

Guidelines for Enhancing Artificial Intelligence Literacy and Professional Competencies of Educational Personnel in Non-Formal Education : A Case Study of Phan Thong Non-Formal Education Center, Chonburi Province

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Abstract

This study aimed to: (1) examine the effectiveness of integrating Artificial Intelligence (AI) in enhancing the professional skills of educational personnel; (2) evaluate the impact of AI on curriculum development in non-formal education; and (3) assess the level of AI awareness among educators in special non-formal education centers in Chonburi Province. A mixed-methods research design was employed, utilizing questionnaires, interviews, and evaluation forms as research instruments. The sample consisted of 26 educational personnel selected using the Taro Yamane formula with a 0.05 margin of error through accidental sampling. Quantitative data were analyzed using descriptive statistics (percentage, mean, and standard deviation), and t-tests were employed for comparative analysis. Qualitative data obtained from interviews and relevant documents were analyzed using content analysis. The findings revealed that: (1) the integration of AI significantly enhanced the professional skills of educational personnel, particularly in digital literacy, instructional design, and data-driven decision-making; (2) AI-supported curriculum development improved the relevance, flexibility, and responsiveness of non-formal education programs; and; (3) educators demonstrated a notable increase in AI awareness and competencies, contributing to more effective, adaptive, and innovative instructional practices.

Keywords: Artificial Intelligence; Educational Personnel; Non-Formal Education

1. Introduction

In the digital era, Artificial Intelligence (AI) has become a transformative force across various sectors, including education [1]. For non-formal education systems, AI serves not only as a technological tool but also as a catalyst for enhancing learning management, improving administrative efficiency, and supporting personalized learning experiences [2]. As learners increasingly require flexible, accessible, and adaptive learning environments, integrating AI into non-formal education has emerged as a critical strategy for improving educational quality and responsiveness [3].

The integration of AI into education has gained increasing scholarly attention due to its potential to influence both formal and non-formal learning systems [4]. In non-formal education, where learners exhibit diverse backgrounds and learning needs, AI is particularly beneficial because it enables flexible and personalized learning environments. Previous studies indicate that AI enhances instructional processes by generating individualized learning content aligned with learner-centered pedagogical principles, allowing educators to tailor instruction to specific learner profiles [5].

AI also plays a significant role in supporting educators' professional responsibilities. Studies emphasize that teachers in non-formal education settings must strengthen their technological competencies, particularly in the application of AI for student data management, curriculum design, communication, and instructional improvement [6], [7]. These competencies are increasingly essential for delivering effective educational services in rapidly evolving learning environments.

Moreover, the application of Social Learning Theory highlights the importance of interactive and collaborative learning supported by digital technologies. AI technologies can facilitate communication and collaboration between learners and instructors, fostering meaningful interactions and shared learning experiences [8], [9]. This suggests that AI functions not only as an instructional tool but also as a mechanism that enhances social engagement and collaborative educational practices.

Despite these advantages, research identifies a persistent gap between the potential benefits of AI and educators' readiness to adopt such technologies effectively [10]. Many teachers in non-formal education lack sufficient awareness, understanding, and practical competencies in AI utilization, limiting their capacity to apply technology effectively in instructional contexts [11]. This disparity underscores the need for structured professional development programs and systematic awareness-building initiatives to equip educators with the necessary knowledge and competencies for AI-enhanced instructional management.

At the Special Non-Formal Education Center in Chonburi Province, educational personnel play a pivotal role in designing curricula, implementing instructional activities, and providing educational services that address learners' diverse needs. [12]. Consequently, enhancing their knowledge, awareness, and competencies in AI utilization is essential for improving instructional effectiveness and educational management.

Given these challenges and institutional needs, it is necessary to develop comprehensive guidelines for strengthening AI literacy, professional competencies, and effective AI integration among educational personnel in non-formal education. [13]. Such guidelines will support educators in adopting AI technologies effectively, improving curriculum development, and enhancing the overall quality of learning management.

Accordingly, this study aims to examine the current levels of awareness, readiness, and competencies of educational personnel in utilizing AI, assess the impact of AI applications on curriculum development and educational management, and develop practical guidelines for effective AI implementation in non-formal education settings. The findings are expected to provide a conceptual and operational framework for future development initiatives and may be adapted for use in other non-formal education institutions across Thailand.

