	Building a Personalized AI Assistant using NotebookLM	• Practical training: Constructing a personal AI assistant based on NotebookLM	Active Experimentation
	Smart School Document and Report Writing with Generative AI	• Applying AI to classroom and administrative documentation • Practice in automating reports and project proposals	Active Experimentation
	Development of Generative AI and Ethics Education	• AI Ethics and Digital Citizenship • Sharing educational and classroom cases	Concrete Experience
	Case Studies of Leading AI/Digital (Edtech) School	• Comparing cases and reflecting on applicability • Deriving strategies for application by individual schools	Reflective Observation
Advanced	Rationale for Digital-based School Management and Future Environmental Changes	• Characteristics of the DX era and leadership cases • Future education cases focused on creativity and problem-solving	Abstract Conceptualization
	School Management with Data and AI	• Exploring AI-based school management cases • Applying data/AI-driven evaluation systems	Concrete Experience
	Principal's Leadership and Role for Customized Education (Linked with Hi-Learning)	• Leadership for supporting customized education using Hi-Learning • Conflict resolution and school culture building in leading schools	Reflective Observation
	Strategies for Improving School Work Efficiency through Digital Utilization Cases	• Communication cases based on digital productivity tools • Collaborative methods among school members using AI	Concrete Experience
	Advanced Strategies for Work Efficiency using Digital Productivity Tools and AI	• Enhancing administrative tasks using Generative AI • AI utilization strategies from a future education perspective	Abstract Conceptualization
	Sharing Solutions for Digital Education Sites	• Practical training in improving school work based on Edtech	Active Experimentation

In the basic course, participants expanded their understanding of digital leadership through hands-on experiences with real-world cases of digital transformation and generative AI, as well as reflective discussions on policy

and ethical considerations. In addition, the course aimed to structure participants' conceptual understanding of generative AI and the Hi-Learning platform (*The Hi-Learning platform is a Korean government-affiliated AI-based educational platform designed to support personalized learning and school management, developed in conjunction with the Ministry of Education of Korea)*. Practical activities, such as AI-assisted document writing and the development of personalized AI assistants, were incorporated to provide direct experience in applying AI tools to administrative tasks.

In the advanced course, the program focused on refining leadership concepts within the context of school management and decision-making. Participants engaged with case studies of data- and AI-driven school management, reflected on strategies for personalized education support, and participated in hands-on activities aimed at improving school operations using EdTech tools.

Through this structured progression, the training program extended beyond the development of digital tool usage skills and aimed to systematically cultivate administrators' practical digital leadership competencies, enabling them to lead school transformation in the context of digital innovation. Hands-on AI tool use and case-based activities were categorized as concrete experiences, while discussion and reflection activities were designed to support reflective observation. Conceptual lectures facilitated abstract conceptualization, and AI-assisted school management projects supported active experimentation.

D. Statistical Analysis

Data were analyzed using IBM SPSS Statistics 29.0. Descriptive statistics, including means and standard deviations, were calculated to summarize participant responses. Paired-samples t-tests were conducted to compare pretest and posttest scores across the three domains. In addition, Cohen's d was calculated to assess the practical significance of the observed changes. Following conventional benchmarks, Cohen's d values of approximately 0.2, 0.5, and 0.8 were interpreted as small, medium, and large effects, respectively. Statistical significance was set at $p < 0.05$.

E. Ethical Considerations

Prior to participation, all participants were informed about the purpose of the study and provided consent for the collection and use of their survey responses and personal information for research purposes. Participation was voluntary, and all data were analyzed anonymously to protect participants' confidentiality.

IV. Result and Discussion

Because this study employed a single-group design without a control group, the pre–post changes reported below should be interpreted as associations observed following the training rather than as effects attributable solely to the intervention.

A. Analysis of Perceived Need for AI Education

1) Basic course

Participants in the basic course demonstrated a statistically significant increase in their awareness of the need for AI education, with mean scores rising from 4.20 (SD = 0.78) in the pretest to 4.80 (SD = 0.31) in the posttest, reflecting an improvement of 0.60 ($t = –3.907$, $p < 0.001$).

