Development of a Challenge based Learning Platform to Enhance Artificial Intelligence Competencies for Vocational Education Students

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ABSTRACT: *Thailand's education system, in general, Vocational education is an aspect of Thailand's educational pathway that aims to practice vocational skills, which plays an important role in driving the development of technical skills. In recent years, the rapid development of artificial intelligence technologies has raised a significant challenge for vocational students regarding knowledge development and technology adoption. To strengthen the artificial intelligence competencies of vocational students, this research proposed a learning platform for vocational students and studied the suitability and competency from the following objectives*: (*1*) *Study the synthesize the challenging-based learning process of vocational students*. (*2*) *Develop a challenging-based learning platform to strengthen vocational students' competency in artificial intelligence technology with experts from various institutions in the design, development, teaching, and learning process*. (*3*) *Study the suitability of the development of a challenging-based learning platform to enhance the AI competencies of vocational students*. *The assessment of the platform consists of* (*1*) *A challenging learning platform architecture to enhance the competency of artificial intelligence of vocational students and* (*2*) *A suitability assessment of the development of a challenging-based learning platform to strengthen the artificial intelligence competencies of vocational students*. *The results show significant suitability of the learning process and procedures and appropriateness of the development of a challenging-based learning platform to enhance the AI competencies of vocational students*.

Keywords: Challenge Based Learning, Artificial Intelligence Competency, Vocational Education

1. Introduction

Vocational education plays an important role in driving and developing quality vocational students. According to the National Economic and Social Development Plan, the National Education Plan, the National Education Act B.E. 2542 (1999), and the Vocational Education Act B.E. 2551 (2008) mentioned the decentralization of academic authority to educational and vocational education institutions. In education management, the Office of the Vocational Education Commission has prepared the National Professional Qualifications Framework B.E. 2562 (2019) that allows educational institutions and vocational education institutions to develop their curriculum based on professional qualification standards and professional education standards according to qualification level and field of study. To develop vocational courses, the curriculum must be competency-based by including practical competencies in professional work from occupational standards or competency standards to develop vocational education courses that

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provide education and readiness in collaboration with establishments for vocational students to match professional competencies. (Office of the Vocational Education Commission, 2019)

Challenge-Based Learning is essential for vocational students to develop practical skills, integrate academic knowledge and practical application, and equip students with the competencies required for success in the 21st-century workforce (Doulougeri et al., 2024). Moreover, Challenge-Based Learning fosters confidence in vocational students' abilities and envisions a clear direction in their career path. This approach allows students to engage in practical problem-solving by tackling real-world challenges in their respective fields, such as machinery repair, software development, or business management (Nilsook, Chatwattana, & Seechaliao, 2021). Students should be able to analyze problems and create innovative and effective solutions, which are crucial skills in the workforce. Encourages students to work collaboratively on projects that require collective thinking with assigned responsibilities such as planning, researching, presenting, or hands-on implementation. This fosters the development of essential social skills, including communication and teamwork. Allowing students to connect their academic knowledge to practical applications, such as developing products for communities or designing automation systems for industries. This approach not only highlights the practical value of their learning but also facilitates its application in real-world contexts (Qu, & Wang, & Miao, 2021) and prepares students for their future by emphasizing the development of critical and necessary skills.

It is undeniable that vocational students equipped with knowledge of AI will have potential in terms of working and adapting to modern technology (Bankins, Hu, & Yuan, 2024), learning AI will foster creativity and innovation in students, enabling them to stay relevant in the digital era. Therefore, developing AI skills is crucial for vocational students (Rujira, Nilsook, & Wannapiroon, (2020), as it enhances their employability, accelerates their ability to adapt to modern technologies, and empowers them to create innovations that benefit the industry. By beginning to learn and practice AI now, students will be well-equipped to become skilled professionals and effectively navigate future technological changes.

