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Guidelines for Developing AI Competencies of Vocational Education Teachers for High-Performance Vocational Education Management According to the Thailand Vocational Qualifications Framework

Phongsak Phakamach[1*], Sakda Supap[2], Sasirada Pangthai[3], Natchaya Sommartdejsakul[4], Ritthidech Phomdee[5]
[1-2] Rattanakosin International College of Creative Entrepreneurship, Rajamangala University of Technology Rattanakosin, Nakhon Pathom, Thailand 73140
[3] Faculty of Education, Pitchayabundit College, Nongbualamphu, Thailand 39000
[4-5] Advanced Future Talent Academy, Udonthani, Thailand 41000
[*] Corresponding author email: phongsak.pha@rmutr.ac.th

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Abstract: This research aimed to study the characteristics, components, and identify guidelines for developing AI competencies of vocational education teachers for high-performance vocational education management according to the Thailand Vocational Qualifications Framework. This research employed a mixed-methods approach. The research process consisted of four stages: 1) Studying the characteristics of AI competencies through document analysis and in-depth interviews with 12 administrators from vocational education institutions. 2) Analyzing the components of AI competencies by surveying a sample group of 504 administrators, teachers, and staff from vocational education institutions in the eastern region, obtained through multi-stage random sampling. 3) Verifying the components of AI competencies using data triangulation. 4) Presenting guidelines for developing AI competencies of vocational education teachers for high-performance vocational education management according to the TVQF through a focus group discussion with 9 vocational education administration experts selected purposively. The research instruments included structured interview forms, questionnaires, and focus group discussion guidelines. Qualitative data were analyzed using descriptive content analysis, and quantitative data were analyzed using exploratory factor analysis, including indicators. The research findings revealed that the guidelines for developing AI competencies of vocational education teachers for high-performance vocational education management according to the TVQF consisted of three main components: 1) Cognitive Domain, 2) Psychomotor Domain, and 3) Affective Domain. The sub-components included: (1) Computer and AI Literacy, (2) AI Access, (3) AI Use, (4) AI Media Production and Creation, (5) AI Communication, (6) AI Media Management, and (7) AI Evaluation. Five methods for developing AI competencies for high-performance vocational education management according to the TVQF were identified: (1) Self-directed Learning and Development, (2) Online Learning, (3) Case Studies, (4) AI-assisted Learning, and (5) Practical Training. The appropriate process for developing AI competencies for high-performance vocational education management according to the TVQF using the PIERI process included: (1) Planning (P), (2) Implementation (I), (3) Evaluation (E), (4) Reflection (R), and (5) Improvement (I). The research results could be used to establish policies or mechanisms for administrators to apply in developing AI competencies for teachers and staff in managing high-performance vocational education according to the TVQF to enhance efficiency and effectiveness.

Keywords: AI competencies, Vocational education teachers, Thailand Vocational Qualifications Framework

Introduction

The era of Education Disruption, under the next normal circumstances in Thailand and globally, has had a severe and continuous impact on vocational education organizations in terms of management, operations, and has triggered a quantum leap in educational policy changes at both national and international levels (Phakamach, 2023). However, in reality, higher education institutions face numerous problems and obstacles in achieving their goals, resulting in student efficiency and graduate quality remaining below standard, with competencies or learning outcomes potentially not aligning with 21st-century skills. Top-level administrators need to shift their thinking and adopt new management approaches that are responsive to change (Ahmed et al., 2023; Phakamach, Panjarattanakorn, & Onsampant, 2023; Mambile & Mwogosi, 2025), especially in the age of Artificial Intelligence Literacy,

which requires comprehensive AI strategic planning covering all aspects of the organization. This leads to the implementation of strategic methods such as establishing an AI-driven organizational structure, fostering an AI culture and environment, applying ICT systems for education, creating educational innovations, managing online education, and integrating strategy control and evaluation into an efficient and effective strategic management model. Senior administrators are directly responsible for the strategic management of vocational education institutions at every stage (Yadav, 2022; Phakamach et al., 2023; Jafar & Keykha, 2024).

The educational management context for vocational education institutions, under Thailand's National Vocational Qualifications Framework B.E. 2567 (2024), outlines a quality framework for graduates across all levels. Vocational qualifications must encompass at least four key aspects: (1) Ethics, Morality, and Desirable Characteristics, referring to graduates should be ethical, moral, possess professional integrity, positive attitudes, and pride in Thai identity. They must respect laws and others' rights, be responsible citizens under a democratic regime, have a public mind, and be environmentally conscious. (2) Knowledge, referring to factual, principled, and theoretical knowledge relevant to their field of study or work. (3) Skills, referring to graduates must demonstrate the ability to perform assigned tasks, apply logical and creative thinking to problem-solving, possess lifelong learning skills, and exhibit practical proficiency aligned with vocational qualification standards at each level. (4) Application and Responsibility, this involves applying knowledge and social skills in professional development, including communication, leadership, responsibility, and independence in operations such as decision-making and accountability (Office of the Vocational Education Commission, 2024).

Thai Vocational Education 4.0 is a teaching and learning approach that instructs learners to creatively integrate knowledge available everywhere in the world to develop various innovations that meet the needs of society. The key skills emphasized for vocational education learners entering Thailand 4.0. Those who directly impact the development of the country's children and youth to possess skills and characteristics suitable for Thailand 4.0 are "teachers." Therefore, teachers must have sufficient knowledge and ability to develop learners with appropriate characteristics for the country's development in the Thailand 4.0 era. Teachers must be able to teach vocational education students to have analytical thinking (a fundamental thinking skill for further advanced thinking), critical thinking (a process of reasoned consideration, with principles and careful examination of all relevant evidence, using established criteria and logic to arrive at the most appropriate or best answer for decision-making, evaluation, or problem-solving), creative thinking (thinking outside the box from existing ideas with the aim of generating new ideas, originality, or prototypes that can be effectively utilized), productive thinking (producing or creating tangible outputs that will become future innovations), and responsibility thinking in the work performed and the outputs produced, ultimately leading to the development of professional skills (Yadav, 2022; Holmes et al., 2022; Saib et al., 2023; Marengo et al., 2024).

Vocational education institutions are vocational training institutions, and administrators and teachers are key drivers of reform directions, such as academic and quality development, behavioral change, providing opportunities for discussion and collaboration with learners, encouraging participation in extracurricular activities, seeking knowledge for self and teaching development to their full potential, creating a learning society, providing appropriate and effective learning media, and building vocational education innovation institutions (Zhao & Ko, 2024). Furthermore, there should be regular reporting of institutional performance, with continuous involvement of stakeholders and the Office of the Vocational Education Commission at every stage. Moreover, there should be

decentralization of administrative authority in curriculum development, teaching and learning process management, learner development activities, assessment and evaluation, and the creation of modern learning media and resources (Ahmed et al., 2023; Phakamach, Panjarattanakorn, & Onsampant, 2023; Mambile & Mwogosi, 2025), all to ensure that the development of learner quality aligns with the standards, has a systematic operational plan, and is clear for practical implementation. The Office of the Vocational Education Commission has set quality development focuses as guidelines for driving the curriculum, learning management, and assessment towards the development of learner quality as a priority (Phakamach, Panjarattanakorn, & Ratchavieng, 2023; Phakamach et al., 2022).

