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The Development of Intelligence Learning Media for Improving Occupational Competence in Thailand Information and Digital Content Competency Level 3

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Abstract: Occupational competency is important for preparing the workforce for growing and enhancing Thai economics in Thailand 4.0. In Thailand 4.0, new technologies and digital innovation are implemented in all sectors of daily life; consequently, intelligence learning media is needed to be developed to enhance the occupational competence of the workforce. Therefore, this research aimed (1) to develop the Intelligent Learning Media for improving occupational competence in Thailand Information and Digital Content Competency Level 3 and (2) to study the efficiency of Intelligent Learning Media for improving occupational competence in Thailand Information and Digital Content Competency Level 3. The learning media was developed by a system development life cycle integrated with artificial intelligent algorithms: Decision Tree. The accuracy of decision tree algorithms considered the quality of learning media. The result of this study showed that (1) the Intelligent Learning Media for Improved Occupational Competence in Thailand Information and Digital Content Competency Level 3 comprised four components, including TPQI competency, students' competency, artificially intelligent algorithms, and learning media that can automatically provide and enhance students with their competency by artificially intelligent algorithms: Decision Tree, and (2) the efficacy of learning media was considered by the 95.23% correctly classified instance by a decision tree. The satisfaction of learning media was $\bar{X}$=4.38, SD=0.14.

Keywords: Learning materials, system evaluation, competency level, professional performance

1. Introduction

Driving the development of the country requires very high professional qualifications. Thailand establishes the National Profession Qualification by cooperation in each career to be used as the competency standard and license that relate to Thailand's human resources development in the future to qualify a competent workforce and also grow in their career path, well preparing for the ASEAN workforce mobility and improving more competitiveness of the country.

The Office of Vocational Education Commission is a government agency that manages and develops workforce quality to meet the needs of national human resources and private sectors (Koseeyaporn, 2013). Vocational education is a very important mechanism in the 20-year nation's development plan to drive and grow the Thai economy to be Thailand 4.0.

The direction of the Vocational Education Commission is to improve the competency of Thailand's workforce. It has to set a goal and plan to achieve that goal through cooperation between the government and private sectors. Thailand Professional Qualification Institute (Public Organization) is one of the institutes that cooperates with the Vocational Education Commission to improve Thailand's qualification standards and workforce by developing the curriculum, promoting and supporting professional qualification and evaluation to create the opportunity for developing professional skills and also improve the competitiveness of the country in the labor market.

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As new technologies and digital innovations of an increasingly more extensive scale and scope are being implemented by businesses, new digital capabilities are emerging that are transforming industries by changing the value proposition of existing goods and services. As a result, there have been fundamental changes in the expectations and behaviors of society and markets, causing disruptions to enterprises' core business across all industries. Known as "digital disruption," this change is hard to predict because new technologies are constantly emerging.

However, analyzing industry trends and recent innovations in your sector will give you some idea of the disruption. The next step is preparing your workforce by engaging them as active participants as you begin your digital transformation journey. Digital Transformation is defined as the use of new technologies over traditional business processes to make change a core competency of the organization. As a result of the resulting agility and dynamic setup, the company is well-positioned to address the challenges of digital disruption.

Thailand 4.0 is an economic model that aims to unlock the country from several economic challenges resulting from past economic development models, which emphasize agriculture (Thailand 1.0), light industry (Thailand 2.0), and advanced industry (Thailand 3.0). These challenges include "a middle-income trap," "an inequality trap," and "an imbalanced trap." To transform Thailand's comparative advantage into a competitive advantage through knowledge, technology, and innovation, a long-term goal to develop 10 Future Industries (First S-Curve and New S-Curve) has been set by the government (Royal Thai Embassy, Washington D.C., 2021)

- The First S-Curves: building upon 5 old industries that already have a solid foundation but still require further innovative improvement and research and development to add value and keep up with the competition in the global field (Next generation Automotive, Smart Electronics, Affluent, Medical and Wellness Tourism, Agricultural and Biotechnology, Food for the Future).
- The New S-Curves: developing the 5 new industries to enhance their capabilities to support future competitiveness (Robotics, Aviation, and Logistics, Biofuels & Biochemical, Digital, Medical Hub)

To attract high-value investments in the 10 future industries, the government has amended the Investment Promotion Act B.E. 2520 and endorsed the draft National Competitiveness Enhancement for Targeted Industries Act to give more benefits to investors, such as corporate tax exemption for up to 13 years for business using advanced technology and innovation, or conducting R&D activities; import duty exemption for machinery and raw materials; etc. (Office of Industrial Economics, 2017).