2. Literature Review

Challenge-Based Learning (CBL) is an effective approach that fosters the development of higher-order thinking skills in students (Apple, 2011). Teaching and learning combine teamwork, self-learning, and judgment to solve real-world problems. Addresses the critical skills students need in the 21st century, driven by globalization and rapid technological advancements. By incorporating CBL, students are more engaged in the learning process, (Gholami et al., 2021) their understanding of the material is deepened, and their abilities in creative and practical applications are enhanced (Premsmith, Wannapiroon, & Nilsook, 2016).

Artificial intelligence (AI) is increasingly integrated into education, with the majority of research on AI literacy concentrating on primary, secondary, and tertiary levels of education. The results of the study indicated that (1) young children are capable of learning the fundamental concepts and knowledge of AI, (2) in terms of AI-related creativity, younger children can design conversational robots through imagination, while older children can build AI robots to assist in tasks such as drawing, and (3) the study emphasizes the positive impact of AI literacy education in preparing children for an AI-driven future (Su, & Yang, 2023). Due to the machine learning capabilities and artificial intelligence (AI) applications, it is essential for these systems to be continuously used to generate rich usage data, enabling them to learn, evolve, and better adapt to the needs of both users and organizational contexts. This research specifically focuses on the practical application of conversational AI, particularly on AI chatbots (Gkinko, & Elbanna, 2023).

The development of AI competence for vocational students in Thailand, spanning from primary to vocational level, initially began with AI functioning as a support tool in the learning process, particularly for teachers and educational institutions. The introduction of AI systems to enhance learning shifted the focus towards encouraging students to leverage AI for more profound and more effective learning experiences (Van den Beemt, Van de Watering, & Bots, 2022). AI has been increasingly utilized in daily life beyond its traditional role in learning. For instance, teachers now employ AI to design instructional content, administer various assessments, and facilitate student submissions through AI systems. Additionally, AI is used to recommend supplementary learning resources, such as tutoring, to help students prepare for subsequent lessons. It can be asserted that AI is rapidly becoming integral to all aspects of the learning process (Chomjit, & Patthamasopasakul, 2025). AI contributes to transforming schools into engaging and secure environments for learning communities by prioritizing safety in the digital world. It plays a key role in fostering digital citizenship among vocational students while leveraging big data to enhance educational quality and refine learning facilitation processes (Jean-Baptiste, 2020).

3. Research Objective

3.1 Study the synthesize the Challenge Based Learning process of vocational students.
3.2 Develop a Challenge Based Learning platform to strengthen the competency of vocational students in artificial intelligence technology.
3.3 Study the suitability for the development of a Challenge Based Learning platform to enhance the AI competencies of vocational students.

4. Methodology

4.1 The synthesis of Challenge-Based Learning processes of vocational students from various research is used to obtain the process in this research. The synthesis results are shown as follows.

Table 1. Synthesis of Challenge Based Learning processes from research-based experts.

Procedure Challenge based Learning	Gallagher, S. E., & Savage, T. (2020).	Nichols, M., Cator, K., & Torres, M. (2016).	Apple. (2011).	Johnson, Smith, Smythe, & Varon, (2009).	Premsmith, J., Wannapiroon, P., & Nilsook, P. (2016).	Synthesis results
1) Big Idea	✓	✓	✓	✓	✓	✓
2) Essential Question	✓	✓	✓	✓	✓	✓
3) The Challenge	✓	✓	✓	✓	✓	✓
4) Solution		✓	✓	✓	✓	✓
5) Taking Act		✓	✓	✓		✓
6) Assessment		✓	✓	✓	✓	✓
7) Publishing	✓		✓	✓		✓

Based on the synthesis of the workflow structure of the Challenge-Based Learning process, the researcher has determined the dependent variables of the workflow of the Challenge-Based Learning process to develop a Challenge-Based Learning platform to enhance the competency of artificial intelligence technology of vocational students. It consists of the following elements:

