Designing Flipped Classroom with Imagineering: A Case Study in Digital Literacy

Rattanakul kongpha*
Academic Scholar, Suan Sunandha Rajabhat University, Thailand, *rattanakul.ko@ssru.ac.th*

Pasawut Cheerapakorn
Academic Scholar, Suan Sunandha Rajabhat University, Thailand, *pasawut.ch@ssru.ac.th*

Kathaleeya Chanda
College of Innovation and Management, Suan Sunandha Rajabhat University, Thailand, *kathaleeya.ch@ssru.ac.th*

*Corresponding author E-mail: rattanakul.ko@ssru.ac.th

Received: 23 April 2023; Revised 8 May 2023; Accepted 22 October 2023

ABSTRACT: *In today's world, technology is used in all aspects of life, including communication, work, learning, gaming, and entertainment. Therefore, technology is essential. Flipped classroom is an appropriate teaching technique for managing teaching in the modern world. This academic paper studies the design of a flipped classroom combined with engineering imagination, a case study of digital literacy, as a guideline for application for undergraduate students at Suan Sunandha Rajabhat University. The researcher studied the concepts, theories, and relevant research of flipped classroom, engineering imagination, and digital citizenship to design a flipped classroom combined with engineering imagination. The course content is "Digital Literacy", which will help promote digital citizenship. The digital citizenship competency of Thailand consists of 5 dimensions: Digital Identity, Digital Use, Digital Security, Digital Literacy, and Digital Communication. Flipped classroom allows students to learn independently through technology-based learning outside the classroom, and in-class activities using the imagineering process will help students develop digital skills for being a digital citizen of Thailand.*

Keywords: Flipped Classroom, Imagineering, Digital Citizen

1. Introduction

Technology is the most important thing for humans today, in all aspects of communication, work, learning, gaming or entertainment, and daily life. Technology has changed human lifestyles in many ways, with the ability to improve work efficiency, improve quality of life, create new things, and work more efficiently. Technology is also important for solving environmental and social problems, such as using technology to reduce energy use and greenhouse gas emissions, increase public safety, and make learning more accessible to students in difficult situations. It also helps humans access information and communicate more quickly and conveniently, strengthening the linkages between humans and society at the global level. Being a quality digital citizen will help improve the efficiency of using digital technology to have a significant impact on social development. It also helps to increase the security and safety of using digital technology, as well as increasing the country's competitiveness at the international level. Currently, being a digital citizen is not just the responsibility of government agencies, but it is also important for businesses and citizens to have good competencies to help as part of social development.

Thailand's digital citizenship competency consists of 5 aspects: Digital Identity, Digital Use, Digital Security, Digital Literacy and Communication. Digital Communication, (Electronic Transactions Development Agency, 2021) has been developed based on the standards from the 8 DQ Framework frameworks of the DQ Institute, a leading research institute in digital intelligence or DQ that aims to develop the world's population to be ready. Toward Quality Digital Citizenship (Yuhyun Park & DQ Institute, 2019)

The Office of General Education and Innovative Electronic, Suan Sunandha Rajabhat University, has been teaching the GEN0304 Digital Literacy course, a general education subject in the bachelor's degree Program Revised in 2019. To ensure the effectiveness of teaching and to develop digital citizenship among students, researchers have studied and researched relevant concepts, theories, and research. They have synthesized the data and designed a flipped classroom model combined with engineering design to promote digital citizenship among students at Suan Sunandha Rajabhat University.

2. Research objectives

To design a flipped classroom together with imagineering to promote digital citizenship in Thailand.

3. Methodology

The researcher has studied and collected research related to the flipped classroom. imagineering process and digital citizenship in Thailand Synthesize and summarize the results of the synthesis flipped classroom.

4. Flipped Classroom learning

Flipped Classroom

Bergmann Jonathan & Sams Aaron. (2012). defined that Flipped classroom learning It is a traditional teaching method that is lecture-based, and the content is organized into an online learning system so that students can access it before studying face-to-face in the classroom. learner-centered knowledge.

Kittiphan. (2017). has given the meaning that Inverted classroom concept means a learning management model that combines learning about basic knowledge from lectures through technology outside the classroom with learning process skills concepts. and high-level thinking skills from classroom activities.

Vicharn. (2013). has given the meaning that Flipped Classroom is a learning where teachers focus on helping students understand principles, not memorization. Teachers focus on helping guide children's learning. not the function of transmitting knowledge Teachers shift from roles interacting with the entire class. It is an individual interaction with students.

