

# Positive behavior and AI support in an inclusive classroom with Google for Education Solutions in Thailand: Enhancing learning outcomes through active learning for 21<sup>st</sup> century students.



Associate Professor Dr. Prakob Koraneekij  
Assistant Professor Dr. Chanisa Tantixalerm  
Professor Dr. Jintavee Khlaisang

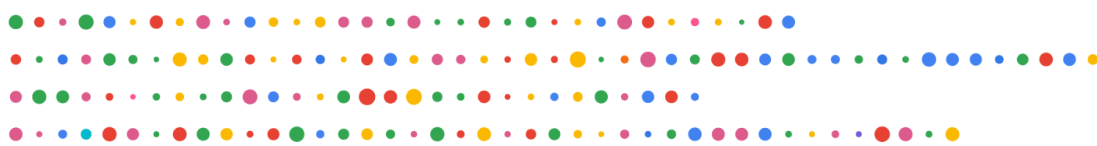
Center of Excellence in Educational Invention and Innovation &  
Special Education and Inclusive Education Research Unit  
Faculty of Education, Chulalongkorn University, Thailand



# Table of contents

page

- 1. Introduction..... 4**
- 2. Objective..... 9**
  - 2.1 Positive behavior and AI support in an inclusive classroom with Google for Education Solutions in Thailand: Enhancing learning outcomes through active learning for 21st-century students..... 9
  - 2.2 The Effects of a Speech-Based Reading Tutor Application on Reading Accuracy and Comprehension Among Secondary School Students..... 9
- 3. Research Scope..... 9**
  - 3.1 Positive behavior and AI support in an inclusive classroom with Google for Education Solutions in Thailand: Enhancing learning outcomes through active learning for 21st-century students..... 9
  - 3.2 The Effects of a Speech-Based Reading Tutor Application on Reading Accuracy and Comprehension Among Secondary School Students..... 11
- 4. Theoretical framework for operations..... 11**
  - 4.1 Positive behavior and AI support in an inclusive classroom with Google for Education Solutions in Thailand: Enhancing learning outcomes through active learning for 21st-century students..... 11
  - 4.2 The Effects of a Speech-Based Reading Tutor Application on Reading Accuracy and Comprehension Among Secondary School Students..... 14
- 5. Design..... 15**
  - 5.1 Teaching with Technology Upskill" Model..... 15
  - 5.2 Google Chromebook and Google Solutions Integration..... 18
  - 5.3 Google Solutions Integration in Active Learning Model and Transformation in Teacher Learning Management..... 19
  - 5.4 Google Gemini..... 21
  - 5.5 The standard class agreement protocol..... 21
- 6. Method..... 22**
  - 6.1 Positive behavior and AI support in an inclusive classroom with Google for Education Solutions in Thailand: Enhancing learning outcomes through active learning for 21st-century students..... 22
    - 1. Participants..... 22
    - 2. Instrument..... 23
    - 3. Research Methodology..... 24
  - 6.2 The Effects of a Speech-Based Reading Tutor Application on Reading Accuracy and Comprehension Among Secondary School Students..... 26
    - 1. Sample Group..... 26
    - 2. Instrument..... 26
    - 3. Research Methodology..... 27
- 7. Findings and impact..... 28**
  - 7.1 Best Practice Observation..... 28
    - 1. Chemistry - Grade 10..... 28
    - 2. Biology - Grade 10..... 31
    - 3. English - Grade 10..... 34
    - 4. Web Development - Grade 10..... 36
    - 5. Mathematic - Grade 10..... 39





6. P.E. - Grade 10.....	41
7. Art - Grade 10.....	44
8. Guidance - Grade 10.....	46
9. Thai - Grade 11.....	49
10. Biology - Grade 11.....	51
11. Design and Technology - Grade 11.....	54
12. Chemistry - Grade 11.....	57
13. Social - Grade 11.....	59
14. P.E. - Grade 11.....	62
15. Art - Grade 11.....	64
16. Guidance - Grade 11.....	66
17. English Club.....	69
7.2 Data analysis.....	71
<b>Part 1: Questionnaire on the Use of Google Workspace in Organizing Learning Activities to Develop 21st Century Skills of Teachers.....</b>	<b>71</b>
Section 1: Perspectives and Usage of Technology.....	71
Section 2: Enablers and Obstacles to Technology Adoption.....	72
Section 3: Baseline Indicators to Measure Impact on Teaching and Learning.....	73
Section 4: Likelihood of Recommending Workspace and Chromebooks:.....	74
Section 5: AI Literacy:.....	77
Section 6: AI Impact on Students:.....	78
Section 7: Growth Mindset:.....	79
Section 8: Teachers' Opinions Towards This Experiment:.....	81
<b>Part 2: Questionnaire on the Use of Google Workspace in Organizing Learning Activities to Develop 21st Century Skills for Students.....</b>	<b>83</b>
Section 1: Google Solutions Usability.....	83
Section 2: Baseline Indicators to Measure Impact on Teaching and Learning.....	84
Section 3: AI Literacy.....	86
Section 4: AI Impact on Student–Teacher Interaction.....	88
Section 5: Happiness in Learning.....	89
Section 6: Students' Opinion Towards The Experiment.....	91
<b>Part 3: The Effects of a Speech-Based Reading Tutor Application on Reading Accuracy and Comprehension Among Secondary School Students.....</b>	<b>92</b>
Section 1: Analysis Results of the Difference in Mean Scores for Accuracy.....	92
Section 2: Results of the Analysis of Differences in Mean Comprehension Scores.....	93
<b>Part 4: Promoting Positive Behavior and Student Engagement in Inclusive Classrooms: Key Indicators.....</b>	<b>95</b>
Mathematic - Grade 10.....	95
Guidance - Grade 10.....	96
Biology - Grade 11.....	98
Guidance - Grade 11.....	99
<b>8. Summary.....</b>	<b>101</b>
<b>9. Challenge and Opportunity.....</b>	<b>102</b>
<b>10. References.....</b>	<b>103</b>





## 1. Introduction

In the modern era, internet usage has become an integral part of the lives of billions worldwide, with increasing penetration rates every year. According to the 2024 Digital Thailand Report, 63.21 million Thai citizens, accounting for 88.0% of the total population, have internet access, marking a 0.1% increase from 2023 (We Are Social & Meltwater, 2024). This growing digital landscape presents new opportunities for leveraging technology to enhance education and student engagement.

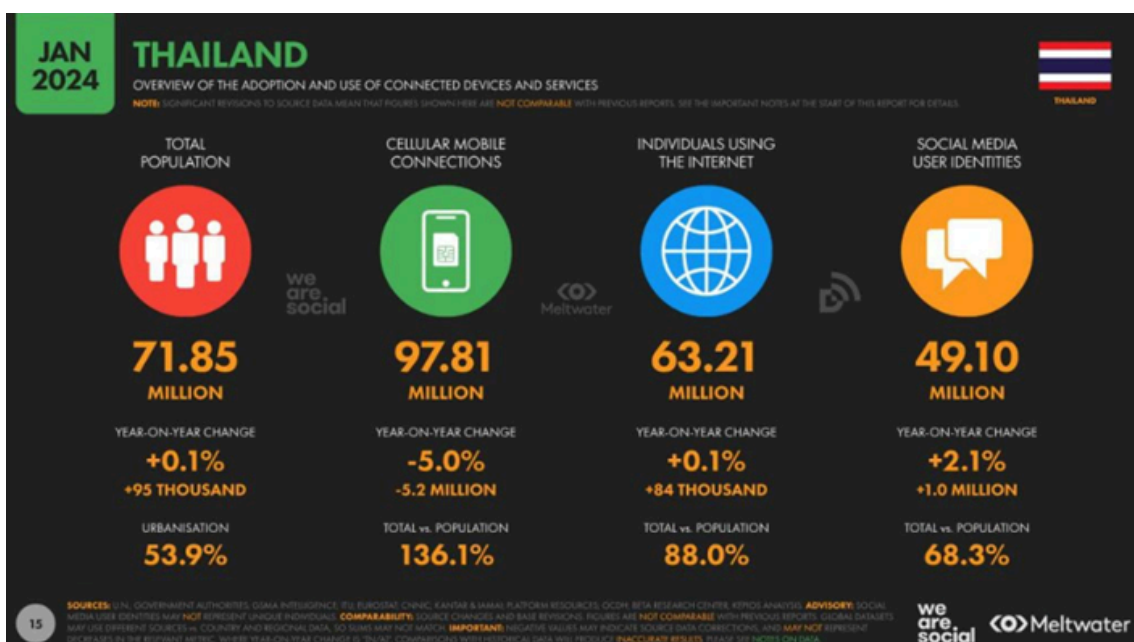


Figure 1: Internet Access and Usage of Thai People

On average, Thai individuals spend 7 hours and 58 minutes online daily, predominantly via mobile phones (approximately 5 hours per day), compared to an average of 3 hours per day on computers. Additionally, social media engagement averages 2.5 hours daily, reflecting its significance in Thai society. The most common online activities include information searching (64.4%), news consumption (60.3%), and entertainment streaming such as movies and videos (58.0%) (We Are Social & Meltwater, 2024). Given these statistics, digital learning initiatives must align with students' online behavior to maximize learning engagement.



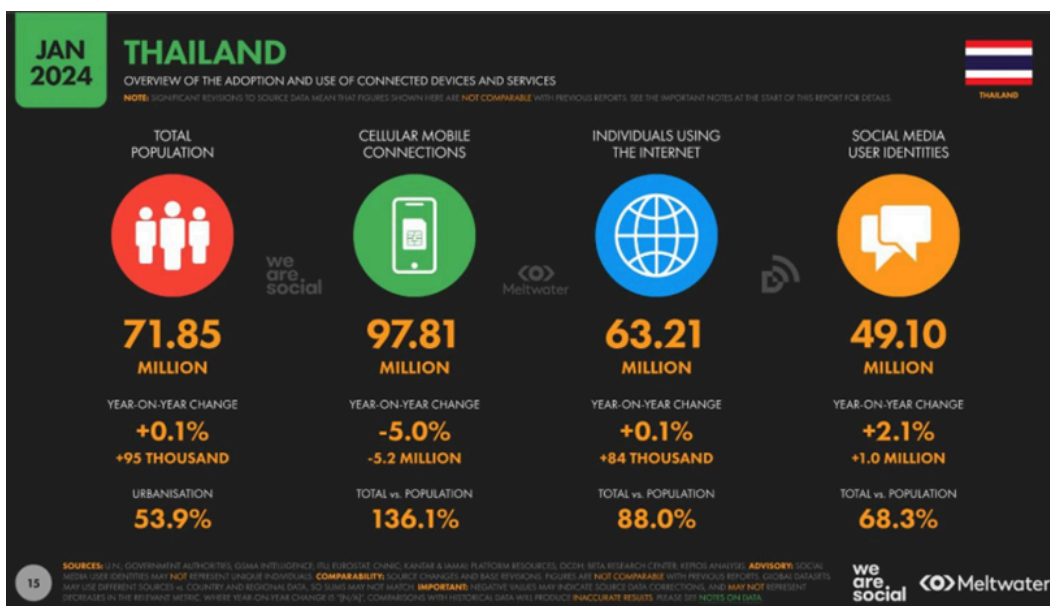


Figure 2: Average Daily Internet Usage of Thai People

The increasing role of technology in education presents a critical opportunity for student development, allowing for ubiquitous learning and the acquisition of digital skills necessary for future global integration. Google has played a significant role in transforming traditional classrooms into flexible and modern online learning environments, enabling teachers and students to interact, collaborate, and manage coursework efficiently through digital platforms such as Google Classroom, Google Docs, Google Meet, and Google Drive (Google, n.d.). These tools facilitate active learning, promote collaboration, and enhance students' critical thinking skills.

Inclusive education is a key policy in Thailand, ensuring that all students, regardless of disabilities, socioeconomic status, gender, ethnicity, religion, or culture, have access to quality education. Schools and educators must create adaptive learning environments, curricula, and assessments that cater to individual student needs, aligning with UNESCO's Education for All framework (UNESCO, 2020; Tantixalerm, 2018). However, more research is needed to explore how digital tools and AI can enhance personalized learning, facilitate accessibility for students with special needs, and improve teacher-student interactions in inclusive education models.

Research indicates that the School-wide Positive Behavioral Interventions and Supports (SWPBIS) framework effectively promotes positive behavior and enhances all students' social and academic outcomes (Carr et al., 2002; Horner et al., 2010). SWPBIS is a proactive behavioral management approach that fosters desirable classroom behaviors, such as emotional regulation and active learning, while minimizing disruptive behaviors (Waasdorp et al., 2012). This approach is particularly beneficial for inclusive classrooms, providing tailored behavioral support for diverse student populations (Agbenyega et al., 2022; Horner et al., 2010; McIntosh &





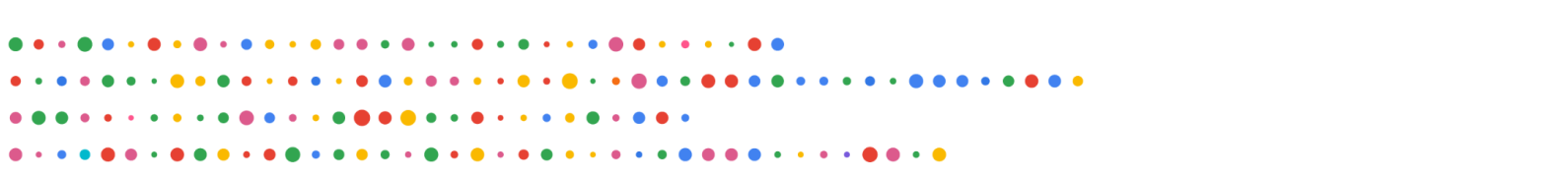
Goodman, 2016). Further exploration into AI-driven behavioral interventions may enhance the efficiency of SWPBIS implementation.

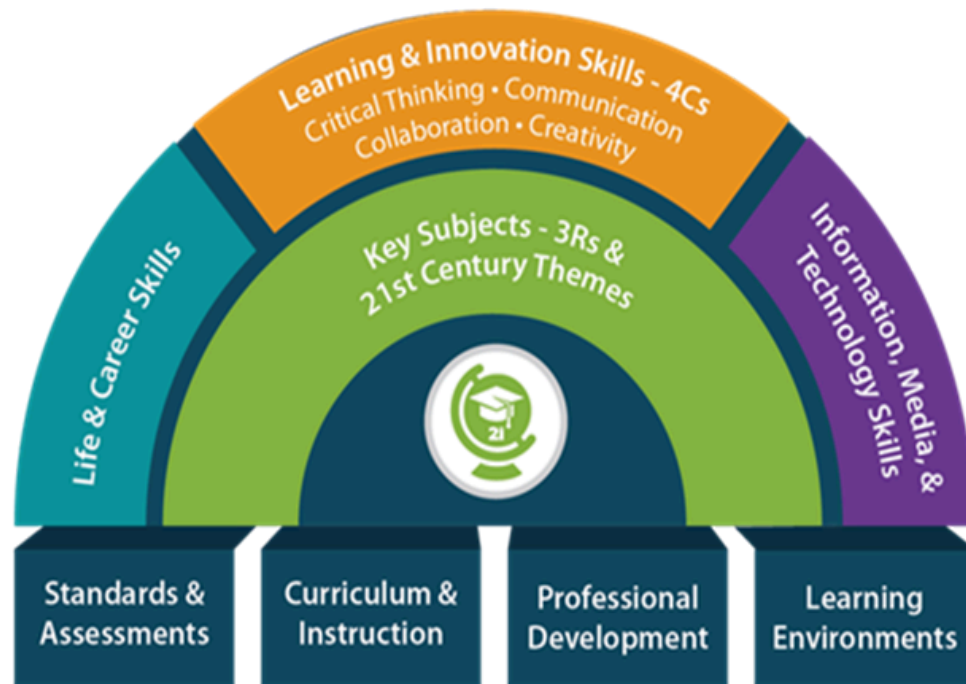
Despite its benefits, implementing SWPBIS in Thai schools faces several challenges, including resource limitations, insufficient teacher training, and inadequate administrative support. Cultural attitudes toward students with special needs or behavioral difficulties further influence teacher readiness to adopt SWPBIS strategies (Tantixalerm & Amornpaisanlert, 2021). To overcome these barriers, professional development programs and digital resources should be tailored to support teachers in implementing SWPBIS more effectively.

Reading proficiency significantly impacts students' academic success across all levels. However, OECD's PISA assessment indicates that Thai students perform below the international average in reading comprehension, with declining scores over the years (OECD, 2022). National O-NET assessments also highlight deficiencies in students' ability to analyze and interpret texts (National Institute of Educational Testing Service, 2023). Focusing on digital reading platforms and AI-assisted literacy programs could provide personalized learning pathways to improve reading proficiency. These programs can be tailored to different student needs by using adaptive learning algorithms that adjust reading materials based on individual skill levels, providing real-time feedback, and incorporating gamification elements to enhance engagement. Additionally, AI-driven voice recognition can help students improve pronunciation and fluency, while data analytics can track progress and identify specific areas for improvement.

Key factors contributing to low reading performance include deficiencies in reading fluency, accuracy, and comprehension (Rasinski et al., 2012). Traditional instruction methods that emphasize silent reading or teacher-led reading sessions may not sufficiently engage students. Interactive Read-Aloud strategies have been shown to enhance reading skills by promoting active participation, vocabulary acquisition, and deeper linguistic understanding (Mol & Bus, 2011). The integration of AI-powered reading applications can further optimize personalized learning experiences.

The Read Along application, initially designed for primary students (K-5), can be adapted for secondary education by selecting more complex content. This study will conduct a pilot test with a small sample group before broader implementation, ensuring content suitability for secondary students. Digital tools such as Read Along can effectively improve reading accuracy and comprehension when appropriately integrated into the curriculum (Mol & Bus, 2011). Future research should explore how AI-driven adaptive learning tools could further enhance reading development.





**Figure 3:** Framework for 21st Century Learning (Battelle for Kids, 2019)

To thrive in the digital era, students must acquire essential 21st-century skills, categorized into four key areas: (1) interdisciplinary core subjects, (2) career and life skills, (3) learning and innovation skills (creativity, critical thinking, communication, and collaboration), and (4) information, media, and technology skills (Chu et al., 2017; Park & Suh, 2018; Khlaisang & Koraneekij, 2019). The role of AI in fostering these skills should be further investigated to ensure optimal curriculum design.

The integration of artificial intelligence (AI) in education is rapidly transforming learning experiences. AI-powered applications facilitate personalized learning, improving student engagement and comprehension (Davenport & Ronanki, 2018). Understanding AI literacy is essential for preparing students to navigate the AI-driven future (Wang, Rau, & Yuan, 2021). However, concerns regarding data privacy, ethical AI implementation, and equitable access must be addressed to ensure responsible AI use in education. Potential solutions include implementing robust data protection policies, ensuring algorithmic transparency, and providing equitable access to AI-driven educational tools. Additionally, developing ethical AI guidelines for academic institutions and offering teacher training on responsible AI integration can help mitigate these challenges.

Thailand faces educational challenges such as technological advancements, economic fluctuations, and social inequality, necessitating adaptive educational reforms. Research indicates that while Thai students report high life satisfaction, they exhibit low academic engagement and school connectedness (OECD, 2017).





Educational reforms should focus on fostering student happiness, knowledge acquisition, and positive behavior to create a more equitable and sustainable society (Hawken et al., 2007). AI and digital tools could play a pivotal role in bridging these gaps.

Phattharaborphit School is a co-educational secondary school offering lower and upper secondary education. It is currently under the jurisdiction of the Secondary Educational Service Area Office 32, which operates under the Office of the Basic Education Commission, Ministry of Education, Thailand. The school was founded on May 4, 1978, and is located in Mueang Buri Ram District, Buri Ram Province. As of the 2024 academic year, the school's director is Mr. Supharoek Phlayngam.



**Figure 4:** Phattharaborphit School

This study integrates active learning strategies with positive behavior reinforcement in AI-powered inclusive classrooms, utilizing Google Workspace and Chromebook technologies developed in partnership with Lenovo and Intel Asia Pacific. The proposed model promotes student engagement, skill development, and digital literacy, addressing the diverse needs of inclusive classrooms. Additionally, assistive technology ensures accessibility for students with special needs, empowering educators to tailor instruction based on individual learning differences. Future research should explore the long-term effects of AI-driven education by employing longitudinal studies, mixed-method approaches, and comparative analyses across different educational settings. Additionally, policy recommendations should focus on AI integration frameworks, teacher training programs, and strategies for ensuring equitable access to AI-enhanced learning tools. By fostering digital literacy, AI awareness, and student well-being, schools can become dynamic learning hubs that inspire lifelong learning and positive social impact.





## 2. Objective

This research examines the integration of Positive Behavior Support and AI-driven learning in inclusive classrooms using Google for Education solutions in Thailand. It also investigates the effects of a speech-based reading instruction application on Reading Accuracy and comprehension among secondary school students, aiming to explore their interconnections and impact within the educational context.

### 2.1 Positive behavior and AI support in an inclusive classroom with Google for Education Solutions in Thailand: Enhancing learning outcomes through active learning for 21st-century students.

1. To study the impact of using an integrated active learning model, Google Workspace, and Chromebooks, with positive behavior and AI support in inclusive classrooms, enhancing learning outcomes for 21st-century students.
2. To examine teachers' and students' opinions of the integrated active learning model of Google Workspace and Chromebooks, with positive behavior and AI support in inclusive classrooms, enhancing learning outcomes for 21st-century students.

### 2.2 The Effects of a Speech-Based Reading Tutor Application on Reading Accuracy and Comprehension Among Secondary School Students

1. To examine the effects of using a speech-based reading instruction application on the reading accuracy of secondary school students.
2. To investigate the effects of using a speech-based reading instruction application on the reading comprehension of secondary school students.
3. To compare the differences in reading accuracy and comprehension before and after using the application.

## 3. Research Scope

The scope of this research focuses on two main areas as follows:

### 3.1 Positive behavior and AI support in an inclusive classroom with Google for Education Solutions in Thailand: Enhancing learning outcomes through active learning for 21st-century students.

This study integrates Google Workspace and Chromebooks with active learning approaches to enhance 21st-century skills, AI literacy, and student well-being in inclusive classrooms. The research scope includes the following components:





1. **Subjects of Study:** The study covers 11 subjects, including Thai language, Chemistry, Biology, English, Career and Technology, Website Development, Mathematics, Health and Physical Education, Art, Guidance, and Design and Technology.

2. **21st-Century Skills:** The research focuses on four key competencies: (1) Critical thinking and problem-solving, (2) Creativity, (3) Communication and collaboration, and (4) Information and communication technology (ICT) literacy.

3. **AI Literacy:** AI literacy consists of four components: (1) Awareness, (2) Application, (3) Evaluation, and (4) Ethical considerations.

4. **Positive Behavior:** This study examines the process of promoting positive behavior by encouraging desirable student actions and fostering a supportive environment aimed at sustaining positive behavioral development.

5. **Integration of Google Workspace and Chromebooks:** The study explores the application of Chromebooks and Google Workspace in learning environments, structured around four core elements: (1) Enhancing classroom instruction by leveraging user-friendly tools to improve collaboration and connectivity, (2) Increasing productivity through streamlined organization, content sharing, and assessment management, (3) Elevating student performance by facilitating high-quality submissions through digital tools, and (4) Ensuring data security through proactive privacy and security measures. Google tools included in this study comprise Google Classroom, Google Drive, Google Docs, Google Sheets, Google Forms, Google Slides, Google Search, Gmail, Google Calendar, YouTube, Google Maps, and other Google-supported educational extensions.

6. **Active Learning Strategies:** This study employs multiple active learning approaches, including (1) Deductive Learning Approach, (2) Inquiry-Based Learning (5E Model), (3) Scenario-Based Learning, (4) Resource-Based Learning, (5) 5W1H Questioning Technique (What, Where, When, Who, Why, and How), (6) Game-Based Learning, and (7) Think-Pair-Share.

7. **Student Well-Being in Learning:** The study assesses student happiness derived from learning experiences, academic engagement, and classroom relationships.

8. **Inclusive Classroom Model:** This study investigates inclusive classroom environments that accommodate diverse student needs, including students with disabilities, special needs, and varying socio-cultural backgrounds. The study emphasizes equal access to quality education and personal development. The inclusive learning model involves modifications in curriculum content, instructional processes, assessments, and learning environments to meet individual student needs. Teachers play a crucial role in facilitating learning through adaptive instruction and appropriate resource utilization. This study also examines integrating technology and innovation to enhance accessibility and student engagement. Additionally, inclusive education policies encourage collaboration among teachers, school administrators, families, and communities to provide students academic, social, and emotional support.





## **3.2 The Effects of a Speech-Based Reading Tutor Application on Reading Accuracy and Comprehension Among Secondary School Students**

### **1. Reading Accuracy**

This research examines the role of reading accuracy in literacy development, focusing on students' ability to correctly pronounce words, phrases, and sentences according to standard linguistic conventions. Reading accuracy encompasses proper pronunciation, fluency, and pacing, all essential for adequate comprehension and critical analysis. The study aims to assess how a speech-based reading tutor application can enhance reading accuracy by providing real-time AI-driven pronunciation feedback, allowing students to improve their fluency and minimize reading errors.

### **2. Reading Comprehension**

Reading comprehension is a fundamental literacy skill that enables students to interpret, analyze, and evaluate textual content. This research explores how speech-based reading instruction supports students' ability to summarize key points, connect new information to prior knowledge, and critically engage with texts. By integrating interactive reading experiences and AI-powered feedback, the study investigates whether students can develop deeper textual understanding and analytical thinking skills.

### **3. Speech-Based Reading Tutor Application (Read Along Application)**

The study utilizes the Read Along application, an AI-driven reading tutor designed to enhance students' reading proficiency through speech-based learning. This research aims to evaluate the effectiveness of the Read Along application in improving reading accuracy and comprehension among secondary school students, contributing to innovative AI-integrated literacy instruction in educational settings.

### **4. Theoretical framework for operations**

The theoretical framework for operations in this research is structured around integrating technological tools in education to enhance learning outcomes. The framework comprises two primary focus areas, each guided by established educational theories and methodologies. The research scope is outlined as follows:

#### **4.1 Positive behavior and AI support in an inclusive classroom with Google for Education Solutions in Thailand: Enhancing learning outcomes through active learning for 21st-century students**

##### **1. Active Learning**

Active learning is an instructional approach that emphasizes student engagement in the learning process through interactive, participatory methods





tailored to different subject areas. This research integrates Google Workspace and Chromebooks with active learning to enhance 21st-century skills, artificial intelligence (AI) literacy, and student well-being in inclusive classrooms. The study incorporates seven active learning models:

1. Deductive Learning Approach
2. Inquiry-Based Learning (5E Model)
3. Scenario-Based Learning
4. Resource-Based Learning
5. 5W1H Questioning Technique (What, Where, When, Who, Why, and How)
6. Game-Based Learning
7. Think-Pair-Share

## 2. Positive Behavior Support (PBS)

Positive behavior support is a proactive approach to managing student behavior by preventing behavioral issues and promoting desirable behaviors in schools and classrooms. This framework creates a supportive learning environment by reinforcing positive behavior and implementing systematic behavioral management. PBS includes three levels of support:

1. Universal Support (Tier 1): Strategies applied to all students.
2. Targeted Support (Tier 2): Interventions for at-risk students.
3. Individualized Support (Tier 3): Personalized interventions for students with specific behavioral needs.

PBS aims to improve both behavioral and academic outcomes, reduce disciplinary issues, and create a safe, inclusive learning environment.

## 3. Google Solutions in Education

Google Solutions in this study refer to the application of Chromebooks and Google Classroom as digital learning tools that facilitate active learning. Google Classroom is used for content integration across subject areas, while various Google Workspace tools—such as Google Docs, Google Slides, and Google Forms—support efficient instructional delivery. This study incorporates coaching to optimize the use of these technologies in education.