Thailand 4.0 is an engine to propel new economic growth by transforming "comparative advantage" into "competitive advantage." This approach will fulfill the country with knowledge, creativity, innovation, science, technology, research, and innovation, and build upon comparative advantage with "5 Groups of Technology and Targeted Industries" (Royal Thai Embassy, Washington D.C., 2021), which comprises:

a) Food, Agriculture, and Bio-Tech: building a stable economy based on biodiversity and environmentally friendly biotechnology and moving Thailand toward becoming the center of premium agricultural products and food, and an exporter of technology in agriculture, seeds, and vaccine.
b) Health, Wellness and Biomedical: building medical infrastructure and moving Thailand forward to be the "Medical Hub" of ASEAN within 2025.
c) Smart Devices and Robotics – Mechatronics: moving Thailand forward to advance as a leader in ASEAN's automatic systems, industrial robotics, and service robotics.
d) Digital, Internet of Things (loT), Artificial Intelligence, and Embedded Technologies: using digital tools and IoT as platforms to enhance productivity, quality, and innovation in various economic activities within agriculture, industrial, service, and education sectors.
e) Creativity, Culture, and High-Value Services: undertaking actions that synergize primary cultural assets, innovation, and technology to increase commercial value and ultimately enable Thailand to move forward in becoming one of ASEAN's "creative hubs" within the next ten years.

The "5 technology and targeted industries" will be transformed into "integrated research" to provide possible solutions to challenges that may arise at the national and global levels, as well as identify business opportunities for the private. At the initial stage, the government will pursue the following five agendas:

a) Integrated research on Food and Agriculture.
b) Integrated research on Energy.
c) Integrated research on Aging Societies.
d) Integrated research on Smart Cities.
e) Integrated research on the Creative Economy.

Against the backdrop of the global geopolitics and geoeconomics of the 21st century, Thailand cannot rely solely on its geographical advantage in Southeast Asia. Still, by achieving four interrelated goals, it must position itself on key strategies to become a trading nation and one of Asia's business centers.

a) We are positioning Thailand as a Trading Nation and one of Asia's Business Centers.
It is one of the key strategies to position Thailand as a trading nation and one of Asia's business centers.
b) Economic Integration in CLMVT Context.
The ASEAN economy is estimated to double in value from 2.6 trillion USD by 2030. To become a regional hub, Thailand must begin to shift its focus from "Border" to "Bridge" and from "Nation to Nation" to "City to

City" through the concept of "Extending Nation." This means that borders between Thailand and neighboring countries should be gradually perceived as bridges linking economies, trade, and investment. At the same time, Thailand should view the four neighboring countries (Cambodia, Laos, Myanmar, and Vietnam) as internal markets with four major cities.

c) International Business Models in the 21st Century.
Thailand will adopt a 'Service Sector Policy and Strategy based on Mode of Supply' to enhance the competitiveness of Thai service providers on the global stage. These four modes include 1) cross-border supply, 2) consumption abroad, 3) commercial presence, and 4) the presence of a natural person. Each mode of supply has distinct 'Service Ecosystems,' requiring different conditions, rules, regulations, and standards, as well as different degrees of service differentiation.

Thailand Professional Qualification Institute (Public Organization) establishes a TPQI-Net platform to provide occupational standards and professional qualification information services following the Royal Decree for Establishment of Thailand Professional Qualifications Institute (Public Organization). This initiative aims to be used as a tool to increase the efficiency of the provision of services to organizations or other relevant stakeholders in line with Thailand 4.0 policy and Digital Government Administration and Services Act, BE 2562, transforming to become an intelligent organization with professionalism (Thailand Professional Qualification Institute, 2021).