The development of high-level manpower to support the Eastern Economic Corridor (EEC) and the country's socio-economic system aims to propose measures and mechanisms to support manpower development to meet the needs of industries in the EEC area, covering both First S-curve and New S-curve industries, and infrastructure development, including rail transport, maritime transport, and logistics. It also covers target manpower groups at vocational, bachelor's, master's, and doctoral levels. Key measures and mechanisms include the development of a national and EEC-specific graduate demand data system and plan, the development of technological capabilities for personnel in establishments with joint manpower development or research (R&D Consortium) agendas, the promotion of manpower development or joint research between educational institutions and establishments in the EEC area through various mechanisms such as Work-integrated Learning, Talent Mobility mechanisms for transferring personnel from vocational education institutions to work in establishments with research questions from establishments in the EEC area, the use of educational innovation Sandbox to develop curricula that align with the needs of establishments in the EEC area, the provision of personnel to offer consulting services to establishments seeking to extend their business strategies towards research, development, and innovation, the commercialization of research findings, and the development of personnel to work effectively in government agencies providing research and innovation services (Office of the Eastern Economic Corridor Policy Board (OCPO). (2021)

Currently, raising awareness and recognizing the importance of effective AI technology or ICT management is a crucial educational issue in the digital economy (Lee & Meng, 2021). Administrative resource factors are being incorporated into the development of AI technology or ICT systems for management in educational institutions to facilitate modern operations and enhance learning efficiency for greater achievement. The use of ICT systems and AI competency of personnel will be critical resources for managing towards the set goals. However, the systematic use of AI technology for educational development requires appropriate management models, planning, monitoring, and continuous improvement as key issues, especially in higher education, where a rapidly changing environment inevitably affects educational effectiveness. If systematic ICT system management is in place to assist in large data storage and the creation and provision of comprehensive educational AI data services that are easy, flexible, convenient, and fast to access, the management of higher education institutions will become more efficient (Holmes et al., 2022; Phakamach, Senarith, & Wachirawongpaisarn, 2022; Oladimeji, 2023; Hao & Demir, 2024; Guo, Gu, & Huo, 2025). Concurrently, the lack of AI competence in vocational education management in Thailand stems from several key factors. Educational personnel often lack the necessary knowledge and skills to apply AI effectively in both teaching and administrative tasks. Furthermore, limitations in infrastructure and technology, such as insufficient access to equipment and the internet, pose significant barriers. Challenges also include the inadequate development of AI-integrated curricula and insufficient teacher

training to keep pace with technological advancements. Strategic planning within vocational institutions also struggles to adapt to the rapidly changing digital environment. These factors collectively hinder the full potential of AI adoption in vocational education. Therefore, developing AI competencies in vocational education institutions for educational personnel is a crucial issue that needs to be addressed through short-term, medium-term, and long-term planning, as well as periodic assessment of AI competencies for personnel performance.

Based on the outlined background and significance, this research aims to explore guidelines for developing AI competencies among vocational education teachers for high-performance vocational education management, aligned with the TVQF. The study has three objectives where: 1) to characterize AI competencies for vocational education teachers in high-performance management under the TVQF; 2) to analyze the components of these AI competencies; and 3) to identify development guidelines for these competencies. This will be achieved through a mixed-methods approach, combining quantitative and qualitative research. The sample and target groups will include individuals directly involved in developing AI competencies for vocational education teachers in high-performance management, focusing on vocational education institutions in Thailand's eastern region. The research will apply relevant theories to align with AI competency development guidelines for vocational education. By analyzing AI competency components for effective teaching and learning, the study will yield appropriate and beneficial guidelines, serving as a crucial mechanism to enhance AI competencies across all vocational education institutions, ensuring quality and efficiency in AI education.

Research methodology

This research employed a convergent parallel mixed methods research design, integrating quantitative and qualitative data concurrently. This design allows for the simultaneous collection and analysis of both quantitative (for component analysis) and qualitative (for characteristic study) data. This concurrent approach facilitates data triangulation, enhancing the validity of findings and leading to robust guidelines for AI competencies development. The specific details are as follows:

Population and Sample

Population: The population consisted of teachers and educational personnel in vocational education institutions in the eastern region during the academic year 2024, from 9 institutions across 4 eastern provinces: Chonburi, Rayong, Chanthaburi, and Trat, totaling 1,568 individuals.

Sample: 1) Qualitative Research Sample: The qualitative research sample comprised 15 administrators from vocational education institutions in the eastern region. These administrators were selected using purposive sampling based on the following criteria and snowball sampling: (1) Directors or former directors of public and private vocational education institutions, (2) Administrators with at least 3 years of experience in managing public and private vocational education institutions, and (3) Administrators who have achieved demonstrable success and quality awards in developing educational organizations at all levels. 2) Quantitative Research Sample: The quantitative research sample included 504 administrators, teachers, and staff from 6 vocational education institutions in the eastern region, under the Office of the Vocational Education Commission, Ministry of Education. This sample was obtained through multistage sampling, with the following steps: step 1: The researcher randomly selected vocational education institutions using simple random

sampling (lottery method). The researcher believed that the fundamental contexts of all 9 vocational education institutions are based on the same principles of the 2021 classification of vocational education institutions. Furthermore, the contexts of educational management and learning management are similar, indicating overall homogeneity among the institutions. Six vocational education institutions in the eastern region were selected: 1) Ban Khai Technical College, 2) Rayong Technical College, 3) Chanthaburi Technical College, 4) Chonburi Technical College, 5) Map Ta Phut Technical College, and 6) Sattahip Technical College. Step 2: From the 6 vocational education institutions selected in Step 1, the researcher randomly sampled 84 teachers and staff from each institution using simple random sampling (lottery method), resulting in a total sample of 504 personnel from vocational education institutions in the eastern region.

Research procedure

Step 1: Studying the Characteristics of AI Competencies: This step focused on the AI competencies of vocational education teachers for high-performance vocational education management according to the TVQF. It involved: (1) Studying concepts and theories from relevant documents, textbooks, and research, and using document analysis regarding AI competencies for vocational education management. (2) Conducting in-depth interviews with 12 administrators of higher education institutions who have demonstrable achievements and success in managing vocational education institutions. The data were analyzed and summarized to identify key characteristics and components of AI competencies for vocational education teachers for high-performance vocational education management according to the TVQF in four areas: AI literacy, AI application, AI problem-solving with AI tools, and AI adaptation to change.