The results suggest that, following the training, participants' recognition of the educational value of AI and digital tools-as well as their perceived necessity in future school management-increased. Notably, the reduction in standard deviation from 0.78 to 0.31 suggests a convergence of perceptions among participants, indicating that the training contributed to forming a shared understanding of the importance of AI education.

At the item level Table 3, the largest increase was observed in the item "AI improves work efficiency", which rose from 3.85 to 4.75 ($\Delta = 0.90$, $p < 0.001$). Similarly, the item "AI is essential for future school management" increased from 4.10 to 4.80 ($\Delta = 0.70$, $p < 0.001$).

Table 3. Item-level analysis: AI education need and awareness (basic course)

Item	Pre M(SD)	Post M(SD)	Diff.	t	p	Cohen's d
AI Work Efficiency	3.85(0.99)	4.75(0.44)	0.9	–5.604	0.001***	1.25
AI in Future School Management	4.1(0.85)	4.8(0.41)	0.7	–4.273	0.001***	0.96
Hi-Learning Practical Impact	4.15(0.81)	4.8(0.41)	0.65	–3.115	0.006**	0.7
Need for Digital Training	4.5(0.83)	4.85(0.37)	0.35	–1.789	0.09	0.4
Digital Competency Requirement	4.4(0.88)	4.8(0.41)	0.4	–2.179	0.042*	0.49
Total	4.2(0.78)	4.8(0.31)	0.6	–3.907	0.001***	0.87

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In contrast, the item "Need for digital training" showed an increase from 4.50 to 4.85, but did not reach statistical significance ($p = 0.09$). This may be attributed to a ceiling effect, as participants already demonstrated a high level of awareness regarding the necessity of digital training prior to the intervention.

Overall, participants in the basic course initially had limited prior experience with AI and digital tools. Following hands-on engagement and exposure to practical applications, participants reported greater recognition of the usefulness and efficiency of AI in real-world administrative contexts, along with an increased perceived need for AI education.

2) Advanced course

Participants in the advanced course showed an increase in their awareness of the need for AI education, with mean scores rising from 4.49 (SD = 0.61) in the pretest to 4.65 (SD = 0.53) in the posttest ($\Delta = 0.16$). However, this increase did not reach statistical significance ($t = –1.976$, $p = 0.058$).

Compared to the basic course, the relatively smaller magnitude of change can be attributed to the participants' already high level of prior awareness regarding the importance of AI education. The pretest mean score of 4.49 indicates a near-ceiling level, suggesting that the potential for further improvement was inherently limited due to a ceiling effect.

At the item level Table 4, only the item "Practical impact of Hi-Learning" showed a statistically significant increase,

rising from 4.28 to 4.55 (t = –2.289, p = 0.03). This result suggests that the advanced course, which focused on concrete application cases of the Hi-Learning platform and practical implementation strategies, contributed to refining and strengthening participants' perceptions in a more specific and context-driven manner.

In contrast, items such as "Need for digital training" (p = 0.745) and "Need for digital competency" (p = 0.232) did not show significant changes. This may be explained by the fact that participants in the advanced course had either completed the basic course or had prior experience with similar training programs, resulting in already high baseline perceptions.

Overall, the findings suggest that, despite limited quantitative gains in general awareness due to ceiling effects, participants demonstrated more refined and context-specific perceptions following repeated hands-on experiences and exposure to advanced content. These findings suggest that advanced-level training is associated more with qualitative refinement of perceptions than with large quantitative increases. Interpreted through Kolb's cycle, these smaller advanced-level gains likely reflect a shift away from concrete experience and conceptualization, which drive initial skill acquisition, toward reflective refinement and contextual transfer, where change is qualitative rather than numerical.