Nowadays, information technology and digital content have gained widespread popularity and can reach people at all levels. Therefore, the development of the details of the unit of competency according to occupational standards and professional qualifications, which enable professionals and interested parties to study on their own through electronic media and digital content, should be continuously developed in parallel with the promotion of professional qualification systems through other means to enhance the quality of workforce to be equipped with competencies which reflect the real need of the business sector and to provide the opportunity to elevate to higher professional qualifications and to compete internationally; thus, resulting in the development of a comprehensive and sustainable professional qualification system which is widely recognized and accepted.

Consequently, TPQI has developed a system for testing the level of competence according to occupational standards and professional qualifications through electronic media and digital content or E-Training. According to the New Growth Engine Strategy, 22 occupational sectors from the targeted industry have been selected from 49 occupational sectors in the fiscal year 2013 – 2017, which is in line with Thailand 4.0 policy to promote quality lifelong learning and to develop new avenues for learning, in both formal and informal education. According to the National Strategy and Development Plan, this initiative is a driving mechanism that provides the opportunity for professionals to elevate to higher professional levels and attain higher income, thus, reducing social disparities and increasing the country's competitiveness.

Information and Digital content are one of the occupational sectors that TPQI qualifies for the standard. However, according to the TPQI report, just 35 percent of examinees passed the qualification. This shows that the quality of the information and digital content workforce does not meet the goal of TPQI. The report on workforce demand showed the gap between demand and supply in the target industry (S-Curve) as follows.

Table 1 - Manpower needs estimates Ability to produce manpower

Job disc	Demand	Supply	GAP
Career in Infrastructure Logistics	7,280	5,670	1,610
Logistics and Supply Chain	6,623,713	38,970	6,584,743
Robotics and Automation	11,521	7,140	4,381
Information and Communication Technology, and Digital Content	87,427	29,670	57,757
Food and Agriculture Profession	177,314	48,864	128,450
Petrochemical, Chemicals Energy & Renewable Energy	2,137	500	1,637

Upskilling and reskilling your employees is essential for a business's survival, especially in pandemic-ridden times like ours. Investing in existing employees ensures better quality control during internal mobility and higher retention rates.

In an organization's L&D strategy, upskilling and reskilling refer to the educational opportunities offered by a business to its employees. While it is easy to get confused between the two, they do mean two different things:

- Upskill: Providing training that improves an employee's skill set to grow in their current role and bring more value to their work in the organization.

- Re-skill is essentially to retrain an employee for a new position. This process is commonly used when an employee's post has become redundant, and the employer looks to retain the workers by training them in a new discipline.

It is a common misconception that training is limited only to the early years of one's career and that we can pick up other skills on the job. In a recent study, PwC found that 79% of CEOs regularly worry about their workforce's existing skills and ability to meet dynamic workplace needs (Mullich, 2002). As business models change and technology improves, employees equipped with the necessary skill sets (both hard and soft) are the torch bearers of organizational success. As a result, internal mobility through upskilling and reskilling is gaining popularity with organizations globally.

The main benefit of digital media in education is that it can increase student engagement. In addition, it helps students work through difficult concepts with multiple resources. Digital instruction helps show complex topics that are often hard to understand.

Referring to this problem, one attempt taken is to synthesize the Learning and Evaluation model for the professional qualification system and also develop the intelligence learning media in the Information and Digital content sector to increase and improve the standard of the Information and Digital content workforce.

2. Methodology

2.1 Population and Sample

This research was divided into two areas: the development of learning materials to enhance performance according to the professional standards of the system developer. A sample of 5 expert tool accuracy for a validity study, a target group for determination, who was studying the relevant profession. The try-out samples were 60 students of the Department of Information Technology and Business Computer under the Institute of Vocational Education in North-eastern 3 divided into 2 groups to determine the effectiveness of using learning materials to enhance performance according to the developer professional standards. The population used in the research includes those who were studying the relevant professions. The samples were 269 students with higher vocational certificates in information technology and simple random sampling (Krejcie & Morgan).