Step 2: Analyzing the Components of AI Competencies: This step involved analyzing the components of AI competencies of vocational education teachers for high-performance vocational education management according to the TVQF. The findings from Step 1 were used to develop a 5-point rating scale questionnaire. The collected data were then subjected to Exploratory Factor Analysis (EFA) to identify significant components. This was done by: (1) Analyzing and extracting components using Principal Component Analysis (PCA) with oblique rotation (Promax). The criteria for considering components included an Eigenvalue of 1.0 or higher, and each variable having a factor loading of .50 or higher. (2) Analyzing correlations using Pearson's Product Moment Correlation Coefficient, which revealed statistically significant correlations at the .05 level, ranging from .05 to .92, with most variables showing moderate and positive relationships, indicating that the indicators were related and suitable for further exploratory factor analysis. Subsequently, Bartlett's Test of Sphericity was conducted on all observed variables, yielding a value of 30145.72 with df = 3841 and a p-value less than .001, indicating that the correlation matrix of the observed variables was not an identity matrix. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) was .953, which is greater than .50, indicating sufficient inter-variable correlation for factor analysis.

Step 3: Verifying the Components of AI Competencies: This step involved verifying the components of AI competencies of vocational education teachers for high-performance vocational education management according to the TVQF using Data Triangulation Methodology, this is a research strategy that compares diverse methods, data sources, or data collectors. Its purpose is to confirm the accuracy and reliability of information, reduce bias, and enhance the comprehensiveness of research findings, leading to well-rounded perspectives and more precise results. Empirical data from Steps 1 and 2

were compared to identify similarities, differences, and consistencies to arrive at conclusions regarding the characteristics and components using composition and narrative methods.

Step 4: Presenting Guidelines for Developing AI Competencies: This step focused on presenting guidelines for developing AI competencies of vocational education teachers for high-performance vocational education management according to the TVQF through a connoisseurship approach, involving a focus group discussion with 9 experts in vocational education institution administration. These experts were selected using purposive sampling. The criteria for selecting experts are as follows: 1) administrators of vocational education institutions with at least 3 years of experience in public and private sector management, 2) administrators of vocational education institutions who have achieved demonstrable success and quality awards in digital organizational development at the vocational education level, and 3) experts or instructors with over 5 years of experience in developing digital competencies within educational organizations. The data from Step 3 were used to formulate guidelines, and content analysis and data classification were employed to determine the appropriate guidelines for developing AI competencies of vocational education teachers for high-performance vocational education management according to the TVQF.

Data collection

Qualitative data were collected through online interviews with 12 vocational education institution administrators and 9 experts in a focus group discussion. Quantitative data were collected using an online questionnaire distributed to 504 individuals, with all 504 questionnaires and data links returned, representing a 100% response rate. Data collection took place between October and December 2024.

Research instruments

1) The quantitative research instrument was a 5-point rating scale questionnaire based on Likert's method, comprising 21 items across 4 dimensions: 1) AI literacy, 2) AI application, 3) AI problem-solving with AI tools, and 4) AI adaptation to change. The scoring criteria were: “Highest” = 5, “High” = 4, “Moderate” = 3, “Low” = 2, and “Lowest” = 1.

2) The qualitative research instrument was a semi-structured interview guide. The quality of the questionnaire was assessed by testing construct and content validity using 3 research instrument experts, selecting items with a Congruence Index (IOC) of .5 or higher, resulting in an IOC of .886. The questionnaire was then pilot-tested with 30 vocational education institution administrators who were not part of the sample group. Reliability was tested using Cronbach’s Alpha Coefficient, and item discrimination was assessed using Item Total Correlation, yielding a reliability coefficient for the entire questionnaire of .924.

Data analysis

Qualitative data were analyzed using content analysis to identify themes/topic groups and key concepts that form the essence of the research, employing composition and narrative methods. Quantitative data were analyzed using the Statistical Package for the Social Sciences (SPSS) by calculating percentages, means, and standard deviations. The 5-point rating scale was used to study the components of AI competencies of vocational education teachers for high-performance vocational education management according to the TVQF, with the following interpretation criteria: Mean score 4.50-5.00 = Highest level of actual practice, 3.50-4.49 = High level of actual practice, 2.50-3.49 = Moderate level of actual practice, 1.50-2.49 = Low level of actual practice, and 1.00-1.49 = Lowest level of

actual practice. The collected data were then reviewed for completeness and accuracy before being summarized and discussed in the final stage.

Research results

Based on the research process outlined, the research findings and data analysis according to the research objectives are presented as follows:

1. Characteristics of AI Competencies of Vocational Education Teachers for High-Performance Vocational Education Management According to the Thailand Vocational Qualifications Framework (TVQF).

The AI competencies of vocational education teachers for high-performance vocational education management according to the TVQF comprises four characteristic domains:

1) AI Literacy: This refers to the AI competencies to appropriately access, search, filter, analyze, synthesize, manage, apply, communicate, create, share, and monitor information and content media without infringing on the rights of others, with responsibility, safety, etiquette, and adherence to relevant laws.

2) AI Skill/ICT Skill: This refers to the AI competencies to use various AI tools and technologies, including ICT systems for education, fluently, efficiently, diversely, and with increasing applicability in various tasks such as occupation, self-development education and learning, and daily life.

3) Problem Solving with AI Tools: This refers to the AI competencies to identify AI needs and resources, make informed decisions in using appropriate AI tools according to objectives and needs, solve interconnected problems using AI tools, creatively utilize AI technology to solve technical issues, and continuously improve one's own competence to keep pace with global advancements.

4) Adaptive AI Transform: This refers to the AI competencies to be flexible and adapt to a rapidly changing world and various trends, such as technological changes and globalization. It includes the ability to work collaboratively with others from diverse social and cultural backgrounds, to initiate and learn independently, and to develop oneself and colleagues towards a complete AI-integrated society.

2. Components of AI Competencies of Vocational Education Teachers for High-Performance Vocational Education Management According to the Thailand Vocational Qualifications Framework (TVQF).

The results of the exploratory factor analysis from empirical data are presented in Tables 1-3, respectively. The findings indicate that the main components of AI competencies for vocational education teachers for high-performance vocational education management according to the TVQF consisted of three components: 1) Cognitive Domain, 2) Psychomotor Domain, and 3) Affective Domain. The sub-components comprise seven elements: (1) Computer and AI Literacy, (2) AI Access, (3) AI Use, (4) AI Media Production and Creation, (5) AI Communication, (6) AI Media Management, and (7) AI Evaluation. These components include a total of 195 indicators. All components together can explain 83.187% of the AI competencies of vocational education teachers for high-performance vocational education management according to the TVQF. The details of each component were as follows:

Table 1: Number of components in the cognitive domain of AI competencies for vocational education teachers for high-performance vocational education management according to the Thailand Vocational Qualifications Framework

Main Components	Sub-Components Name	Number of items from the questionnaire	Egen Value	Percentage of variance
Cognitive domain	- Knowledge of Computer and AI Fundamentals	8	8.298	6.215
	- Knowledge of AI Access	10	15.106	16.104
	- Knowledge of AI Use	10	15.106	16.104
	- Knowledge of AI Media Production and Creation	9	10.156	8.066
	- Knowledge of AI Communication	8	8.298	6.215
	- Knowledge of AI Media Management	11	19.377	22.798
	- Knowledge of AI Evaluation	9	10.146	8.066
	Total			83.568

Based on Table 1, the items and details were as follows:

(1) Knowledge of Computer and AI Fundamentals: This refers to having knowledge about basic computer and AI concepts. This component has 8 items: 1) Concepts of computers and ICT systems for education, 2) Principles of operation, roles, and benefits of computers and AI, 3) Computer assembly, installation, and maintenance, 4) Peripheral device installation with drivers, 5) Basic operating system (OS) installation, 6) Application software installation, 7) Application of ICT systems and troubleshooting methods, and 8) Application of AI platforms for education.

