Application of Gamified Hybrid Competency-Based Learning to Enhance Vocational Students' Digital Safety Skills

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***Abstract*—Digital safety skills are essential for vocational students as technology becomes a core component of almost every industry. Thus, students' understanding of how to stay safe online and use digital tools responsibly is critical for their academic and future success. However, traditional learning methods cause students to lack motivation and not understand the risks associated with the digital world. Without a clear understanding of these risks, learning about digital safety becomes less of a priority. This study presents an application of Gamified Hybrid Competency-Based Learning (GH-CBL). We designed and developed a GH-CBL system to enhance digital safety skills among vocational students. Experts validated the system design to ensure the appropriateness of its components for educational implementation. A pre-experimental research design was employed with a one-group pretest-posttest method with a sample of 40 vocational students. The research findings revealed that experts consider GH-CBL suitable for vocational students' learning. In addition, the students' digital safety achievement scores increased significantly before and after learning.**

***Keywords*—vocational education, competency-based learning, gamification, digital platform, digital safety**

I. Introduction

In the rapidly evolving 21st-century context, technological advancement has become a key driver of transformation across economic, social, and environmental dimensions. This shift is significantly influencing the way of life in Thailand. The country strongly emphasizes Vocational Education and Training (VET), recognizing its critical role in economic development, social stability, and workforce transformation [1]. As a result, the demand for labor efficiency in the future will also change. Preparing for the era of transformational changes in education management may not be able to meet the needs of today's changing world because the educational curriculum that educational institutions have existed for a long time may become obsolete. They may no longer be able to develop the knowledge, skills, and competencies necessary for the current world and students' future [2].

In addition, the knowledge and abilities of some professions are no longer in demand. These challenges are something that all school administrators must be aware of and proactive about. To keep up with such changes, it is essential to improve schools' teaching and learning management. Problems in curriculum, teaching, and learning management, and measurement and evaluation affect the development of education quality and the quality of students [3].

Therefore, the researcher has the idea of designing competency-based hybrid learning with gamification through digital platforms to promote safe digital skills for vocational education students.

The gamification design in this research was centered around motivating engagement and reinforcing learning outcomes through game elements. These included points to reward correct responses and safety-conscious decisions. We have designed quests and challenges such as real-life digital safety scenarios where students had to make decisions, helping them apply their knowledge practically. In addition, during the students' participation in the game, the levels of progress bars could be seen to visualize learning progress and motivate completion of all modules. The design focused on providing immediate feedback, increasing motivation, and encouraging repeated practice, which are key factors in developing competency in digital safety.

The primary research questions are as follows.

1) Is the Gamified Hybrid Competency-Based Learning considered suitable by experts?
2) How the vocational students have digital safety skills after learning compared to before?

II. Literature Review

A. Competency-Based Curriculum

The competency-based curriculum refers to a curriculum that emphasizes measuring performance based on competencies rather than memorizing content solely for exams. Competency-based assessments focus on applying knowledge in practice [4]. This approach replaces the current curriculum with a competency-based framework grounded in the following principles, which promote the development of individual learner potential, allowing learners to take ownership of their learning and continuously develop themselves [5]. In addition, it is important to develop students' well-being regarding health, intellectual intelligence, social skills, and emotional balance, emphasizing equity and developing essential competencies for daily life, problem-solving in various situations, and contributing to society as well as developing learners to aware and adaptable to changes in social conditions and technological advancements.

B. Gamification

Gamification refers to the application of gameplay elements to activities. The game itself is not used to stimulate and motivate learners to learn; it is used to engage learners in learning in a fun way. It has been used as a learning tool for centuries. It is becoming more prominent in educational settings. When it comes to learning, being focused and

immersed can massively improve a student's experience [6, 7]. Gamification can promote significantly improved student learning performance compared to before its implementation. Furthermore, the student's learning motivation significantly increased and showed high satisfaction with gamification [8].