## 4. Learning Outcomes

The study evaluates three primary learning outcomes: 1) 21st-Century Skills, 2) AI Literacy, AND 3) Student Well-Being in Learning

**1) 21st-Century Skills:** 21st-century skills are essential competencies for students in a rapidly evolving digital world. These include:

- Critical Thinking & Problem-Solving
- Creativity
- Communication & Collaboration
- Information and Communication Technology (ICT) Literacy

These skills are assessed based on teacher evaluations using a 21st-century skills rubric adapted from Khlaisang & Koraneekij (2019).

### **(1) Critical Thinking & Problem-Solving**





Student's ability to identify problems, analyze sources, generate hypotheses, evaluate alternatives, and apply solutions is assessed using four criteria:

- Clearly identifying the problem
- Evaluating sources of information
- Formulating hypotheses and assessing options
- Drawing conclusions and identifying implications

## **(2) Creativity**

Students' ability to generate innovative ideas, explore diverse solutions, and present unique approaches is assessed based on:

- Originality (Generating novel ideas)
- Fluency (Expanding and refining ideas)
- Flexibility (Developing alternative solutions)

## **(3) Communication & Collaboration**

Students' ability to effectively convey ideas, listen actively, and collaborate is evaluated based on:

- Effective verbal and written communication
- Active listening and comprehension
- Purpose-driven communication
- Appropriate use of digital tools
- Communication across diverse settings
- Respect for others in teamwork
- Adaptability in group work
- Responsibility and contribution to group tasks

## **(4) ICT Literacy**

Student's ability to access, manage, evaluate, integrate, and communicate information using digital technology is assessed through:

- Accessing information efficiently
- Organizing and managing data
- Integrating and synthesizing information
- Evaluating information accuracy
- Creating digital content
- Communicating information effectively

**2) AI Literacy:** AI literacy measures students' ability to recognize, utilize, and critically assess AI-related products and tools. AI literacy includes four key dimensions:

1. Awareness
2. Application
3. Evaluation
4. Ethics

This study employs an AI literacy assessment adapted from Wang, Rau, & Yuan (2021), utilizing a 5-point Likert scale across 12 items.





**3) Student Well-Being in Learning:** Student well-being in learning is assessed based on students' responses to active learning methodologies integrated with Google Workspace and Chromebooks. A self-assessment questionnaire, adapted from Palphai (2018), measures student happiness in learning on a 5-point Likert scale across 15 items.

## 5. Inclusive Classroom Model

An inclusive classroom is an educational environment that accommodates diverse student needs, including students with disabilities, special learning requirements, or socio-cultural differences. This model ensures equity in education by modifying curricula, instructional strategies, and assessments to meet individual learning needs. Inclusive education policies promote:

- Equitable access to quality education
- Differentiated instruction to support diverse learners
- Teacher adaptation using appropriate resources and digital tools
- Collaboration among educators, administrators, families, and communities to support holistic student development

### 4.2 The Effects of a Speech-Based Reading Tutor Application on Reading Accuracy and Comprehension Among Secondary School Students

#### 1. Reading Accuracy

Reading accuracy refers to students' ability to correctly pronounce words, phrases, or sentences according to standard spelling and linguistic conventions. Accuracy also includes proper pronunciation and reading fluency, which are fundamental to advanced literacy skills such as comprehension and critical analysis.

#### 2. Reading Comprehension

Reading comprehension refers to students' ability to interpret and understand textual meaning, summarize key points, connect information to prior knowledge, and analyze or evaluate content appropriately.

#### 3. Read Along Application

The **Read Along** application is an AI-powered reading tool designed to enhance students' reading proficiency. It focuses on speech-based reading practices through interactive storytelling. The application includes:

- **Guided Reading:** Displays text alongside narrated audio, allowing students to follow along with highlighted words.





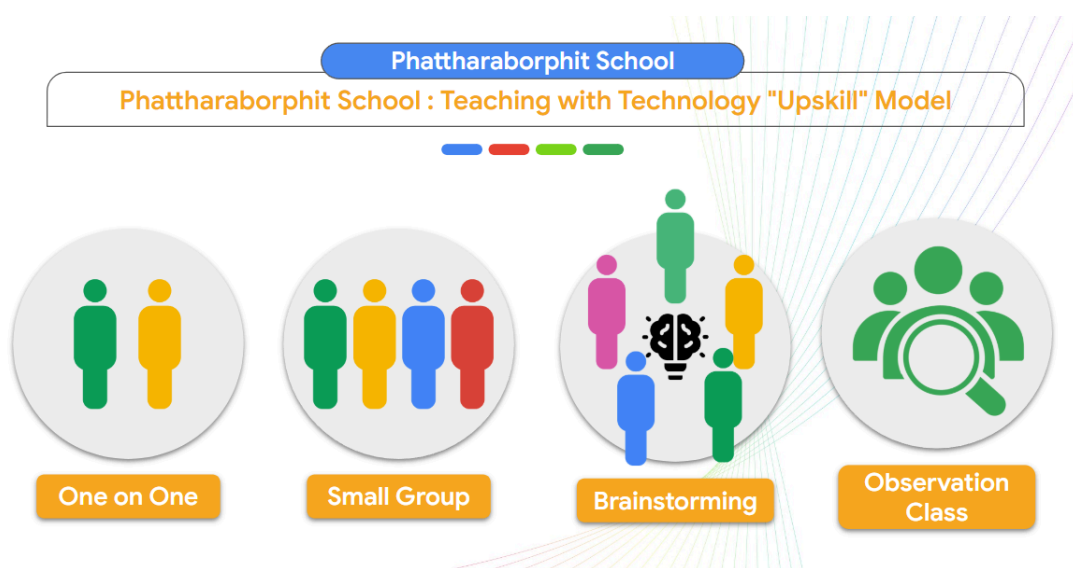
- **Speech Recognition:** AI-powered speech recognition is used to assess pronunciation and provide feedback on reading accuracy.
- **Diverse Content:** Offers a variety of reading materials, including fiction, real-life stories, and science-related articles at different difficulty levels.
- **Personalized Feedback:** Provides real-time suggestions for pronunciation, pacing, and intonation, as well as adaptive content recommendations based on reading performance.

## 5. Design

Based on operational theories, two models have been established: The Teaching with Technology Upskill Model and the Google Chromebook and Google Solutions Integration Model. The Professional Development Model focuses on improving educators' competencies through structured training, fostering collaboration, and enhancing proficiency in contemporary teaching methodologies. Together, these models provide educators with effective frameworks for seamless technology integration in teaching, equipping students with essential skills for the digital era.

### 5.1 Teaching with Technology "Upskill" Model

The training model for Phatharaborphit School enhances 21st-century learning skills and promotes the integration of technological tools in education to improve learning outcomes. The **"Teaching with Technology Upskill" Model** was developed to facilitate this process and consists of four primary stages: (1) one-on-one coaching, (2) small group training, (3) collaborative brainstorming, and (4) Observation Class, as illustrated in Figure 5.



**Figure 5:** Phatharaborphit School: Teaching with Technology "Upskill" Model





The One-on-One training phase, as depicted in Figure 6, focuses on Active Learning Pedagogy with Google Workspace Workshop, where educators participate in hands-on training with digital tools to enhance classroom instruction.

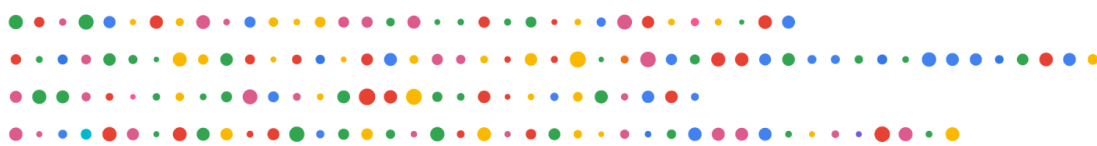
Following this, the Small Group training phase, shown in Figure 7, emphasizes collaborative learning through Google Workspace Workshops, allowing educators to engage in hands-on training within a group setting to refine their digital teaching strategies.

Next, the Brainstorming session, illustrated in Figure 8, fosters collaborative discussion and idea generation among educators to enhance technology-integrated teaching practices and encourage innovative instructional methods.

Finally, as shown in Figure 9, the Observation Class phase involves classroom implementation and monitoring, where teachers integrate technology-enhanced learning strategies while being observed to assess their effectiveness and student engagement.



**Figure 6:** Active Learning Pedagogy with Google Workspace Workshop (One-on-One)



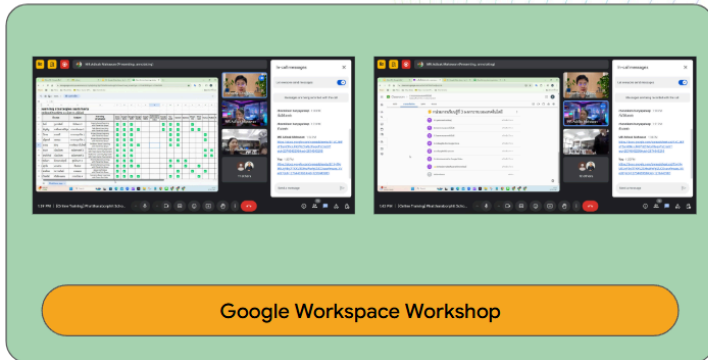


Phattharabhorphit School

Potisarn : Teaching with Technology "Upskill" Model



Small Group



Google Workspace Workshop

Figure 7: Active Learning Pedagogy with Google Workspace Workshop (Small Group)

Phattharabhorphit School

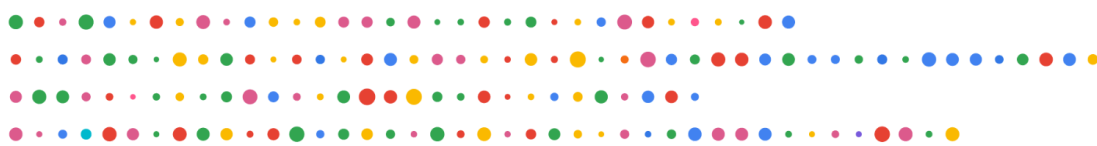
Phattharabhorphit School : Teaching with Technology "Upskill" Model



Brainstorming



Figure 8: Active Learning Pedagogy with Google Workspace (Brainstorming)





Phattharaborphit School

Phattharaborphit School : Teaching with Technology "Upskill" Model



Observation  
Class



**Figure 9:** Active Learning Pedagogy with Google Workspace (Observation Class)

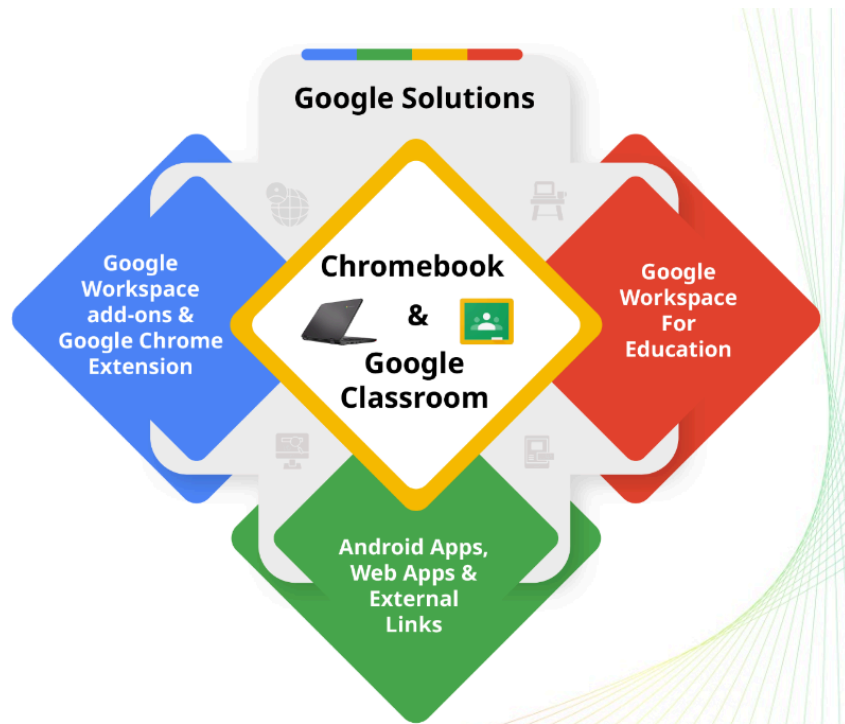
## 5.2 Google Chromebook and Google Solutions Integration

This model enhances digital learning and classroom management. As exhibited in Figure 10, At the center of the model, Chromebook and Google Classroom serve as the core digital learning tools, facilitating collaborative and interactive instruction. Surrounding this core, the framework incorporates three key components:

1. **Google Workspace for Education (Red Section)** – Supports cloud-based collaboration, communication, and content creation through tools such as Google Docs, Sheets, Slides, and Forms.
2. **Google Workspace Add-ons & Chrome Extensions (Blue Section)** – Enhances functionality by integrating customized tools and applications that improve productivity and efficiency.
3. **Android Apps, Web Apps, & External Links (Green Section)** – Expands learning opportunities by providing access to diverse educational applications and online resources that complement traditional instruction.

This model underscores the comprehensive approach to technology-enhanced learning, where Google Solutions streamlines educational processes, improve accessibility, and foster 21st-century digital literacy skills.





**Figure 10:** Google Chromebook and Google Solutions Model

### 5.3 Google Solutions Integration in Active Learning Model and Transformation in Teacher Learning Management

The integration of Google Solutions in Active Learning and Transformation in Teacher Learning Management highlights the use of Google Classroom and AI-powered tools to enhance both student engagement and instructional efficiency. As seen in Figures 11 and 12, various Google Workspace applications, including Docs, Slides, Search, Gemini AI, and Blooket, are embedded across subjects to support interactive and technology-driven learning.

Subjects like Mathematics, Science, History, and Languages utilize tools such as Google Docs, Slides, Search, Gemini AI, Blooket, and Kahoot for problem-solving, research, and gamified learning. Additionally, technical subjects like Computer Science, Agriculture, and Mechanical Work integrate Tinkercad, Canva, and Speech-to-Text for hands-on digital learning. This model fosters AI-driven education, 21st-century skills development, and interactive, technology-enhanced learning experiences across various disciplines.

Instructors also leverage Chromebooks, Google Workspace for Education, and digital extensions to streamline lesson planning, assessment, and collaboration. This approach fosters AI-enhanced education, personalized learning, and improved digital competency, ensuring that both students and educators are equipped with 21st-century skills for an evolving educational landscape.

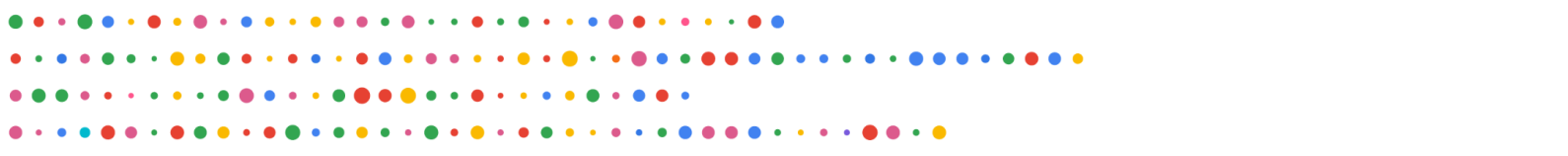




Figure 11: Implementing Google Solutions integration within an active learning model, segmented across various subjects.



Figure 12: Implementing Google Solutions Integration for Transformation in Teacher Learning Management





### 5.4 Google Gemini

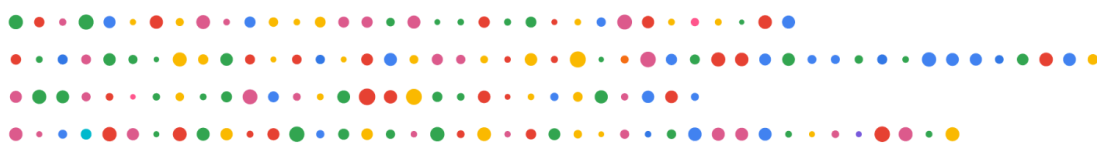
Google Gemini, the latest educational tool, is extensively employed across various subjects to elevate students' learning performance. Functioning as a virtual thinking partner, Gemini actively collaborates with students, encouraging critical thinking and deepening their understanding of the material. Gemini fosters a dynamic learning environment that enhances student engagement and comprehension by providing personalized guidance and feedback.



Figure 13: Science student’s chat with Google Gemini

### 5.5 The standard class agreement protocol

The standard class agreement protocol includes rules for students using Chromebooks during lessons and how to behave in class to stay safe and respectful.





**Chromebook Rules for Students**

- Carry the Chromebook with the lid closed and with two hands or “hug it like you love it.”
- Do not bang, hit or slam your Chromebook on your desk!
- Sit down when using the Chromebook.
- Stay focused on the activity and raise your hand if you need help.
- Do not visit sites that are not directly related to your assignment!
- Do not touch someone else's Chromebook. If they ask for help, tell them how to do it and watch while they do it.
- When I need your attention, descreen!
- Keep food and drinks away from the Chromebook!
- Shut down before closing the Chromebook lid.
- At the end of the day, return your Chromebook to storage and plug it in.
- Use Chromebook between 07.30 am. -10.00 pm. each day.

Figure 14: The standard class agreement protocol

## 6. Method

### 6.1 Positive behavior and AI support in an inclusive classroom with Google for Education Solutions in Thailand: Enhancing learning outcomes through active learning for 21st-century students

#### 1. Participants

The study participants included teachers and students from Phattharaphopit School in Buriram Province, Thailand.





**1.1 Student Participants:** A total of 74 high school students voluntarily participated in the study. The selection criteria required that participants be enrolled at Phattharaphopit School, which has adequate technological infrastructure and network systems. Students provided informed consent before participation and could withdraw at any time without academic repercussions.

**1.2 Teacher Participants:** A total of 22 teachers participated in the study. Eligibility criteria required that teachers be employed under the Office of the Basic Education Commission (OBEC), teach at Phattharaphopit School, and complete at least 80% of a professional development training program on integrating Google Workspace and Chromebooks into active learning methodologies. Teachers who did not provide written consent or failed to meet the attendance requirement were excluded from the study.

## 2. Instrument

The research employed various data collection instruments to assess the impact of Google Workspace and Chromebook integration on active learning.

**2.1 Lesson Plans and Learning Modules** were developed within Google Classroom to provide a structured approach to teaching. These modules incorporated different pedagogical strategies based on the subject, including Deductive Learning with Think-Pair-Share (TPS) for Mathematics, Inquiry-Based Learning with TPS for Science, and Activity-Based Learning with TPS for the Thai Language. Teachers used these lesson plans as a guide to deliver lessons effectively while maintaining consistency with the research objectives.

**2.2 Questionnaires** were used to gather data from teachers before and after the intervention. The pre-study questionnaire for teachers collected demographic details and baseline data regarding their experience using Google Workspace and Chromebooks. It comprised 27 items divided into two categories: personal background (17 items) and Google Solutions usage (10 items). After the intervention, the post-study questionnaire assessed teachers' perceptions of Google Workspace's impact on student learning, teaching effectiveness, and overall satisfaction. This survey included 25 items focused on teaching improvement, digital tool integration, and professional development experiences.

**2.3 Rubric-based assessments** were designed to evaluate students' skill development throughout the study. Adapted from Khlaisang & Koraneekij (2019), the rubric measured four key competencies: critical thinking and problem-solving, creativity, communication and collaboration, and ICT literacy. Three experts in educational technology and Google for Education validated the rubric to ensure its accuracy and reliability before implementation.





**2.4 AI literacy assessment** was used to evaluate students' understanding and awareness of artificial intelligence. Adapted from Wang, Patrick Rau, and Yuan (2023), this instrument consisted of 12 Likert-scale items categorized into four dimensions: awareness, application, evaluation, and ethics. Students' AI literacy levels were assessed through their responses, and three experts validated the instrument. The reliability of this assessment, tested using Cronbach's Alpha, resulted in a score of 0.92, indicating high internal consistency.

**2.5 student learning happiness scale** was administered to measure students' overall satisfaction and emotional engagement with the learning process. This scale, adapted from Palphai (2018), assessed three key dimensions: student engagement, learning experience, and social relationships. The survey helped determine how technology integration influenced students' motivation and well-being in the classroom. The reliability of this scale was tested with 30 students, yielding a Cronbach's Alpha score of 0.84, confirming its consistency and validity.

### 3. Research Methodology

#### Phase 1: Preparation and Coordination

This phase involved setting up the research environment and ensuring all stakeholders were informed and resources were in place.

**1. Collaboration with School Administration:** Researchers engaged with school administrators to present the study's objectives and coordinate the setup of Google Workspace for Education and Chromebook deployment.

**2. Equipment and Technology Setup:** Lenovo and Intel Asia Pacific were the technology partners to facilitate the provision and delivery of Chromebooks, while Google for Education Thailand and its authorized resellers assisted in establishing the digital learning environment by creating Google Workspace for Education accounts for teachers and students.

**3. Teacher and Student Onboarding:** Participants were informed of the research process, and initial preparations were made to ensure smooth integration of Google tools within the school's infrastructure.

#### Phase 2: Implementation and Training

In this phase, teachers were trained, and students engaged in the learning modules while data collection began.

**1. Data Collection:** Teachers completed the pre-study questionnaire assessing their experience and familiarity with Google Workspace.

**2. Professional Development for Teachers:**





**2.1 One-on-One Coaching (1 hour):** Teachers received individualized support on effectively integrating Google Workspace tools into their lesson plans.

**2.2 Group Workshop (5 hours):** Teachers participated in hands-on training sessions on utilizing Google applications for active learning.

**3. Lesson Plan Implementation:** Teachers developed and executed lesson plans integrating Google Workspace and Chromebooks.

**4. Student Engagement and Data Collection:**

- Students participated in learning activities across five weeks.
- Assessments of 21st-century skills, AI literacy, and learning happiness were conducted during Modules 1, 3, and 5.

**5. Ongoing Monitoring and Support:** Researchers provided continuous support to teachers to address any challenges and ensure smooth integration.

### Phase 3: Evaluation and Analysis

The final phase focused on collecting and analyzing data to assess the impact of the intervention.

**1. Post-Study Data Collection:** Teachers completed the post-study questionnaire to provide feedback on their experience with Google Workspace integration. Teachers submitted reports summarizing student engagement and performance.

**2. Data Analysis:**

**2.1 Descriptive Statistical Analysis:** Basic statistics such as frequency, percentage, mean, and standard deviation were calculated for survey responses.

**2.2 Inferential Statistical Analysis:**

**Paired t-tests** were conducted to determine whether there were significant differences in teachers' perceptions before and after the intervention.

**Repeated Measures ANOVA** was used to analyze the progression of students' 21st-century skills, AI literacy, and learning happiness across the different modules.

**3. Interpretation and Reporting:** The results were analyzed to determine the effectiveness of Google Workspace and Chromebooks in fostering an active learning environment.





## 6.2 The Effects of a Speech-Based Reading Tutor Application on Reading Accuracy and Comprehension Among Secondary School Students

### 1. Sample Group

The study targets secondary school students who possess foundational reading and comprehension skills but require further development for enhanced reading proficiency. The sample consists of 54 lower-secondary school students divided into two groups:

**1.1 Experimental Group (27 students):** This group will receive reading instruction through the Read Along application. Students will take a pre-test before using the application and a post-test after completing the intervention to measure progress.

**1.2 Control Group (27 students):** This group will follow the conventional reading curriculum without integrating the Read Along application.

### 2. Instrument

The research utilizes three main instruments:

#### 2.1 Reading Accuracy Test

This test is designed to measure the ability to read aloud correctly according to grammatical and structural principles of the language. It evaluates four key components of **Reading Accuracy**:

1. **Decoding Accuracy** – Ability to correctly decode words.
2. **Pronunciation Accuracy** – Ability to pronounce words correctly.
3. **Word Recognition Accuracy** – Automatic recognition of words without hesitation.
4. **Contextual Accuracy** – Ability to read fluently with appropriate context.

#### 2.2 Reading Comprehension Test (administered through the Read Along application)

This test assesses students' ability to understand the content they read. It evaluates five key components of **Reading Comprehension**:

1. **Primary Idea Identification** – Ability to determine the main idea of the text.
2. **Inferencing & Interpretation** – Ability to make inferences and interpret meanings.
3. **Text Connection Ability** – Ability to connect information within and across texts.
4. **Summarization Ability** – Ability to summarize key points.





5. **Critical Reading & Evaluation** – Ability to critically analyze and evaluate the text.

### 2.3 Questionnaire on Users' Opinions about the Read Along Application

This questionnaire gathers students' feedback on their experiences and perceived benefits of using the Read Along application. It consists of 10 questions that assess various aspects of their interaction with the app. The responses are measured using a 5-point Likert Scale, where 1 represents "Strongly Disagree" and 5 means "Strongly Agree." The questionnaire provides insights into students' satisfaction, engagement, and perceived impact on their reading skills.

## 3. Research Methodology

The research will be conducted within designated secondary schools, following a six-month structured timeline. The study will be implemented in four key phases:

### 3.1 Phase 1: Research Preparation (Months 1-2: June - July 2024)

3.1.1 Reviewing literature and relevant studies.

3.1.2 Designing research instruments, including reading accuracy, comprehension assessments, and student feedback surveys.

3.1.3 Selecting and training participants on the use of the Read Along application.

### 3.2 Phase 2: Data Collection and Application Implementation (Months 3-4: December 2024 - January 2025)

3.2.1 Developing and validating research tools, including pre-test and post-test reading assessments and student surveys.

3.2.2 Installing and setting up the Read Along application on designated devices.

3.2.3 Introducing students to the application and providing guidelines on its use.

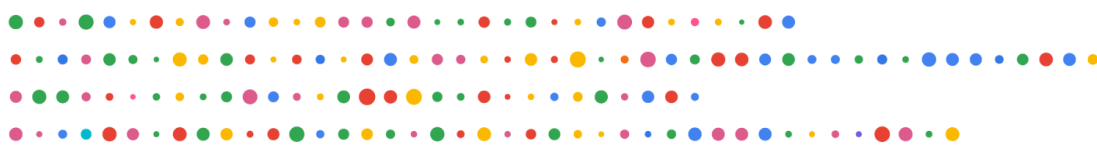
3.2.4 Submitting research ethics approval for human subjects.

### 3.3 Phase 3: Data Analysis and Evaluation (Months 5-6: February - March 2025)

3.3.1 Conducting the study according to the research framework.

3.3.2 Analyzing collected data and assessing learning outcomes.

3.3.3 Interpreting results, discussing findings, and summarizing the research outcomes.





## 7. Findings and impact

### 7.1 Best Practice Observation

The following section outlines best practice strategies implemented in various subjects taught to Grade 10 and Grade 11 students. These strategies encompass proposed learning methodologies, instructional techniques, examples of learning materials, digital worksheets, student performance evaluations, and learning environments. The subjects featured in this section include:

#### Grade 10

- Chemistry
- Biology
- English
- Web Development
- Mathematics
- Physical Education (P.E.)
- Art
- Guidance

#### Grade 11

- Thai
- Biology
- Design and Technology
- Chemistry
- Social Studies
- Physical Education (P.E.)
- Art
- Guidance

Additionally, this section includes best practices from the English Club, which is designed to support junior high school students (Grades 7–9) in enhancing their language proficiency and literacy skills.