(2) Knowledge of AI Access: This refers to having knowledge about accessing AI. This component has 10 items: 1) Appropriate and flexible AI access, 2) Evaluation of retrieved AI, 3) Efficient use of AI in all forms, 4) Use of AI in diverse formats, 5) Methods for appropriate AI retrieval, 6) AI evaluation, 7) Efficient use of desired AI, 8) Internet usage for access, 9) Usage of Web Browsers, Search Engines, AI platforms for education, and various applications, and 10) Sources for standard AI retrieval.

(3) Knowledge of AI Use: This refers to having knowledge about using AI for educational management. This component has 10 items: 1) Quality of AI from retrieved sources, 2) Beneficial use of AI, 3) Ethical use of AI, 4) Appropriate selection of AI, 5) Ability to analyze AI usage, 6) Appropriate synthesis of retrieved AI, 7) Evaluation of retrieved AI, 8) Efficient use of AI, 9) Creative use of AI, and 10) Critical use of AI.

(4) Knowledge of AI Media Production and Creation: This refers to having knowledge about producing and creating AI media for teaching and learning management. This component has 9 items: 1) Using word processing programs, 2) Using spreadsheet programs, 3) AI media production and creation processes, 4) Creative analysis and design of AI media, 5) AI media synthesis, 6) AI media evaluation, 7) Development of modern AI platforms, 8) Critical production and creation of AI media, and 9) Efficient production and creation of AI media.

(5) Knowledge of AI Communication: This refers to having knowledge about AI communication for educational development. This component has 8 items: 1) Using presentation programs, 2) AI communication for living and working, 3) Selecting

communication techniques via internet channels, 4) AI communication that enhances work efficiency, 5) AI communication in terms of benefits, 6) AI communication and appropriate usage trends, 7) Developing efficient AI communication formats, and 8) Applying AI tools for educational communication.

(6) Knowledge of AI Media Management: This refers to having knowledge about AI media management. This component has 11 items: 1) AI media management, 2) Selecting communication techniques in management, 3) Management of data collection, 4) Management of data verification, 5) Management of data processing, 6) Management of data maintenance, 7) Managing data import as needed, 8) Managing data compilation into files, 9) Managing the correct categorization of data, 10) AI media management related to report generation, and 11) Data security and setting up data protection.

(7) Knowledge of AI Evaluation: This refers to having knowledge about AI evaluation. This component has 9 items: 1) Evaluating the value/quality of AI, 2) Measuring and evaluating AI, 3) AI-based analysis, 4) AI-based synthesis, 5) AI evaluation processes, 6) Appropriate AI evaluation formats, 7) Evaluating and verifying content accuracy, 8) Evaluating AI in terms of reliability, and 9) Evaluating AI in terms of modernity.

Table 2: Number of components in the psychomotor domain of AI competencies for vocational education teachers for high-performance vocational education management according to the Thailand Vocational Qualifications Framework

Main Components	Sub-Components Name	Number of items from the questionnaire	Egen Value	Percentage of variance
Psychomotor domain	Skills in Computer and AI Fundamentals	8	7.994	6.118
	Skills in AI Access	10	14.762	15.987
	Skills in AI Use	10	14.762	15.987
	Skills in AI Media Production and Creation	9	9.916	8.128
	Skills of AI Communication	8	7.994	6.118
	Skills of AI Media Management	11	18.909	21.664
	Skills of AI Evaluation	9	9.916	8.128
	Total			82.130

Based on Table 2, the items and details were as follows:

(1) Skills in Computer and AI Fundamentals: This refers to having skills in basic computer and AI concepts. This component has 8 items: 1) Use tools and equipment for computer maintenance, 2) Assemble, install, and maintain computers, 3) Install peripheral devices with drivers, 4) Install basic operating system (OS), 5) Install application software, 6) Install AI communication programs, and 7) Troubleshoot using ICT processes.

(2) Skills in AI Access: This refers to having skills in accessing AI. This component has 10 items: 1) Access appropriate AI, 2) Evaluate retrieved AI, 3) Use AI efficiently in all forms, 4) Use AI in diverse and flexible formats, 5) Methods for appropriate AI retrieval, 6) Evaluate AI results, 7) Use desired AI efficiently, 8) Use the internet for access, 9) Use Search Engines and Web Browsers, and 10) Access standard AI retrieval sources.

(3) Skills in AI Use: This refers to having skills in using AI. This component has 10 items: 1) Recognize the quality of AI from retrieved sources, 2) Use AI beneficially, 3) Use AI ethically, 4) Select appropriate AI, 5) Analyze AI usage, 6) Appropriately synthesize

retrieved AI, 7) Evaluate retrieved AI results, 8) Use AI efficiently, 9) Use AI creatively, and 10) Use AI critically.

(4) Skills in AI Media Production and Creation: This refers to having skills in producing and creating AI media. This component has 9 items: 1) Use word processing programs, 2) Use spreadsheet programs, 3) Produce and create AI media, 4) Creatively analyze and design AI media, 5) Synthesize AI media, 6) Evaluate AI media results, 7) Develop modern AI platforms, 8) Critically produce and create AI media, and 9) Efficiently produce and create AI media.

(5) Skills in AI Communication: This refers to having skills in AI communication. This component has 8 items: 1) Use presentation programs, 2) Communicate using AI for living and working, 3) Select communication techniques via internet channels, 4) Communicate using AI to enhance work efficiency, 5) Communicate the benefits of AI, 6) Communicate about AI and appropriate usage trends, 7) Develop efficient AI communication formats, and 8) Communicate using AI for educational development.

(6) Skills in AI Media Management: This refers to having skills in managing AI media. This component has 11 items: 1) Manage AI media, 2) Select communication techniques in management, 3) Manage data collection, 4) Manage data verification, 5) Manage data processing, 6) Manage data maintenance, 7) Manage data import as needed, 8) Manage data compilation into files, 9) Manage the correct categorization of data, 10) Manage AI media related to report generation, and 11) Protect and configure data security.

(7) Skills in AI Evaluation: This refers to having skills in evaluating AI. This component has 9 items: 1) Evaluate the value/quality of AI, 2) Measure and evaluate AI results, 3) Analyze using AI, 4) Synthesize using AI, 5) Apply AI evaluation processes, 6) Use appropriate AI evaluation formats, 7) Evaluate and verify content accuracy, 8) Evaluate AI in terms of reliability, and 9) Evaluate AI in terms of modernity.