1. The Big Idea stage is an idea that can be explored in various ways. This concept requires a relationship between the learner and society.
2. Essential Questions: Ask essential questions to guide learners to understand the context and key concepts.
3. The Challenge stage turns necessary questions into practice, encouraging learners to be interested and generate solutions.
4. Solution stage: Solving each step of the problem. This must be carefully determined by the learner who has designed the solution to solve the problem step by step from the learning source chosen by the learner to study.
5. Taking Act: Self-defined activities or worksheets designed and presented or disseminated externally.
6. Assessment: The solution must be measurable according to challenges and lead to the development of problem-solving skills in the 21st century.
7. Publishing stage: at each stage of the challenge process, Learners should record and distribute experience information through video recordings or related tools to create resources for reflection and evaluation. These resources can be used as a portfolio of learning, as well as a discussion and contribution where students publish their work in print media, online media, in-service signs, or exhibitions.

4.2 The development of a Challenge Based Learning platform to strengthen the competency of vocational students in artificial intelligence technology. Challenge-Based Learning (CBL) is a concept developed by Apple in the Apple Classroom of Tomorrow Today (ACOT2) program in early 2008 that incorporates challenges to stimulate curiosity

and create opportunities for learners to discuss and encourage practice in solving current challenges, which is explained as follows:

1. Inputs
1) Student Vocational Level. 1st year, Samut Songkhram Polytechnic College, Samut Songkhram Province There are 20 students currently studying. By specific selection
2) Teacher (Teacher) Teacher in Computer Course, Samut Songkhram Province
3) Class Point is a suitable teaching material for challenging teaching and learning to motivate learners to learn and promote various skills. In the use of technology

2. Learning process
Challenge-based Learning process workflow, the researcher has determined the dependent variables of the Challenge-based Learning process to develop a Challenge-Based Learning platform to enhance the competency of AI technology of vocational students, consisting of 7 steps: 1) Big Idea, 2) Essential Question, 3) The Challenge, 4) Solution, 5) Taking Act, 6) Assessment and 7) Publishing as shown in Figure 1.