#### 7.7.1 Grade 10

##### 1. Chemistry - Grade 10

In this subject, Inquiry-based learning with the Think Pair Share technique was applied to teach Chemistry to Grade 10 students. "Inquiry-based learning" is an educational strategy where students are encouraged to learn by asking questions, conducting investigations, and exploring various sources of information. The goal is to stimulate curiosity and foster a deeper understanding of the subject by engaging learners in the process of discovery rather than just presenting them with facts. This learning strategy involves five consecutive steps:



1. **Understanding** – The first step involves gaining an initial understanding of the subject.
2. **Exploration & Research** – Learners explore and research relevant information to deepen their knowledge.
3. **Explain & Summarize** – This phase involves explaining concepts and summarizing knowledge.
4. **Expanding Knowledge** – Learners extend their understanding by connecting new information with previous knowledge.
5. **Evaluation** – The final step is evaluating learning outcomes and reflecting on the acquired knowledge.

Meanwhile, "Think-Pair-Share" is a collaborative learning technique often used within the broader context of inquiry-based learning. This technique not only helps students develop their ideas through dialogue but also promotes active engagement, critical thinking, and the ability to articulate their thoughts clearly. The structural framework of this technique is illustrated in figure 15

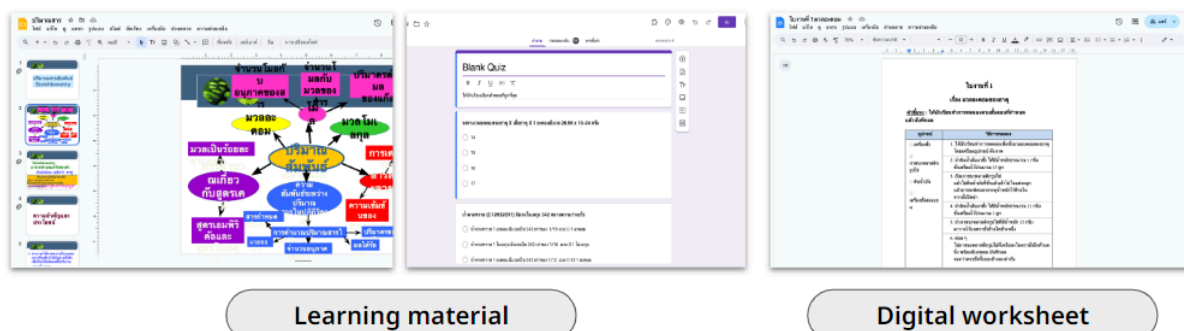


Figure 15: Chemistry's Best Practice



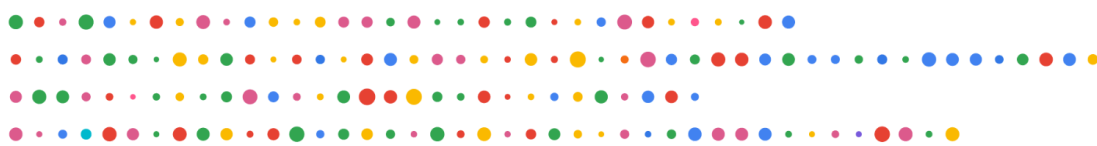
**Figure 16:** Chemistry's Learning Environment

The course also applied a structured digital learning environment integrating multimedia learning materials, digital quizzes, and worksheets, which are essential for enhancing engagement and conceptual understanding in science education. Figure 16 illustrates the classroom learning environment, showing the instructor using multimedia learning materials to actively engage the students with the topic. In figure 17, the left section showcases a concept map or interactive slide, visually organizing key ideas using a constructivist approach. The middle section features a digital quiz, likely used for formative assessment, providing real-time feedback to support self-directed learning. The right section displays a digital worksheet structured to guide inquiry, facilitate active learning, and encourage collaboration. Together, these tools create an interactive and student-centered learning experience.



**Figure 17:** Chemistry's Learning Materials and Digital Worksheet

Figure 18 illustrates part of the performance of grade 10 students in the Chemistry subject. Following the inquiry-based learning approach, students are required to explore and explain their research questions. Observation and note-taking help reinforce their understanding, encouraging them to articulate their knowledge more effectively.



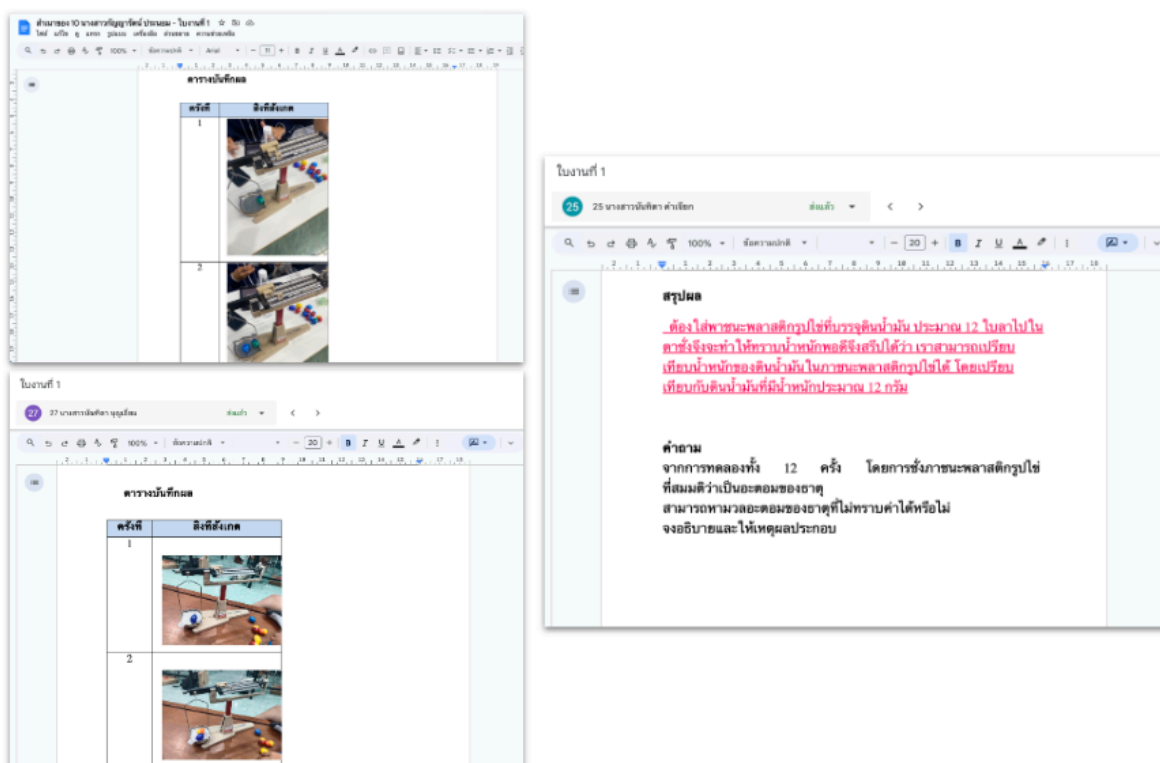


Figure 18: Chemistry's Learning Performance

## 2. Biology - Grade 10

This course also applies Inquiry-Based learning with the "Think-Pair-Share" technique for teaching Biology to grade 10 students. Applying the learning strategy to Biology class, the course is organized into modules. Figure 19 exhibits the framework for the learning strategies and the study module that applies the strategy. Module 1: The Study of Mendelian Genetics, after beginning with Defining Learning Objectives, structured into five steps:

1. **Owning Interest** – Engaging students with foundational curiosity.
2. **Exploration & Research** – Investigating genetic principles.
3. **Explain & Summarize** – Synthesizing Mendelian concepts.
4. **Expanding Knowledge** – Applying genetic theories in broader contexts.
5. **Evaluation** – Assessing comprehension and learning outcomes.

This module integrates guided inquiry with digital learning tools, promoting self-directed exploration and collaborative problem-solving.





# Biology

การเรียนรู้แบบสืบสอบ ร่วมกับเทคนิคเพื่อนคู่คิด  
(Inquiry-based learning with Think Pair Share)



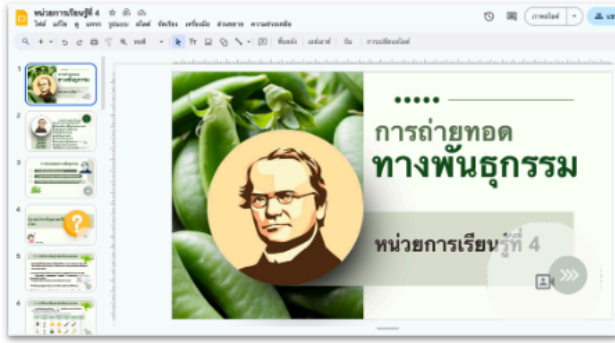
Figure 19: Biology's Best Practice

The Biology course has integrated various digital learning tools in genetics education, combining multimedia learning materials with structured digital worksheets to enhance student engagement and conceptual understanding, as illustrated in figure 20 and figure 21. The use of digital documents also allows for collaborative learning, real-time feedback, and iterative refinement of knowledge.

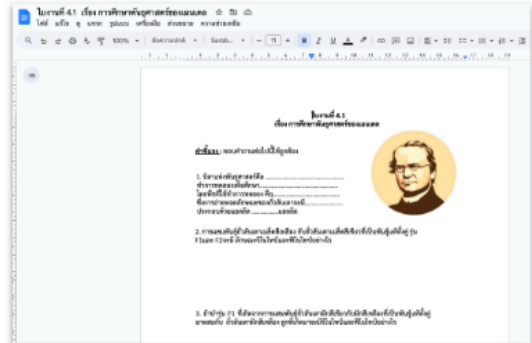


Figure 20: Biology Learning Environment





Learning material



Digital worksheet

Figure 21: Biology's Learning Materials and Digital Worksheet

Figure 22 depicts a collaborative digital worksheet that guides students in summarizing research findings systematically. The integration of AI tools, such as Gemini AI, supports real-time information retrieval, fostering evidence-based reasoning and contextual learning. Hosted on Google Docs, these digital resources enable collaborative writing, peer review, and iterative refinement of knowledge.

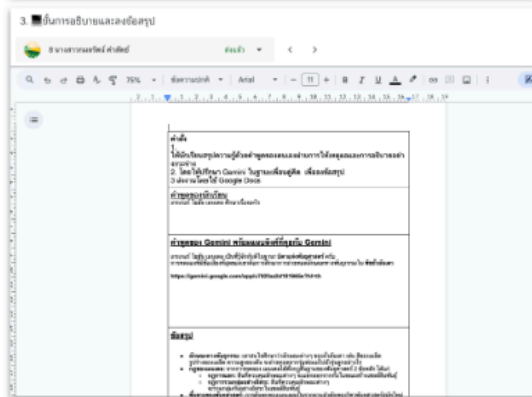
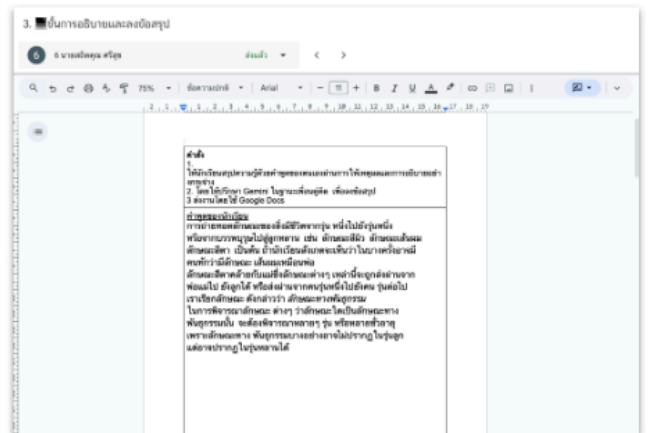
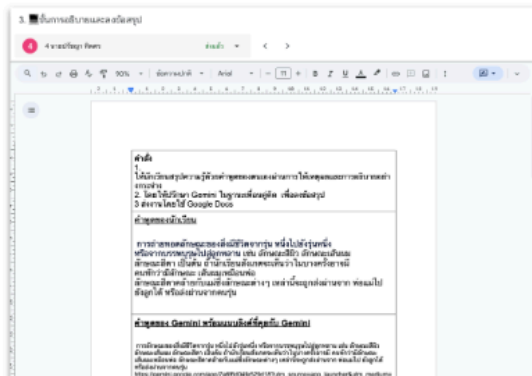
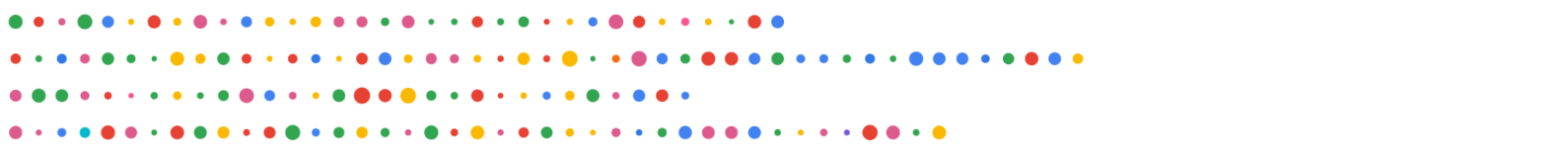


Figure 22: Biology's Students' Performance





### 3. English - Grade 10

The English course for Grade 10 students implemented a Task-Based Learning (TBL) approach integrated with Think-Pair-Share techniques, emphasizing collaborative and experiential learning in an English course. Task-based learning, as depicted in the Learning Strategies structure in figure 23, follows a three-phase structure:

1. **Pre-Task Preparation** – This phase involves understanding the task, setting objectives, and preparing necessary resources before engaging in practical application. It ensures that learners have a clear framework and background knowledge to approach the task effectively.
2. **Task Execution and Collaboration**– Students engage in the actual task, applying language skills in a communicative context while collaborating with peers using the Think-Pair-Share technique. This encourages peer interaction, knowledge exchange, and deeper engagement with the content.
3. **Practice and Self-Correction** – The final phase focuses on reviewing and refining the work. Students analyze their output, receive feedback, and make necessary revisions to improve accuracy and effectiveness, reinforcing self-directed learning and continuous improvement.



Figure 23: English's Best Practice

Figure 24 presents a technology-enhanced language learning classroom integrating multimedia instructional materials and interactive digital worksheets to support student engagement in an English language course. For the course materials, as depicted in figure 25, slide-based learning material titled "Unit 2: Have You Seen It Yet?" under the theme of Social Life serving as an introduction to lesson

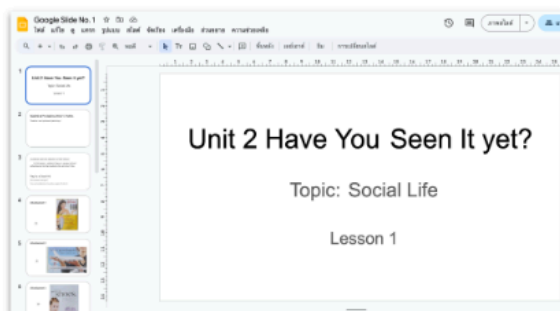




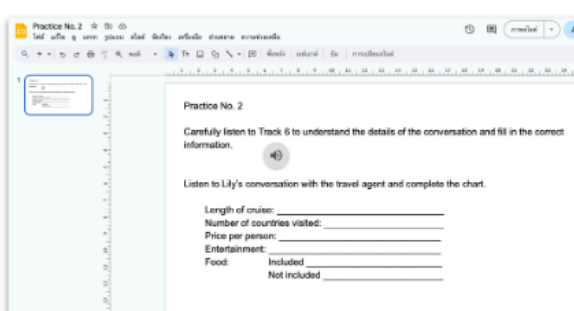
content, vocabulary, and grammar structures. The right panel in figure 25 showcases a digital worksheet designed for listening comprehension practice, where students engage with an audio-based task and extract key details from a conversation with a travel agent. The worksheet requires students to fill in missing information, reinforcing active listening, note-taking, and information-processing skills.



**Figure 24:** English's Learning Environment



Learning material



Digital worksheet

**Figure 25:** English's Learning Materials and Digital worksheet

For course assessment, students' performance was assessed in a listening comprehension task within an English language learning context, demonstrating the application of digital worksheets for formative assessment. The three panels in figure 26 showcase individual student responses to a structured practice activity, where learners listen to an audio recording of a conversation with a travel agent and fill in missing information. The integration of task-based learning and digital tools enhances language acquisition, promoting critical thinking, detailed listening, and contextual understanding, which are essential components of communicative competence in second-language learning.



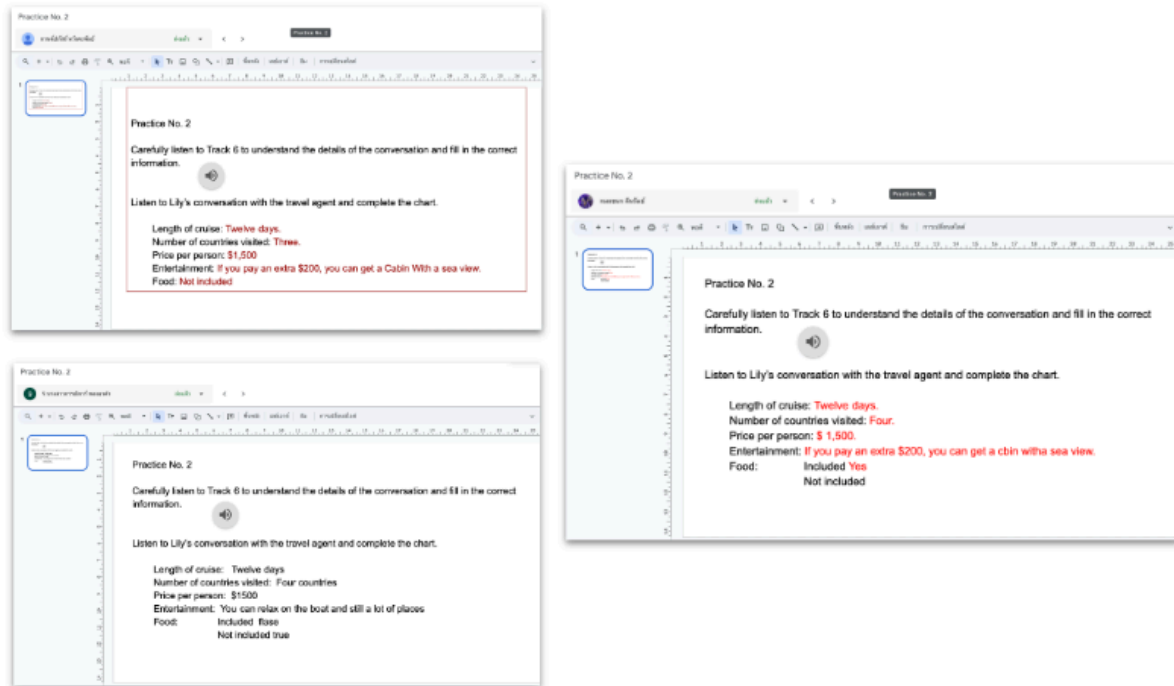


Figure 26: English's Students' Performance

#### 4. Web Development - Grade 10

The course utilized a problem-based learning strategy with an emphasis on "Think Pair Share," to teach Web Development to grade 10 students. The six steps of Problem-based Learning (PBL) as depicted in figure 27 are structured to foster an iterative and interactive learning environment:

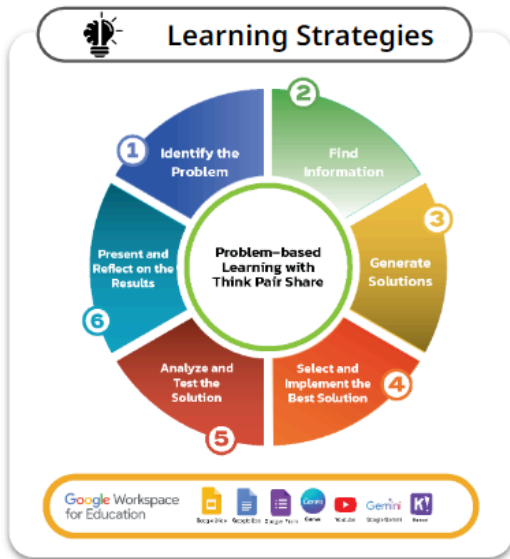
1. **Identify the Problem** - In the context of web development, this could involve identifying a need for a specific type of website or a problem with an existing website.
2. **Find Information** - Once the problem is identified, students seek out necessary information and resources to understand the problem better and start formulating solutions.
3. **Generate Solutions** - This step encourages creativity and collaborative thinking, where students can propose various design and functional elements for a website.
4. **Select and Implement the Best Solution** - From the range of generated solutions, students evaluate the options and select the best one to implement.
5. **Analyze and Test the Solution** - After implementing their solution, students test and critically analyze the outcome.
6. **Present and Reflect on the Results** - The final step involves presenting the created website and reflecting on the project process.





# Web development

การเรียนรู้โดยใช้ปัญหาเป็นฐาน ร่วมกับเทคนิคเพื่อนคู่คิด (Problem-based Learning with Think Pair Share)



### Study Module

หน่วยที่ 1 ความรู้เบื้องต้นเกี่ยวกับการสร้างเว็บไซต์

- 1.1 ชื่อที่ 1 นำเสนอเนื้อหา
- 1.2 ชื่อที่ 2 ทักษะการคิดวิเคราะห์
- 1.3 ชื่อที่ 3 คำแนะนำการเรียนเนื้อหา
- 1.4 ชื่อที่ 4 สมมติฐานก่อนเรียนเนื้อหา
- 1.5 ชื่อที่ 5 ปรึกษา Gemini ในฐานเพื่อนคู่คิด
- 1.6 ชื่อที่ 6 สรุปการเรียนรู้เนื้อหาของตนเอง

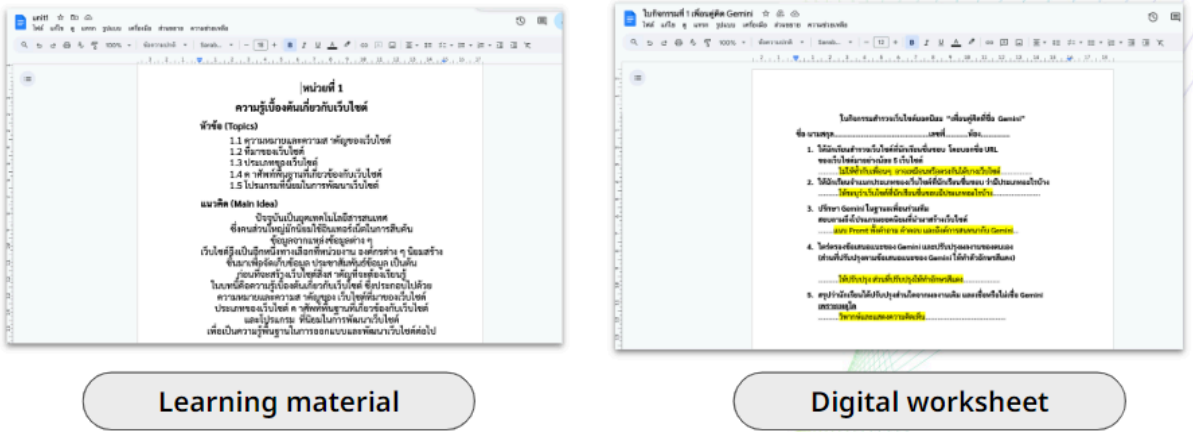
Figure 27: Web Development's Best Practice

Students make use of Google Cloudbook to access digital tools and resources throughout the learning process (figure 28). For the course materials, Google Document was utilized for content delivery, collaboration, and real-time editing, allowing students to engage with instructional materials in a dynamic and interactive manner. On the right panel of figure 29, a digital worksheet is presented, resembling the original learning material but modified for interactive engagement. This version is designed to facilitate active learning by prompting students to engage with the material through comprehension questions, exercises, or reflection prompts.



Figure 28: Web Development's Learning Environment





Learning material

Digital worksheet

Figure 29: Web Development’s Learning Material and Digital Worksheet

Students utilized Google Cloud-based tools which enable seamless collaboration, real-time feedback, and personalized learning experiences. Documents exhibited in figure 30 are part of a collaborative learning process where students utilize digital tools to complete and personalize their assignments. Each document follows a common instructional framework, with numbered sections and hyperlinks to online resources. The inclusion of web links suggests that students are engaging with external sources, demonstrating research and information retrieval skills.

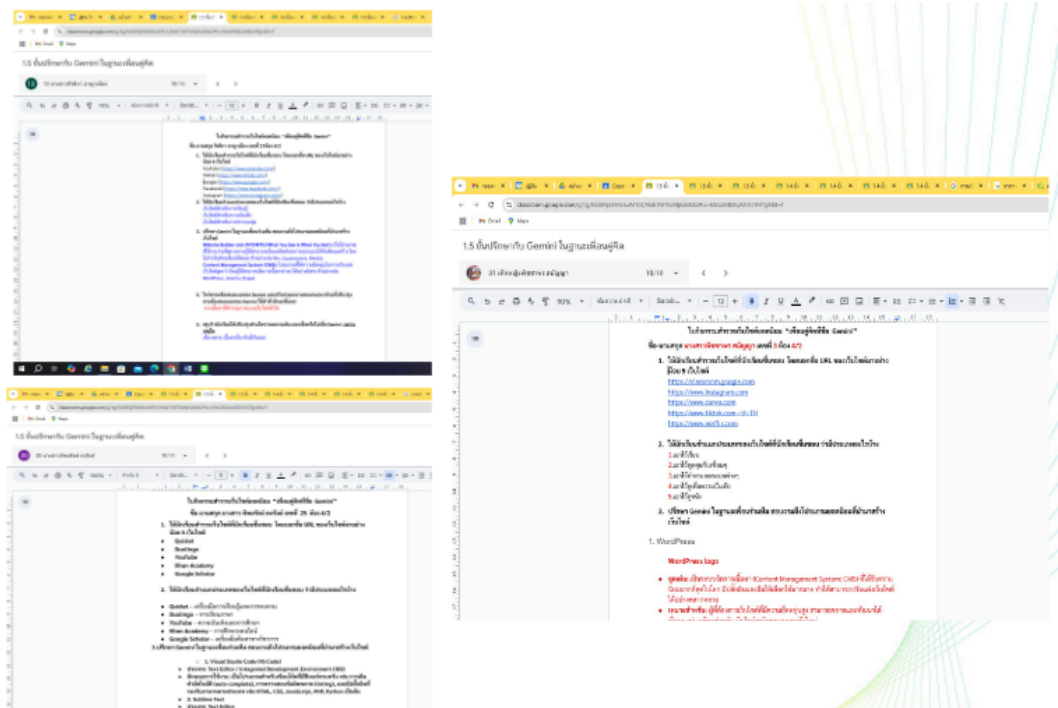


Figure 30: Web Development’s Students’ Performance



## 5. Mathematic - Grade 10

A structured educational framework for grade10's Mathematics course incorporates a deductive learning approach combined with Team Game Tournament (TGT) strategies. This pedagogical model emphasizes collaborative and competitive learning, fostering both cognitive development and teamwork skills. The framework consisted of five steps, as depicted in figure 31:

1. **Understanding Construction** – This initial phase focuses on building foundational knowledge, ensuring that learners comprehend key mathematical concepts.
2. **Exploration and Inquiry** – Students engage in research, problem identification, and information-seeking activities to deepen their understanding.
3. **Explanation and Conclusion** – This stage involves structured discussions, explanations, and formulation of key mathematical principles.
4. **Knowledge Expansion** – Learners apply their acquired knowledge in new contexts, reinforcing their skills through practice and extension activities.
5. **Assessment and Evaluation** – The final phase assesses students' understanding and performance, allowing for feedback and adjustments in learning.

This cyclical process aligns with constructivist learning principles, where knowledge is actively constructed through exploration, collaboration, and application. On the right panel of figure 31, the study module, which follows the structured framework, is illustrated, with the first unit focusing on concept mapping and multiplication principles. The sequence follows the five-phase learning strategy, progressing through understanding construction, exploration and inquiry, explanation and conclusion, knowledge expansion, and assessment and evaluation, ensuring a comprehensive learning experience.