2.2 Research Tool

A synthetic tool for developing learning materials for professional competency is a structured interview form of system developers for expert interviews. The following were also used as research tools: Index of Consistency (IOC) assessment form, content consistency assessment by IOC, materials for software development Toolkit (Linux Server, Moodle, MySQL, Chrome, Firefox, Weka), Hardware(Server), switching hub, lead line internet and demo of performance test relevant to TPQI standard.

Performance assessment of the learning media is a satisfaction questionnaire on using learning media for competency according to the professional standards of system developers.

2.3 Data Analysis

Data preparation and data analysis for efficient study of learning media development were utilized to enhance competency according to professional standards in System Developers.

- Validity analysis of learning materials to enhance professional competence in system developers.
  - Content Analysis by documentation, research, and report paper of TPQI.
  - Quality assessment of learning media model by the experts.
  - Data collection from target group by questioner and quizzes
- Analysis of teaching media efficiency to enhance professional competence of the system developer.
  - Model's validity analysis by content analysis and IOC.
  - Decision tree analysis for intelligence model from quizzes score by j48 algorithm in WEKA.
  - Analyze the results of the users' satisfaction by the mean and standard deviation.

3. Results

Process of learning media system for improving occupational competence in Thailand Information and Digital Content Competency Level 3 comprised 4 components including TPQI competency, students' competency as shown in figure 1 and Test Tables 2-3.

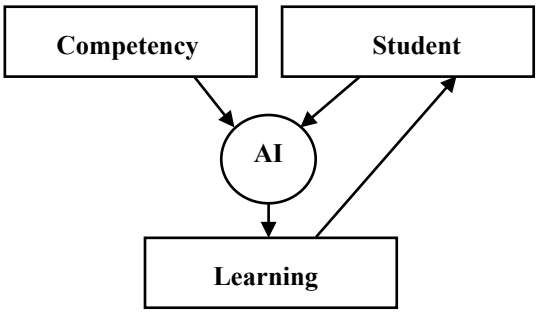

Fig. 1 - System Chart Instructional management system applied to online training materials

Table 2 - Determines the performance base module from the competence according to the professional qualifications framework

Capacity	Sub-Unit	Learning Outcomes
1. Implementation of program development	1.1 Convert screens and/or workflows into flowcharts	1.1.1 Can read the screen draft (GUI) and/or workflow corectly.
		1.1.2 Review and edit the draft screen (GUI) and/or workflow (Work Flow) correctly.
		1.1.3 Write a flow chart (Flow Chart) as specified.
	1.2 Develop a program according to the flow chart	1.2.1 Read the flow chart correctly.
		1.2.2 Write a program according to the flow chart correctly.
2. Test the Sub-Program	2.1 Design a test for a sub-program	2.1.1 Read the flow chart correctly
		2.1.2 Write a program according to the flow chart correctly.
	2.2 Check, test, subprogram	2.2.1 Explain the operation of each function of the program correctly.
		2.2.2 Able to write a test program for each function.
		2.2.3 Write a test plan for a subprogram.
	2.3 Test the sub-program according to the test	2.3.1 Describe the receiving and sending of data for each function.
		2.3.2 Explain the results of each function.
		2.3.3 Identify the cause of error occurring for each function.
	2.4 Error logs from subprogram tests	2.4.1 Write a breakdown of problems occurring in the test of each function.
		2.4.2 Step-by-step describe the testing process that causes errors.
3. Bug fixes	3.1 Find the fault point according to the error log	3.1.1 Correctly identify the location of the point of error.
		3.1.2 Describe possible causes of errors.
		3.1.3 Describe the effects of errors occurring on the Digestible program.
		3.1.4 to be able to suggest or suggest a way to correct the error at each point.
	3.2 Fix program errors	3.2.1 The error point can be corrected as specified.
		3.2.2 Explain how to correct any errors that may occur.
	3.3 Test for fixing program errors	3.3.1 Determining the test plan of the subprogram after the error has been corrected
		3.3.2 The subprogram test plan shall follow the sequence of program execution.