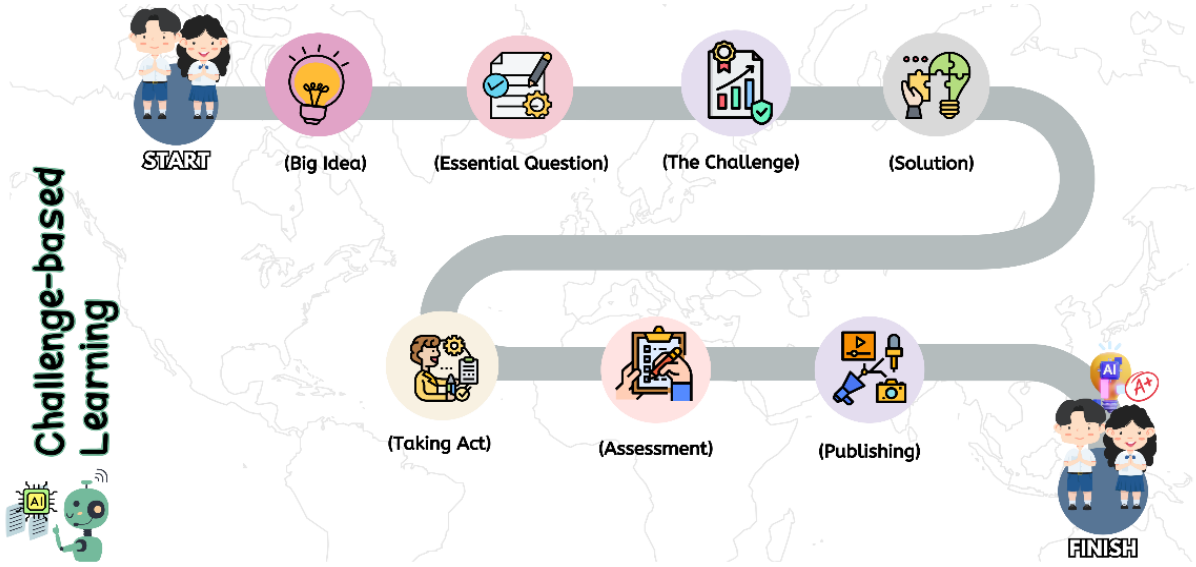

Figure 1. Model CbL *(*Challenge-based Learning*)*

3. Productivity
The output of Challenge Based Learning platform to strengthen the AI technology competencies of vocational students consisted of learning skills in artificial intelligence technology from the challenge activities assigned by the teacher as follows:
1) Technique 1: Creating animations with artificial intelligence technology (D-ID: Clip Avatar).
2) Technique 2: Creative problem-solving with artificial intelligence (ChatGPT: Chat Bot AI).
3) Technique 3: Imaging with Artificial Intelligence (Midjourney: AI)
4) Technique 4: Creative Presentation with Artificial Intelligence (TOME: AI Presentation).

Table 2. Criteria for evaluating individual units of competency.

Artificial intelligence performance	Artificial Intelligence Performance (%) Assessment Results	
	Pass	Not Pass
Technique 1: Creating animations with artificial intelligenceTechnology (D-ID: Clip Avatar)	80%	Below 50%
Technique 2: Creative problem solving with artificial intelligenc (ChatGPT: Chat Bot AI)	80%	Below 50%
Technique 3: tificial Intelligence (Midjourney: AI)	80%	Below 50%
Technique 4: Creative Presentation with Artificialintelligence (TOME: AI Presentation)	80%	Below 50%

4. Feedback

Skills from learning on Challenge-Based Learning platforms could strengthen the competencies of vocational students in artificial intelligence technology from the platform.

4.3 Study the suitability for the development of a Challenge-Based Learning platform to enhance the AI competencies of vocational students from five experts by using the Rating Scale method.

4. Results and Discussion

4.1 The synthesized results of the Challenge-Based Learning (CBL) processes for vocational students, along with the outcomes of developing a CBL platform to enhance the artificial intelligence competencies of vocational students evaluated by five experts. The experts assessed the platform and contributed to the development of a model designed to facilitate learners' understanding, as shown in Figure 2.