2. Research Objectives

2.1 To determine the effectiveness index and compare the outcomes of AI awareness in enhancing teachers' skills for developing instructional management in the Non-Formal Special Education Center, Chonburi Province.

2.2 To establish a standard criterion for the use of artificial intelligence in enhancing teachers' skills for developing instructional management for students in the Non-Formal Special Education Center, Chonburi Province.

2.3 To explore the approach to using artificial intelligence in enhancing teachers' skills for improving instructional management in the Non-Formal Special Education Center, Chonburi Province.

Conceptual Framework

The conceptual framework of this study comprises two independent variables influencing one dependent variable, as follows:

Independent Variable 1: AI Awareness

AI awareness refers to educators' cognitive readiness and perceptions regarding the use of artificial intelligence in educational settings. It consists of four components:

Mindfulness

Self-reflection

Inquiry and critical questioning

Listening and observational skills

These components influence educators' attitudes, acceptance, and readiness to integrate AI into instructional practices.

Independent Variable 2: AI-related Skills for Instructional Management

AI-related skills refer to educators' competencies in effectively applying artificial intelligence to support instructional management. These skills include:

Learning capability

Analytical and reasoning skills

Self-correction and adaptability

Creativity in instructional design

These competencies determine educators' ability to utilize AI tools effectively in real educational contexts.

Dependent Variable: Development of Practical Guidelines

The dependent variable focuses on the development of practical guidelines aimed at:

Enhancing AI awareness among educational personnel

Strengthening AI-based instructional competencies

Improving instructional management in non-formal education settings, particularly at the Special Non-Formal Education Center

The framework proposes that AI awareness and AI-related instructional skills collectively influence the formulation of effective guidelines for AI integration in non-formal education.

3. Research Methodology

3.1 Research Design

This study employed a concurrent mixed-methods design, integrating quantitative and qualitative approaches to evaluate the effectiveness of AI-awareness interventions and to explore practical approaches for applying AI to enhance instructional management in non-formal special education settings.

3.2 Scope of the Study

The study was conducted at Special Non-Formal Education Centers serving 11 subdistricts in Chonburi Province: Phan Thong, Nong Tamlueng, Map Pon, Nong Kakha, Nong Hong, Khok Khi Non, Ban Kao, Na Pradu, Bang Nang Ko, Loi Bang Hak, and surrounding areas.

Participants were classified into three groups:

- 1) Training participants (census sample)
- 2) Expert informants
- 3) Pilot implementation group

3.3 Population and Sampling

3.3.1 Population

Administrators, specialist teachers, and instructors working in non-formal special education centers across the 11 subdistricts of Chonburi Province.

3.3.2 Quantitative Sample

A total of 26 educational personnel who participated in the AI training program during the first semester of the 2024 academic year were included. This group represented a census sample (100% sampling) because all trainees were included in the pre- and post-assessments.

3.3.3 Qualitative Sample

1) Expert informants: Five experts in special education, instructional design, and AI in education were purposively selected for in-depth interviews.

2) Pilot implementation group: A subgroup of 20 participants who implemented AI-supported instructional management during the second semester of the 2023 academic year.

3.4 Research Instruments

3.4.1 Awareness and Skills Assessment Battery

A researcher-developed questionnaire consisting of three parts:

1) AI Awareness Assessment

- Mindfulness toward AI
- Self-reflection
- Inquiry and questioning
- Listening and observation

2) AI-related Instructional Skills Assessment

- Learning capability
- Analytical and reasoning skills
- Self-correction and adaptability
- Creativity in instructional design

3) Training Program Evaluation

- Training quality

- Instructor competence
- Technology readiness
- Learning environment
- Classroom research integration
- Academic development
- Perceived skill improvement

Instrument development process:

Literature review → Item construction → Expert validation → Pilot testing → Reliability testing

Validity and Reliability:

- Content validity verified using Item-Objective Congruence (IOC = 0.67–1.00)
- Internal consistency reliability: Cronbach’s alpha = .902
- Test-retest reliability conducted to ensure stability over time

3.4.2 Semi-Structured Interview Guide

Used for expert informants and selected teachers. Interview topics included AI perceptions, adoption barriers, classroom applications, ethical concerns, and guideline recommendations.