Table 3: Number of components in the affective domain of AI competencies for vocational education teachers for high-performance vocational education management according to the Thailand Vocational Qualifications Framework

Main Components	Sub-Components Name	Number of items from the questionnaire	Egen Value	Percentage of variance
Affective Domain	- Awareness/Understanding of Computer and AI Fundamentals	8	8.141	6.228
	- Awareness/Understanding of AI Access	10	14.996	16.175
	- Awareness/Understanding of AI Use	10	14.996	16.175
	- Awareness/Understanding of AI Media Production and Creation	9	10.241	8.109
	- Awareness/Understanding of AI Communication	8	8.141	6.228
	- Awareness/Understanding of AI Media Management	11	19.775	22.841
	- Awareness/Understanding of AI Evaluation	9	10.241	8.109
	Total			83.864

Based on Table 3, the items and details were as follows:

(1) Awareness/Understanding of Computer and AI Fundamentals: This refers to having awareness/understanding of basic computer and AI concepts. This component has 8 items: 1) Using tools and equipment for computer maintenance, 2) Assembling, installing, and maintaining computers, 3) Installing peripheral devices with drivers, 4) Installing basic operating system (OS), 5) Installing application software, 6) Troubleshooting using ICT processes, 7) Applying AI tools for education, and 8) Using AI platforms for education.

(2) Awareness/Understanding of AI Access: This refers to having awareness/understanding of AI access. This component has 10 items: 1) Accessing appropriate AI, 2) Evaluating retrieved AI, 3) Using AI efficiently in all forms, 4) Using AI in diverse formats, 5) Methods for appropriate AI retrieval, 6) Evaluating AI results, 7) Using desired AI efficiently, 8) Using the internet for access, 9) Using Search Engines and Web Browsers, and 10) Sources for standard AI retrieval.

(3) Awareness/Understanding of AI Use: This refers to having awareness/understanding of AI use. This component has 10 items: 1) Using information by considering quality from retrieval sources, 2) Using information beneficially, 3) Using information ethically, 4) Using information appropriately, 5) Analyzing information use, 6) Appropriately synthesizing retrieved information, 7) Evaluating retrieved information results, 8) Using information efficiently, 9) Using information creatively, and 10) Using information critically.

(4) Awareness/Understanding of AI Media Production and Creation: This refers to having awareness/understanding of producing and creating AI media. This component has 9 items: 1) Using word processing programs, 2) Using spreadsheet programs, 3) AI media production and creation processes, 4) Creatively analyzing and designing AI media, 5) Synthesizing AI media, 6) Evaluating AI media results, 7) Developing modern AI platforms, 8) Critically producing and creating AI media, and 9) Efficiently producing and creating AI media.

(5) Awareness/Understanding of AI Communication: This refers to having awareness/understanding of AI communication. This component has 8 items: 1) Using presentation programs, 2) AI communication for living and working, 3) Selecting communication techniques via internet channels, 4) AI communication that enhances work efficiency, 5) AI communication in terms of benefits, 6) AI communication and appropriate usage trends, 7) Developing efficient AI communication formats, and 8) Developing AI competencies for education.

(6) Awareness/Understanding of AI Media Management: This refers to having awareness/understanding of AI media management. This component has 11 items: 1) Managing AI media, 2) Selecting communication techniques in management, 3) Managing data collection, 4) Managing data verification, 5) Managing data processing, 6) Managing data maintenance, 7) Managing data import as needed, 8) Managing data compilation into files, 9) Managing the correct categorization of data, 10) Managing AI media related to report generation, and 11) Protecting and configuring data security.

(7) Awareness/Understanding of AI Evaluation: This refers to having awareness/understanding of AI evaluation. This component has 9 items: 1) Evaluating the value/quality of AI, 2) Measuring and evaluating AI results, 3) Analyzing using AI, 4) Synthesizing using AI, 5) Applying AI evaluation processes, 6) Using appropriate AI evaluation formats, 7) Evaluating and verifying content accuracy, 8) Evaluating AI in terms of reliability, and 9) Evaluating AI in terms of modernity.

From previous research findings, a point of interest lies in the study of “AI Competencies Components” and “Characteristics of AI Competencies” among vocational

education teachers. This focuses on analyzing and clearly identifying indicators across cognitive, psychomotor, and affective domains, which will lead to the establishment of "Development Guidelines" for AI competencies in high-performance vocational education management, in accordance with the Thailand Vocational Qualifications Framework, to be presented in the next section.

3. Guidelines for Developing AI Competencies of Vocational Education Teachers for High-Performance Vocational Education Management According to the Thailand Vocational Qualifications Framework (TVQF).

Based on the component verification results, guidelines for developing AI competencies of vocational education teachers for high-performance vocational education management according to the TVQF can be established using data triangulation and a focus group discussion with 9 experts. These guidelines encompass development methods, development processes, and success factors for AI competencies development, as follows:

3.1 Methods for Developing AI Competencies: Five methods for developing AI competencies of vocational education teachers for high-performance vocational education management according to the TVQF were identified: (1) Self-directed learning and development, (2) Online learning, (3) Case studies, (4) AI-assisted learning, and (5) Practical training. Development activities include AI knowledge exchange, learning from role models, and experiential learning. In practice, appropriate development methods should be adapted based primarily on the context of each vocational education institution.

3.2 Process for Developing AI Competencies: The appropriate process for developing AI competencies of vocational education teachers for high-performance vocational education management according to the TVQF, using the PIERI process, comprised: (1) Planning (P): Defining projects or development plans for AI competencies that align with the core missions of each institution. This includes specifying formats, tools, methods, and timelines for AI competence development that can be implemented and evaluated. (2) Implementation (I): Implementing the defined projects or plans, which may involve dividing implementation based on functional areas or usage levels. (3) Evaluation (E): Assessing the outcomes resulting from the implementation of projects or plans and methods. Clear indicators must be established to ensure that participants achieve AI competencies at the specified levels. (4) Reflection (R): Reflecting on the implementation by analyzing and synthesizing the results obtained from the AI competencies evaluation of development participants. (5) Improvement (I): Analyzing the results of the reflection on the AI competence evaluation of development participants to inform the improvement of formats and methods, as well as planning for future AI competencies development. For effective development of AI competencies among vocational education teachers for high-performance vocational education management according to the TVQF, the development format should be structured as practical training modules separated by functional areas (e.g., academic and support staff) or usage levels (based on defined competencies such as basic, operational, and advanced). Indicators for monitoring and evaluating overall AI competencies periodically or cyclically should be established for continuous improvement of AI competence.