Table 4. Item-level analysis: AI education need and awareness (advanced course)

Item	Pre M(SD)	Post M(SD)	Diff.	t	p	Cohen's d
AI Work Efficiency	4.48(0.74)	4.72(0.53)	0.24	–1.885	0.07	0.35
AI in Future School Management	4.62(0.68)	4.69(0.60)	0.07	–0.812	0.424	0.15
Hi-Learning Practical Impact	4.28(0.8)	4.55(0.69)	0.28	–2.289	0.03*	0.43
Need for Digital Training	4.59(0.63)	4.62(0.73)	0.03	–0.328	0.745	0.06
Digital Competency Requirement	4.48(0.69)	4.66(0.61)	0.17	–1.223	0.232	0.23
Total	4.49(0.61)	4.65(0.53)	0.16	–1.976	0.058	0.37

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

B. Competency in Using AI Tools and Platforms

1) Basic course

The most pronounced effect observed in the basic course was in participants' understanding and practical competency in using AI tools, as shown in Table 5. The mean score increased substantially from 2.63 (SD = 1.13) in the pretest to 4.50 (SD = 0.71) in the posttest, representing a large gain of 1.87. This improvement was statistically highly significant (t = –10.376, $p < 0.001$).

These findings indicate that participants initially possessed limited competency in using AI tools and showed marked improvement in their practical skills following the structured hands-on training. The magnitude of this change suggests not only statistical significance but also strong practical significance, and is consistent with the potential value of experiential learning-based training in developing real-world competencies.

At the item level, the largest gains were observed in "AI-based official document writing" and "AI content generation," both of which increased from 2.65 to 4.70 (Δ = 2.05, $p < 0.001$). These findings indicate that hands-on activities involving generative AI for document creation and content production were perceived as highly practical and immediately applicable by participants.

At the item level, the largest gains were observed in "Explaining Hi-Learning features" and "Using Google tools", indicating substantial improvement in practical AI tool use.

Notably, the standard deviation decreased from 1.13 to 0.71 in the posttest, suggesting a reduction in variability among participants. This pattern suggests that participants' competency levels became more consistent following the training.

Overall, the findings are consistent with the potential value of hands-on, experiential training for supporting the development of AI-related competencies among educational administrators. These gains are consistent with experiential-learning studies of teacher professional development [20–22], which reported comparable improvements in problem-solving, self-efficacy, and willingness to implement; the present study extends this evidence to school administrators.

Table 5. Item-Level analysis: AI tool competency (basic course)

Item	Pre M(SD)	Post M(SD)	Diff.	t	p	Cohen's d
AI Official Writing	2.65(1.23)	4.7(0.57)	2.05	–8.731	0.001***	1.95
AI Content Creation	2.65(1.23)	4.7(0.66)	2.05	–9.180	0.001***	2.05
Hi-Learning Features	2.35(1.31)	4.3(0.92)	1.95	–8.305	0.001***	1.86
Google Tools Usage	2.50(1.24)	4.35(0.93)	1.85	–8.865	0.001***	1.98
AI School Application	3(1.38)	4.45(0.83)	1.45	–5.9	0.001***	1.32
Total	2.63(1.13)	4.5(0.71)	1.87	–10.376	0.001***	2.32

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

2) Advanced course

In the advanced course, participants' competency in using AI tools increased from a pretest mean of 3.90 (SD = 0.94) to a posttest mean of 4.49 (SD = 0.70), representing a gain of 0.59. This improvement was statistically highly significant (t = –5.738, $p < 0.001$).

Compared to the basic course, the magnitude of improvement was relatively smaller, which may reflect participants' already moderate-to-high baseline competency levels. Despite this, the statistically significant increase suggests further improvement in participants' competencies beyond basic skill acquisition, particularly in advanced application strategies and practical methodologies applicable to real-world school contexts.

At the item level Table 6, the largest gains were observed in competencies related to practical school-based AI application. Additional gains were observed across all applied competency areas, indicating consistent learning effects in the advanced course.

In contrast, the item "AI-based official document writing" increased from 4.21 to 4.45 but did not reach statistical significance (p = 0.129). This may be explained by the participants' prior familiarity with this task, suggesting a ceiling effect in this specific competency area.