Joshua. (2016). The use of technology and content creation is an easy task for educators. They utilize computers to organize their learning systems, websites, YouTube, Google, social media, smartboards, iPads, and many other technologies to develop content. The classroom has transformed with the advent of these tools, and the results in the 21st century are numerous for educators.

Waraporn, (2021). Flipping the classroom involves a teaching approach that differs from the traditional model. It entails taking homework or learning activities that students used to do at home and having them complete these tasks at school, with the teacher guiding, advising, and explaining the content. The conventional classroom format, which focuses on in-class lectures delivered by the teacher, is transformed into a self-directed learning process outside the classroom, where students research and explore the content using learning materials prepared by the teacher.

Piyawadee. (2016). Flipped Classroom means assigning learners to learn lessons by themselves from various learning media outside the class according to individual aptitudes. In class, it will be homework, exercises or quizzes and various activities together, with instructors giving advice and advice closely.

Prachyanun. (2021). said that classroom teaching is Flipped Classroom. Happened first time: watching video tutorials at home or listen to the teacher's podcast Take a quick assessment so teachers can gauge their understanding before tomorrow's class. Happens a second time: doing homework (previously assigned homework) with teachers and friends Teachers can provide one-on-one assistance. mentions the process of Flipped Classroom. Steps outside the classroom

1. Learners study lectures through electronic media.
2. Learners research and question teachers online.
3. Learners study content by themselves online.
4. Learners summarize their understanding.

Classroom steps

1. Teacher guides students to complete homework and assignments.
2. Students present work learned at home.
3. Teachers assess learners' knowledge and skills.

5. Imagineering

5.1 Meaning of Imagineering

From the study of information about the meaning of mental engineering learning from various documents, there are definitions. and the mental engineering learning process as follows the title of the paper should appear on the top edge of the first page of the document. Type the title in uppercase and lowercase letters, centered between the left and right margins and in Times New Roman 14-point, boldface type. Capitalize the first letter of nouns, pronouns, verbs, adjectives, and adverbs; do not capitalize articles, coordinate conjunctions, or prepositions, unless the title begins with such a word. In case the title is two or more lines, single-space between the lines. Insert a blank single-spaced line after the title.

Imagineering is the process of mental engineering for converting human-embedded knowledge into operational knowledge (Chenail, 2004)

Imagineering learning (Prachyanun, 2013) means that Imaginary engineering learning (Imagineering) is the application of mental engineering. which is a combination of the word "Imagine" and the word "Engineering" means making what is imagined into reality in practice. It is the use of what creates images in the mind to become tangible inventions and innovations that are used in education. Appears in mental engineering learning method. which has a step-by-step learning model by bringing the imagination of the human mind to become real things together with educational activities that require the application of mental engineering concepts to achieve learning from the abstract to the concrete and finally understand and can be put to good use.

Imagineering learning (Pinanta, 2018) is a learning process that focuses on developing the characteristics of learners in the 21st century, namely creativity and innovation. The goal is to be an innovative piece that learners must start with the process of imagining, designing, developing, presenting, improving, evaluating and selecting appropriate technology as a tool.

Imagineering (Somsak, 2016) is a learning process. in organizing ideas and strategic inspiration and creative framework to have initiative Imaginations and dreams that do not exist today Become a reality by doing or inventing to use in everyday life.

5.2 Teaching and Learning with Imagineering.

Imagineering-based learning can be applied in teaching at all levels of education, using a project-based approach. The teacher acts as a facilitator and encourages students to create their own work independently, taking into account the students' interests and abilities. Imagineering-based learning is a learner-centered approach in which students participate in the learning process in its entirety, from idea generation, planning, creation, evaluation, and application of knowledge in real-world settings. Imagineering-based learning therefore helps students develop various skills and abilities.It is a learner-centered learning that truly emphasizes the learner. (Prachyanun & Panita, 2013)

5.2.1. Imagination: Students have imagination from an early age, such as when young children are given clay to make different monsters. The children can mold different shapes according to their imagination, even if they are not beautiful or like the real monsters in novels or cartoons. However, it is an imagination based on the images in the children's minds. When they grow up to be adults, if their imagination is continuously developed, they will become great thinkers and valuable creators. For example, when students grow up to be university students, they will be able to imagine freely when they are given assignments to create works to solve problems. They may use brainstorming with others to study the feasibility of what they imagine and try to make them come true.