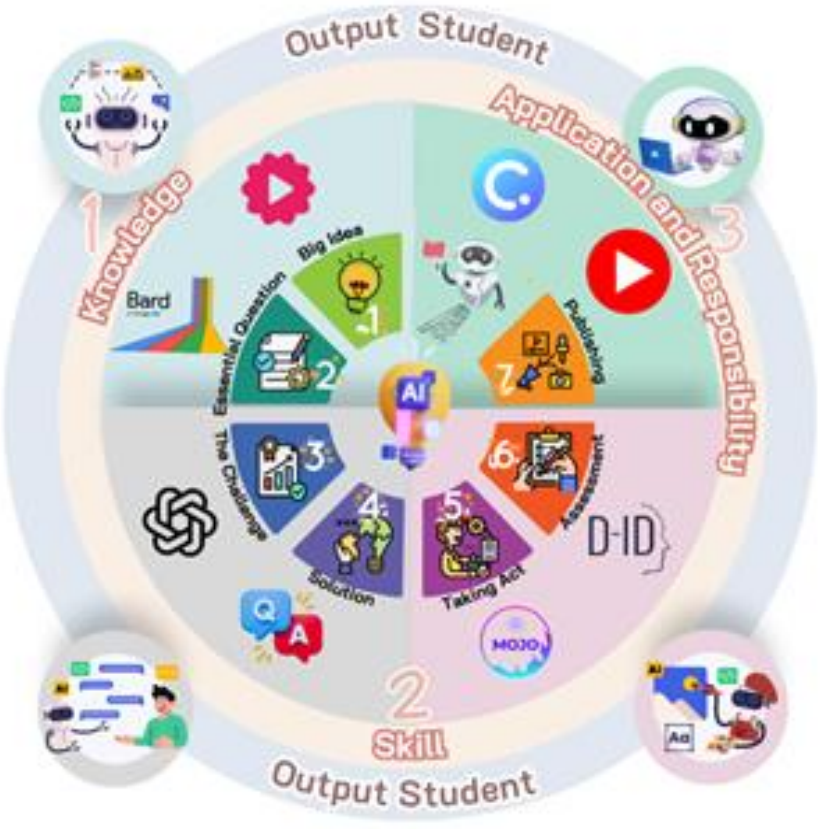

Figure 2. Development of a Challenge Based Learning Platform

The synthesis indicates the potential to develop a Challenge-Based Learning platform aimed at enhancing the AI competencies of vocational students, which comprises three key components as follows: 1) The main components of the teaching system consist of (1) Input factors, (2) Learning process (3) Output (4) Feedback data. The input factors consist of (1) Learner analysis, (2) Teacher analysis, (3) Learning media, 2) The main components of the learning process consist of 7 main steps: (1) Big Idea stage, (2) Essential Question stage, (3) The Challenge stage (4) Solution stage (5) Taking Act stage (6) Assessment stage and (7) Publishing stage 3) The main components of the output or challenging activity techniques consist of (1) Creating animations with the AI technology (D-ID: Clip Avatar) (2) Creative problem solving with AI (ChatGPT: Chat Bot AI) (3) Creating images with AI creativity (Midjourney: AI) and (4) Creative presentation with AI (TOME: AI Presentation)

4.2 The assessment results of the components of the learning platform challenges to enhance the AI competencies of vocational students from five experts. Based on the assessment table from five experts, the development of a Challenge Based Learning platform to strengthen the competency of vocational students in artificial intelligence technology. Overall, the results have shown that the design of the Challenge-Based Learning platform is highly suitable for strengthening the AI competencies of vocational students.

Table 3. Assessment results of the components of the learning platform Challenges to enhance the AI competencies of vocational students from five experts.

Components of the learning platform Challenges	*M*	*SD*	Suitability
The learning process			
1) Input	5.0	0.00	Highest
2) Learning process	4.6	0.54	Highest
3) Productivity	4.8	0.44	Highest
4) Feedback	5.0	0.00	Highest
The teaching process			
1) Big Idea	5.0	0.00	Highest
2) Essential Question	5.0	0.00	Highest
3) The Challenge	4.8	0.44	Highest
4) Solution	5.0	0.00	Highest
5) Taking Act	4.8	0.44	Highest
6) Assessment	4.8	0.44	Highest
7) Publishing	5.0	0.00	Highest

Based on the assessment table from five experts who qualified as vocational education teachers with a minimum of five years of teaching experience in vocational education, the development of a Challenging Learning platform to strengthen the competency of vocational students in artificial intelligence technology. The result shows that in the overall design of the learning platform, it is appropriate to the greatest extent. The assessment table from five experts includes an assessment of the components of the learning platform. The criteria for evaluating individual units of competency in Artificial intelligence performance on teaching techniques of learning units are shown as follows:

Table 4. Assessment of the components of the learning platform from five experts on teaching techniques of learning units.

Organization	*M*	*SD*	Suitability
Technique 1: Creating animations with artificial intelligence Technology (D-ID : Clip Avatar)	5.0	0.00	Highest
Technique 2: Creative problem solving with artificial intelligence (ChatGPT : Chat Bot AI)	5.0	0.00	Highest
Technique 3: Artificial Intelligence (Midjourney : AI)	5.0	0.00	Highest
Technique 4: Creative Presentation with Artificial Intelligence (TOME : AI Presentation)	4.8	0.44	Highest

The results shown that (1) suitability for the development Learning platform development Challenge to enhance competency in artificial intelligence of vocational students that developed was overall appropriate at the highest level ($M = 5.00, SD = 0$) and (2) suitability in Learning process and steps in the learning platform Challenge to enhance competency in artificial intelligence of vocational students Overall appropriateness is at the highest level ($M = 5.00$,