The advanced course targeted participants with intermediate-level competency and focused on refining

practical application skills and implementation strategies. The findings indicate that participation in the advanced course was associated with further improvements in participants' AI application competencies, emphasizing depth and contextual application rather than large quantitative gains. This pattern is consistent with the AI-literacy literature [16, 17], which distinguishes applied AI competency from conceptual awareness and indicates that hands-on exposure is especially effective for building tool-specific skills.

Table 6. Item-level analysis: AI tool competency (advanced course)

Item	Pre M(SD)	Post M(SD)	Diff.	t	p	Cohen's d
AI Official Writing	4.21(1.01)	4.45(0.91)	0.24	–1.565	0.129	0.29
AI Content Creation	4(1.1)	4.59(0.78)	0.59	–4.308	0.001***	0.8
Hi-Learning Features	3.52(1.09)	4.31(0.93)	0.79	–4.960	0.001***	0.92
Google Tools Usage	3.93(1.1)	4.45(0.74)	0.52	–3.775	0.001**	0.7
AI School Application	3.86(0.99)	4.66(0.55)	0.79	–5.218	0.001***	0.97
Total	3.9(0.94)	4.49(0.7)	0.59	–5.738	0.001***	1.07

Note: $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

C. Intention to Apply and Share Learning in School Settings

1) Basic course

Participants in the basic course demonstrated a statistically significant increase in their intention to apply and share learned content in school settings, with mean scores rising from 4.01 (SD = 0.68) in the pretest to 4.69 (SD = 0.47) in the posttest ($\Delta = 0.68$; $t = -4.749$, $p < 0.001$).

This finding suggests that participants reported a stronger intention to apply learned content in school settings and to share AI-related practices with colleagues following the training.

At the item level Table 7, the largest increase was observed in "In-school use of Hi-Learning," which rose from 3.60 to 4.55 ($\Delta = 0.95$, $p < 0.001$). This indicates that participants perceived a high level of applicability after being exposed to concrete use cases of the Hi-Learning platform, including examples of in-school training and instructional material development.

Similarly, the item "Planning for work improvement" increased from 3.90 to 4.70 ($\Delta = 0.80$, $p < 0.001$), suggesting that participants developed a more concrete vision for improving administrative processes using digital tools. The item "Applying AI to administrative documents" also showed a significant increase from 4.00 to 4.65 ($\Delta = 0.65$, $p = 0.002$), while "Execution of practice tasks" improved from 4.15 to 4.70 ($\Delta = 0.55$, $p = 0.004$).

The item "Sharing AI tools with colleagues" was already high at the pretest (4.40), but further increased to 4.85 ($\Delta = 0.45$, $p = 0.025$), indicating a strong inclination among participants to disseminate acquired knowledge and skills within their professional communities.

Overall, participants reported greater confidence in the practical value of AI and digital tools for improving work efficiency following the basic course. More importantly, it was associated with stronger self-reported motivation to implement and share AI practices in school settings. As this study measured intention rather than actual implementation, these results are best interpreted as a precursor to—rather than direct evidence of—diffusion-oriented leadership within educational organizations. This emphasis on diffusion aligns with conceptualizations of digital leadership in prior research [6, 7], in which administrators create the conditions for technology adoption across the organization rather than merely using the tools themselves.

Table 7. Item-level analysis: Implementation intention (basic course)

Item	Pre M(SD)	Post M(SD)	Diff.	t	p	Cohen's d
AI Document Application	4(0.86)	4.65(0.59)	0.65	–3.577	0.002**	0.8
In-School Hi-Learning Use	3.6(1.14)	4.55(0.76)	0.95	–5.146	0.001***	1.15
AI Tool Sharing	4.4(0.75)	4.85(0.37)	0.45	–2.438	0.025*	0.55
Work Improvement Planning	3.9(0.72)	4.7(0.47)	0.8	–5.812	0.001***	1.3
Practice Task Execution	4.15(0.75)	4.7(0.57)	0.55	–3.24	0.004**	0.71
Total	4.01(0.68)	4.69(0.47)	0.68	–4.749	0.001***	1.06

Note: $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

2) Advanced course

Participants in the advanced course showed a statistically significant increase in their implementation intention, with mean scores rising from 4.27 (SD = 0.71) in the pretest to 4.59 (SD = 0.58) in the posttest ($\Delta = 0.32$; $t = -2.952$, $p = 0.006$).