5.2.2. Design: Students should not be limited in their thoughts and imagination. In the design of imagineering-based learning, there are no rules or frameworks in the design. Students are free to design anything they want without limits.

There are tools to help students design that reflect their imagination, such as sketching, drawing illustrations to tell stories, writing sequences of steps for mutual understanding, and making prototypes to simulate the desired work before taking action. The teacher provides guidance or may teach students how to sketch, use design tools, and write scripts in a step-by-step manner, but does not interfere with the student's imagination or design in progress and is flexible to adjust according to the student's thoughts at any time.

5.2.3. Development: In the development stage, students begin to create the things they have designed. This is the stage where imagination is turned into reality. Students of all levels can create their own work in any subject as long as the teacher accepts the student's ideas and designs without being constrained by beauty, but rather by functionality, quality, and efficiency. Imagineering-based learning does not require the beauty or perfection of the work. If the work that is created has been tested for usability, performance, and quality, and can be used in the real world, it is considered good, commendable, and worthy of praise. However, if the student is unable to create the work perfectly according to their imagination, the work should be considered a prototype of the imagination, not a failure of learning. The prototype can be used by the student to explain their imagination and creativity and is a starting point for further development.

5.2.4. Presentation is a process in which all students must present their developed works in front of the class. The presentation can be oral, in the form of a board, poster, or multimedia slide, depending on the students' abilities. The teacher may arrange a classroom exhibition for students to manage their own presentation areas. There is a competition and awards for students, with no rankings. All works should receive at least one award. Students are also asked to give their opinions, compliments, or positive suggestions for all works. The teacher may submit students' works or select works for further competition.

5.2.5. Improvement is a process of reflecting on the presentation. After the students have presented their works, the teacher has a role in providing guidance together with other students. Experts may be invited to provide additional feedback, but it is important to be careful not to give feedback that is beyond the students' abilities. It is also important to be careful not to give negative feedback that could become insults to the students, causing them to lose motivation and give up on their imagination. Provide appropriate guidance and encouragement to the students in improving their works. Provide sufficient time for the students to improve their works to be consistent with their imagination as much as possible, until the final product reflects the students' true imagination. It does not have to be a perfect or functional work, just a work that the students acknowledge as being in line with their true imagination.

5.2.6. Evaluation is the final step in evaluating student work. Students and teachers should work together, with students assessing themselves to see if their work meets their initial vision, meets their ideas, and answers the questions they set out to answer. Students assess their own work based on the quality of the work that actually happened, with the teacher summarizing the assessment results. The teacher assesses the student's initial design, whether the work created meets the imagination and design, whether the student's presentation of the work is impressive to both the teacher and other viewers, and the student's efforts in creating the work. The student's collaboration in improving the work is also assessed. Regardless of whether the work is complete or incomplete, the quality of the work can be assessed for all works created by the student.

5.3 Imagineering learning process.

The concept of imagineering learning is a synthesis of the imagineering learning process from (Prachyanun & Panita, 2013), Imagineering learning (Pinanta, 2018), Project-based web-based learning system with Imagineering to enhance the skills of creating creative multimedia works and collaborative learning skills (Somsak, 2016), Imagineering science learning model with augmented reality technology for STEM literacy, resulting in the imagineering learning process as follows.

5.3.1. Imagination consists of 4 steps: Problem determination, Brainstorm, Discussion, and Imagination feasibility analysis. (Feasibility)
5.3.2. The design (Design) consists of 4 steps: the drafting process (Draft), the storyboard writing process (Storyboard), the scripting process (Script) and the creation of a prototype (Prototype).
5.3.3. Development consists of 2 steps: Create and Test.
5.3.4. Presentation consists of 3 steps: Show, Competition and Suggestion.
5.3.5. Improvement consists of 2 steps, namely, revised process and conclusion process (Conclusion).
5.3.6. Evaluation consists of 2 steps: Process Evaluation and Product Evaluation.

Figure 1. Imagineering Model (Prachyanun & Panita, 2013)

The imagineering learning process is a framework for developing 21st-century learners that focuses on developing the essential skills of creativity and innovation. It is a sequential learning model that uses imagination to turn ideas into reality.