3.4.3 Observation and Implementation Log

A structured observation checklist and reflective logs were used to record classroom implementation processes, model fidelity, and learner responses.

3.4.4 Document Review Form

Used for reviewing institutional documents, training materials, and learner outputs collected during implementation.

3.5 Data Collection Procedures

3.5.1 Quantitative Data Collection

Participants completed questionnaires before and after the training program (pre-test and post-test). Data collection was conducted during the first semester of the 2024 academic year.

3.5.2 Qualitative Data Collection

In-depth interviews were conducted with experts and selected teachers. Classroom observations and implementation logs were collected during the pilot phase in the second semester of the 2023 academic year.

3.5.3 Document Collection

Curriculum documents, training materials, and institutional reports were collected for triangulation.

3.6 Data Analysis

3.6.1 Quantitative Analysis

- 1) Descriptive statistics: mean, percentage, standard deviation
- 2) Inferential statistics: paired-sample t-test for pre-post comparisons
- 3) Independent t-test for subgroup comparisons
- 4) Effect size calculated using Cohen's d
- 5) Effectiveness index computed using composite standardized scores

3.6.2 Qualitative Analysis

Content and thematic analysis procedures:

- 1) Data transcription
- 2) Open coding
- 3) Axial coding
- 4) Thematic categorization
- 5) Cross-case comparison
- 6) Triangulation with quantitative finding

3.7 Development and Evaluation of Guidelines

- 3.7.1 Draft guidelines formulated from integrated findings
- 3.7.2 Expert validation for feasibility and accuracy
- 3.7.3 Pilot implementation in selected centers
- 3.7.4 Revision and finalization of guidelines

3.8 Ethical Considerations

3.8.1 Informed consent obtained from participants

3.8.2 Confidentiality and anonymity ensured

3.8.3 Secure storage of research data

3.8.4 Voluntary participation and right to withdraw

3.8.5 Compliance with institutional research ethics standards

3.9 Methodological Consistency

The quantitative sample comprised a census of all trainees (100% sampling). Previous references to alternative sampling methods were removed to ensure consistency with the research design and abstract.

4. Research Findings

Objective 1 To determine the effectiveness index and to compare the achievement of awareness development in the use of artificial intelligence (AI) and the skill enhancement of educational personnel in non-formal education management at Special Non-Formal Education Centers in Chonburi Province.

4.1 Pre- and Post-Training Achievement

Table 1 The comparison of participants' achievement scores before and after the training.

Test	N	Mean (M)	S.D.	t	p
Pre-training	26	17.29	1.79		
Post-training	26	34.27	1.82	53.22	< .05

The results showed that the mean post-training score ($M = 34.27$, $S.D. = 1.82$) was significantly higher than the pre-training score ($M = 17.29$, $S.D. = 1.79$). The paired-sample t-test yielded a value of $t = 53.22$, indicating statistical significance at the .05 level.

Interpretation: These findings indicate that the training program significantly improved participants' awareness of AI and their instructional skills. The high t-value suggests a strong effect of the intervention.

4.2 Changes in AI Awareness Components

Table 2 Comparison of AI awareness components: before and after the training.

AI Awareness Component	N	Full Score	Pre-Training		Post-Training		t	p
			(M)	S.D.	(M)	S.D.		
Mindfulness	26	41	34.58	3.33	38.91	1.54	14.033	.000
Mindfulness	26	41	34.58	3.33	38.91	1.54	14.033	.000
Self-Reflection	26	41	20.30	3.40	29.77	2.30	16.623	.000
Self-Questioning	26	41	26.30	2.92	31.51	2.65	26.543	.000
Listening & Observing	26	27	13.00	2.81	16.49	2.81	19.412	.000
Total	26	150	95.19	6.82		6.80		.000

Note: Significant at .05 level

All components showed statistically significant improvements at the .001 level. The greatest increase was found in self-reflection, followed by self-questioning, mindfulness, and listening and observing skills. The total awareness score also increased significantly.

Interpretation: The results demonstrate that the training effectively enhanced participants' metacognitive awareness of AI usage. The notable improvement in self-reflection indicates that participants developed stronger abilities to evaluate and adjust their instructional practices when integrating AI.

4.3 Comparison of AI-Related Instructional Skills by Gender

Table 3 The comparison of AI-related instructional skills between male and female participants.