# Mathematics

## การจัดการเรียนรู้แบบนิรนัย ร่วมกับการเรียนแบบทีมแข่งขัน (Deductive Learning Approach with Team Game Tournament)

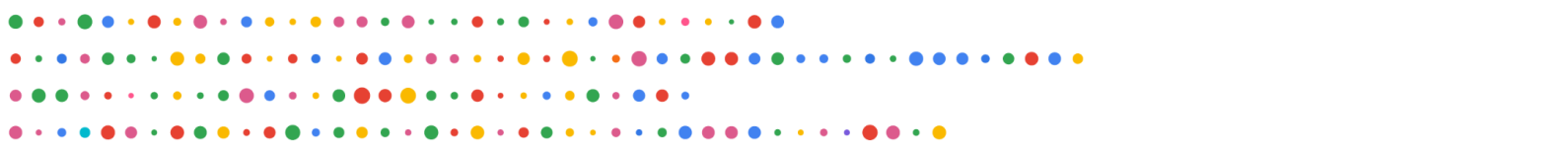


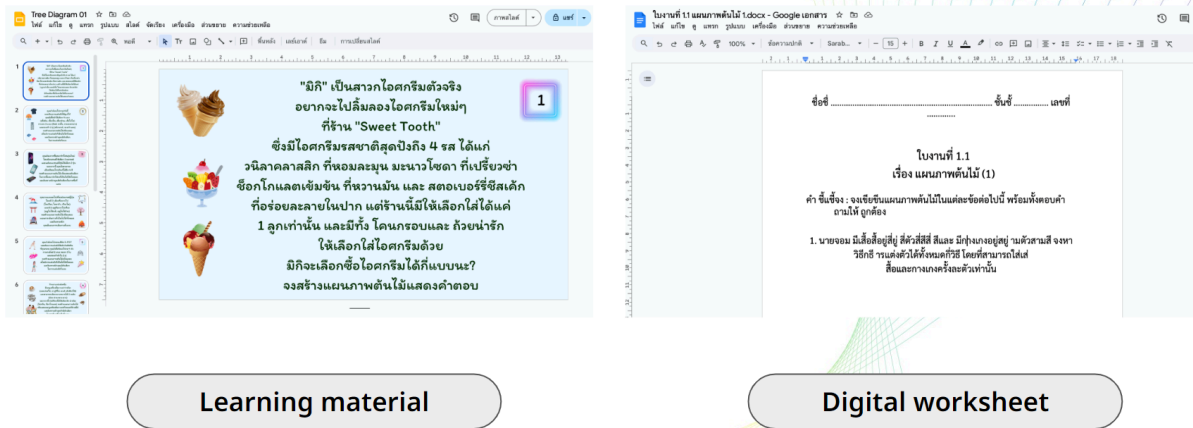
Figure 31: Mathematics’s Best Practice

In this course, a technology-enhanced learning environment is encouraged where students engage with digital learning materials and interactive activities in a collaborative classroom setting. The use of Google Cloud-based tools supports active learning, digital collaboration, and personalized instruction, as illustrated in figure 32 and figure 33. Both Learning Material and Digital Worksheet implemented a structured Google Document designed for active student participation, prompting learners to apply knowledge, answer questions, and engage in problem-solving activities.



Figure 32: Mathematics’s Learning environment



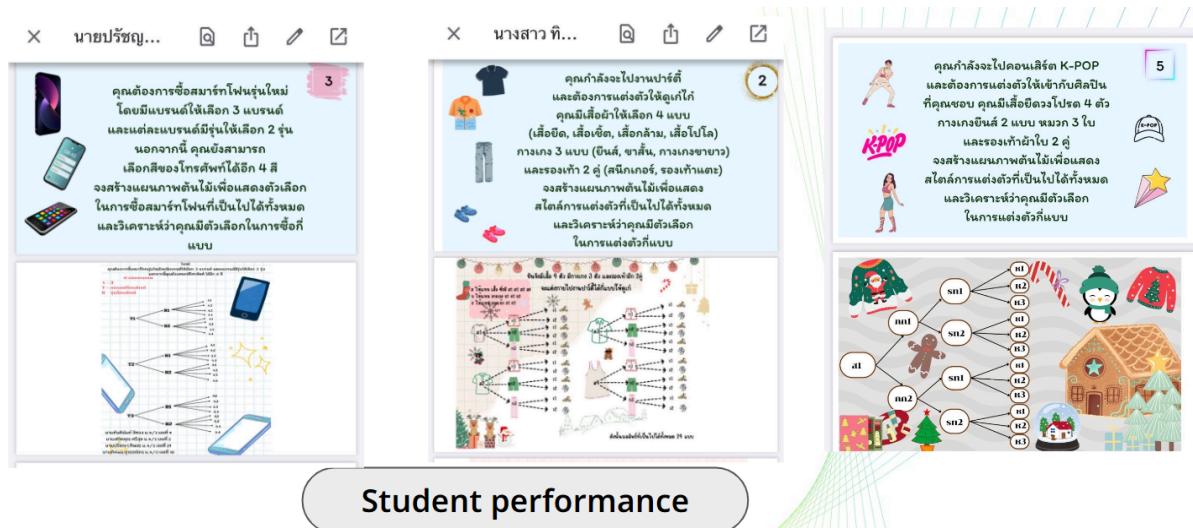


Learning material

Digital worksheet

Figure 33: Mathematics's Learning Materials and Digital Worksheet

Figure 34 showcased student performance through three distinct presentation slides, each demonstrating analytical thinking and problem-solving skills. The slides contain structured textual explanations, graphical representations, and illustrations related to decision-making scenarios. The first slide discusses smartphone selection using a mathematical approach, the second focuses on clothing choices with a systematic decision-making process, and the third explores K-POP-related interests through categorization and logic-based mapping. These presentations highlight students' ability to apply logical reasoning and structured problem-solving techniques in various real-life contexts.



Student performance

Figure 34: Mathematics's 2 Students Performance

6. P.E. - Grade 10

This course presents an educational framework for P.E., emphasizing Activity-Based Learning with the Think Pair Share technique as shown in figure 35. The proposed strategy consists of five key steps:



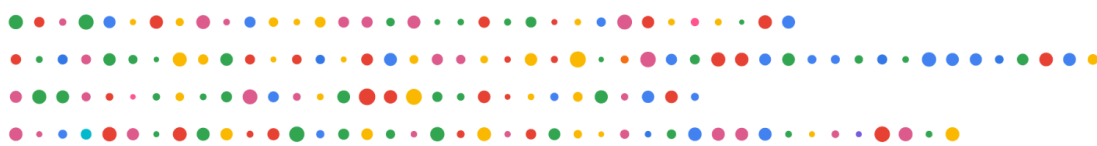
1. **Understanding Construction** - This stage emphasizes cognitive processing, where students connect new knowledge with prior experiences.
2. **Exploration and Inquiry** - This phase promotes critical thinking and curiosity, allowing students to engage with the content beyond passive learning
3. **Explanation and Conclusion** - This stage helps in clarifying misunderstandings, reinforcing learning, and ensuring that knowledge is logically structured.
4. **Knowledge Expansion** - This phase encourages further inquiry and connection-building, where students apply their knowledge in broader or more complex contexts.
5. **Assessment and Evaluation** - This final step involves reflecting on learning outcomes through self-assessment, peer evaluation, and instructor feedback.

By following this structured learning cycle, students engage in a dynamic and interactive educational experience, fostering higher-order thinking skills, problem-solving abilities, and collaborative learning.



**Figure 35:** P.E.'s Best Practice

By integrating Activity-Based Learning approach combined with the Think-Pair-Share technique to enhance student engagement in community health education, the course featured several online resources, such as a YouTube video titled "Health Promoting in Community" (figure 37) that served as a multimedia learning resource to introduce and visually explain key concepts. A digital worksheet in the right panel of figure 37 depicted a design that reinforces learning through





structured activities, such as written reflections, diagram-based exercises, and critical thinking prompts. Using the Think-Pair-Share technique, students first individually engage with the video content ("Think"), then collaborate with peers to discuss insights and reflection worksheet activities ("Pair"), and finally share their conclusions in group discussions or presentations ("Share").



Figure 36: P.E.'s Learning Environment



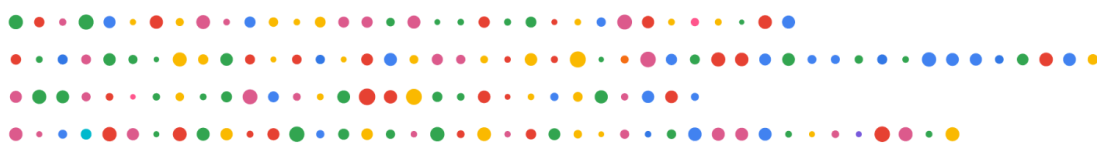
Learning material



Digital worksheet

Figure 37: P.E.'s Learning Material and Digital Worksheet

Figure 38 showcases student performance. It displays three instances of a digital worksheet completed by different students, reflecting their engagement in collaborative learning and critical thinking. This method not only promotes conceptual understanding of community health but also enhances communication and teamwork skills.



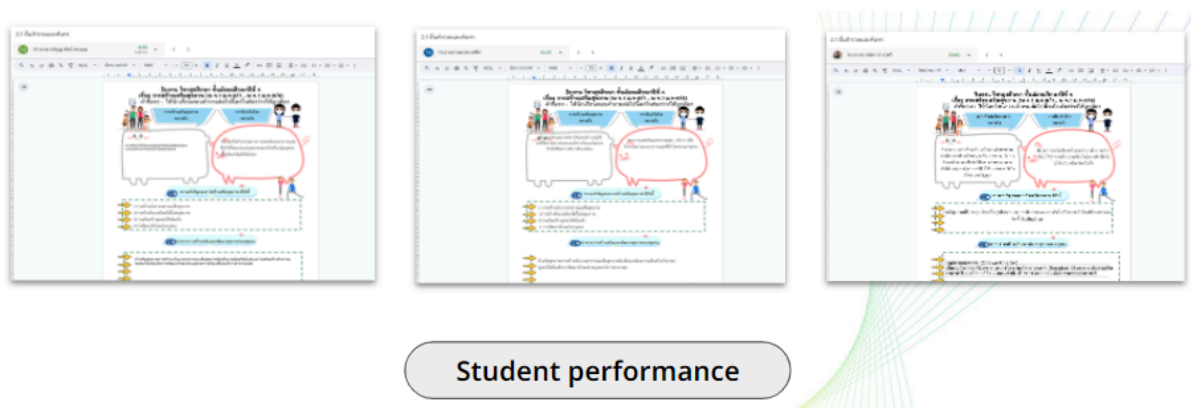


Figure 38: P.E.'s Students' Performance

### 7. Art - Grade 10

The Art course integrated Activity-Based Learning with the Think-Pair-Share technique. This method encourages students to actively construct knowledge, collaborate with peers, and refine their learning through reflection and assessment with four key learning steps as illustrated in figure 39:

1. **Building Understanding** – This initial phase focuses on introducing key concepts related to the topic. Students engage with learning materials such as videos, readings, or demonstrations to gain a foundational understanding.
2. **Study Phase** – In this phase, students apply their knowledge through hands-on activities such as analyzing musical compositions, experimenting with instruments, or engaging in group discussions.
3. **Summarization** – This phase focuses on synthesizing and consolidating learning through reflection and structured presentation of key concepts.
4. **Evaluation** – The final phase involves assessing understanding, providing feedback, and identifying areas for improvement.

This structured approach fosters critical thinking, creativity, and a deeper appreciation of musical heritage.





# Art

การเรียนรู้โดยใช้กิจกรรมเป็นฐาน ร่วมกับเทคนิคเพื่อนคู่คิด (Activity-Based Learning with Think Pair Share)



Figure 39: Art’s Best Practice

Implementing an Activity-Based Learning approach integrating the Think-Pair-Share technique to enhance students’ understanding of the History of Western Music helped create a collaborative, student-centered, and inquiry-driven learning environment as depicted in figure 40.

Figure 41 displays learning material that introduces key concepts related to Western music history. The right panel shows a digital worksheet designed to reinforce knowledge through reflection and collaborative discussion, encouraging students to summarize and critically analyze what they have learned.



Figure 40: Art’s Students’ Performance





Learning material



Digital worksheet

Figure 41: Art's Learning Material and Digital Worksheet

Student performance in a collaborative digital learning environment, demonstrating engagement with Activity-Based Learning and the Think-Pair-Share technique. Figure 42 showcases students' responses in a discussion-based platform, where they share reflections, analyze concepts, and provide feedback on learning topics.



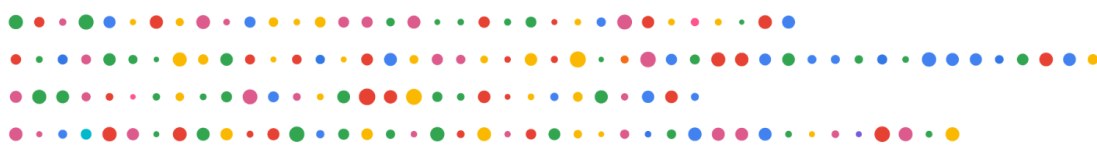
Student performance

Figure 42: Art's Students' Performance

### 8. Guidance - Grade 10

The Guidance course proposed a collaborative learning framework integrating the Jigsaw technique with the Think-Pair-Share method to enhance student engagement and knowledge acquisition. Figure 43 illustrates a structured learning strategy cycle, consisting of five stages:

1. **Understanding Construction** – Students grasp the foundational concepts of the topic by engaging in reading, multimedia content, or instructor-led discussions.





2. **Exploration and Inquiry** – Learners investigate further, ask critical questions, and seek deeper understanding through collaborative activities, research, and discussions.
3. **Explanation and Conclusion** – Through Think-Pair-Share, students synthesize their findings, clarify misunderstandings, and present key takeaways.
4. **Knowledge Expansion** – The Jigsaw technique facilitates peer teaching, allowing students to build on each other's knowledge, encouraging interdisciplinary connections and application-based learning.
5. **Assessment and Evaluation** – The final phase involves reflection, peer feedback, and formal assessments, ensuring that students can effectively apply and articulate their acquired knowledge.

By integrating the Jigsaw technique with Think-Pair-Share, this collaborative learning model fosters active engagement, critical thinking, teamwork, and deeper conceptual understanding, making it an effective strategy for student-centered education.

Guidance

การจัดการเรียนรู้แบบร่วมมือด้วยเทคนิคจิ๊กซอว์ ร่วมกับเทคนิคเพื่อนคู่คิด (Jigsaw technique with Think Pair Share)

Learning Strategies

Study Module

หน่วยการเรียนรู้ที่ 1

1. ชั้นสร้างแรงบันดาลใจ
2. การสำรวจและค้นหา
3. การอธิบายและทดสอบสรุป
4. ชั้นขยายความรู้
5. ชั้นประเมินผล

**Figure 43:** Guidance Subject Best Practice

The course utilized a career-themed digital learning resource, incorporating visual elements related to various professions, tools, and innovation, suggesting an engaging multimedia presentation, as depicted in figure 44 and figure 45. A digital worksheet utilized in the course aimed at reinforcing students' understanding by prompting them to reflect on career-related topics, such as skills assessment, future aspirations, and career pathways. This blended learning approach encourages active participation, self-reflection, and structured knowledge application, helping





students explore career options, set goals, and make informed decisions about their professional futures.



Figure 44: Guidance Subject Learning Environment



Learning material



Digital worksheet

Figure 45: Guidance Subject Learning Material and Digital Worksheet

Figure 46 showcases student performance in a career exploration learning activity, where students engage with a digital worksheet to reflect on their career interests, goals, and skill development. The three displayed documents indicate individual responses, demonstrating students' ability to analyze career options,





organize their thoughts, and articulate their aspirations.

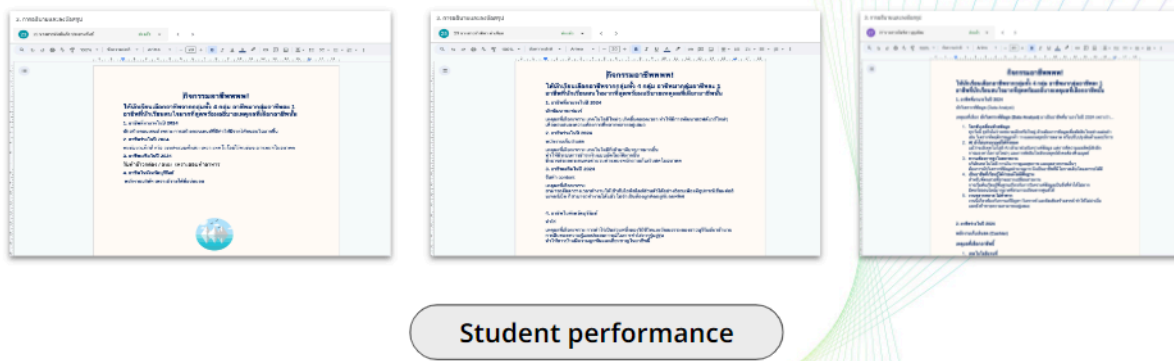


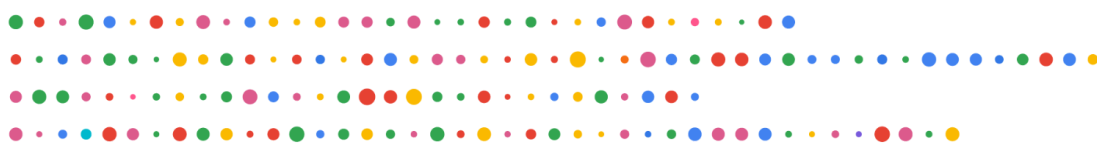
Figure 46: Guidance Subject Students' Performance

7.7.2 Grade 11

9. Thai - Grade 11

For Thai course, one of the subjects for grade 11 students, presents an innovative learning framework incorporating Scenario-Based Learning (SBL) with the Team-Pair-Solo technique to enhance student engagement and critical thinking skills. As illustrated in figure 47, the proposed structured learning strategy cycle consisting of four interconnected stages:

1. **Introduction and Knowledge Sharing** - Students receive foundational knowledge and background information related to the scenario.
2. **Problem Analysis and Solution** - Learners critically examine the scenario, identify challenges, and discuss possible solutions.
3. **Discussion and Reflection** - Learners share their findings, justify their solutions, and reflect on the learning process.
4. **Peer and instructor feedback** - Guide improvements and enhance metacognitive skills.





# Thai

การจัดการเรียนรู้โดยใช้ฉากทัศน์เป็นฐาน ร่วมกับเทคนิคกลุ่ม คู่ เดี่ยว (Scenario-Based Learning with Team Pair Solo)

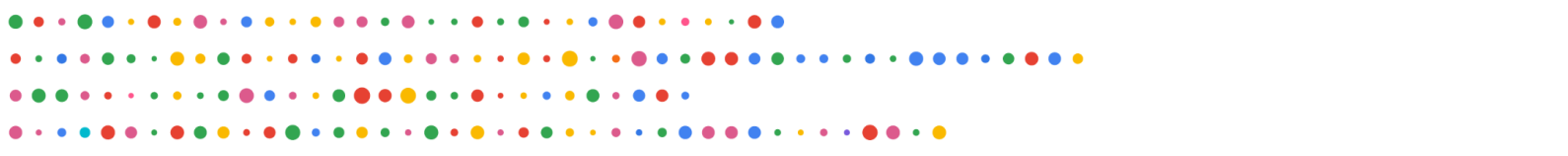


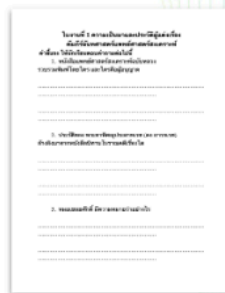
Figure 47: Thai's Best Practice

Scenario-Based Learning helps promote an interactive learning approach for a Thai language lesson as exhibited in figure 48, focusing on the study of medical lexicons and analytical sciences. The learning materials, as shown in figure 49, featured a presentation slide with textual explanations and a concept map, which visually organizes key terms related to the subject matter. The digital worksheet is designed to reinforce students' understanding through structured exercises, reflective writing, and analytical tasks.



Figure 48: Thai's Learning Environment



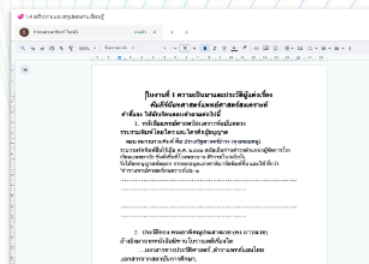
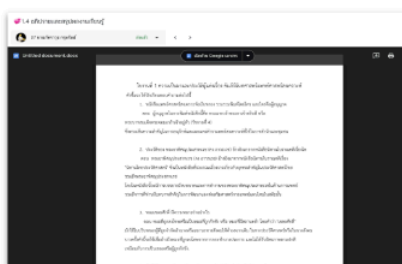
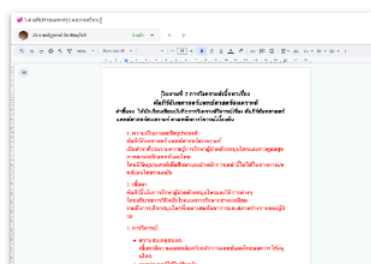


Learning material

Digital worksheet

Figure 49: Thai's Learning Material and Digital Worksheet

Figure 50 showcases student performance in a digital learning environment, where students engage with structured worksheets to demonstrate their understanding of medical lexicons and analytical sciences in the Thai language. The three panels display individual responses, indicating a varied approach to content comprehension, organization, and reflection. Some submissions include detailed answers and highlighted text, suggesting revisions or emphasis on key concepts, while others maintain a structured format for concise analysis.



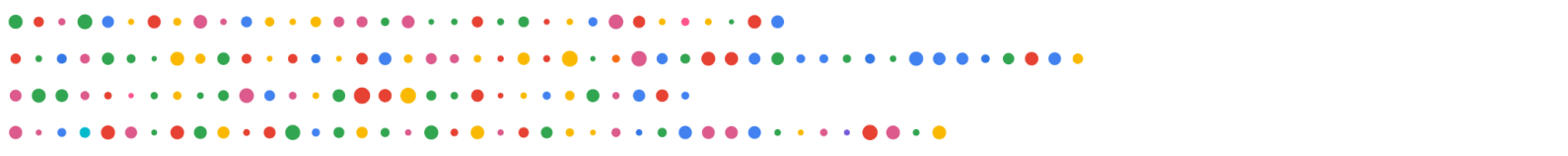
Student performance

Figure 50: Thai's Students' Performance

### 10. Biology - Grade 11

Grade 11's Biology course implemented the inquiry-based learning approach following a structured cycle of scientific exploration, integrating the Think-Pair-Share technique to enhance critical thinking, collaboration, and problem-solving skills. The cycle consists of four key steps, as shown in Figure 51 each designed to engage students in active inquiry and knowledge construction:

- 1. **Generating Interest** - This step lays the foundation for self-directed exploration by fostering intrinsic motivation and cognitive engagement in the learning process.
- 2. **Exploration and Investigation** - Students formulate explanations based on observations, using logical reasoning to interpret patterns or trends in biological systems.





**3. Discussion and Conclusion** - This stage reinforces higher-order thinking skills, allowing students to challenge assumptions, debate interpretations, and refine their scientific explanations.

**4. Knowledge Expansion** - The final phase aims to extend learning beyond the initial investigation by applying acquired knowledge to new contexts, real-world scenarios, or cross-disciplinary connections.

By following this structured inquiry-based learning approach, students actively participate in the learning process, develop scientific literacy, and enhance their ability to think critically, analyze information, and apply knowledge effectively.

**Biology** การเรียนรู้แบบสืบสอบ ร่วมกับเทคนิคเพื่อนคู่คิด (Inquiry-based learning with Think Pair Share)

**Learning Strategies**

Inquiry-based learning with Think Pair Share

Building Understanding

Study Phase

Summarization

Evaluation

1

3

Google Workspace for Education

**Study Module**

**Module 1 การสืบพันธุ์ของสัตว์**

- จุดประสงค์การเรียนรู้
- 1. ชื่นชมความสนใจ
- 2. ชื่นชมและค้นหา
- 3. ชื่นชมและลงข้อสรุป
- 4. ชื่นชมความรู้อย่างดี

**Figure 51:** Biology’s Best Practice

The proposed Best Practice created a technology-enhanced learning environment, where students were actively engaged in digital learning using Chromebooks as depicted in figure 52. The course’s learning materials and a digital worksheet designed for Biology 4, as illustrated in figure 53, focusing on asexual reproduction in animals, features a YouTube video lesson Where a teacher explains the concept with supporting visuals, promoting engagement through multimedia instruction. A digital slide with images of animals that reproduce asexually, encouraging students to observe, analyze, and discuss key biological characteristics. A structured digital worksheet was designed to reinforce learning through guided inquiry, categorization, and comparative analysis of different reproductive methods.

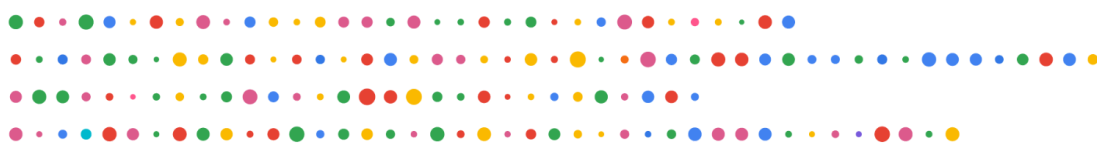
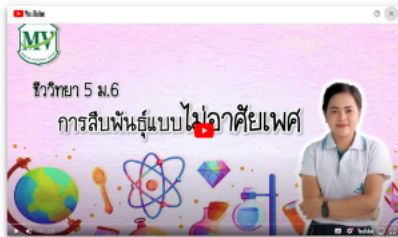




Figure 52: Biology's Learning Environment



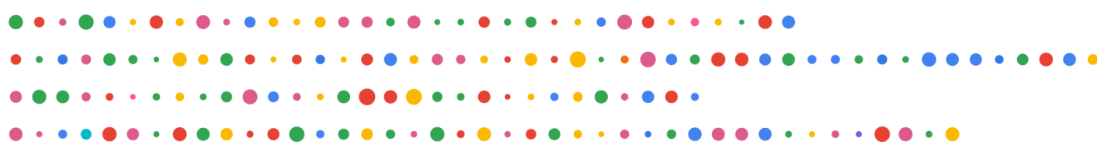
Learning material



Digital worksheet

Figure 53: Biology's Learning Material and Digital Worksheet

Figure 54 showcases student performance in Biology 4, demonstrating their engagement with digital learning materials and analytical exercises on asexual reproduction in animals. The left panel displays students' work on interactive digital slides, where they have formulated responses, analyzed images, and provided explanations based on given prompts. Whereas the right panel features structured





written responses from digital worksheets

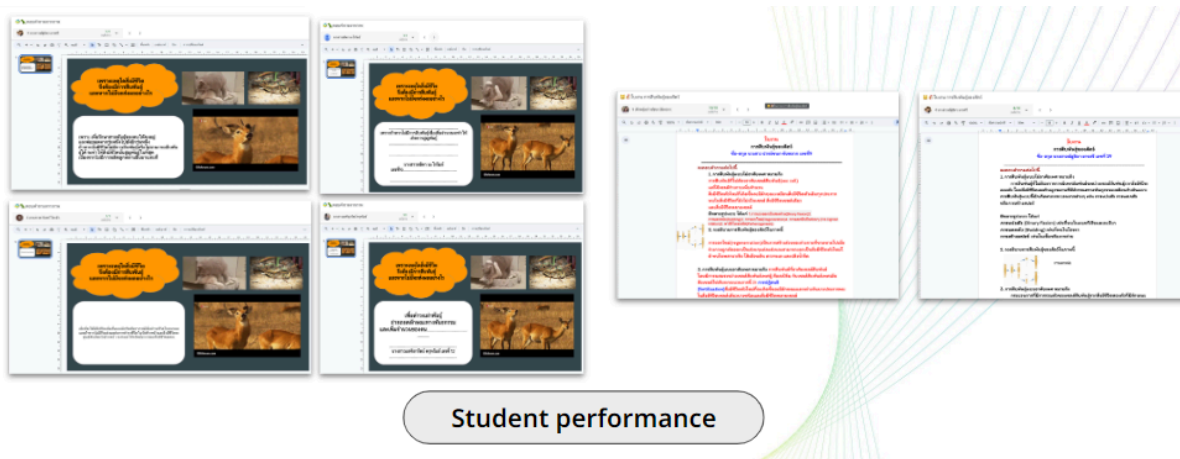


Figure 54: Biology's Student Performance

## 11. Design and Technology - Grade 11

This course presents a cooperative learning framework that integrates AI-assisted learning to enhance problem-solving, critical thinking, and collaborative engagement to teach Design and Technology to grade11 students. The proposed structured learning strategy cycle, as shown in figure 55, consists of five key stages:

- 1. Understanding Construction** - The goal of this stage is to introduce fundamental concepts and principles related to the technology topic.
- 2. Exploration and Inquiry** - This stage promotes self-directed learning and inquiry-based exploration, allowing students to develop analytical and research skills.
- 3. Explanation and Conclusion** - This phase emphasizes clarity, logical reasoning, and structured communication of technological concepts.
- 4. Knowledge Expansion** - Students apply their learning to new or complex problems, using AI tools to enhance creativity and innovation.
- 5. Assessment and Evaluation** - The final stage focuses on assessing student performance, reflecting on learning outcomes, and identifying areas for improvement.