3.3 An effective strategy for developing AI competencies in vocational education teachers were as follows: 1) Developing Clear AI Curricula and Competency Standards: (1) Define a framework for essential AI competencies for vocational education teachers, covering knowledge, skills, and desirable attitudes, and (3) Systematically integrate AI content into pre-service teacher training and in-service professional development curriculum. 2) Investing in Modern AI Infrastructure and Technology: (1) Provide vocational education institutions with necessary computer equipment, AI software, and learning

platforms, and (2) Establish dedicated laboratories or spaces for teachers to practice using AI. 3) Implementing Continuous and Diverse Teacher Professional Development Programs: (1) Design practical, hands-on AI training courses for teachers, available in both online and offline formats, and (2) Promote knowledge sharing among teachers and foster AI-focused Professional Learning Communities (PLCs). 4) Supporting Research and Development (R&D) of AI Innovation in Education Management: (1) Allocate budgets and resources to encourage teachers and institutions to conduct research and develop AI tools or AI-based teaching innovations, and (2) Create platforms for disseminating research findings and innovations to other educational institutions. 5) Fostering Collaboration with Industry and AI Experts: (1) Organize activities that connect teachers with experts from the AI industry to facilitate learning from real-world experiences, and (2) Promote joint research, internships in companies, or collaborative curriculum development to ensure teachers possess AI skills relevant to labor market demands.

3.4 Success Factors for Developing AI Competencies: The success factors for developing AI competence of vocational education teachers for high-performance vocational education management according to the TVQF included: (1) Having an AI competencies development curriculum, (2) Providing appropriate resources for AI competencies development, (3) Defining AI competencies indicators that allow for realistic competence assessment, (4) Continuous and systematic monitoring and evaluation, and (5) Establishing networks for AI competencies development for education at both national and international levels.

Discussion

From the research findings and the summary mentioned above, there are significant points that can be discussed to highlight the research issues according to the objectives, aligning with previous research and academic works, as follows:

1. The characteristics of AI competencies of vocational education teachers for high-performance vocational education management according to the Thailand Vocational Qualifications Framework comprised 4 domains: 1) AI Literacy, 2) AI Skill/ICT Skill, 3) Problem Solving with AI Tools, and 4) Adaptive AI Transform, which aligns with the framework of the National Information Technology Committee (2019) for personnel development for AI-driven education management.

2. Components of AI Competencies of Vocational Education Teachers for High-Performance Vocational Education Management According to the Thailand Vocational Qualifications Framework:

2.1 The components of knowledge, skills, and awareness/understanding of computer and AI fundamentals are integral to AI competencies. This indicated that practitioners possess the knowledge, skills, and awareness/understanding of basic computer and AI for daily application, consistent with the research of Agila-Palacios et al. (2022), Jafar & Keykha (2024), and Hao & Demir (2024), which found that knowledge of computer and AI fundamentals enables users to fully utilize AI tools for educational management and achieve learning objectives.

2.2 The components of knowledge, skills, and awareness/understanding of AI access are integral to AI competencies. This indicated that practitioners possess the knowledge, skills, and awareness/understanding of AI access for retrieving beneficial information to improve service quality, consistent with the research of Bodiako et al. (2021), Agila-Palacios et al. (2022), Jafar & Keykha (2024), and Marengo et al. (2024), which found

that AI access is a crucial competence for searching, recording, and storing data for achieving desired goals.

2.3 The components of knowledge, skills, and awareness/understanding of AI use are integral to AI competencies. This indicated that practitioners possess the knowledge, skills, and awareness/understanding of AI use, consistent with the research of Bodiako et al. (2021), Agila-Palacios et al. (2022), Jafar & Keykha (2024), Hao & Demir (2024), and Mambile & Mwogosi (2025), which found that the ability and skills in using AI for education within organizations can empirically demonstrate the efficiency of personnel performance.

2.4 The components of knowledge, skills, and awareness/understanding of AI media production and creation are integral to AI competencies. This indicated that practitioners possess the knowledge, skills, and awareness/understanding of AI media production and creation for developing quality media or innovations, consistent with the research of Bodiako et al. (2021), Parkatti et al. (2022), Agila-Palacios et al. (2022), Marengo et al. (2024), and Mambile & Mwogosi (2025), which found that AI media production and creation is a working ability for developing organizations towards efficient innovation.

2.5 The components of knowledge, skills, and awareness/understanding of AI communication are integral to AI competencies. This indicated that practitioners possess the knowledge, skills, and awareness/understanding of AI communication for communication and fostering collaboration, consistent with the research of Agila-Palacios et al. (2022), Hao & Demir (2024), and Marengo et al. (2024), which stated that communication in the AI era is essential for living and working in the present and future. Personnel must be able to communicate using AI in all forms for work and supporting educational services.

2.6 The components of knowledge, skills, and awareness/understanding of AI media management are integral to AI competencies. This indicated that practitioners possess the knowledge, skills, and awareness/understanding of AI media management for application in management, consistent with the research of Agila-Palacios et al. (2022), Hao & Demir (2024), Marengo et al. (2024), and Mambile & Mwogosi (2025), which found that AI media management is another form of strategy used as a tool for work and organizational development towards excellence. Therefore, personnel must have the ability to manage AI systematically.

2.7 The components of knowledge, skills, and awareness/understanding of AI evaluation are integral to AI competencies. This indicated that practitioners possess the knowledge, skills, and awareness/understanding of AI evaluation for understanding the benefits and ethics of AI, consistent with the research of Agila-Palacios et al. (2022), Hao & Demir (2024), Marengo et al. (2024), and Mambile & Mwogosi (2025), which found that personnel should have the ability to distinguish the benefits of AI media and the ability to use quality media for the sustainable development of the organization.

3. The guidelines for developing AI competencies of vocational education teachers for high-performance vocational education management according to the Thailand Vocational Qualifications Framework could be used to develop AI competencies for personnel in terms of knowledge, skills, and awareness/understanding of AI, consistent with the research of Bodiako et al. (2021), Agila-Palacios et al. (2022), Marengo et al. (2024), Jafar & Keykha (2024), Hao & Demir (2024), Zhao & Ko (2024), and Mambile & Mwogosi (2025), which found that developing AI competencies for personnel in the AI-driven economy era is essential for living and applying it in work. AI literacy will help enable collaboration with others in all situations, allowing organizations to survive and grow sustainably amidst disruptive AI changes. The research findings reflect the urgent necessity

for vocational education teachers to possess AI competencies for quality educational management. This is the core of preparing for a future labor market driven by AI. A lack of expertise in this area will undermine students' potential to adapt and compete. Therefore, in the context of vocational education management, developing teachers' AI competencies is a crucial strategy to ensure vocational education can produce high-quality personnel who truly meet the demands of modern industries.

Finally, it can be concluded overall that the research study on "Guidelines for Developing AI Competencies of Vocational Education Teachers for High-Performance Vocational Education Management According to the Thailand Vocational Qualifications Framework," following the presented research methodology, yielded characteristics, components, and guidelines for developing AI competencies of vocational education teachers for high-performance vocational education management according to the TVQF. The research results can be used as guidelines for developing educational personnel and building vocational education innovation organizations in the AI era, which will benefit relevant educational agencies and serve as a model for planning the development of AI competence for personnel in vocational education institutions to be efficient and suitable for AI-driven education management in the future.