Skill	Male (N=8)	S.D.	Female	S.D.
	Mean		(N=18) Mean	
Learning Capability	3.63	0.83	3.68	0.61
Reasoning Skills	3.75	0.61	3.75	0.61
Self-Correction & Adaptability	3.58	0.95	3.69	0.83
Creativity	3.68	0.61	3.81	0.77

The findings indicated that both male and female participants had relatively similar mean scores across all skill areas, including learning capability, reasoning, self-correction, and creativity. Female participants showed slightly higher mean scores in most dimensions. However, no inferential statistical analysis was conducted to determine the significance of these differences.

Interpretation: Although slight differences were observed, no definitive conclusions can be drawn. Further analysis using inferential statistics (e.g., independent-sample t-test) is recommended to determine whether gender significantly affects AI-related instructional skills.

Objective 2 to evaluate the impact of AI on curriculum development in non-formal education

4.4 Effectiveness of the Training Program

Table 4 The participants' evaluation of the training program effectiveness.

Item	Mean	S.D.
Curriculum Design	3.75	0.71
Teaching Methods	3.85	0.61
Assessment Methods	3.65	0.80
Overall Mean	3.75	0.70

The overall effectiveness was rated at a good level ($M = 3.53$). High-rated aspects included training design, teaching methods, instructor expertise, academic development, and learning environment. In contrast, the technology aspect received comparatively lower ratings.

Interpretation: Strengths: Training design, instructional methods, instructor expertise, and academic development are strong.

Weaknesses: Technology readiness (AI capability, system stability, accessibility) remains limited.

Implication: The effectiveness of AI training is partially constrained by technological infrastructure.

4.5 Comparison of Training Effectiveness Before and After Implementation

Table 5 The comparison of the effectiveness of various aspects before and after training.

Aspect	N	Full Score	Before (M)	S.D.	After (M)	S.D.	t	p
Training	26	12	8.72	1.37	9.67	1.32	3.764	.001
Trainers	26	12	7.51	1.47	10.60	1.45	9.807	.000
Trainer Personnel	26	12	8.42	0.98	9.65	1.49	4.788	.000
Technology	26	12	8.00	0.95	9.74	1.00	7.558	.000
Learning Environment	26	12	7.28	1.28	10.42	1.53	10.781	.000
Classroom Research	26	12	7.84	1.33	10.09	1.88	6.461	.000
Academic Development	26	12	9.33	1.21	10.35	1.51	3.800	.000
Total	26	84	81.93	5.67	100.74	7.92	15.661	.000

Note: Significant at .05 level

All aspects showed statistically significant improvements at the .001 level. The most substantial improvements were found in the learning environment and trainers aspect, while the technology aspect also showed significant progress.

The overall mean score increased from 81.93 to 100.74 ($t = 15.661$, $p < .001$). Interpretation: These results confirm that the training program significantly improved multiple dimensions of instructional management. The improvement in technology-related scores indicates increased competence in utilizing AI tools among participants.

Objective 3 : to assess the level of AI awareness among educators

The qualitative analysis revealed the following key themes: Development of AI Awareness

Teachers demonstrated increased understanding of AI and shifted from traditional teaching approaches to integrating AI into instructional practices.

Enhancement of Teaching Skills

AI enabled teachers to design more flexible and personalized learning experiences, particularly for students with special needs.

Impact on Student Learning

AI-supported instruction increased student engagement, interaction, and comprehension.

Technology and Resource Development

The development of technological infrastructure and support systems is essential for effective AI integration.

Continuous Assessment and Improvement

Teachers became more reflective and continuously improved their teaching practices through AI-supported evaluation.

Future Recommendations

Ongoing training and professional learning communities are recommended to support sustainable AI integration in education.

Overall Summary

The findings indicate that the AI training program significantly enhanced both awareness and instructional competencies among educational personnel. All AI awareness components improved, particularly self-reflection skills. The program was positively evaluated overall; however, technological readiness remains an area for further development.

These results confirm that the training contributes to more effective instructional management and supports the integration of AI in educational practice.