Although the magnitude of increase was smaller than that observed in the basic course, this can be attributed to participants' already high baseline levels of implementation intention. Notably, statistically significant improvement despite these high initial scores is consistent with participants reporting more refined and actionable implementation intentions following the advanced course.

At the item level Table 8, all items demonstrated statistically significant improvements. Among them, "In-school use of Hi-Learning" showed a relatively larger increase, rising from 3.93 to 4.31 ($\Delta = 0.38$, $p = 0.019$). This indicates that exposure to advanced use cases and practical implementation strategies enhanced participants' willingness to apply these tools in their school contexts.

Table 8. Item-level analysis: Implementation intention (advanced course)

Item	Pre M(SD)	Post M(SD)	Diff.	t	p	Cohen's d
AI Document Application	4.31(0.93)	4.66(0.61)	0.34	–1.907	0.067	0.35
In-School Hi-Learning Use	3.93(0.96)	4.31(0.85)	0.38	–2.491	0.019*	0.46
AI Tool Sharing	4.45(0.78)	4.79(0.49)	0.34	–2.167	0.039*	0.4
Work Improvement Planning	4.31(0.85)	4.62(0.68)	0.31	–2.073	0.048*	0.38
Practice Task Execution	4.34(0.81)	4.59(0.63)	0.24	–2.254	0.032*	0.42
Total	4.27(0.71)	4.59(0.58)	0.32	–2.952	0.006**	0.55

Note: $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

The item "Applying AI to administrative documents" increased from 4.31 to 4.66 ($\Delta = 0.34$), although it approached but did not reach statistical significance

(p = 0.067). The item "Sharing AI tools with colleagues" improved from 4.45 to 4.79 (Δ = 0.34, p = 0.039), while "Planning for work improvement" increased from 4.31 to 4.62 (Δ = 0.31, p = 0.048). The item "Execution of practice tasks" showed the smallest increase, from 4.34 to 4.59 (Δ = 0.24, p = 0.032), which may be attributed to the already high pretest score.

Overall, participants in the advanced course already reported a strong intention to implement AI and digital tools in school settings prior to the training. Following the advanced course, their responses were consistent with more refined and context-specific implementation intentions.

In addition, the reduction in standard deviation to 0.58 in the posttest suggests that participants' implementation intentions became more consistent and consolidated across the group.

Taken together, these findings indicate that advanced-level training was associated with a shift from general intention toward more actionable and context-specific implementation readiness; whether this *self-reported* readiness translates into sustained, organization-wide diffusion of AI practices was not measured and remains an open question for future research.

D. Training Satisfaction Analysis

Overall satisfaction with the training program was very high across both levels, with mean scores of 4.91 for the basic course and 4.66 for the advanced course, as shown in Table 9.

In particular, participants rated instructor expertise (4.87) and practical applicability (4.83) highly, indicating that the program was perceived as professionally relevant and practically useful. Despite the relatively higher level of difficulty in the advanced course, participants still reported high levels of comprehension (4.56) and practical applicability (4.59). These findings suggest that the advanced content remained accessible while retaining its relevance to school practice.

These satisfaction ratings, however, are also self-reported and may be influenced by social desirability; they indicate participant perceptions of the program rather than objective evidence of effectiveness.

Table 9. Overall training satisfaction analysis

Item	Basic M(SD)	Advanced M(SD)
Content Understanding	4.75(0.52)	4.56(0.67)
Practical Usefulness	4.83(0.37)	4.59(0.67)
Instructor Clarity & Expertise	4.87(0.33)	4.56(0.67)
Overall Satisfaction	4.91(0.28)	4.66(0.65)
Total	4.84(0.3)	4.59(0.63)

V. Conclusion

A. Conclusions and Implications

This study examined the effectiveness of a stepwise, hands-on AI training program on educational administrators' digital competence and implementation intention. The findings support three key conclusions.