Recommendations for applying the research results were followed.

1) Relevant agencies, including the Ministry of Education and other vocational education institutions, can utilize the identified components to establish criteria/job standards for personnel in the AI-driven vocational education era. These standards should include characteristics or behaviors within each component as indicators and can be structured as training modules for self and organizational development, categorized by personnel competencies into two types: (1) Core Competencies, including the use of AI for the overall benefit of the organization, the use of AI to enhance the organization's overall potential, and the use of AI to achieve the organization's overall goals; and (2) Functional Competencies, including AI skills for supporting tasks within the job function, AI capabilities for continuous professional development, and the development of skills to keep pace with educational disruption.

2) When applying the guidelines for developing AI competencies to enhance excellence in educational management at vocational education institutions in the eastern region, based on the research findings, consideration should be given to the specific context of each vocational education institution, including its physical aspects and work environment. Furthermore, the formats, methods, and processes of practical training for developing the characteristics of AI competencies can be adapted as appropriate.

3) Policy Recommendations for Developing AI Competencies in Vocational Education Teachers:

(1) Develop a National AI Competency Framework and Curricula for Vocational Teachers: Establish national policies to create a clear and concrete AI competency framework for vocational education teachers. This framework should define the necessary cognitive, psychomotor, and affective skills for both teaching AI-related subjects and integrating AI into pedagogical practices and educational management. Teacher training and pre-service curricula must be continuously updated to align with these standards.

(2) Invest Sustainably in Modern AI Infrastructure and Platforms in Educational Institutions: Allocate long-term budgets and enact policies to support the acquisition and maintenance of high-performance hardware, AI software, and high-speed internet connectivity in all vocational education institutions. This also includes developing or procuring centralized AI learning platforms that teachers can access for training, experimentation, and integrating AI tools into their teaching effectively and widely.

(3) Create an Incentive System and Diverse, Continuous Professional Development for AI: Formulate policies that link the development of AI competencies for vocational education teachers to their career progression paths, potentially through specialized allowances, academic promotions, or opportunities for specialized AI education. Simultaneously, establish diverse professional development programs, including online/offline workshops, peer-to-peer learning, and Professional Learning Communities (PLCs) focused on AI.

(4) Support AI Research, Development, and Innovation for Vocational Education Management: Allocate dedicated research grants and establish specific policies to encourage R&D in AI within the vocational education context. Promote research by teachers and institutions to create AI-powered learning tools, innovative AI-based teaching methods, or AI models for educational management. Mechanisms for disseminating successful innovations and best practices nationwide should also be established.

(5) Foster Collaboration Among Government, Private Sector, and Educational Institutions in AI: Implement clear policies and mechanisms to promote robust collaboration between vocational education institutions, relevant AI industries, and government agencies. This partnership should aim to jointly develop cutting-edge curricula, facilitate teacher training by industry experts, and provide real-world practical experience and cooperative education opportunities for both teachers and students.

Recommendations for future research were followed.

1) Future research should involve participatory action research on the development of AI competencies for educational management in vocational education institutions in the eastern or other regions of Thailand, developing specialized practical training modules that truly reflect the characteristics of vocational education managers.

2) Future research should investigate the positive factors that lead to the successful development of AI competencies for educational management in vocational education institutions in the eastern or other regions of Thailand. This data can be used to develop effective administrative models for vocational education institutions that align with the national strategy.

3) In-depth research should be conducted to develop AI platforms for use in enhancing AI competencies for innovative teaching and learning management that aligns with the context of Thai society and strives for international standards.

Conclusion

From the research conducted, the research findings can be summarized according to the research objectives, with the following key points:

1. The characteristics of AI competencies of vocational education teachers for high-performance vocational education management according to the Thailand Vocational Qualifications Framework (TVQF) comprise 4 domains: 1) AI Literacy, 2) AI Skills/ICT Skills, 3) Problem Solving with AI Tools, and 4) Adaptive AI Transform.

2. The components of AI competencies of vocational education teachers for high-performance vocational education management according to the TVQF consist of 3 main components: 1) Cognitive Domain, 2) Psychomotor Domain, and 3) Affective Domain; and 7 sub-components: (1) Computer and AI Literacy, (2) AI Access, (3) AI Use, (4) AI Media Production and Creation, (5) AI Communication, (6) AI Media Management, and (7) AI Evaluation. These components include a total of 195 indicators, and collectively, they

can explain 83.187% of the AI competencies of vocational education teachers for high-performance vocational education management according to the TVQF.

3. The guidelines for developing AI competencies of vocational education teachers for high-performance vocational education management according to the TVQF, as illustrated in Figure 1, include: (1) Five methods for developing AI competencies: (1) Self-directed learning and development, (2) Online learning, (3) Case studies, (4) AI-assisted learning, and (5) Practical training. Development activities include AI knowledge exchange, using modern AI technology and innovation media, learning from role models, and experiential learning. (2) The appropriate process for developing AI competencies of vocational education teachers for high-performance vocational education management according to the TVQF using the PIERI process includes: (1) Planning (P), (2) Implementation (I), (3) Evaluation (E), (4) Reflection (R), and (5) Improvement (I). This involves establishing clear annual policies and action plans for personnel development with measurable competencies, enabling all vocational education institutions in the eastern region and other regions to utilize these guidelines for further developing the AI competencies of their personnel. The results from all three research objectives can be summarized in the diagram shown in Figure 1 below.