6. Conclusion

This study examined the effectiveness of AI integration in enhancing AI awareness and instructional competencies among educational personnel in non-formal education settings. The findings confirm that structured AI training programs significantly strengthen educators' cognitive awareness, instructional capabilities, and overall instructional management effectiveness. AI awareness components particularly reflective thinking and metacognitive understanding demonstrated substantial development following the intervention. Moreover, AI-supported instructional tools enabled educators to implement more adaptive, flexible, and learner-centered teaching strategies.

The study also generated practical guidelines that support sustainable AI integration in educational practice. These guidelines highlight the importance of continuous professional development, technological readiness, and institutional support mechanisms to ensure effective implementation. Overall, the research underscores the transformative potential of artificial intelligence in strengthening instructional management and enhancing the quality of non-formal education.

7. Discussion

Discussion for Research Objective 1: Awareness of AI among Educational Personnel. The findings revealed a significant improvement in AI awareness among educational personnel after participating in the training program. The increase in post-test scores suggests that participants developed a deeper understanding of how AI can be applied in curriculum design, instructional planning, and learner support. This improvement may be attributed to the training's emphasis on hands-on practice, where educators engaged directly with AI tools and explored real instructional use cases. These findings are consistent with Transformative Learning Theory [14], [20] which posits that individuals undergo perspective transformation when they experience disorienting dilemmas and engage in critical reflection through experiential activities. By engaging with AI tools in authentic educational scenarios, participants re-examined their existing beliefs about technology and its instructional value. Consequently, their awareness evolved into a more sophisticated understanding of AI integration in teaching and learning [15], aligning with the significant pre-post differences reflected in Tables 1 and 2.

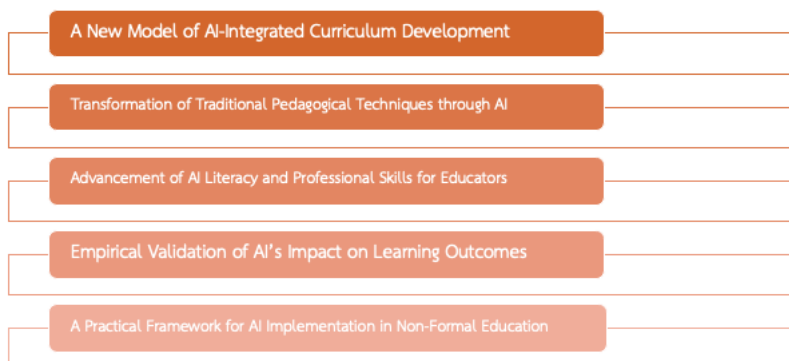
Discussion for Research Objective 2: Improvement of Teaching Skills through AI Integration. The results from Objective 2 demonstrated that the training effectively enhanced educators' teaching skills, particularly in learner engagement, instructional personalization, and adaptive teaching strategies. The marked increase in mean scores related to learner motivation and personalized learning indicates that educators were able to apply AI tools to tailor instruction to students' diverse needs. This improvement can be partly explained by the nature of AI-powered instructional supports, such as automated feedback, personalized content generation, and differentiated task recommendations. These tools enabled educators to respond to individual learning differences more efficiently, thereby increasing participation and overall classroom satisfaction. These outcomes align with the principles of Differentiated Instruction [16], which advocate flexible teaching approaches based on students' readiness, interests, and learning profiles. The integration of AI

technologies acts as an enabler of differentiation, allowing educators to implement personalized learning at scale [4].[19] This is reflected in the significant skill improvements observed across training evaluation dimensions in Tables 4 and 5.

Discussion for Research Objective 3: Impact of AI Integration on Student Learning Outcomes. The results for Objective 3 showed that the use of AI technologies had a positive and measurable impact on student learning outcomes, especially in non-formal education contexts. Improvements in student engagement, learning performance, and participation reflect the transformative effect of AI-supported learning environments. One explanation is that AI facilitates adaptive and interactive learning processes, enabling students to engage with content at their own pace while receiving timely feedback and individualized support. This finding is particularly important for learners in non-formal and special education settings, where personalized instructional support is essential. These results align with Constructivist Learning Theory [17], [18] which emphasizes active, meaningful, and learner-centered learning experiences. AI tools provide opportunities for learners to construct knowledge through exploration, collaboration, and problem-solving, contributing to improvements reported across key effectiveness dimensions [6], as shown in Table 5.