By integrating AI-assisted cooperative learning, this framework enhances digital literacy, fosters critical and creative thinking, and enables adaptive learning experiences. Students gain a more personalized, data-driven, and collaborative approach to technology education, preparing them for emerging technological advancements and real-world problem-solving.





# Design and Technology

การเรียนรู้แบบร่วมมือ ร่วมกับผู้ช่วยเสมือน และเทคนิคเพื่อนคู่คิด (Cooperative Learning with AI-Assisted Think Pair Share)



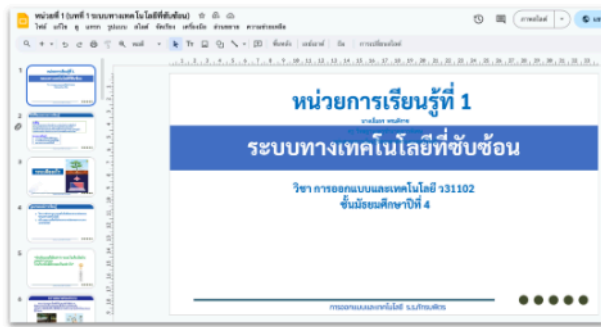
Figure 55: Design and Technology's Best Practice

The proposed structure encouraged an engaging learning environment as exhibited in figure 56. The Learning materials and a digital worksheet designed for this subject, as shown in figure 57, specifically focus on complex technological systems. The left panel features a presentation slide deck, serving as a structured resource for introducing key concepts, system components, and technological processes. The right panel displays a digital worksheet, which includes visual diagrams, structured exercises, and analytical questions to guide students through understanding system interactions and problem-solving applications.

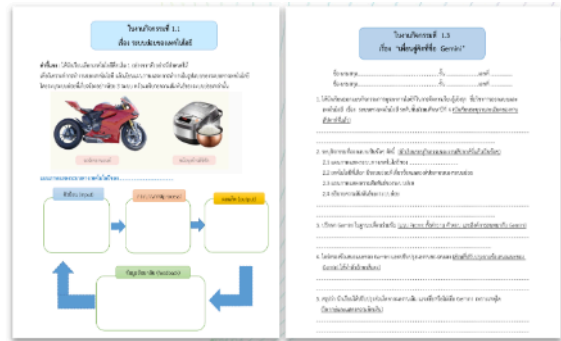


Figure 56: Design and Technology's Learning Environment





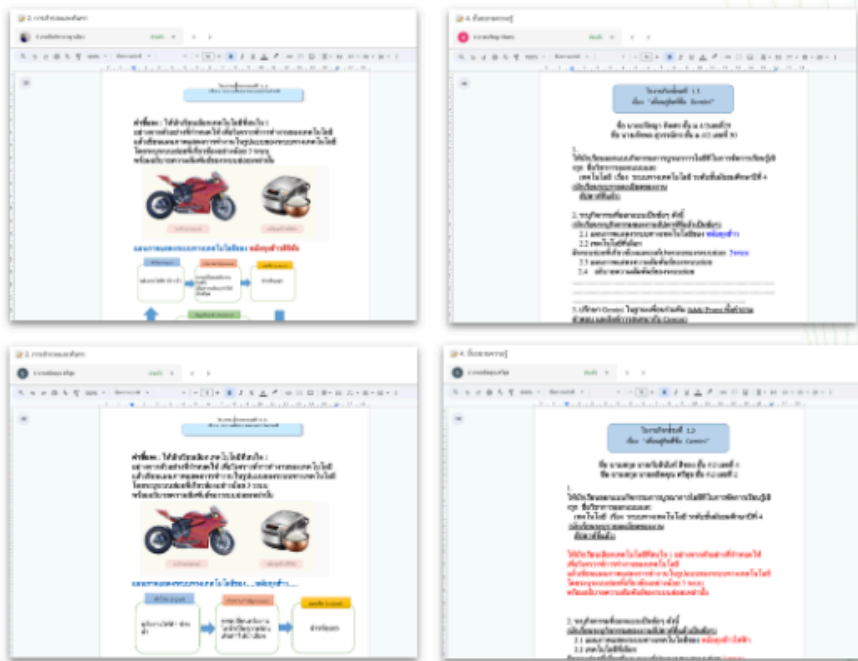
Learning material



Digital worksheet

Figure 57: Design and Technology's Learning Material and Digital Worksheet

Figure 58 illustrated student performance in the Design and Technology subject, demonstrating their engagement with digital worksheets and structured assessments on complex technological systems. students have analyzed technological processes, such as mechanical system interactions (e.g., a motorcycle and helmet), using flowcharts and categorization techniques in the assigned interactive worksheets.



Student performance

Figure 58: Design and Technology's Student Performance





## 12. Chemistry - Grade 11

For grade 11's Chemistry, the instructor proposed inquiry-based learning with Think-Pair-Share technique framework, as shown in figure 59, focusing on the study of gas laws consisting of five interconnected stages:

**1. Understanding Construction-** The goal is to activate prior knowledge and create a strong conceptual foundation before deeper exploration.

**2. Exploration and Inquiry** - This phase encourages questioning, hypothesis formation, and data analysis to deepen understanding.

**3. Explanation and Conclusion** - This stage enhances scientific reasoning, logical deduction, and collaborative discussion to clarify concepts.

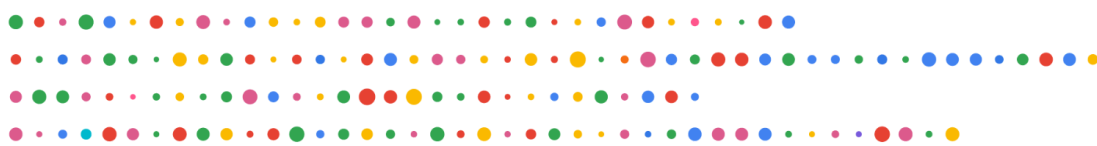
**4. Knowledge Expansion** - The focus here is on applying learned concepts to new problems, such as solving real-world gas law applications or interdisciplinary connections.

**5. Assessment and Evaluation** - This final phase involves evaluating student understanding through quizzes, peer reviews, and reflections.



Figure 59: Chemistry's Best Practice

This teaching and learning approach created a dynamic classroom where students actively participate in hands-on chemistry experiments and teacher-led discussions as depicted in figure 60. The multimedia learning resources and digital worksheets used in the Chemistry course are designed to enhance student comprehension and engagement. As shown in figure 61, the learning materials feature a YouTube video on acids and bases, illustrating molecular structures in an interactive format, with digital presentation on Gas Laws, serving as a structured instructional resource. The digital worksheets are also designed to incorporate

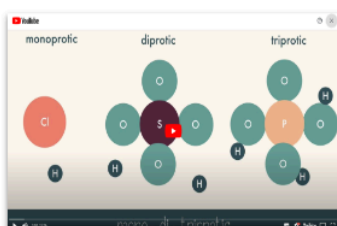




concept mapping, problem-solving exercises, and reflection prompts, promoting active learning, self-assessment, and deeper application of chemistry concepts in both theoretical and practical contexts.



Figure 60: Chemistry's Learning Environment



สารอินทรีย์แก๊สพิษ	สารอินทรีย์ระเหยง่าย
1. เมื่อผสมกับสารละลาย H <sub>2</sub>	กลายเป็นเป็นสีน้ำตาล
2. เมื่อเติมสารละลาย HCl	เกิดตะกอนสีขาว
3. เมื่อเติมสารละลาย Ca(OH) <sub>2</sub>	เกิดตะกอนสีขาว

บทเรียน "สารอินทรีย์ระเหยง่าย"

ชื่อของสาร.....

ชื่อของสาร.....

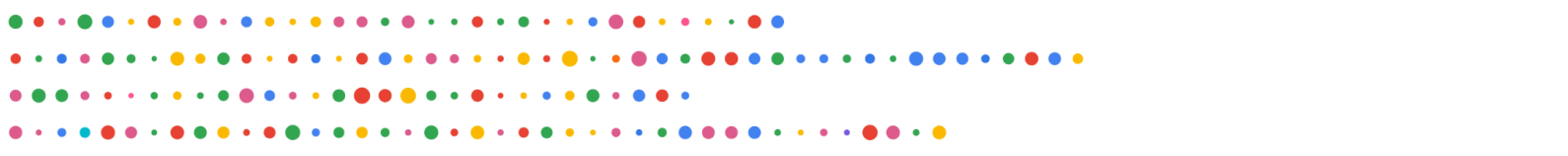
1. เมื่อเติมสารละลาย H<sub>2</sub> จะเกิดสีน้ำตาลขึ้น
2. เมื่อเติมสารละลาย HCl จะเกิดตะกอนสีขาวขึ้น
3. เมื่อเติมสารละลาย Ca(OH)<sub>2</sub> จะเกิดตะกอนสีขาวขึ้น
4. เมื่อเติมสารละลาย H<sub>2</sub>O จะเกิดสีน้ำตาลขึ้น
5. เมื่อเติมสารละลาย H<sub>2</sub>O จะเกิดสีน้ำตาลขึ้น

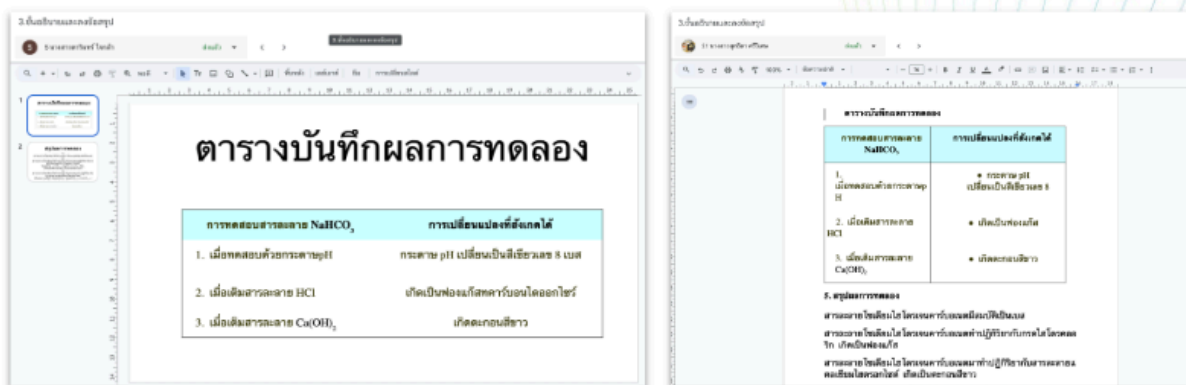
Learning Materials

Digital Worksheet

Figure 61: Chemistry's Learning Material and Digital Worksheet

Figure 62 showcases student performance in a Chemistry experiment, where students have documented their experimental observations and analysis using digital tools. The left panel presents a structured data recording table while the right panel expands on this by including detailed explanations, reflections, and conclusions, demonstrating critical thinking and scientific reasoning.





Student performance

Figure 62: Chemistry’s Student Performance

### 13. Social - Grade 11

Grade 11’s Social 4 course presents an Activity-Based Learning framework that incorporates interactive video-based learning to enhance student engagement, critical thinking, and real-world application of economic concepts. The proposed structured learning strategy cycle, as shown in figure 63, consisting of five interconnected stages:

- 1. Building Understanding** - This initial phase introduces key economic concepts and foundational knowledge.
- 2. Exploration** - Students actively investigate topics through research, case studies, or data analysis.
- 3. Activity** - This phase involves hands-on or interactive learning experiences, such as simulations, debates, problem-solving exercises, or digital projects.
- 4. Discussion** - Students share insights, debate perspectives, and refine their understanding through structured discussions.
- 5. Conclusion** - The final stage focuses on synthesizing learning, reflecting on key takeaways, and applying knowledge to new situations.

By integrating Activity-Based Learning with Interactive Video, this approach fosters engagement, deeper comprehension, and real-world application of economic concepts, ensuring students become active participants in their learning journey.





## Social การเรียนรู้โดยใช้กิจกรรมเป็นฐาน ร่วมกับสื่อวิดีโอแบบมีปฏิสัมพันธ์ (Activity-Based Learning with interactive video)



Figure 63: Social's Best Practice

The designed learning materials and a digital worksheet for Social Studies, as depicted in figure 65, focusing on economic systems. It features an educational YouTube video that visually explains key economic concepts, making learning engaging and interactive. The digital worksheet is designed with guided questions and interactive exercises, allowing students to analyze and apply economic principles in real-world contexts.



Figure 64: Social 4 Learning Environment





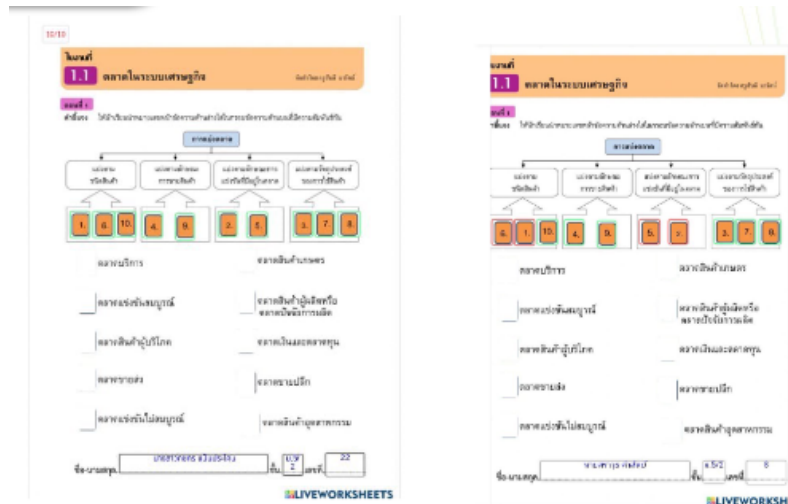
Learning material



Digital worksheet

Figure 65: Social 4 Learning Material and Digital Worksheet

Student performance in Social Studies, as illustrated in figure 66, specifically focusing on economic systems through digital interactive worksheets. The worksheets, completed on the Liveworksheets platform, include structured exercises, matching activities, and categorization tasks to assess students' understanding of different types of economic systems. The responses indicate active engagement with digital learning tools, enabling students to apply theoretical knowledge, analyze economic structures, and reinforce their comprehension through interactive exercises.



Student performance

Figure 66: Social's Student Performance





### 14. P.E. - Grade 11

For P.E. (Grade 11) course, the Activity-Based Learning with Think Pair Share approach was implemented. Focusing on a structured learning strategy and study module. The Learning Strategy in figure 67 displayed a circular diagram divided into five interconnected segments, representing key steps in the learning process:

1. **Understanding Construction:** This stage involves building foundational knowledge and comprehension of the subject matter.
2. **Exploration and Inquiry:** Learners engage in active exploration, posing questions, and investigating concepts to deepen understanding.
3. **Explanation and Conclusion:** Students synthesize their findings, articulate their understanding, and draw conclusions based on their exploration.
4. **Knowledge Expansion:** This phase encourages learners to connect new knowledge with prior learning, expanding their understanding.
5. **Assessment and Evaluation:** The final step involves assessing students' learning outcomes and evaluating their progress.

The strategy emphasizes collaboration through the Think-Pair-Share technique, where learners individually think about a topic, discuss their ideas with a partner, and then share insights with the larger group. This approach fosters critical thinking, peer interaction, and active participation.



Figure 67: P.E.'s Best Practice

The proposed teaching approach encourages a collaborative learning atmosphere. In figure 68, students were working in groups with their Chromebooks in a technology-integrated classroom setting. For learning materials and digital worksheets used in the lesson, which illustrated in figure 69, features a presentation

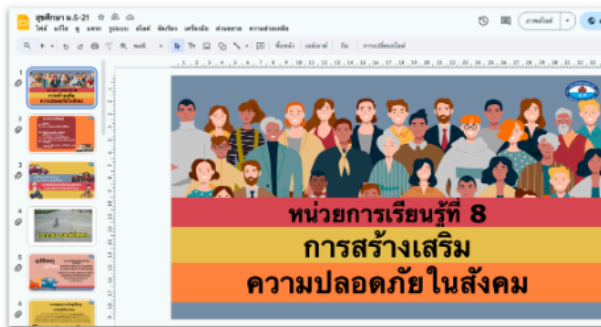




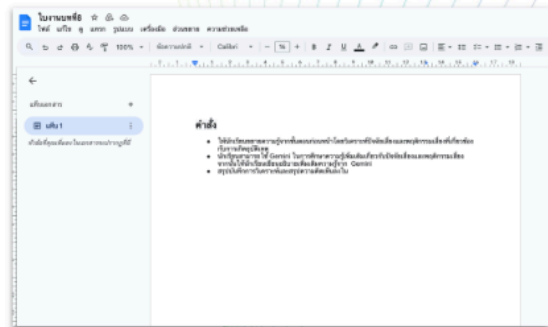
slide titled "Unit 8: Promoting Safety in Society," which serves as a structured instructional resource to introduce key concepts and facilitate discussion. The digital worksheet is also designed to guide students through interactive exercises, reflections, and structured responses related to community safety and well-being.



Figure 68: P.E.'s Learning Environment



Learning material



Digital worksheet

Figure 69: P.E.'s Learning Material and Digital Worksheet

For students' performance in Grade 11 Physical Education (P.E. 4), specifically focusing on analyzing the causes of accidents and safety measures in society. As shown in figure 70, The three panels display digital worksheets completed by students, where they have researched, structured, and documented





their understanding of accident causes, prevention strategies, and risk factors.

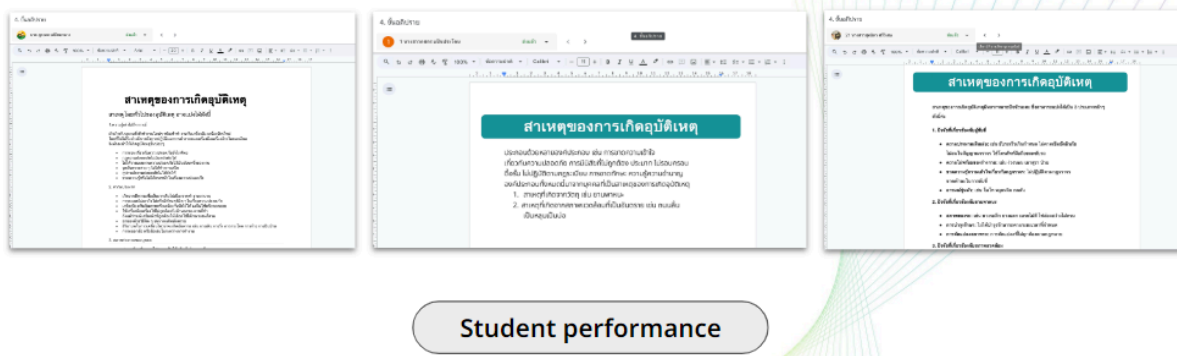


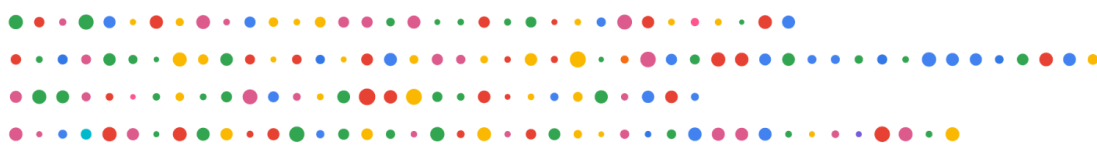
Figure 70: P.E.'s Student Performance

### 15. Art - Grade 11

The Art course for grade11 students incorporates Activity-Based Learning with the Think-Pair-Share technique to enhance student creativity, collaboration, and critical thinking. Figure 71 illustrates a learning strategy model, guiding students through the following five-step process for artistic exploration and skill development:

1. **Understanding Construction** - Students build foundational knowledge by exploring art history, artist styles, and key artistic movements.
2. **Exploration and Inquiry** - This phase involves independent and collaborative research, where students investigate art techniques, influences, and creative methodologies.
3. **Explanation and Conclusion** - Students synthesize their findings and present interpretations of selected artworks or artistic styles.
4. **Knowledge Expansion** - This phase focuses on applying acquired knowledge to practical artwork creation.
5. **Assessment and Evaluation** - The final step involves self-reflection, peer feedback, and instructor evaluations to assess students' creative process, technical skill, and conceptual depth.

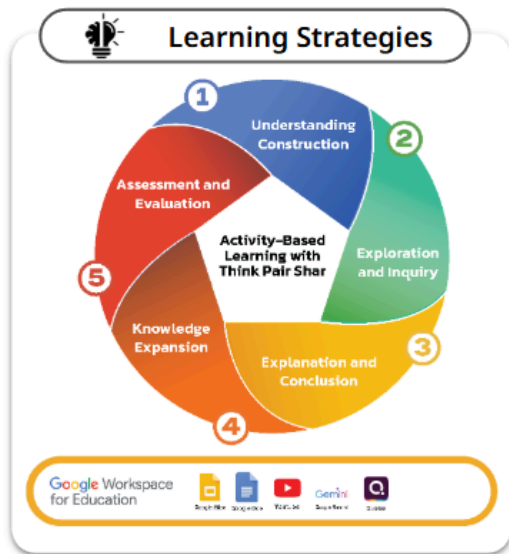
By integrating Activity-Based Learning with the Think-Pair-Share method, this approach encourages deep artistic exploration, critical discussion, and personalized creative development, ensuring students actively engage with art theory and practice in meaningful ways.





# Art

การเรียนรู้โดยใช้กิจกรรมเป็นฐาน ร่วมกับเทคนิคเพื่อนคู่คิด (Activity-Based Learning with Think Pair Share)



### Study Module

#### โมดูล 1 ตามรอยศิลปิน

1. ชำนาญ
2. ชั้นศึกษา
3. ชั้นสร้างสรรค์ผลงาน
4. ชั้นสรุป
5. ชั้นประเมินผล

Figure 71: Art's Best Practice

Figure 72 and Figure 73 depict Art learning environment and learning materials. The learning materials and digital worksheet were designed focusing on techniques for creating artwork inspired by famous artists. The learning material features a YouTube video lesson, which serves as an instructional resource, providing students with techniques, artistic principles, and inspirations for creating their own artwork. The digital worksheet displays structured instructions for students to analyze, interpret, and create artwork based on famous artistic styles.



Figure 72: Art's Learning Environment





The image shows a YouTube video player on the left and a digital worksheet on the right. The video player has a title in Thai: "เทคนิควิธีการ ในการสร้างผลงานทัศนศิลป์ของศิลปิน" (Techniques for creating art works of artists) and a large number "2". The worksheet is titled "คำสั่ง" (Instructions) and contains a list of tasks for students to follow, such as creating art from a photograph and using Google Slides. Below the worksheet is a button labeled "Digital worksheet".

Figure 73: Art's Learning Material and Digital Worksheet

Figure 74 showcases students' performance and their creative outcomes as a direct result of guided instructions from the digital worksheet. Following these instructions, students explored various art styles and conceptual approaches, leading to the diverse artistic outputs.

The image displays three examples of student art. The first shows two blue vases with green plants on a red background. The second shows a still life with a blue pitcher and fruit. The third shows several line drawings of faces in profile. Each example has a caption in Thai describing the student's work and the techniques used.

Figure 74: Art's Student Performance

### 16. Guidance - Grade 11

The Guidance course for grade 11 proposed a collaborative learning framework using the Jigsaw Technique with Think-Pair-Share which is designed to enhance student engagement, knowledge sharing, and cooperative problem-solving. As shown in Figure 75, This approach follows a structured four-step learning process:

- 1. Building Understanding** - The goal is to ensure students understand core concepts before engaging in collaborative activities.
- 2. Study Phase** - Each student focuses on a specific part of the topic, becoming an expert in that section. This phase promotes inquiry, critical thinking, and deep learning.





**3. Summarization** - Students return to their original groups and teach their assigned sections to peers. Discussions allow students to connect ideas, compare perspectives, and refine understanding.

**4. Evaluation** - The final stage includes self-assessment, peer feedback, and instructor evaluation. AI-assisted tools and Google Workspace facilitate real-time feedback and digital collaboration.

By integrating Jigsaw Technique with Think-Pair-Share, this approach enhances teamwork, deepens understanding, and fosters independent learning, ensuring that students actively construct knowledge rather than passively receive information.

**Guidance** การจัดการเรียนรู้แบบร่วมมือด้วยเทคนิคจิ๊กซอว์ ร่วมกับเทคนิคเพื่อนคู่คิด (Jigsaw technique with Think Pair Share)

**Learning Strategies**

Google Workspace for Education

Google Meet, Google Docs, Google Slides, Google Classroom

**Study Module**

หน่วยการเรียนรู้ที่ 1

- 1. สารสำคัญ
- 2. จุดประสงค์การเรียนรู้
- 3. 1. ขั้นตอนผู้เรียนเข้ากลุ่มและทำความเข้าใจ
- 4. 2. ขั้นสมาชิกในกลุ่มบ้านของเรา
- 5. 3. ขั้นสมาชิกกลุ่มผู้เชี่ยวชาญ
- 6. 3.1 สมาชิกกลุ่มผู้เชี่ยวชาญ
- 7. 4. ขั้นผู้เรียนทุกคนทำแบบทดสอบ

**Figure 75:** Guidance’s Best Practice

As depicted in Figure 76, The Jigsaw Technique with Think-Pair-Share approach helps foster an active learning and engaging environment in the classroom where students take ownership of their learning, collaborate effectively with peers, develop critical thinking skills, and deepen their understanding through structured discussion and knowledge-sharing

The learning materials and a digital worksheet were designed to help students understand the TCAS 67-68 university admission system. The featured YouTube video (Figure 77, left panel) provides a detailed explanation of TCAS (Thai University Central Admission System). This video serves as an informative resource to guide students through the university application process whereas the digital worksheet, was designed to encourage students to reflect on their university plans, identify suitable TCAS rounds, and evaluate their readiness for higher education.