C. Digital Literacy

Digital literacy, the skills necessary to access, navigate, understand, and contribute to the modern digital information economy [9], has evolved from early definitions highlighting users' ability to access and adapt to digital media. It broadens the scope to include the ability, attitude, and awareness to use digital tools effectively for communication, knowledge creation, and meaningful social interaction [10]. This evolution underscores the importance of digital literacy in the modern economy.

D. Digital Safety Skill

Digital safety skills encompass the knowledge and strategies to protect personal information, devices, and online identities. These skills are vital for students who frequently engage with digital platforms and are increasingly exposed to phishing, malware, and identity theft risks. Proficiency in digital safety enables students to manage privacy settings, create secure passwords, and respond effectively to online threats [11]. And negative interactions with technology, including incidents of cyberbullying and access to inappropriate content online [12]. Therefore, digital safety is a foundational skill for the modern workforce. The students with strong digital safety competencies are better prepared for digital environments in the educational system and the workplace.

III. Materials and Methods

A. Participants

A pre-experimental research design was employed with a one-group pretest-posttest method with a sample of 40 second-year vocational students in the Electrical Power Engineering program who were interested in participating in this course. Their age range was 18–20. We obtained voluntary and informed consent from the participants before involving them.

B. Design the Architecture System

The research process is divided into 4 phases as follows:

- Synthesis: This phase involved synthesizing a competency-based hybrid learning approach integrated with gamification through a digital platform. The objective was to establish a theoretical foundation and identify key components for promoting digital safety skills among vocational education students.
- Design: This phase designed a competency-based hybrid learning model incorporating gamification elements. The design emphasized instructional alignment, digital platform functionality, and gamified learning experiences to enhance digital safety competencies.
- Development: This phase developed a competency-based hybrid learning system through a digital platform that embedded gamification. This included creating digital content, gamified modules, and interactive learning activities tailored to vocational students.
- Evaluation: This phase focused on evaluating the effectiveness of the implemented learning system. It assessed learning outcomes, specifically digital safety skill acquisition and learner engagement with the gamified digital platform.

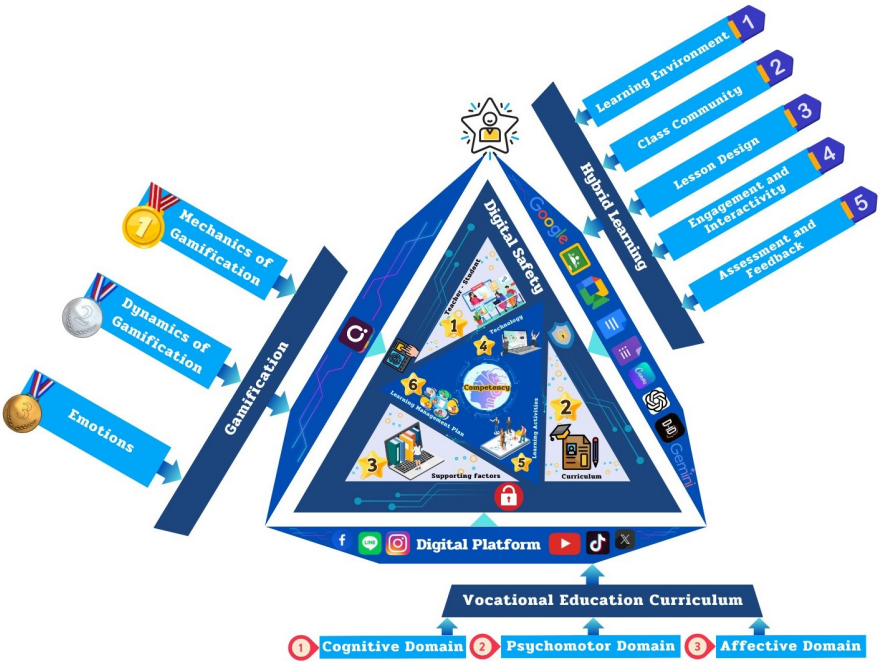

Fig. 1. The architecture of gamified hybrid Competency-based learning system.