Table 3 - Variables used for data classification by data mining techniques

variable	Substitution Meaning	Status
Unit-1	Convert screens and/or workflows into flowcharts.	Input
Unit-2	Develop a program according to the flow chart.	Input
Unit-3	Design a sub-program test	Input
Unit-4	Check, test, subprogram.	Input
Unit-5	Test the subprogram according to the test statement.	Input
Unit-6	Error logs from subprogram tests.	Input
Unit-7	Find fault points by error log.	Input
Unit-8	fix program errors	Input
Unit-9	Test the error correction of the program.	Input
Result	knowledge assessment results	Output

Intelligence analysis by the J48 algorithm creates a Decision Tree to be an intelligence model using scores from test data. The researcher has defined common attributes for analysis processing consisting of 9 competency modules to classify students' competencies.

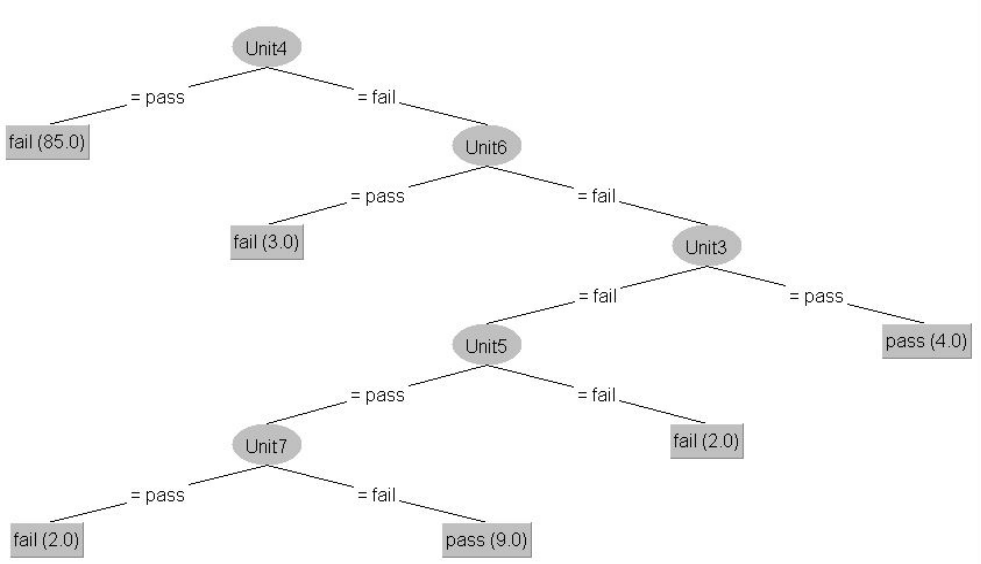

Fig. 3 - Score classification decision tree to determine learner's competency

The satisfaction analysis of learning media results to enhance performance according to the professional standards of system developers found that the satisfaction of the students was at a very satisfactory level ($\bar{x}$= 4.38, S.D. = 0.14). When considering the details, it was found that the students had the highest satisfaction with learner information management, lesson design, study and assessment activities, and communication. As for other aspects, the students were satisfied at a high level.

Table 4 - Correctly classified instances

Number of instances	Correct	Percent of Correctly classified	Mean Absolute Error
105	100	95.23	0.041

Table 5 - The satisfaction of learning media (n=100)

Assessment item	Average	SD value	Satisfaction Level
1. Lesson Design	4.53	0.11	Very high
2. Learner Management	4.55	0.15	Very high
3. Problem situations and learning resources	3.76	0.24	High
4. Learning and Evaluation Activities	4.57	0.08	Very high
5. Communication	4.52	0.13	Very high
Total	4.38	0.14	High

4. Discussions

According to the research results, there are issues discussed as follows.