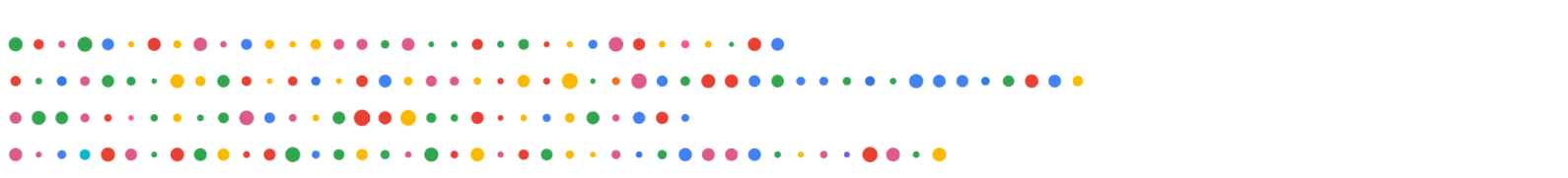
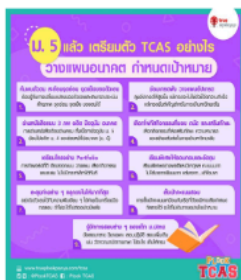




Figure 76: Guidance's Learning Environment



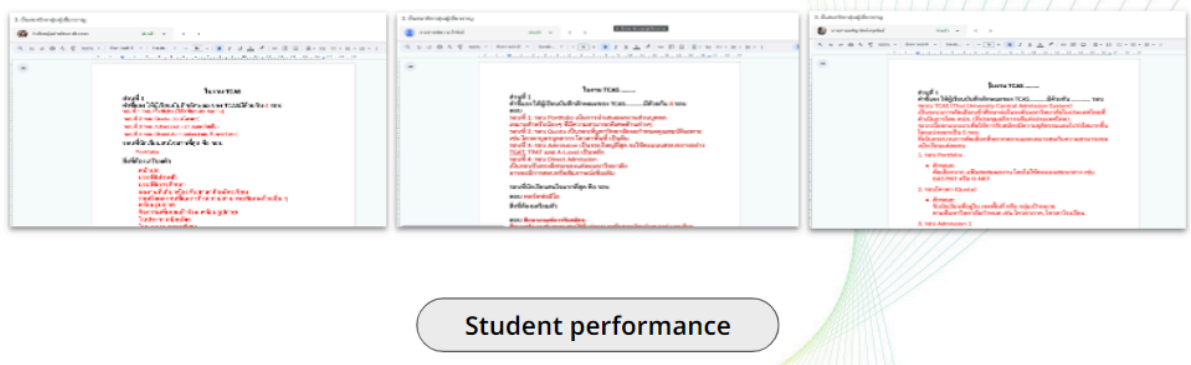
Learning material

Digital worksheet

Figure 77: Guidance's Learning Material and Digital Worksheet

As a result from the assigned worksheet, figure 78 displayed documents containing structured responses, where students have reflected on their university admission options, analyzed different TCAS rounds, and evaluated their own readiness for higher education. The use of red text formatting suggests teacher feedback, revisions, or highlighted key points, indicating an iterative learning process. These student responses demonstrate critical thinking, goal setting, and personalized academic planning, as students engage with research-based decision-making and self-assessment.

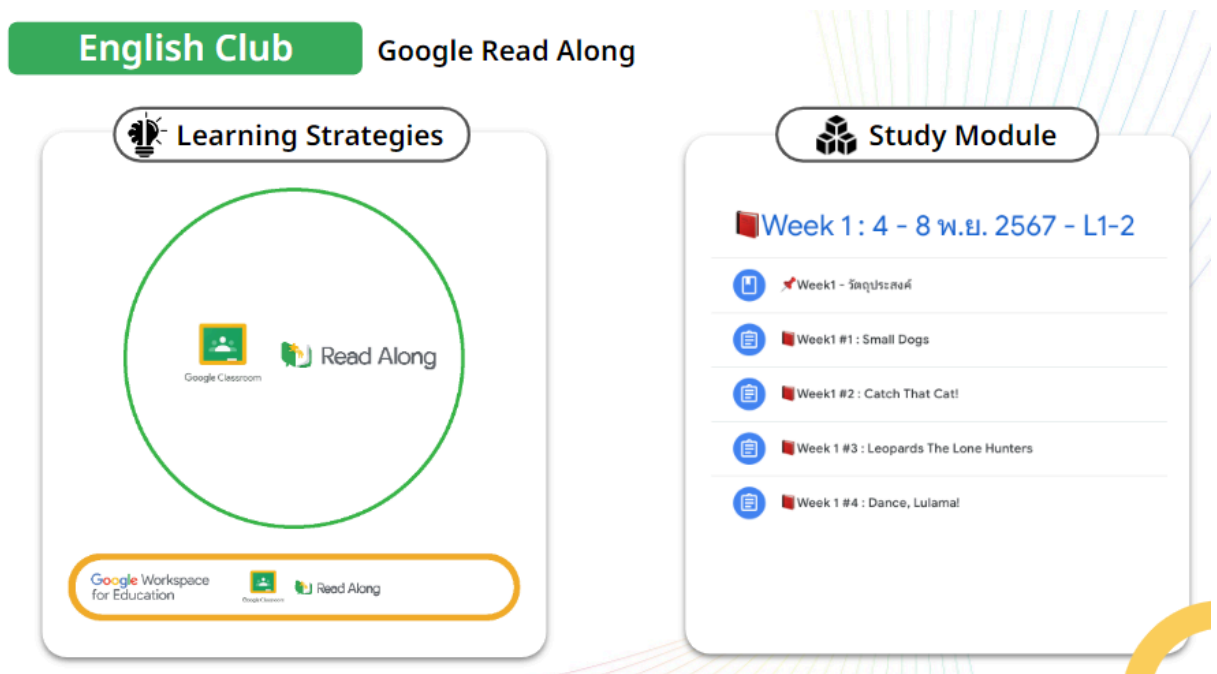




**Figure 78:** Guidance’s Student Performance

### 17. English Club

The English Club's learning strategy highlights the importance of technology in fostering effective and engaging literacy practices, ensuring that students enhance their reading skills through personalized and interactive learning experiences. The course then focused on improving reading comprehension and accuracy by providing real-time feedback, pronunciation correction, and engaging learning environments using technology-enhanced learning. The instructor utilized the Read Along app and Google Classroom (figure 79) to integrate interactive reading activities and collaborative discussions, which encouraged active participation, critical thinking, and sustained reading development.



**Figure 79:** English’s Club Best Practice

Figure 80 depicts students actively engaged in a digital learning session, where they follow along with a teacher-led lesson displayed on a screen and

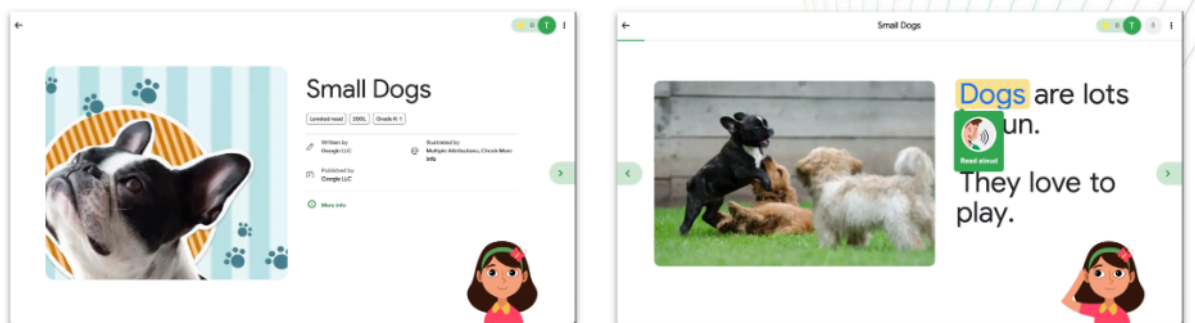


participate in small group learning with interactive reading activities on Chromebooks, fostering collaboration and engagement.

The Learning Materials from Read Along app interface within Google Classroom shown in Figure 81, provides interactive reading exercises with visual and auditory feedback. The app supports reading fluency, comprehension, and pronunciation improvement.



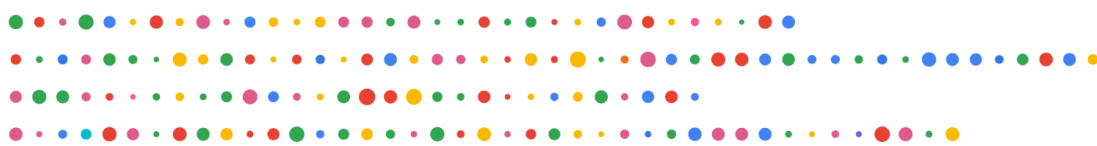
Figure 80: English Club's Learning Environment

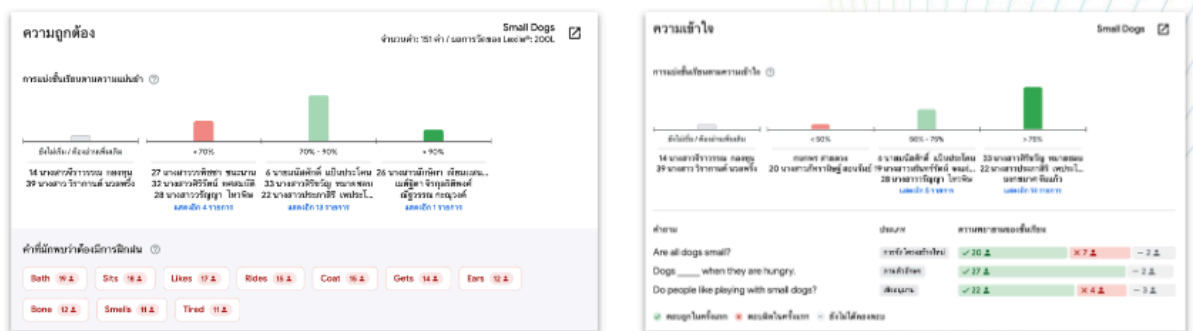


Learning material

Figure 81: English Club's Learning Material

Figure 82 presents student performance data from the Read Along app, analyzing reading accuracy and comprehension, displaying word recognition proficiency and error analysis through a progress bar and categorized vocabulary performance. It highlights words that students struggled with and those successfully recognized, allowing educators to track individual learning needs. This data-driven feedback system enables teachers to monitor reading progress, identify learning gaps, and personalize instruction, ensuring students receive targeted support to improve their reading skills through technology-assisted learning.





Student performance

Figure 82: English Club’s Student Performance

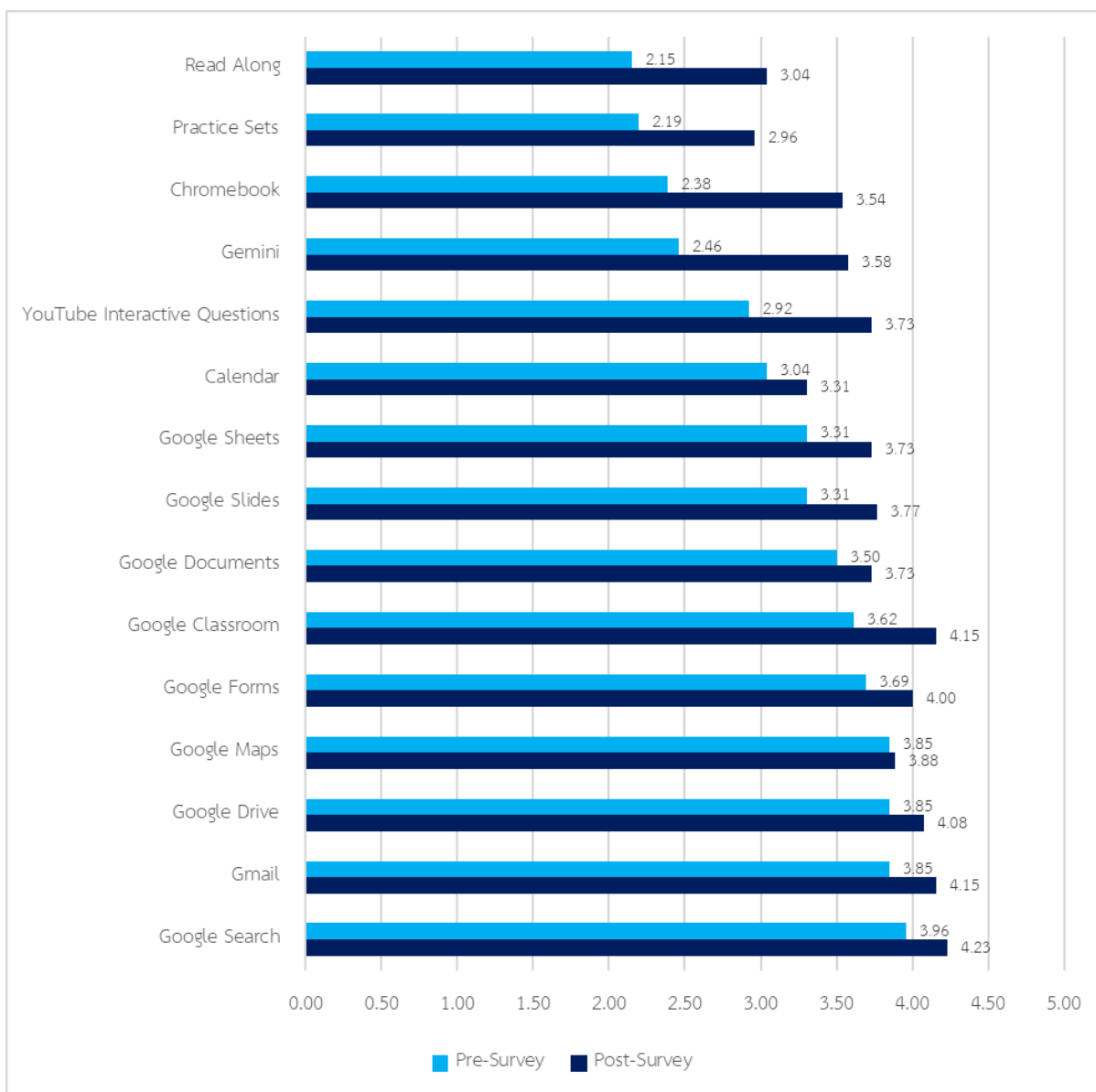
### 7.2 Data analysis

#### Part 1: Questionnaire on the Use of Google Workspace in Organizing Learning Activities to Develop 21st Century Skills of Teachers

##### Section 1: Perspectives and Usage of Technology

From the analysis of the use of Google Solutions (GS) before and after the experiment, overall, there was an increase in the level of comfort in using Google Applications across all applications. Before the experiment, the average score was 3.21 (SD = 0.83), and after the experiment, the average increased to 3.73 (SD = 0.84). The most significant change was in the use of Chromebooks, where usage before the experiment had an average of 2.38 (SD = 0.69), and after the experiment, it rose to 3.54 (SD = 1.08). In addition, it was found that the usage of Gemini by teachers before the experiment had an average of 2.46 (SD = 0.88), and after the experiment, it increased to 3.58 (SD = 0.82), as depicted in Figure 83.





**Figure 83:** Using Google Solutions (GS) before and after the experiment

### **Section 2: Enablers and Obstacles to Technology Adoption**

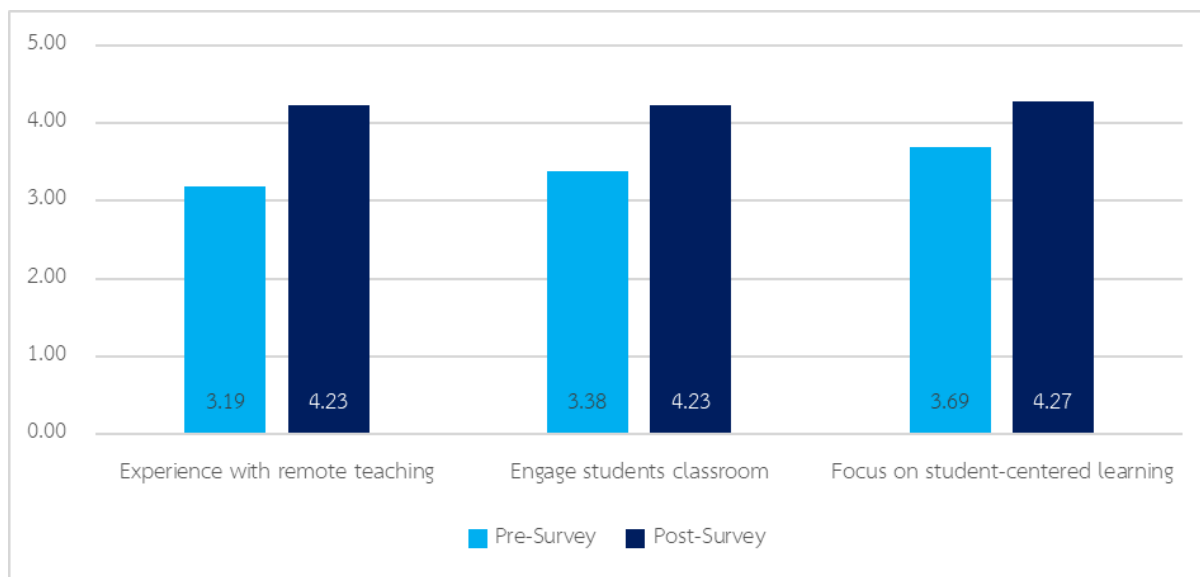
From the analysis of the use of Google Workspace and the acceptance of technology, it was found that overall, teachers showed an increasing trend in accepting technology use for classroom management and instructional development. Regarding teachers' perspectives on distance teaching, it was found that before participating in the experiment, their opinions were at a moderate level (Mean = 3.19, SD = 0.56), and after the experiment, their opinions rose to a good level (Mean = 4.23, SD = 0.58).

Additionally, before joining the project, teachers observed that students participated in class at a generally participative level (Mean = 3.38, SD = 0.62), and after the experiment, student participation increased to a high level (Mean = 4.23, SD = 0.58). Moreover, before the project, teachers conducted learner-centered instruction at a moderate level (Mean = 3.69, SD = 0.61), and after joining the





project, learner-centered teaching improved to a good level (Mean = 4.27, SD = 0.59). Figure 84 illustrates the differences between the pre-post survey results.

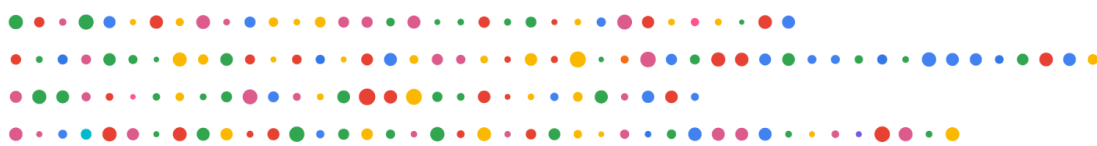


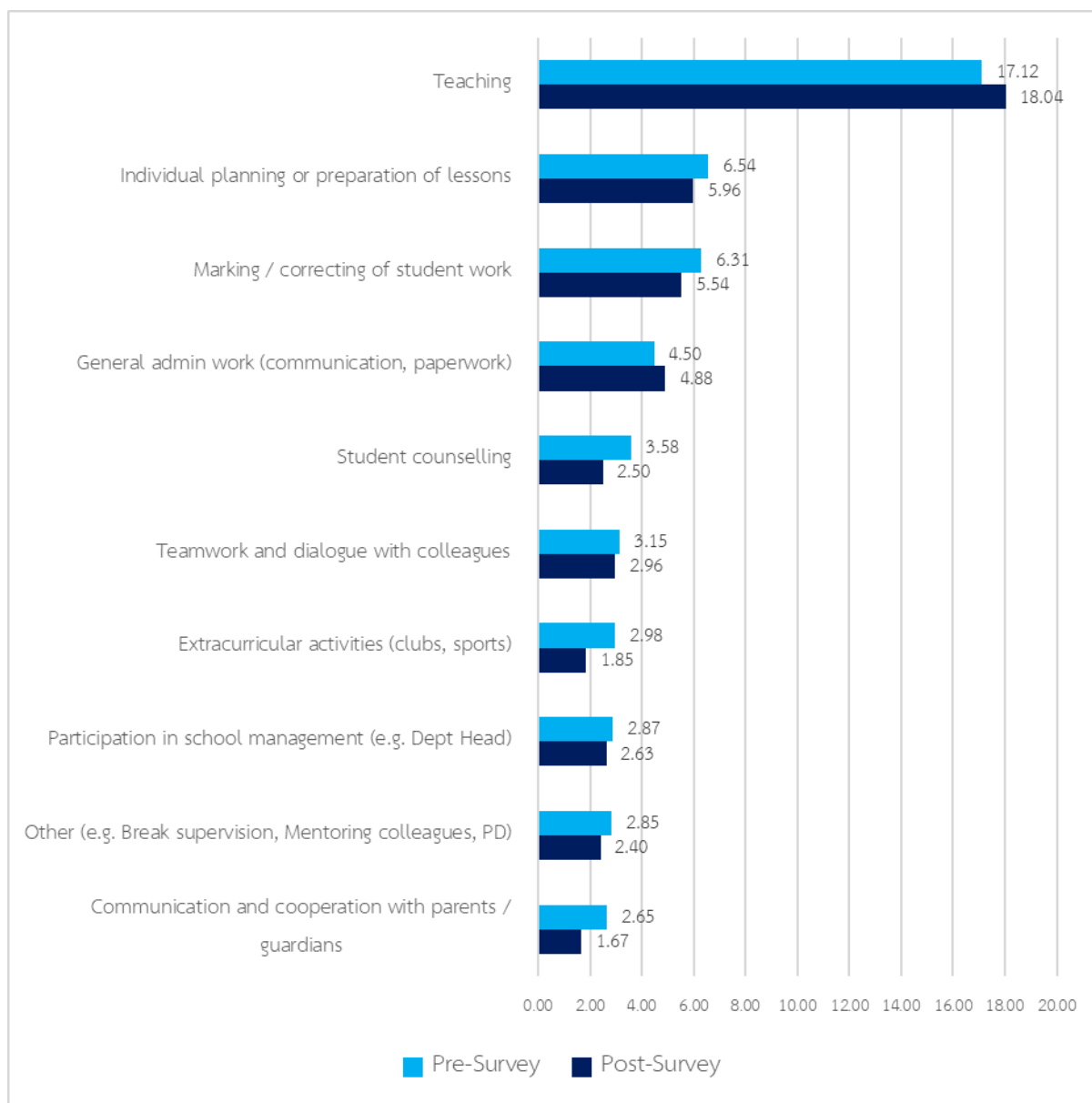
**Figure 84:** Enablers and obstacles to technology adoption

### **Section 3: Baseline Indicators to Measure Impact on Teaching and Learning**

An analysis of the impact on teachers' work before and after participating in the experiment revealed that Google Workspace significantly supported teachers in managing their teaching duties and enhancing instructional effectiveness. Prior to the experiment, teachers reported spending an average of 17.12 hours per week on teaching tasks. Following the experiment, this average increased to 18.04 hours per week, indicating a positive shift in instructional engagement.

Interestingly, the time spent on extracurricular activities, such as clubs and sports, decreased. Before the experiment, teachers spent an average of 2.98 hours per week on such activities, but this figure dropped to 1.85 hours afterward. A similar trend was observed in student counseling, where the average time commitment was reduced from 3.58 to 2.50 hours per week. Additionally, communication and collaboration with parents or guardians also saw a decline in time spent, decreasing from 2.65 to 1.67 hours per week after the experiment.





**Figure 85:** Baseline indicators to measure impact on teaching and learning

**Section 4: Likelihood of Recommending Workspace and Chromebooks:**

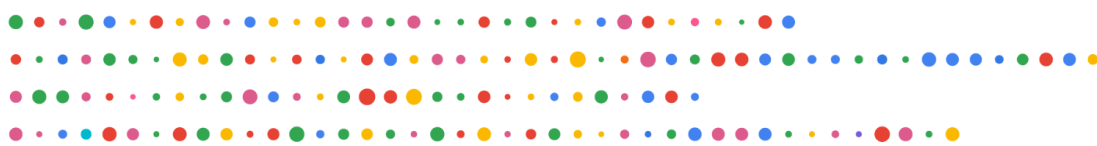
Overall, Google Solutions (GS) helped teachers save time on key professional activities following the experimental phase. According to the analysis, 46.15% of teachers reported significant time savings, with more than 5 hours saved per week. Another 38.46% indicated moderate time savings of 1 to 5 hours per week, while 11.54% experienced minor time savings of less than 1 hour per week. Only 3.85% of participants stated that there was no impact on their working time.

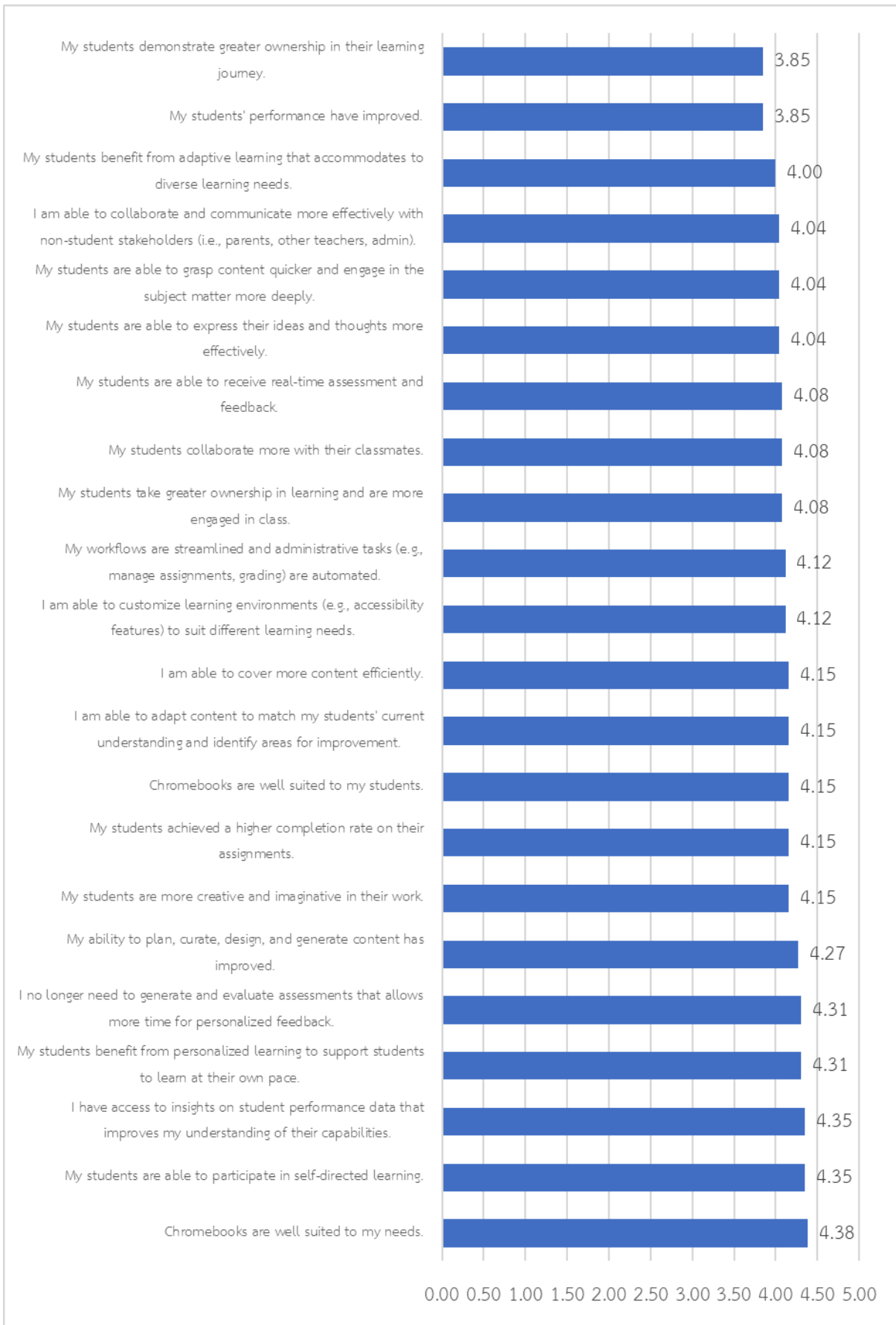
Moreover, when comparing the experiences of both students and teachers before and during the trial, the majority of teachers agreed that Chromebooks were well-suited to their educational needs, reflected in a high agreement level (Mean = 4.38). Teachers also observed that their students became more capable of learning independently. In addition, teachers gained better access to learning analytics and





performance data, which allowed them to better understand each student's potential—this perception also received a strong level of agreement (Mean = 4.35). Furthermore, teachers noted that their students benefited from more personalized learning experiences, enabling them to learn in ways that suited their individual needs. This, too, was positively received, with an average agreement score of 4.31.