Fig. 1 shows blended learning based on three domains of competency-based for student in vocational education curriculum with the learning process aiming to strengthen digital safety to develop students' ability to apply knowledge, skills, and attitudes via digital platforms to integrate work operations to be effective and efficient, consisting of main components, as follows:

1) Vocational education curriculum

This course is part of the Vocational Certificate

Curriculum, B.E. 2562 (2019), under the Commerce Program, Business Computer Department, categorized under the Professional Competency Subject Group within the Office of the Vocational Education Commission, Ministry of Education. Unit 1: Using Computers, Information Systems, and the Internet for Professional Work and Unit 2: Safe Digital Practices in Professional Work.

- Students are enrolled in the Computer and Information Technology for Professional Work course under the Vocational Certificate Curriculum.
- Teachers are crucial in delivering the course content and managing the learning process. They are responsible for developing learning materials, providing guidance, and designing learning activities to promote safe digital practices among students.
- Supporting factors facilitate hybrid competency-based learning integrated with gamification through a digital platform to enhance safe digital skills. Learning materials, such as textbooks, instructional videos, and educational websites, serve as input factors for student learning. Devices, including computers, laptops, tablets, and mobile phones, support the learning process.
- Technology refers to tools and technical processes that aid in creating, developing, designing, and enhancing services to meet the needs and address challenges in learning activities.
- Learning Activities involve actions designed to facilitate learning. Students actively engage in activities with teachers, individually or collaboratively, leading to knowledge acquisition and skill development that align with the educational objectives. A learning management plan is a systematically prepared teaching strategy that outlines learning activities in a structured manner. It compiles relevant information to create a comprehensive teaching plan to ensure students achieve the desired learning objectives.

2) Hybrid learning

The hybrid competency-based learning combines face-to-face and online learning, offering flexibility and efficiency in education. This approach is well-suited for the digital era, allowing students to adapt and develop skills effectively. It consists of five key components:

- A learning environment that incorporates both online and offline settings or blended hybrid models is essential. Effective platforms include Google Classroom, Google Meet, and other digital tools that support hybrid learning.
- A class community is structured within a community-based model that simulates classroom interactions in an online environment. This allows learners to exchange knowledge, discuss, and support one another in learning.
- Lesson design must effectively meet students' needs, enabling them to leverage technology for enhanced learning experiences.
- Engagement and interactivity are online or offline learning sessions that include interactive activities to maintain student interest, promote participation, and enhance engagement in the learning process.
- Assessment and feedback are learning processes that incorporate assessments and feedback mechanisms, including evaluations of academic performance, progress in online learning, and competency development, integrated to create a balanced and effective evaluation system based on student needs.

C. Instruments

To evaluate students' digital safety skill before and after the application intervention, we have developed the pre-test post-test was validity, and reliability outlines the following procedures: (i) the construction of a 30-item test based on a two-way specification table; (ii) content validity evaluation, yielding an Item-Objective Congruence (IOC) index of 0.88; (iii) pilot item analysis, with item difficulty indices ranging from 0.34 to 0.77 and discrimination indices ranging from 0.31 to 0.71; and (iv) reliability assessment, with a Kuder–Richardson Formula 20 (KR-20) coefficient of 0.88 for the test and a Cronbach's alpha of 0.91 for the expert-review checklist. These results provide strong evidence of the instrument's validity and reliability.

D. Data Collection

Fig. 2. The student learning activity in classroom.