8. New Knowledge from Research

This research provides several new contributions to the fields of educational technology, non-formal education, and AI-enhanced pedagogy. The following insights expand existing theoretical and practical knowledge



8.1 A New Model of AI-Integrated Curriculum Development. The study introduces empirical evidence demonstrating how AI can be systematically integrated into curriculum development within non-formal education settings. Educators in special education centers were able to design adaptive learning activities, generate AI-supported instructional materials, and utilize real-time learner data to refine lesson plans. This contributes a context-specific model showing how AI can enhance curriculum flexibility, personalization, and learner-centered instructional design.

8.2 Transformation of Traditional Pedagogical Techniques through AI. Findings reveal that AI tools help transform traditional teacher-led instruction into more interactive and collaborative learning approaches. Teachers adopted new strategies such as digital scaffolding, automated feedback, and personalized content generation that increased learner engagement. This knowledge enriches pedagogical theory by illustrating how AI operationalizes active learning principles in non-formal and special education contexts.

8.3 Advancement of AI Literacy and Professional Skills for Educators. The research provides new insights into the development of AI awareness and competency among educational personnel. Participants demonstrated enhanced capacity to evaluate AI tools, apply AI in instructional activities, and integrate digital assessment methods. This contributes to the emerging theoretical framework on AI competency standards for educators, particularly in non-formal and special education settings.

8.4 Empirical Validation of AI's Impact on Learning Outcomes. The findings offer concrete evidence that AI-enhanced learning environments improve learner motivation, engagement, and academic performance. This adds to the academic literature by providing quantitative and qualitative evidence specific to non-formal education an area historically underrepresented in AI research.

8.5 A Practical Framework for AI Implementation in Non-Formal Education. The study proposes a practical, replicable framework for integrating AI into instructional design, professional development, and classroom implementation. This framework emphasizes awareness-building, hands-on practice, reflective teaching, and ongoing

evaluation. It represents a valuable blueprint for institutions seeking to adopt AI systematically and ethically. Overall, this research extends current knowledge by showing how AI can enhance instructional effectiveness, teacher competency, and learner outcomes in non-formal education environments, while also providing a structured implementation model for future practice.

9. Suggestions

9.1 Suggestions for Applying the Research Results

9.1.1 Based on Research Objective 1: Enhancing AI Awareness and Curriculum Integration

Since the study found that AI integration significantly improved curriculum design and learner engagement, the following actions are recommended:

- Develop structured training programs that equip educators with practical skills for incorporating AI into lesson planning and curriculum development.
- Establish institutional guidelines for AI adoption, ensuring accessibility, ethical use, and alignment with learner diversity particularly for non-formal and special education groups.

9.1.2 Based on Research Objective 2: Improving Teaching Methodologies through AI

Given that AI-supported techniques enhanced teaching effectiveness and fostered student-centered learning:

- Encourage educators to adopt innovative AI-based teaching practices by providing resources, coaching, and ongoing technical support.
- Promote professional learning communities (PLCs) where teachers can exchange best practices, analyze AI-integrated teaching cases, and reflect on student outcomes collectively.

9.1.3 Based on Research Objective 3: Building AI Skills and Competency Among Educational Personnel

Because AI awareness and skills improved significantly among participants:

- Implement continuous professional development (CPD) programs focusing on AI literacy, hands-on experimentation, and classroom integration.
- Establish mentorship systems pairing experienced AI users with novice teachers to support progressive, sustainable adoption of AI-assisted teaching practices.

9.2 Suggestions for Future Research

To expand upon the findings of this study and address areas beyond its scope, the following recommendations are proposed:

9.2.1 Examine Long-Term Impacts of AI in Education

Future research should investigate sustained effects of AI on learning outcomes, instructional practices, and student development across multiple semesters or school years.

9.2.2 Identify Barriers and Challenges in AI Adoption

Studies should explore obstacles educators face such as technological limitations, ethical concerns, training gaps, and resistance to change and propose strategies to mitigate these barriers.

9.2.3 Compare Different AI Tools and Platforms

Comparative research is recommended to evaluate the effectiveness of various AI applications across diverse learner groups, including students with special needs, adult learners, and learners in informal settings.

9.2.4 Explore Learner Perspectives on AI-Enhanced Education

Understanding how students perceive AI-supported learning environments would provide a more holistic view of AI's pedagogical impact.

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