6. Digital Citizen Thailand

The 5 Digital Intelligence Framework training content Covering all 5 digital intelligence frameworks that ETDA Electronic Transactions Development Agency and Khon Kaen University have jointly developed, aiming to raise knowledge and awareness of important issues that are sensitive to youth and the elderly, namely: (Electronic Transactions Development Agency, 2021)

1. Digital Identity: Raise awareness of creating an online identity to understand and be careful when disclosing personal information online.
2. Digital Use Proper use of digital technology: Understanding how to balance screen time. and perceive the effects on physical and mental health from using the Internet on themselves and others.
3. Digital Security: Security management in the digital world: raising awareness of risky behaviours or insecurity that may occur in the digital world. Including creating an understanding of cyber threats that are dangerous to data, systems, and equipment, including knowing methods or basic tools to help prevent and able to cope with threats.
4. Digital Literacy: building knowledge to understand the variety of information in the digital world. To be able to search, analyse and disseminate content that is legal and ethical.
5. Digital Communication: Understanding the importance of the positive and negative effects of digital footprint. Good knowledge of digital trace management tools and methods and interaction to create good collaboration in the digital world.

Figure 2. Digital Citizen Thailand
(Electronic Transactions Development Agency, 2021)

7. Research Methods

Instructional designers have studied research related to the flipped classroom instructional design and Imagineering learning process. as follows.

7.1 Flipped Classroom Synthesis Results

Table 1. Flipped Classroom synthesis table.

Flipped Classroom	(Bergmann Jonathan & Sams Aaron, 2012)	(Joshua, 2016)	(Vicharn, 2013)	(Piyawadee, 2016)	(Kittiphan, 2017)	(Waraporn, 2021)	(Prachyanun, 2021)	Researcher
1. Outside the classroom								
1.1 Learners study lectures through electronic media.	✓						✓	✓
1.2 Learners research and question teachers online.			✓	✓		✓	✓	✓
1.3 Learners study content by themselves online.	✓			✓		✓	✓	✓
1.4 Learners summarize their understanding.							✓	✓
2. In the classroom								
2.1 The teacher guides students to complete homework and assignments.							✓	✓
2.2 Students present work learned from home.				✓			✓	✓
2.3 Teachers assess learners' knowledge and skills.							✓	✓

3. Characteristics								
3.1 Interaction			✓					
3.2 Learners are the center of learning.	✓							
3.3 Learning outside the classroom				✓	✓	✓		✓
3.4 Activities in class				✓				✓
3.5 Teachers use technology to manage the learning system. and develop content		✓			✓			✓
3.6 Face-to-face learning	✓				✓	✓		✓

Based on the synthesis of the inverted classroom, Flipped Classroom is a change in traditional teaching methods by using technology to enhance student learning. By allowing the learners to study the content assigned outside the classroom first. Then come to study in class, where the instructor will help teach in practice. and answer the student's questions.

The Flipped Classroom has the following features:
1. Outside the classroom, students study lectures through electronic media. Learner's research and question instructors online. Learners study content by themselves online. and learners summarize understanding.

2. In the classroom, the teacher guides learners to complete homework and assignments, learners present their work learned from home, and the teacher assesses learners' knowledge and skills." This means that the flipped classroom uses class time for more active and engaging learning activities, such as group work, problem-solving, and presentations.

3. The characteristics of the classroom were reversed in terms of learning outside the classroom, doing classroom activities. Teachers use technology to manage learning systems and develop content. and face-to-face learning

7.2 The classroom instructional design is reversed in conjunction with Imagineering.

Table 2. Teaching and learning management in the classroom are reversed in conjunction with Imagineering.

	Researcher								
Imagineering	Flipped Classroom		Student				Teacher		
	home	School	Study via electronic media.	Search by yourself	Study the content online.	summary of understanding	Assign work	Use the technology	Assess knowledge and skills
1. Imagine	✓	✓	✓	✓	✓	✓	✓	✓	✓
2. Design		✓	✓	✓	✓	✓	✓	✓	✓
3. Develop	✓	✓	✓	✓	✓	✓	✓	✓	
4. Present		✓	✓	✓	✓	✓	✓	✓	✓
5. Improvement	✓	✓	✓	✓	✓	✓	✓	✓	
6. Evaluate		✓	✓	✓	✓	✓	✓	✓	✓

The design of flipped classroom instruction combined with imagineering to promote digital citizenship is a learning method that focuses on students engaging in activities at school while learning and researching from home. This is done through activities that follow the 6 steps of the imagineering process which are: Imagine, Design, Develop, Presentation, Improvement, and Evaluate, where the learners have a role. is Lectures through electronic media search by yourself study material online and summarize understanding the role of the teacher is Guide learners to complete homework and assignments. Use technology to manage the learning system. and develop content Assess the knowledge and skills of learners.