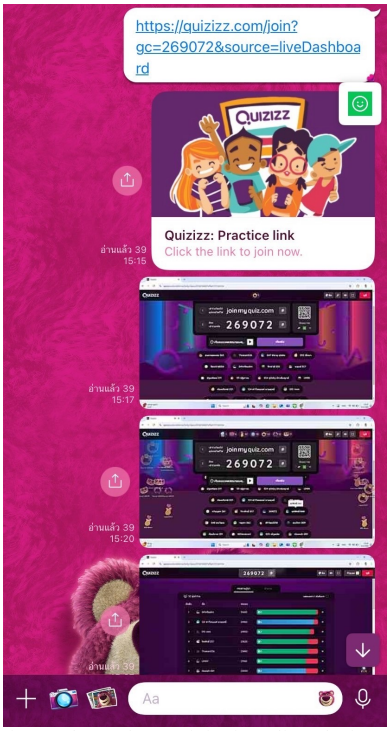

Fig. 3. The student activity in online platform.

At the beginning of the research experiment, the students took the 30-question pre-test to measure digital safety skills.

Then, they participated in an 18-week learning activity. The course content was divided into nine learning units, and the evaluation was based on the teaching and learning activities using this model. The teacher presented a learning activity that applied gamified hybrid competency-based learning to activities in the classroom (see Fig. 2). The students have engaged in online platforms, we use the Quizizz application as game to drive in this learning activity (see Fig. 3). In addition, they can know their learning feedback immediately (see Fig. 4). After that, they took 30-question post-tests.

Fig. 4. The screenshot of gamification.

IV. Result and Discussion

RQ 1: Is the Gamified Hybrid Competency-based Learning considered suitable by experts?

Table 1 presents the assessment results regarding applying a gamified hybrid competency-based learning (GH-CBL) process to enhance computer skills. The findings indicate that the overall appropriateness of this instructional approach is rated at the highest level (Mean = 4.93, S.D. = 0.19), suggesting a strong consensus among evaluators. Each component of the learning model was considered suitable for practical implementation and could be effectively leveraged to develop a comprehensive learning system further. Such a system would aim not only to strengthen students' computer skills but also to serve as a pedagogical tool that supports instructional design, facilitates teaching and learning processes, and promotes the development of digital and technological literacy.

Table 1. Results of the suitability assessment by experts

Assessment List	Evaluation Results	
	Mean	S.D.
Analyze learners	4.71	0.49
Analyze the instructor	4.71	0.49
Technology	4.71	0.49
Learning Activities	4.43	0.53
Learning Management Plan	4.71	0.49
Motivation	4.57	0.53
Information	4.71	0.49
Application	4.57	0.53
Progress	4.86	0.38
Academic achievement	4.86	0.38
Satisfaction	4.86	0.38
Academic achievement assessment results	4.86	0.38
Evaluation Results of Word Processor Use	5.00	0.00
Satisfaction Assessment Results	5.00	0.00
Overall suitability	**4.93**	**0.19**

RQ 2: How the vocational students have digital safety skills after learning compared to before?

Table 2 presents the descriptive statistics for digital safety skills levels before and after the intervention. The mean digital safety skills score before the intervention was 16.05 (SD = 3.74), while the mean score after the intervention increased significantly to 45.73 (SD = 7.86).

A paired-sample t-test was conducted to assess whether there was a statistically significant difference between the before and after scores. The t-test results revealed a significant difference in digital safety skills levels, with a t-value of 24.6, indicating a large effect size. The p-value was reported as $p < 0.001$, well below the conventional threshold of 0.05, confirming that the difference observed is highly statistically significant.

The significant difference between the before and after means suggests that the intervention (such as a training or educational program) substantially improved participants' digital safety skills. The high t-value further reinforces the strength of the effect.