(1) The development of intelligent learning media for improving occupational competence in Thailand Information and Digital Content Competency Level 3 comprised four components, including TPQI competency, students' competency, artificially intelligent algorithms, and learning media that can automatically provide and enhance students with their competency by artificially intelligent algorithms: Decision Tree. This is possible that teaching and learning management to produce vocational human resources in occupation, information technology, and digital business needs to upgrade skill standards to meet career standards required by business and industry sectors in the information technology and digital business professions. This certification process enables individuals to be recognized for their knowledge, skills, and abilities and obtain professional qualifications consistent with competence, experience, and knowledge. Consequently, these 4 components were composed in the development. The professional qualification system was implemented to develop their career advancement in the future, which can be comparable and linked to other qualification systems at home and abroad. This is consistent with Wichai (2016) that using learning management processes and competency-based learning models to lead to action by combining both classroom learning with practice-based learning provides learners with competent skills to enter the labor market effectively. It also corresponds to Pannee et al. (2004) that the industrial workplace sectors needed to create a curriculum to develop the potential of workers to have the knowledge, academic skill, and professional skill required by the workplaces. Therefore, the researcher developed the model to solve problems of students' competency for job training or graduation as needed for the workplace.

(2) According to the research results, to create a model to support decision-making to assess students' competency from 9 units by comparing the use of classification algorithms with Decision Trees, it was found that the model designed with algorithm Decision Tree: J48 had high accuracy. Therefore, the researcher chose the model created with the algorithm J48 to classify the scores to determine the student's competency to study additional learning units based on the competency they needed to improve through media. This is consistent with Suphakchaya (2017), who used an algorithm. The Decision Trees classification technique in the test showed that the model created using the Decision Tree Algorithm: J48 scored the highest accuracy. In addition, the developed learning media to enhance performance according to the developer's professional standards was suitable and efficient at a high level since there was an analysis of knowledge and competence to define a group of content in which media users had to review and study further to gain knowledge and gain more skills to have the competency that meets the needs of workplaces. This is consistent with Pawaphan (2017) that the development of learning management systems and the development of online teaching management systems include applying the advantages of a learning management system and selecting from the elements necessary for the learning management system to enhance students' competency according to professional standards. As a result, the test takers became competent and passed the assessment criteria according to the specified performance criteria.

Similarly, Kantapon (2015) also found that in evaluating students based on the principles of competency-based assessment (McClelland, 1973), learners were assessed according to criteria designed to align with their professional performance. There were also the criteria for passing the assessment in each competency unit. Consequently, the process of student development was highly effective. As same as in this research, to improve students' competent from teaching media, students were able to apply knowledge from the classroom to real practice in the workplace and learn

about the working system, planning, and solving problems that created true learning until becoming skillfully in both knowledge and practice and eventually had more confidence in working.

5. Conclusion

The development of learning media to enhance performance according to the professional standards of system developers using the decision tree process includes the learning model development, intelligence learning media development, and study of intelligence learning media efficiency. The objectives of this research include the development of intelligent learning media for improving occupational competence in Thailand Information and Digital Content Competency Level 3 and studying the efficiency of Intelligent Learning Media for improving occupational competence in Thailand Information and Digital Content Competency Level 3. The learning media was developed by a system development life cycle integrated with intelligent artificial algorithms: Decision Tree. The quality of learning media was considered by the accuracy of decision tree algorithms which was the J48 algorithm.

The result of this study showed that the Intelligent Learning Media for improving occupational competence in Thailand Information and Digital Content Competency Level 3 comprised 4 components, including TPQI competency, Students' competency, artificially intelligent algorithms, and learning media that can automatically provide and enhance students with their competency by intelligent artificial algorithms: Decision Tree. The efficacy of teaching media was considered by the 95.23% correctly classified instance by the decision tree. The satisfaction with learning media was high ($\bar{X}$=4.38, SD=0.14)**.**

In addition, an expert system was used to classify media users by analyzing knowledge and competence to define a group of content that media users have to review and study to gain knowledge and skills. This provided test takers competency that genuinely meets the needs of workplaces.

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