8. Conclusion and Discussion

8.1 Conclusion
8.1.1 Instructional Design Conceptual Framework

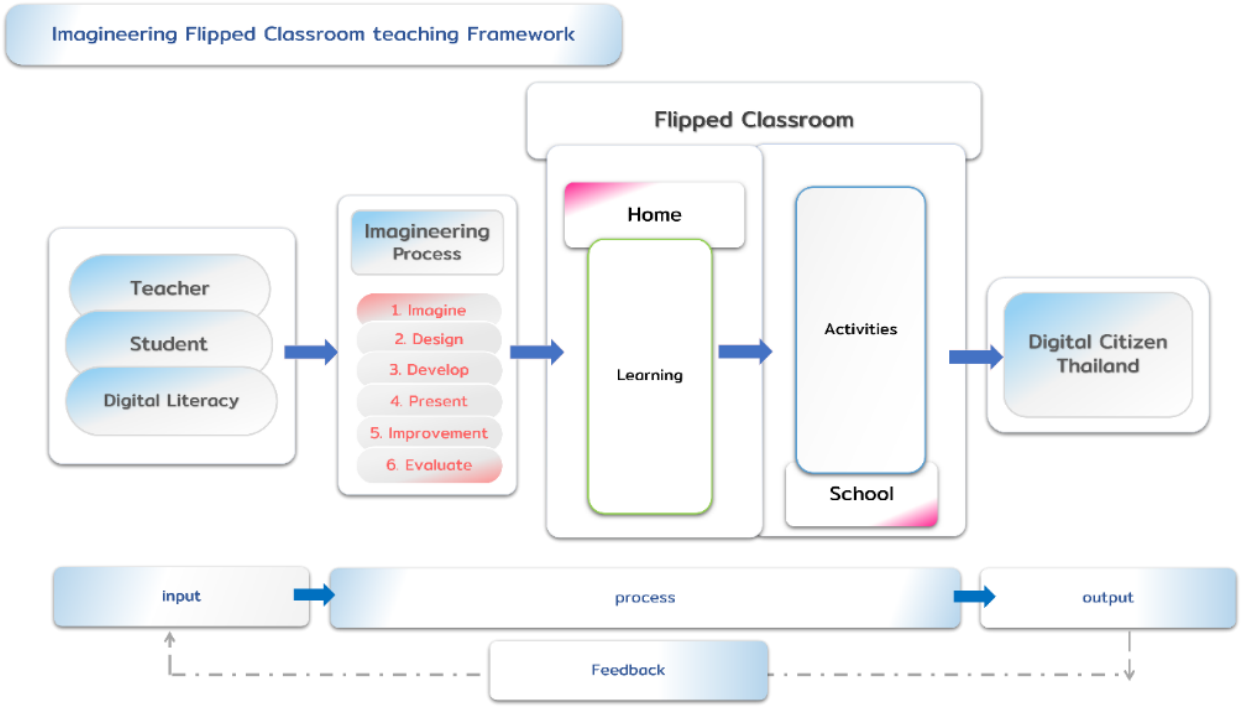

Figure 3. Imagineering Flipped Classroom teaching framework.

The results of the synthesis of flipped classroom instruction combined with imagineering led to the creation of a learning design framework, which was then further developed into a flipped classroom instruction model combined with imagineering to promote digital citizenship.