Table 2. Results of paired samples t-test of students' safety skills

Test	Mean	S.D.	t	Sig.
Pre-test	16.05	3.74	24.59	0.00**
Post-test	45.73	7.86		

** $p < 0.001$

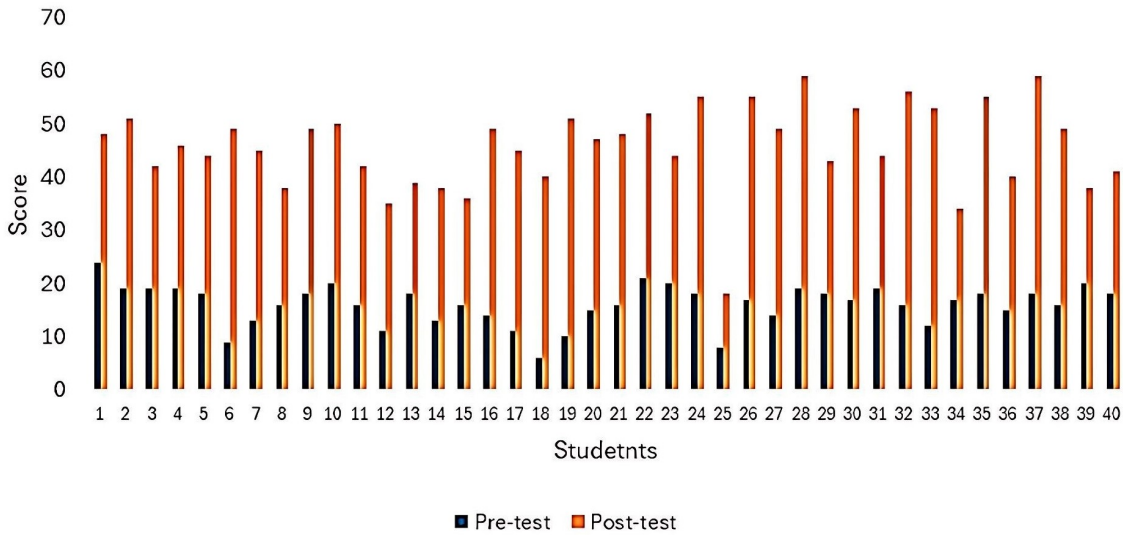

Fig. 5. The students' digital safety skills.

Fig. 5 illustrates a bar graph depicting a comparative analysis of the digital safety skills of 40 students, measured both before and after participation in the learning activity. The graph provides a visual representation of the improvement in students' safety competencies, highlighting the effectiveness of the instructional intervention in enhancing their awareness and application of digital safety practices.

V. Conclusion

The study on the use of a hybrid learning model based on competency combined with gamification through digital platforms to promote digital safety skills for vocational students revealed the following results: The students who were part of the sample group participated in activities according to the learning objectives and the developed lesson plan for 18 weeks. The course content was divided into nine learning units, and the evaluation was based on the teaching and learning activities using this model. The findings showed that students who studied through the application of gamified hybrid competency-based learning had significantly higher learning achievement after the course. Additionally, the students demonstrated good digital safety skills after the course.

This study is consistent with a growing body of research indicating that gamification can significantly enhance academic performance, learner engagement, and motivation among vocational education students [13, 14]. These positive outcomes are particularly evident when gamification is implemented within blended-learning environments, which integrate face-to-face and online instructional methods. Such environments provide flexible, student-centered learning opportunities that foster autonomy and active participation and stimulate students' interest and persistence throughout the educational process [15]. The alignment of this study's findings with prior research reinforces the potential of gamified blended-learning approaches as effective pedagogical strategies in vocational education contexts.

However, this study's limitations include a relatively small sample size and a context-specific nature. In addition, the experimental design employed in this study was a pre-experimental design, which is considered methodologically weak due to the absence of a control group. Future research should investigate gamified hybrid competency-based learning implementation across diverse vocational domains and cultural contexts and examine its long-term effects on digital safety behavior.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

N.S.: Conceptualization, research design, system development, data collection, and original draft preparation. S.C.: Methodology guidance, data analysis, validation, and manuscript editing. P.N.: Supervision, project administration, and final review. All authors approved the final manuscript.

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