**Figure 86:** The average score of Google Solutions (GS) usage after the project



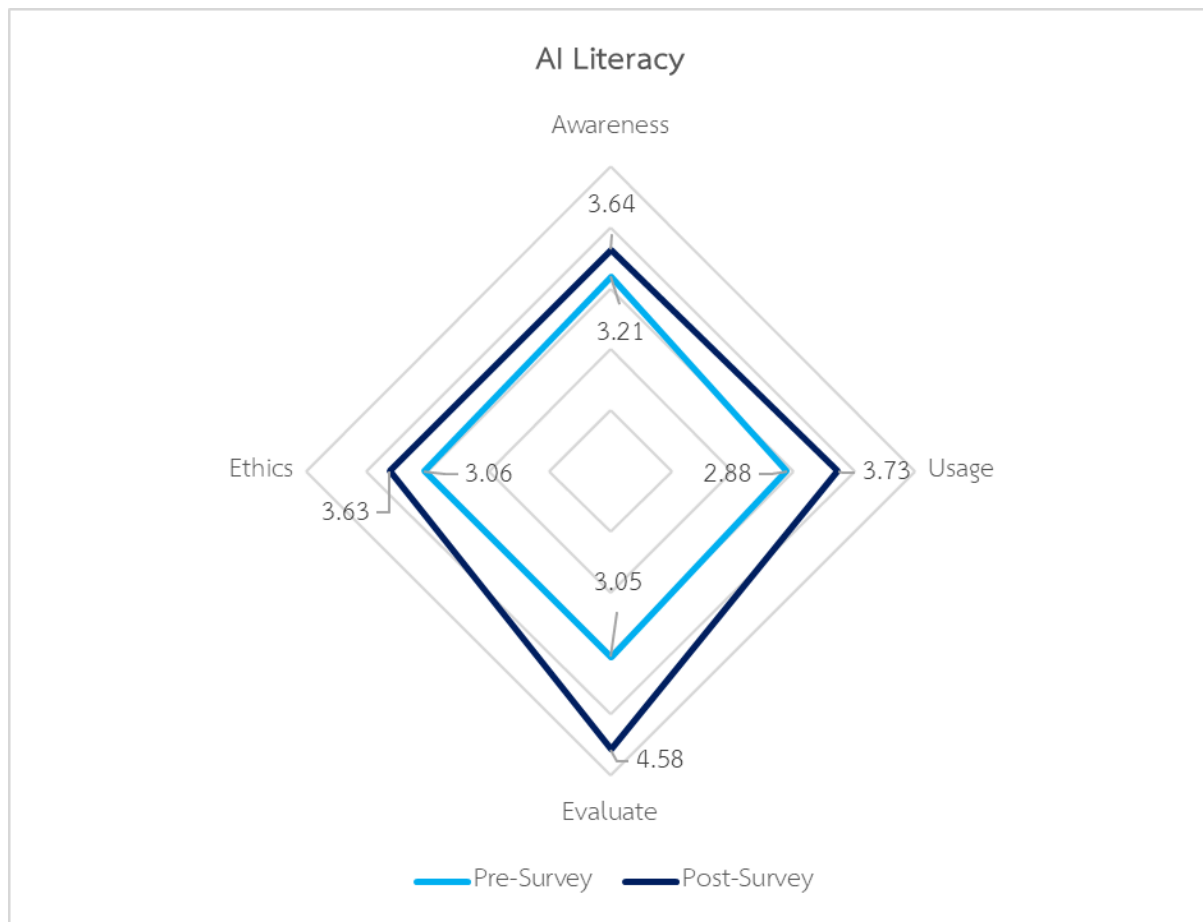


### Section 5: AI Literacy:

An analysis of teachers' AI literacy before and after participating in the experiment revealed a marked improvement. Before the experiment, the average AI literacy score among teachers was 3.05 (SD = 0.16). After the experiment, this average increased significantly to 3.89 (SD = 0.13), reflecting a positive shift in understanding and engagement with artificial intelligence.

When breaking down the analysis by specific components of AI literacy, it was evident that all components showed improvement post-experiment. For the Awareness component, the average score increased from 3.21 (SD = 0.02) to 3.64 (SD = 0.08). In terms of Usage, the average rose from 2.88 (SD = 0.13) to 3.73 (SD = 0.17), indicating greater comfort and familiarity with AI tools in practical contexts.

The most significant improvement was observed in the Evaluate component, where the average score jumped from 3.05 (SD = 0.07) to an impressive 4.58 (SD = 0.05), suggesting that teachers became considerably more capable of critically assessing AI tools and their outputs. Lastly, in the Ethics component, which involves understanding the ethical implications of AI usage, the average score rose from 3.06 (SD = 0.42) to 3.63 (SD = 0.23), demonstrating a stronger awareness of responsible AI use. These results suggest that the intervention not only increased functional AI competencies but also enhanced teachers' ethical understanding and evaluative abilities in the AI context.





**Figure 87:** Average scores of AI Literacy components among teachers before and after the experiment

### **Section 6: AI Impact on Students:**

The study asked teachers to reflect on several key statements:

- 1. Whether they believed AI could handle repetitive, simple questions, allowing them to focus on more meaningful communication with students:** Before the experiment, 24 teachers agreed with this idea while 2 did not. After the experiment, all 26 teachers supported this statement, reflecting a clear consensus that AI could enhance classroom efficiency.
- 2. Whether teachers felt they could predict conflicts in teaching arising from misunderstandings about AI or misleading information:** Prior to the experiment, 19 teachers agreed and 7 disagreed. After the experiment, agreement increased to 25 teachers, with only 1 disagreeing—indicating a growing awareness of potential instructional challenges involving AI.
- 3. Whether AI could be effectively used to provide timely, personalized support to students:** Before the experiment, 22 teachers believed so, while 4 did not. Following the experiment, 25 teachers expressed belief in this capacity of AI, with only 1 dissenting.
- 4. Whether teachers were concerned that excessive reliance on AI might hinder students' ability to explore and discover on their own:** Before the trial, 22 teachers were not concerned, and 4 were. Afterward, the number of unconcerned teachers increased to 25, with only 1 expressing concern—implying that most saw AI as a supportive, not obstructive, tool in student development.
- 5. Whether teachers believed that integrating AI would help them become more aware of students' individual needs:** Initially, 16 teachers agreed and 10 disagreed. Post-experiment, support for this view rose slightly, with 18 agreeing and 8 disagreeing. While the increase was modest, it suggests a gradual shift toward recognizing AI's potential in enhancing personalized teaching.
- 6. Whether teachers were concerned about using AI to interpret students' social interactions:** Before the experiment, 11 teachers expressed no concern, while 15 were worried. Afterward, 12 teachers remained unconcerned, but 14 still expressed reservations—indicating that concerns about AI's role in social-emotional interpretation remained somewhat steady.





In summary, the data show, as depicted in Figure 88, an overall positive shift in teacher perception of AI’s usefulness in supporting instruction and personalizing student learning, although some caution remains—especially regarding its impact on social interaction and discovery-based learning.

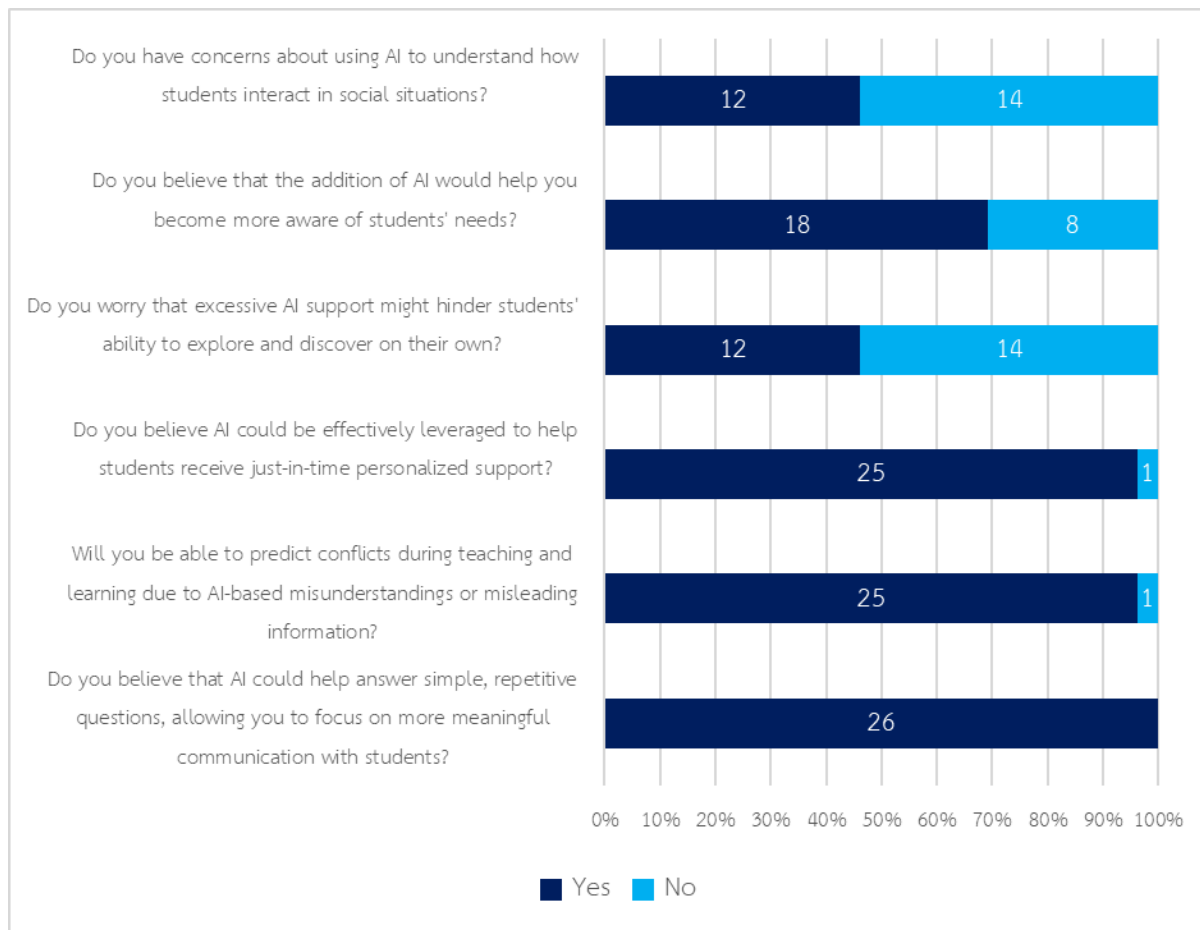


Figure 88: Teachers’ Perspective towards AI Impact on Student [Pre-Survey]

### Section 7: Growth Mindset:

An analysis of the growth mindset of 27 teachers, comparing data from before and after the experimental phase, revealed a slight overall increase. The average score before the experiment was 4.36 (SD = 0.76), which rose to 4.45 (SD = 0.72) afterward, indicating a generally positive shift in teachers' mindset toward personal and professional development. When broken down into specific components of the growth mindset, varying patterns emerged:

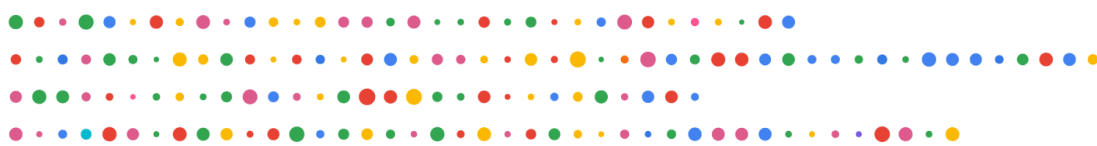
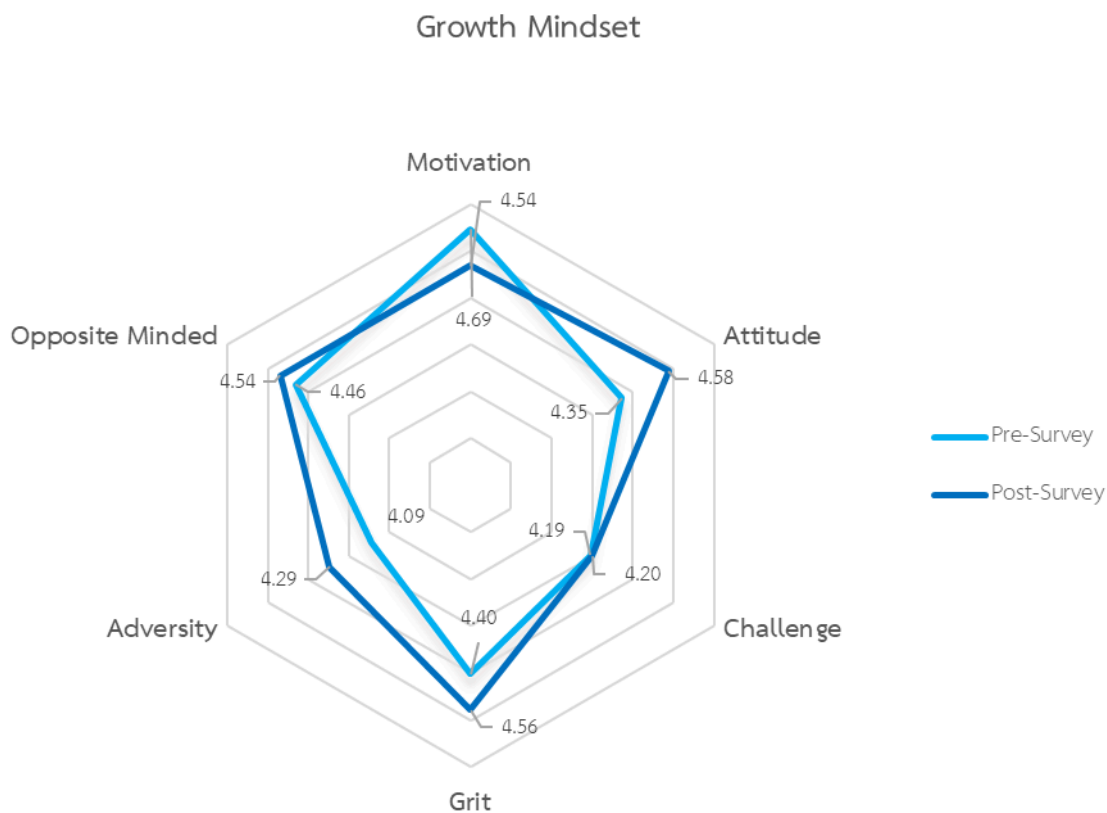
- For the **Motivation** component, interestingly, there was a slight decrease—from an average of 4.69 (SD = 0.54) before the experiment to 4.45 (SD = 0.63) after it. This may suggest a shift in perception or recalibration of expectations once engaged with new tools and challenges.





- In contrast, the **Attitude** component showed improvement, with the average score increasing from 4.35 (SD = 0.73) to 4.58 (SD = 0.62), reflecting enhanced openness and positivity toward change and learning.
- The **Challenge** component remained relatively stable, with only a slight rise from 4.19 (SD = 0.86) to 4.20 (SD = 0.82), indicating consistent comfort in facing new or difficult tasks.
- The **Grit** component—representing perseverance and passion for long-term goals—saw a meaningful increase, with the average score moving from 4.40 (SD = 0.68) to 4.56 (SD = 0.57), highlighting teachers' growing resilience and commitment.
- For **Adversity**, the score rose from 4.09 (SD = 0.85) to 4.29 (SD = 0.81), indicating an increased ability to bounce back from setbacks.
- Lastly, the **Opposite-Minded** component, which reflects flexibility in considering different viewpoints, also improved—from 4.46 (SD = 0.79) to 4.54 (SD = 0.77), suggesting more openness to new ideas and diverse thinking.

As seen in Figure 89, these results show that while overall growth mindset scores improved modestly, specific strengths such as grit, attitude, and adaptability to adversity experienced clearer gains, underscoring the positive influence of the intervention on teachers' personal growth and mental flexibility.





**Figure 89:** Average scores of each Growth Mindset component among teachers before and after the experiment

**Section 8: Teachers’ Opinions Towards This Experiment:**

Following the conclusion of the experiment, a post-experiment survey was conducted. Many teachers have expressed increasingly positive attitudes toward the integration of technology in teaching and learning. They recognized the value of using technology not only to support their own instructional practices but also to enhance student learning outcomes, particularly in fostering essential 21st-century skills.

Teachers felt that technology helped them save time in lesson planning, allowing for more efficient preparation and delivery. It also opened up opportunities to explore innovative teaching models, encouraging creativity and flexibility in adapting instructional methods to suit various learning needs.

Furthermore, teachers noted that the use of technology provided avenues for more creative and purposeful work, and enabled both teachers and students to engage more actively in the educational process. The experiment was seen not only as a technological intervention but as a catalyst for meaningful pedagogical transformation.

Additional teacher feedback included individual reflections on how the tools impacted their professional practice:

*“Students have skills in using technology and it is the foundation for developing thinking skills, problem-solving skills, and communication skills. Learners can apply knowledge to solve problems in everyday life. From the observation of teachers who observed the sample group of Mathayom 4 students, they have skills in using communication tools and Chromebook fluently and need to use them as tools that learners cannot do without in order to achieve learning objectives set by teachers and learners.”*

Opinion of Teacher 1

*“The use of IT in teaching helps expand learning but requires time for preparation and development of teaching appropriate to students and can reduce the preparation time when developed.”*

Opinion of Teacher 2

*“From the experimental results in teaching management, it resulted in higher academic achievement of students and*





*students had better quality in learning and gaining knowledge, it was convenient and timesaving, and they could carry out various activities retrospectively.*

Opinion of Teacher 3

*“Because there is a management system between Chromebook that is easy to use, convenient, fast to meet the needs of searching, working, planning the use by experts in using it, training teachers to have skills in using and using application programs that meet the needs of teachers, introducing teaching techniques that will be used to organize learning that focuses on learners, having Active Learning activities, teachers playing a role in positively reinforcing learners to stimulate learning, integrating AI to search and practice analytical thinking, distinguishing, summarizing important points before learners decide to do it step by step, having regular supervision, following up, and consulting with teachers, making teachers' activities continuous according to the set objectives.”*

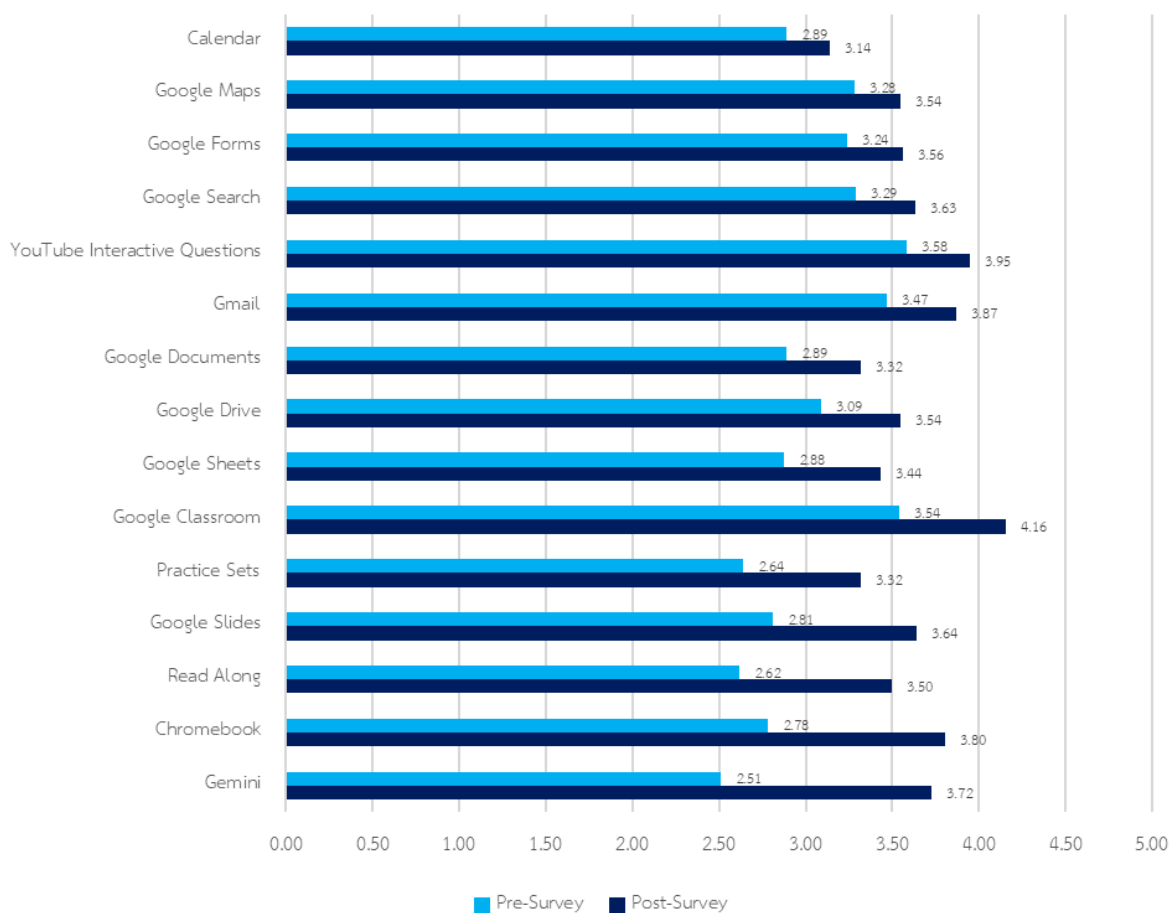
Opinion of Teacher 4

*“Using Chromebook makes teaching management faster and easier for teachers and creating projects more efficiently.”*

Opinion of Teacher 5





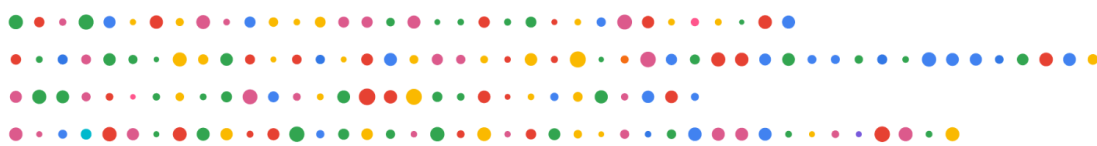


**Figure 91:** Students' usage of Google Solutions (GS) before and after the experiment

### **Section 2: Students' Classroom Experiences with the Use of Google Workspace**

**Figure 92** illustrates students' perceptions across various dimensions related to their academic growth, collaboration, creativity, and adaptability through the use of Google Workspace in their classrooms. The chart reveals valuable insights into students' experiences with Chromebooks and adaptive learning tools in the classroom. The statement "Chromebooks are well suited to my needs" received an average score of 3.70, indicating a moderately positive alignment between students' needs and the devices provided. A slightly higher score of 3.71 was observed for "I feel a greater sense of ownership in my learning journey," suggesting that the integration of technology has fostered greater personal responsibility among students. Progress in academic engagement is evident, with statements such as "I am able to grasp content quicker and engage in the learning" and "I achieved a higher completion rate on my assignments" both scoring around 3.73 and 3.74, respectively, demonstrating steady improvement in learning effectiveness.

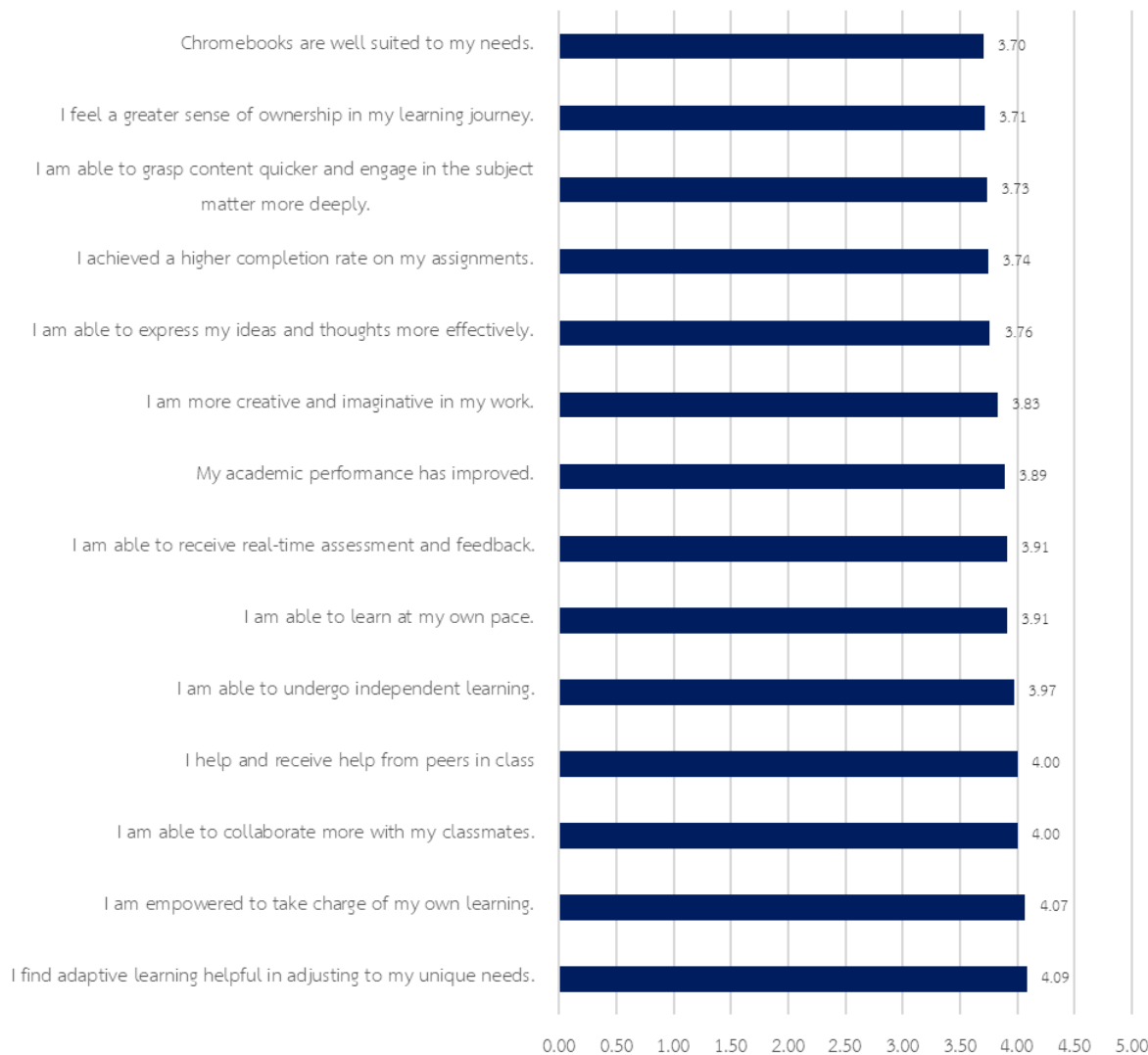
Further reflecting the development of essential skills, students rated their ability to "express ideas and thoughts more effectively" at 3.76, while a higher score





of 3.83 for "I am more creative and imaginative in my work" highlights technology's role in fostering creativity. Academic outcomes appear positively influenced, as shown by a 3.89 rating for "My academic performance has improved." Indicators of adaptability, such as receiving real-time assessment and learning at an individualized pace, each achieved strong ratings of 3.91, emphasizing the importance of flexible, student-centered learning approaches.