8.1.2 Designing a teaching and learning model. Flipped classroom combined with imagineering process.

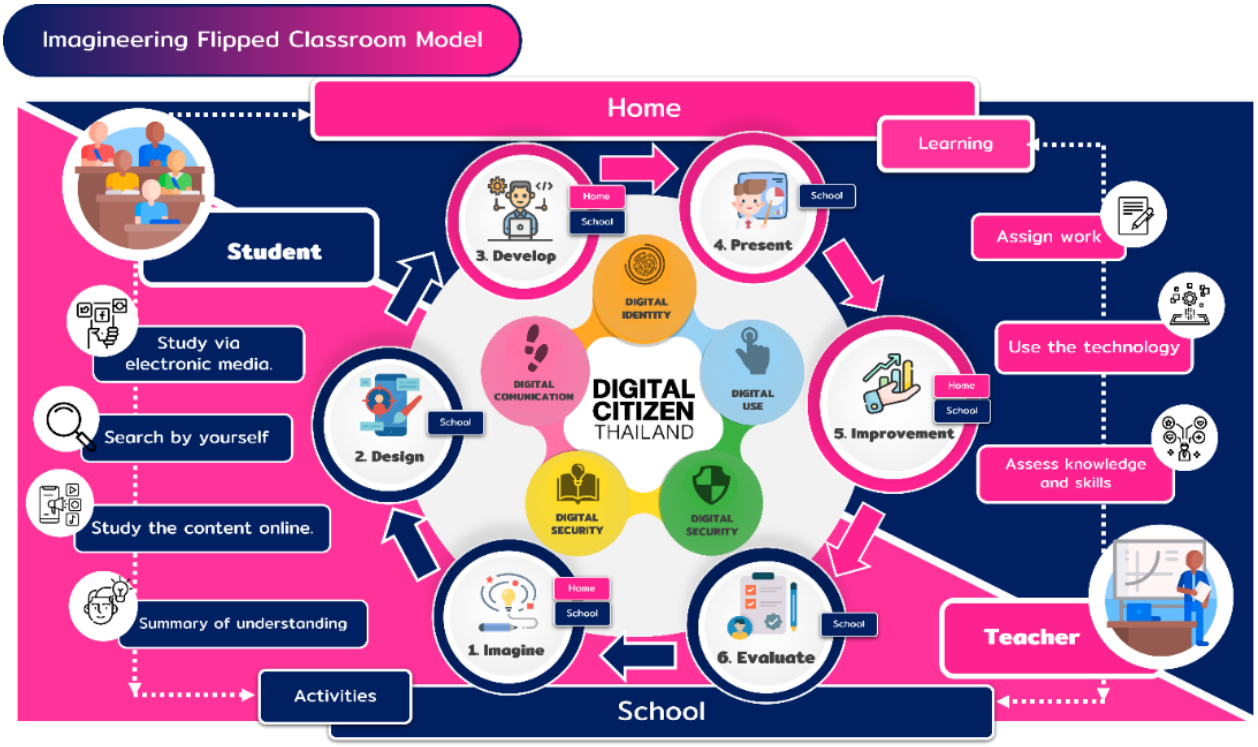

Figure 4. The teaching and learning model of the flipped classroom with Imagineering for digital citizenship.

The flipped classroom instruction model combined with imagineering to promote digital citizenship is a design of flipped classroom instruction combined with imagineering to promote digital citizenship. It is a learning method that focuses on students engaging in activities at school while learning and researching from home. The teaching process will follow the six steps of the imagineering process, which are:1. Imagine: Students generate ideas for solutions to a problem or challenge. 2. Design: Students create a prototype of their solution. 3. Develop: Students build a working model of their solution. 4. Present: Students present their solution to others. 5. Improvement: Students reflect on their solution and make improvements. 6. Evaluate: Students evaluate their solution and make recommendations for future improvement.

During these six steps, the teacher will provide guidance to students, both in their activities and in answering questions about the content. The flipped classroom instruction model combined with imagineering will enhance five aspects of Thai digital citizenship:
1. Digital Identity: Students understand their own digital identity and how it is represented online.
2. Digital Use: Students use technology responsibly and ethically.
3. Digital Security: Students protect themselves from online threats.
4. Digital Literacy: Students understand how technology works and how to use it effectively.
5. Digital Communication: Students communicate effectively and respectfully online.

8.2 Discussion

Designing the Flipped Classroom with Imagineering: A Case Study of Digital Literacy. The researcher studied and collected research data on the concept of the flipped classroom from various researchers to define the scope of the flipped classroom. The researcher also studied and collected data on the imagineering process and designed a flipped classroom teaching model with the imagineering process to promote digital citizenship in Thailand. The results of the discussion are as follows:
8.2.1. Classroom instruction is reversed in terms of activities that take place in the classroom, outside the classroom, and the learning environment. Including the roles of learners and teachers. The classroom instructional model is

reversed in conjunction with Imagineering to promote digital citizenship. It has designed the learning environment to be online outside of the classroom. This is consistent with (Bergmann Jonathan & Sams Aaron, 2012), which studied Flip Your Classroom Reaching every student in every class every day, said classroom learning is reversed. It is a traditional teaching method that is lecture-based, and content is organized online so that students can access it before learning face-to-face in the classroom. Learner-centered learning is reversed. and was designed according to the characteristics of the inverted classroom. which is consistent with online learning outside the classroom.