First, a staged and cumulative competency development model shows promise, with participants in both courses demonstrating statistically significant improvements across all three competency domains. Second, participants demonstrated significant gains in practical competencies in real-world school tasks—such as AI-assisted document writing and Hi-Learning platform use—following the hands-on training, narrowing the gap between theory and application. Third, as measured by self-reported intention, participants exhibited a strong willingness to share AI tools and practices with colleagues, suggesting administrators' potential role in facilitating organizational diffusion of AI practices.

These findings extend Experiential Learning Theory into the context of AI-based administrator training in two ways. First, they show that the "active experimentation" stage of Kolb's cycle can be productively reconceptualized as organizational application intention-a self-reported readiness to transfer individual learning into school-wide practice-thereby linking individual experiential learning to a transfer-to-organization step that prior teacher-focused ELT studies rarely operationalized. Second, the differential pattern of gains across competency levels (larger experiential gains for low-baseline learners; qualitative refinement for high-baseline learners) suggests that the four-stage cycle operates differently depending on learners' prior competency. Accordingly, structuring programs according to Kolb's four stages appears to foster both competency development and self-reported readiness (intention) to apply learning in organizational contexts, rather than directly measured organizational change.

The study provides a scalable training model for educational administrators with three key recommendations. First, extend the program beyond two days to allow deeper skill development, given participants' strong preference for hands-on activities such as NotebookLM-based AI assistant development and AI-driven document writing. Second, implement pre-assessment and differentiated instruction, as participants with lower baseline competency appeared to show greater improvement, thereby supporting learning across participants with diverse competency levels. Third, develop context-specific, case-based training linked to school characteristics and curriculum implementation, ensuring direct relevance to administrators' specific school contexts.

B. Limitations and Future Research

This study has several limitations that should be acknowledged. The analysis was based on 49 respondents from a single training program, limiting generalizability. Moreover, the small subgroup sizes (n = 20 for the basic course and n = 29 for the advanced course) reduce statistical power, increase vulnerability to Type II error, and yield unstable effect-size estimates; these sample sizes were not informed by an a priori power analysis. Because participation was voluntary and recruitment occurred within a specialized training program, participants may have been more motivated or positively predisposed toward AI than the broader population of educational administrators Therefore, caution is warranted when generalizing these findings. The single-group pretest–posttest design without a control group restricts causal inference. In addition, all outcomes relied on self-report, which may not fully reflect actual competency or implementation behavior and may be subject to social-desirability and common-method bias, particularly given the voluntary and motivated nature of the sample. Outcomes were also assessed only immediately after

training.

A further important limitation concerns the construct validity of the measurement instrument. Although the instrument demonstrated high internal consistency (Cronbach's α) and content validity established through expert review, its construct validity was not formally tested. No Exploratory Factor Analysis or Confirmatory Factor Analysis (EFA/CFA) was conducted, partly because the per-course sample sizes were insufficient to support stable factor-analytic estimation. Consequently, the three hypothesized domains-awareness, competency, and implementation intention-should be regarded as theoretically assumed rather than empirically validated dimensions. Future studies with larger samples should establish construct validity through EFA/CFA before drawing firm conclusions about the measured constructs.

To strengthen this line of research, future studies should employ randomized controlled designs with larger, diverse samples and include multiple measurement methods (e.g., performance-based assessment, artifact analysis) beyond self-report. Because the present study measured implementation intention rather than actual organizational behavior, longitudinal analyses are needed to examine whether improved competencies and intentions translate into sustained organizational change and actual AI implementation. Qualitative studies exploring the relationship between administrators' digital leadership and school-wide AI utilization would clarify mechanisms of organizational change. Finally, studies measuring school-level outcomes such as teacher digital competence and student learning would illuminate the broader impact of administrator training on school transformation. Despite these limitations, the findings suggest that hands-on, experiential AI training represents a promising approach to strengthening educational administrators' capacity to lead digital transformation in schools.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Y.K. designed the training program and wrote the introduction and theoretical background. K.L. designed the survey, conducted the data analysis, and wrote the relevant sections. Both authors collaboratively developed the conclusions and implications, and contributed to revising and editing the manuscript. Both authors approved the final version.

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