SD = 0) In general, the learning platform The challenge model to enhance competencies in artificial intelligence of vocational students has been developed. It is possible to Use a learning platform to enhance competencies in artificial intelligence. Overall appropriateness is at the highest level (*M* = 5.00, *SD* = 0)

The utilization of the developed learning platform to enhance the artificial intelligence competencies of vocational students demonstrates that students could effectively engage with and learn from the provided platform (Premsmith, Wannapiroon, & Nilsook, (2016). Additionally, the platform presents challenges that encourage students to produce relevant work for each learning technique. As a result, students develop the expected artificial intelligence skills, fostering innovation and knowledge acquisition. Based on observations and a summary of the student's activities, it was found that the use of this Challenge-Based learning platform led to the following learning experiences for the students.

1. Students demonstrate high levels of interest and engagement with the subjects as the content is current and relevant. They are particularly motivated by the interactive nature of the material and the ability to submit their work via mobile devices (Marin, Hargis, & Cavanaugh, 2013). The teacher fosters effective interaction with students through questions and answers through appropriate media.
2. Students are able to participate in the activities as specified to create a fast-learning process. As a result of organizing activities in each step shown the interaction between teacher and students. The learning process is structured with engaging steps, and learners effectively acquire knowledge through the media, aligning with the established learning process (Jean-Baptiste, (2020).
3. Students' work met the evaluation criteria and submitted their work on time. The results of the activities reflected that students have increased knowledge and skills (Gallagher, & Savage, (2020). Students remain consistently engaged with strong enthusiasm for learning throughout the study process.

6. Conclusions

The synthesis of Challenge-Based Learning processes of vocational students and the development of a Challenge-Based Learning platform to strengthen vocational students' competency in artificial intelligence technology. Five experts evaluated the learning platform. Resulting in an appropriate outcome in each learning technique. The research on the development of a Challenge-Based Learning platform to enhance the artificial intelligence competencies of vocational students focuses on the key aspects discussed in relation to the research findings, intending to promote innovation and facilitate knowledge acquisition for students as follows:

1. Inputs Learners are interested and excited about the subjects they study because they are new and modern. Students are interested in content and teaching materials because they are always provided and can use their mobile devices to work on submissions. The instructor has a good interaction with the learners and has a Q&A through appropriate media.
2. Learning process: Each step allows learners to have fun and constantly interact with the instructor. There is an interesting learning process, and the learner learns through the medium according to the learning process steps.
3. Productivity: All learners have their assignments submitted on time. Learners have increased knowledge and skills while showing interest during classes and are always excited about studying.
4. Feedback: Learners enjoy studying, completing assignments, and passing all assessment criteria. Learners are interested in using media.

The achievement of a Challenge-Based Learning platform to strengthen the AI technology competencies of vocational students consists of four learning skills in artificial intelligence technology as follows:

Technique 1 Creating animations with artificial intelligence technology (D-ID: Clip Avatar)
Technique 2 Creative problem solving with artificial intelligence (ChatGPT: Chat Bot AI)
Technique 3 Imaging with Artificial Intelligence (Midjourney: AI)
Technique 4 Creative Presentation with Artificial Intelligence (TOME: AI Presentation)

The development of a Challenge-Based Learning platform to enhance the artificial intelligence competencies of vocational students demonstrates that the overall design of the learning platform is highly appropriate and effective. This validates that the Challenge-Based Learning platform developed to enhance the artificial intelligence competencies of vocational students is appropriate for effective application with learners. Suggestions for future research are listed as follows: (1) The application utilized in this Challenge-Based Learning activity effectively promotes learning, skill

development, and competency while meeting the identified needs. However, a limitation exists regarding access rights, as the application is offered free of charge, which restricts its usage to a predefined scope. (2) To enhance the learning experience, the range of scenarios or tasks provided in the activity should be expanded, thereby increasing the challenge for learners in selecting the most suitable application based on their capabilities.

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