8.2.2. Using the imagineering process as a learning step will promote digital skill training, allowing learners to imagine, design, develop, present, improve, and be evaluated (Prachyanun & Panita, 2013) Imagineering learning is a type of learning that can be applied to teaching at all levels of education because imagination can occur at all levels of learners, from preschool to working adults. The teacher serves as a facilitator and organizes imagineering learning to suit the learners' age. Promotes learners to be able to create what they think from imagination in a systematic way, define problems that lead to work, propose a process in the form of a project for learners to create, promote learners to work with others, know how to think, design and create their own work, as well as express themselves by presenting their own work in various forms and listening to suggestions for improvement until it is complete as expected.

9. Acknowledgments

This research article was successfully completed with the help and support from faculty and staff from many departments. This allows researchers to work more efficiently and to produce more quality and valuable work. The researcher would like to thank Assistant Professor Dr. Jarumon Nukong, Deputy Director for Academic Affairs School of General Education and Electronic Learning Innovation Assistant Professor Dr. Nattapat Kaewrattanapat Deputy Director of Research and Innovation School of General Education and E-Learning Innovation for giving advice and suggestions that are beneficial to education. Including checking and fixing various defects with great care, making this research article more useful and valuable.

We would like to thank my colleagues in Information Technology for Communication and Education. That helps to search for various sources of knowledge to study and find useful information. and thanks to the faculty members of the Master of Industrial Education Program Branch of information technology for communication and education, everyone who has endowed valuable knowledge Thank you to all department heads and colleagues. which has assisted in collecting data for the purpose of studying the data Synthesize to research and design a virtual learning platform with artificial intelligence. make this research article more effective.

Thanks to the researcher from the research. Searching for relevant documents and research, anyone who can provide useful information for the study. To be used as a guideline for developing and improving the quality of education to satisfy both learners and teachers.

References

Bergmann Jonathan, & Sams Aaron. (2012). *Flip your classroom: reach every student in every class every day*.

Chenail, R. J. (2004). When Disney meets the research park: Metaphors and models for engineering an online learning community of tomorrow. *The Internet and Higher Education*, *7*(2), 107–121. https://doi.org/10.1016/J.IHEDUC.2004.03.001

Electronic Transactions Development Agency. (2021). *ETDA continues the "Digital Citizen" course, strengthening digital citizens for almost 500 people.* Https://Www.Etda.or.Th/Th/Pr-News/ETDA-Updates-Digital-Citizen-Courses.Aspx.

Joshua, W. (2016). *Flipped Learning in a Middle School Classroom*. UNIVERSITY OF HAWAI.

Kittiphan, W. (2017). *Effects of Organizing Mathematics Learning Activities Using the Flipped Classroom Approach And Active Learning On Mathematical Problem Solving And Critical Thinking Abilites of Eleventh Grade Students*. Chulalongkorn University.

Pinanta, C. (2018). The synthesis of activity model using project-based learning of imagineering to enchance creative construction of multimedia skills and cooperative skills. *Silpakorn University Journal*, *38*(1), 161–161.

Piyawadee, P. (2016). *Development of a Flipped Classroom by Scientific Inquiry Learning on a Social Cloud Model to Enhance Lifelong Learning Skills for Undergraduate Students*. King Mongkut's University of Technology North Bangkok.

Prachyanun, N. (2021). *Teaching and learning techniques based on vocational competency.* https://www.slideshare.net/prachyanun1/2-248108454

Prachyanun, N., & Panita, W. (2013). Imagineering Learning. *Journal of Technical Education Development*, *26*(86), 33–37.

Somsak, T. (2016). *Learning Model of Scientific Imagineering through Augmented Reality in order to enhance STEM Literacy*. King Mongkut's University of Technology North Bangkok.

Vicharn, P. (2013). *Teachers for pupils build a classroom upside down.* (Vol. 2). The Siam Commercial Foundation.

Waraporn, P. (2021). *The Development of learning achievment science Course usingflipped classroom with google clasroom for grade 8 student*. Rangsit University.

Yuhyun Park, & DQ Institute. (2019). *Digital Intelligence DQ Global Standards Report 2019*. https://www.dqinstitute.org/dq-framework