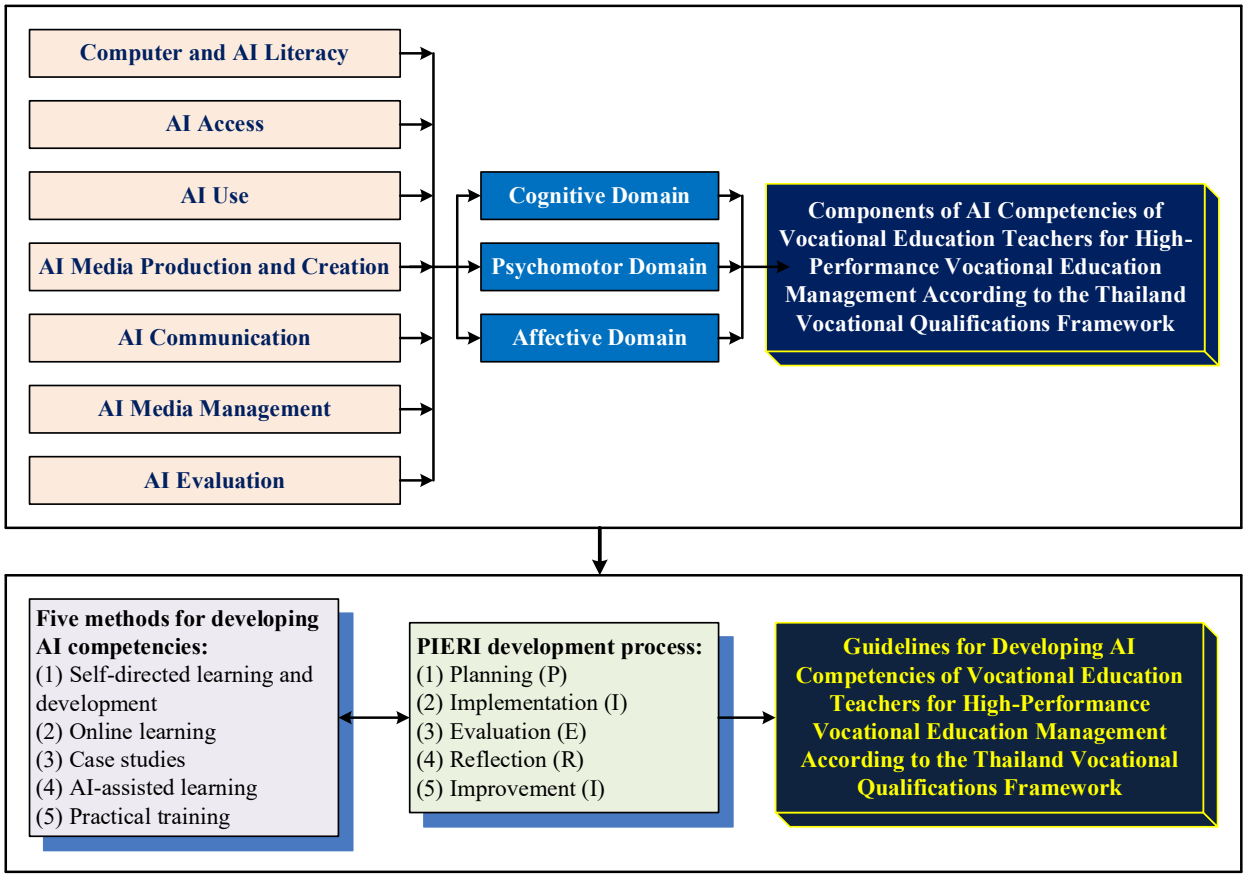


Figure 1: Guidelines for developing AI competencies of vocational education teachers for high-performance vocational education management according to the Thailand Vocational Qualifications Framework

References

Agila-Palacios, M. V., Muñoz-Repiso, A. G.-V., & Ramírez-Montoya, M. S. (2022). Influence of active methodologies: Projects and cases in the development of AI competences with mobile devices. *Journal of Applied Research in Higher Education, 14*(3), 1007-1020.

Ahmed, S. F., Alam, M. S. B., Hassan, M., Rozbu, M. R., Ishtiak, T., Rafa, N., & Gandomi, A. H. (2023). Deep learning modelling techniques: Current progress, applications, advantages, and challenges. *Artificial Intelligence Review, 56*, 13521-13617. https://doi.org/10.1007/s10462-023-10466-8

Bodiako, A. V., Ponomareva, S. V., Rogulenko, T. M., Melnik, M. V., & Gorlov, V. V. (2021). Professional and qualification potential of the AI society: Indicative evaluation and systemic management. *International Journal of Sociology and Social Policy, 41*(1/2), 50-61.

Guo, M., Gu, M., & Huo, B. (2025). The impacts of automation and augmentation AI use on physicians' performance: An ambidextrous perspective. *International Journal of Operations & Production Management, 45*(1), 114-151.

Hao, X., & Demir, E. (2024). Artificial intelligence in supply chain decision-making: An environmental, social, and governance triggering and technological inhibiting protocol. *Journal of Modelling in Management, 19*(2), 605-629.

Holmes, J., Moraes, O. R., Rickards, L., Steele, W., Hotker, M., & Richardson, A. (2022). Online learning and teaching for the SDGs–Exploring emerging university strategies. *International Journal of Sustainability in Higher Education, 23*(3), 503-521.

Jafar, F., & Keykha, A. (2024). Identifying the opportunities and challenges of artificial intelligence in higher education: A qualitative study. *Journal of Applied Research in Higher Education, 16*(4), 1228-1245.

Lee, J. J., & Meng, J. (2021). Digital competencies in communication management: A conceptual framework of readiness for industry 4.0 for communication professionals in the workplace. *Journal of Communication Management, 25*(4), 417-436.

Mambile, C., & Mwogosi, A. (2025). Transforming higher education in Tanzania: Unleashing the true potential of AI as a transformative learning tool. *Technological Sustainability, 4*(1), 51-76.

Marengo, A., Pagano, A., Pange, J., & Soomro, K. A. (2024). The educational value of artificial intelligence in higher education: A 10–year systematic literature review. *Interactive Technology and Smart Education, 21*(4), 625-644.

National Information Technology Committee. (2019). *The essential digital competencies for undergraduate students in Thai higher education institutions*. http://https://www.incits.org/

Office of the Eastern Economic Corridor Policy Board (OCPO). (2021). *Eastern Economic Corridor (EEC)*. https://www.eeco.or.th/

Office of the Vocational Education Commission. (2024). *Thailand's National Vocational Qualifications Framework B.E. 2567.* Office of the Vocational Education Commission.

Oladimeji, O. O. (2023). Machine learning in smart health research: A bibliometric analysis. *International Journal of Information Science and Management, 21*(1), 117-126.

Parkatti, A., Saari, T., Tammelin, M., & Villi, M. (2022). Framing digital competence in media work: The case of Finland. *International Journal of Sociology and Social Policy, 42*(13/14), 15-29.

Phakamach, P. (2023). Educational innovation: Elements and mechanisms for the development of Thai educational institutions towards internationalization. *Journal of Education and Innovative Learning, 3*(2), 161-180.

Phakamach, P., Panjarattanakorn, D., & Onsampant, S. (2023). Conceptualization and development of digital leadership to drive corporate digital transformation for sustainable success. *International Journal of Educational Communications and Technology, 3*(2), 27-39.

Phakamach, P., Panjarattanakorn, D., Saengkaew, P., Pangthai, S., & Onsampant, S. (2023). Innovative practices in vocational education administration. *International Journal of Educational Communications and Technology, 3*(2), 1-19.

Phakamach, P., Senarith, P., & Wachirawongpaisarn, S. (2022). ICT systems development guidelines for educational innovation management of Rajamangala University of Technology in Thailand. *Journal of Education and Innovative Learning, 2*(2), 109-130.

Saib, M. O., Rajkoomar, M., Naicker, N., & Olugbara, C. T. (2023). Digital pedagogies for librarians in higher education: A systematic review of the literature. *Information Discovery and Delivery, 51*(1), 13-25.

Yadav, A. K. S. (2022). The essential skills and competencies of LIS professionals in the digital age: Alumni perspectives survey. *Global Knowledge, Memory and Communication, 71*(8/9), 837-856.

Zhao, Y., & Ko, J. (2024). Vocational teachers' perceptions on workplace learning in facilitating students' professional engagement in the context of industry-university collaboration in China. *Journal of Workplace Learning, 36*(4), 282-297.