Independent learning was even more positively rated, with a notable score of 3.97, showing students feel increasingly capable of self-directed study. Collaboration and peer support, critical components of 21st-century skills, were both highly rated at 4.00, suggesting that technology also enhances social and cooperative learning experiences. Empowerment in learning emerged as a significant theme, with "I am empowered to take charge of my own learning" receiving a score of 4.07. The highest-rated statement, "I find adaptive learning helpful in adjusting to my unique learning needs," with an average of 4.09, underscores the strong endorsement of personalized learning tools among students.

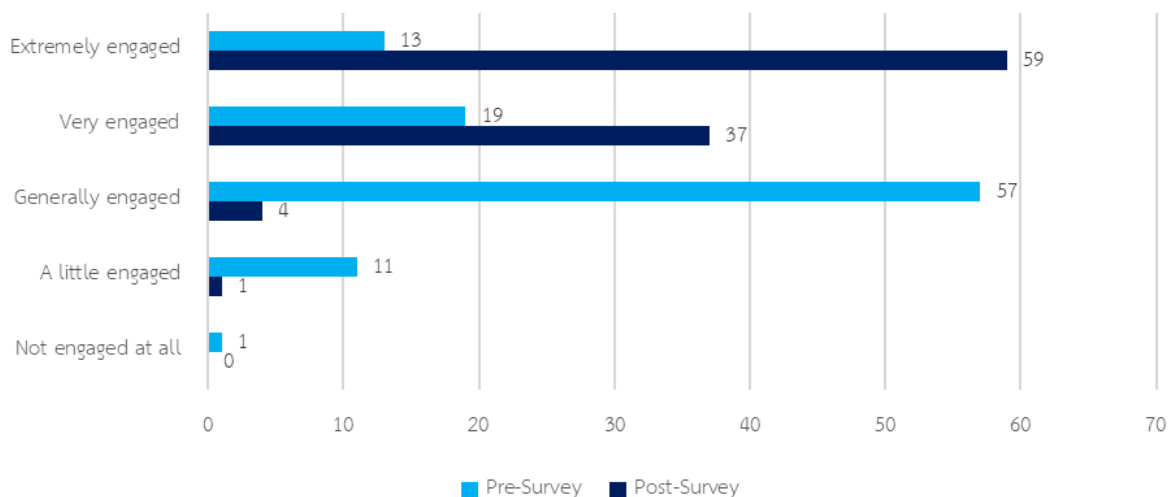


**Figure 92:** Students' Classroom Experiences with the Use of Google Workspace



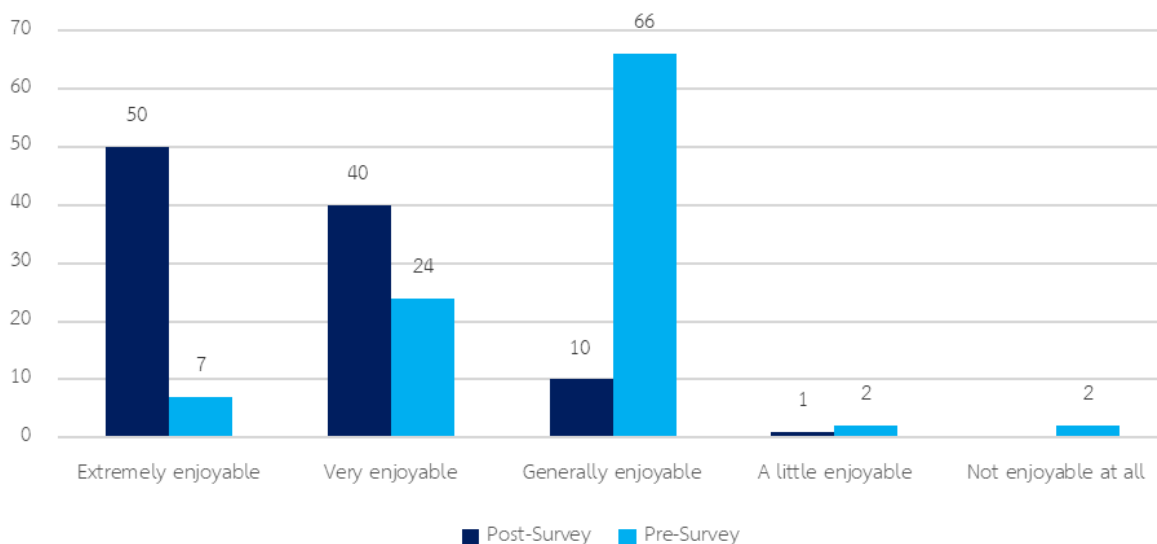


Furthermore, after the experiment, students reported feeling more engaged in the classroom. There was a significant increase in the level of student participation—prior to the experiment, only 13 students (12.87%) indicated a high level of classroom engagement. After the experiment, this number rose substantially to 59 students (58.42%).



**Figure 93:** Students' level of engagement in class during pilot

In terms of students' remote learning experience, the findings showed a notable improvement in their overall enjoyment of learning. Before participating in the experiment, only 7 students (6.93%) reported feeling that learning was enjoyable. After the experiment, this number increased significantly, with 50 students (49.50%) expressing that they found learning more enjoyable.



**Figure 94:** Changes of Level of Enjoyment before and during pilot



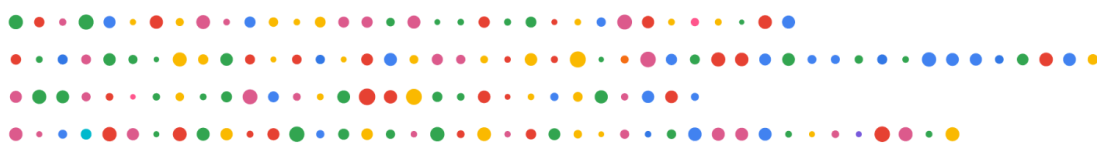
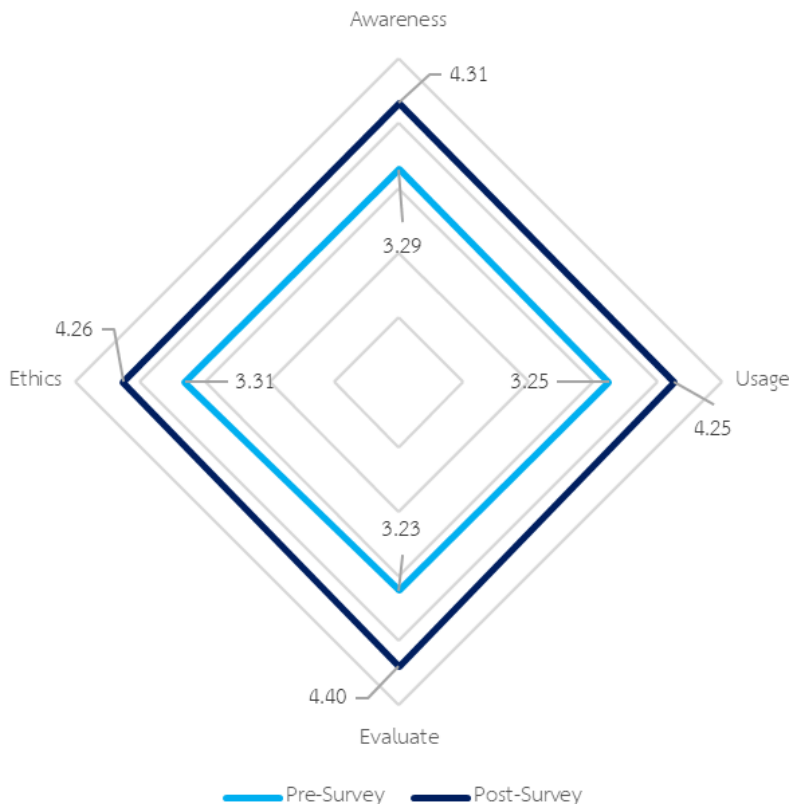


### Section 3: AI Literacy

An analysis of students' AI literacy before and after participating in the experiment revealed a significant improvement. Prior to the experiment, students had an average AI literacy score of 3.27. After the intervention, this average rose markedly to 4.30 (SD = 0.06), reflecting stronger awareness, understanding, and confidence in using artificial intelligence.

When broken down into individual components of AI literacy, the analysis showed improvements in every aspect after the experiment, as depicted in Figure 95:

- The Awareness component increased from an average of 3.29 (SD = 0.92) to 4.31 (SD = 0.66), indicating students became more familiar with AI and its presence in daily life.
- The Usage component rose from 3.25 (SD = 0.98) to 4.25 (SD = 0.66), suggesting students became more comfortable applying AI tools in practical scenarios.
- For the Evaluate component, which involves critical thinking and assessing AI outputs, scores improved from 3.23 (SD = 0.84) to 4.40 (SD = 0.60)—the highest increase among all components.
- The Ethics component, reflecting awareness of AI's ethical implications, also showed a notable rise from 3.31 (SD = 0.95) to 4.26 (SD = 0.71).





**Figure 95:** Average scores of each AI Literacy component among students before and after the experiment

#### **Section 4: AI Impact on Student–Teacher Interaction**

An analysis of students’ perspectives before and after the experiment regarding the impact of artificial intelligence (AI) on their interactions with teachers revealed several insightful trends:

**1. AI helps reduce anxiety and encourages students to ask more questions.**

Before the experiment, 82 students (81.19%) agreed with this statement, while 19 students (18.81%) disagreed. After the intervention, belief in this benefit increased slightly, with 85 students (84.16%) agreeing and only 16 students (15.84%) expressing doubt.

**2. AI may provide unreliable answers and negatively affect students’ grades.**

Prior to the experiment, 64 students (63.37%) agreed with this concern, and 37 students (36.63%) disagreed. After the experiment, agreement increased modestly to 66 students (65.35%), with disagreement decreasing to 35 students (34.65%)—indicating that concerns over AI accuracy persisted even after exposure.

**3. AI supports personalized learning experiences, especially in individual and group project work.**

Before the experiment, 89 students (88.12%) believed in AI’s support in this area, and 12 students (11.88%) did not. Post-experiment, belief in AI’s role grew stronger, with 93 students (92.08%) agreeing and only 8 students (7.92%) remaining skeptical.

**4. AI might negatively affect students’ ability to learn effectively in groups.**

This concern was held by 43 students (42.57%) before the experiment, while 58 students (57.43%) were not worried. After the experiment, worry decreased to 36 students (35.64%), and 65 students (64.36%) expressed no concern—indicating a more positive view of AI’s role in group learning.

**5. AI can address privacy concerns and still support student–teacher connections by interpreting social cues without needing personal camera data.**

Before the experiment, 72 students (71.29%) agreed with this idea, and 29 students (28.71%) disagreed. After the experiment, belief in this capability slightly decreased, with 68 students (67.33%) agreeing and 33 students (32.67%) disagreeing—suggesting a slight increase in privacy-related skepticism.

**6. Students are concerned about AI monitoring subconscious behavior.**

Prior to the experiment, 60 students (59.41%) expressed concern, while 41 students (40.59%) did not. After the experiment, concern slightly declined to





56 students (55.45%), while 45 students (44.55%) stated they were not worried—indicating a subtle shift toward reduced anxiety about this issue.

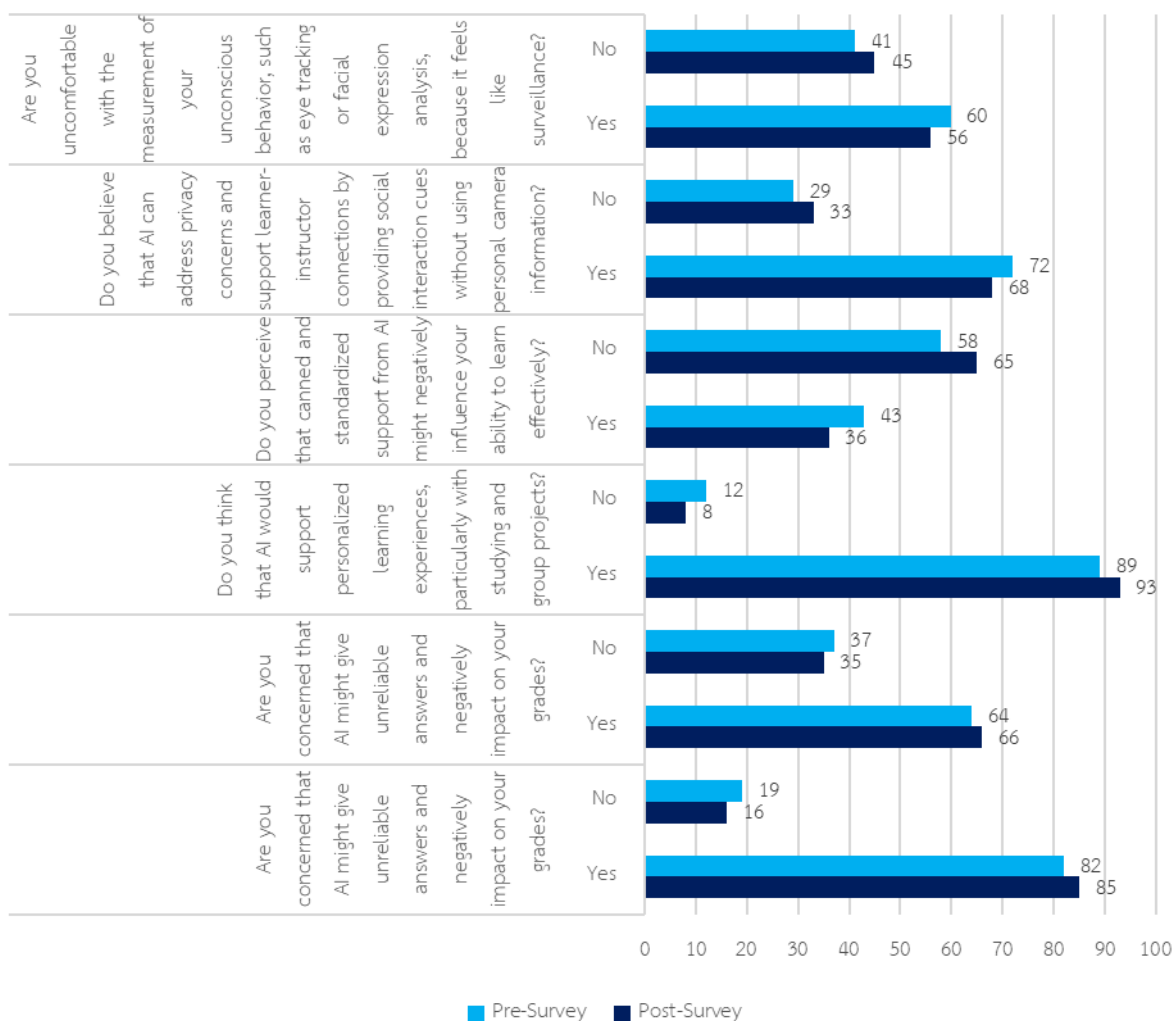


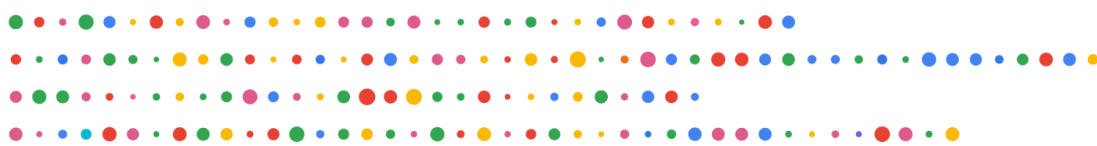
Figure 96: AI Impact on Student - Teacher Interaction

### Section 5: Happiness in Learning

The analysis of students' happiness in learning before and after the experimental period showed a noticeable improvement. Overall, the average happiness score before the experiment was 3.71 (SD = 0.93), which significantly increased to 4.58 (SD = 0.56) afterward, indicating a substantial enhancement in students' emotional engagement with learning.

The most significant change was observed in the aspect of accessing tools and gathering information before the teacher begins each lesson, where the average score rose from 3.51 (SD = 0.91) to 4.28 (SD = 0.69). This suggests that students felt more prepared and equipped to learn, thanks to the technology and resources integrated during the experiment.

Another area showing improvement was students' initiative when assignments were given. Before the experiment, students' average response score was 3.53 (SD



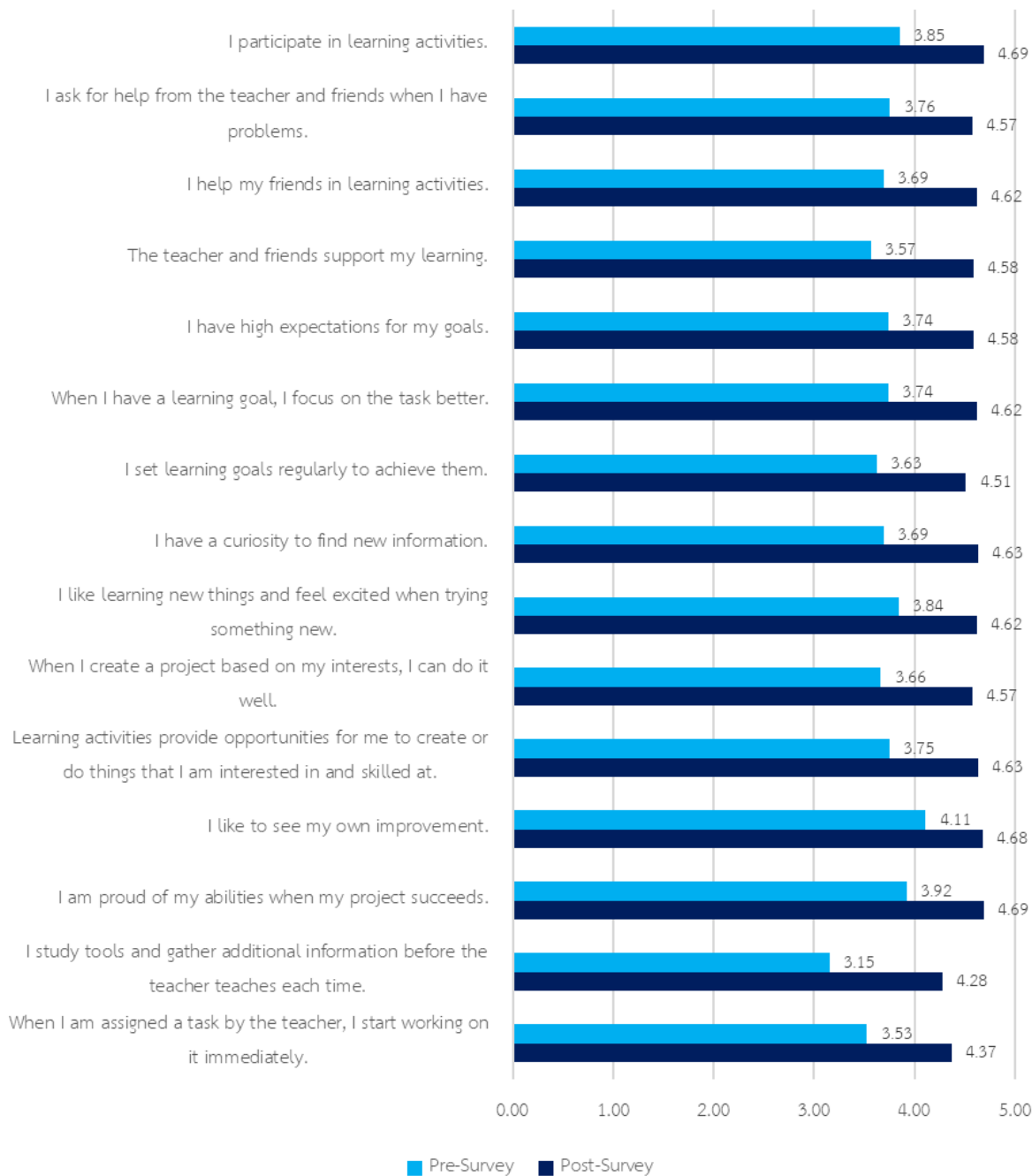


= 0.97), increasing to 4.37 (SD = 0.64) after the experiment, reflecting stronger motivation and readiness to engage with tasks promptly.

Students also reported feeling more confident in creating projects based on their own interests, with the average score rising from 3.66 (SD = 0.88) to 4.57 (SD = 0.60). This indicates that personalized, interest-driven learning was more successfully supported post-intervention.

The highest post-experiment scores were found in two key areas: (1) Students' pride in their abilities when completing successful projects, and (2) Active participation in learning activities. Both saw increases from 3.92 and 3.85 before the experiment to 4.69 (SD = 0.50) and 4.69 (SD = 0.46) respectively after the experiment.



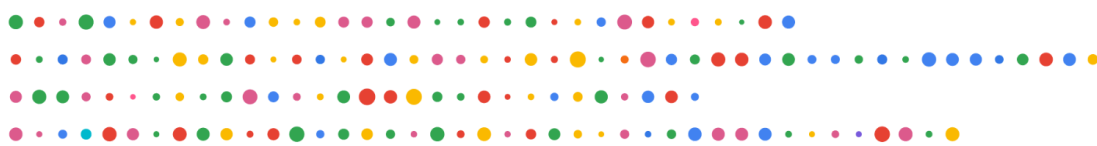


**Figure 97: Happiness in Learning**

**Section 6: Students' Opinion Towards The Experiment**

Following their participation in the experiment, students expressed a positive attitude toward the integration of technology in learning. Many reported feeling more actively involved in the learning process, and also noted that learning became more enjoyable and engaging as a result of the tools and platforms introduced.

Students appreciated the way technology supported their learning, especially in terms of accessibility and flexibility. The tools enabled them to learn anytime and





anywhere, giving them more control over their educational experience and promoting a sense of independence.

In their feedback, students highlighted that the learning environment felt more dynamic and inclusive, and they valued the opportunities to interact, collaborate, and explore topics using digital tools:

*“Before the experiment, learning was usually just listening and taking notes in a notebook. But during the experiment, teachers often used applications to teach, such as quiz games, which made learning more fun and gave them more freedom to learn”*

Opinion of student 1

*“The classroom experience was improved and more engaging during the trial period as new tools and activities increased the fun and engagement in the classroom”*

Opinion of student 2

*“I feel that it is a very good experience. I have learned many things. I can learn anywhere and anytime. It is very convenient to use”*

Opinion of student 3

*“During the trial period, we found that there was a slight increase in the use of tools and resources in the classroom, with better understanding and engagement with various activities”*

Opinion of student 4

*“I use it to do the work that the teacher assigned but I can't do it on my phone, so I use Chromebook to work conveniently and easily”*

Opinion of student 5





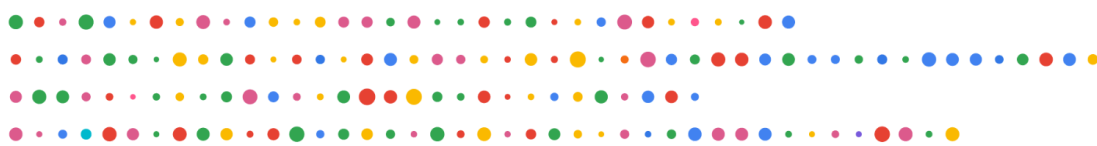
**Figure 98:** Overall of Students' opinion towards this experiment

**Part 3: The Effects of a Speech-Based Reading Tutor Application on Reading Accuracy and Comprehension Among Secondary School Students**

This part of the study aims to evaluate the impact of a speech-based reading instruction application on secondary school students by examining its effects on reading accuracy and comprehension, and comparing their performance before and after using the application. The data analysis was conducted using a t-test to compare the mean scores of the experimental and control groups prior to the implementation of the lessons.

**Section 1: Analysis Results of the Difference in Mean Scores for Accuracy**

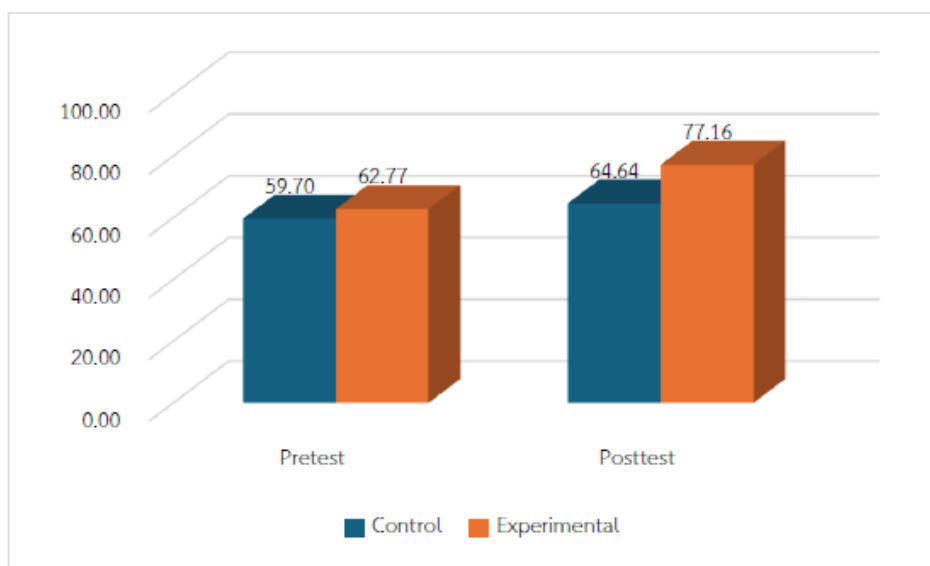
As depicted in Table 1 and Figure 99, the analysis of the difference in mean scores for accuracy between the experimental and control groups revealed that the pre-instruction accuracy scores of both groups were not significantly different at the .05 level (t-test = .602, p = .549). This indicates that both groups had comparable accuracy performance prior to the intervention. However, when examining the post-instruction accuracy scores, a statistically significant difference was found between the control and experimental groups at the .05 level (t-test = 3.487, p = .001), with the experimental group achieving a higher mean score in accuracy (Control group: Mean = 64.64, SD = 17.33; Experimental group: Mean = 77.16, SD = 6.91). This suggests that the treatment used in the study had a positive effect on improving students' reading accuracy.





**Table 1:** Results of the Analysis of Differences in Mean Accuracy Scores

Testing	Group				Levene's test		t-test	p	Result
	Control		Experimental		F	p			
	Mean	SD	Mean	SD					
Pretest	59.70	18.60	62.77	18.85	.294	.590	.602	.549	-
Posttest	64.64	17.33	77.16	6.91	8.515	0.005	3.487	.001	E > C

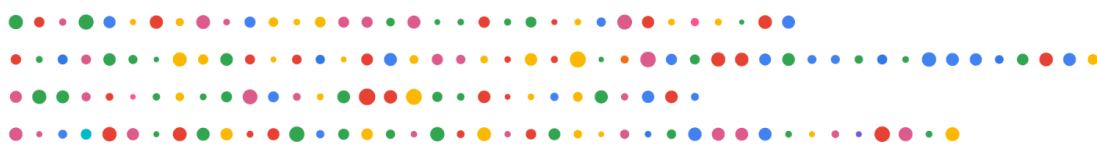


**Figure 99:** Results of the Analysis of Differences in Mean Accuracy Scores

**Section 2: Results of the Analysis of Differences in Mean Comprehension Scores**

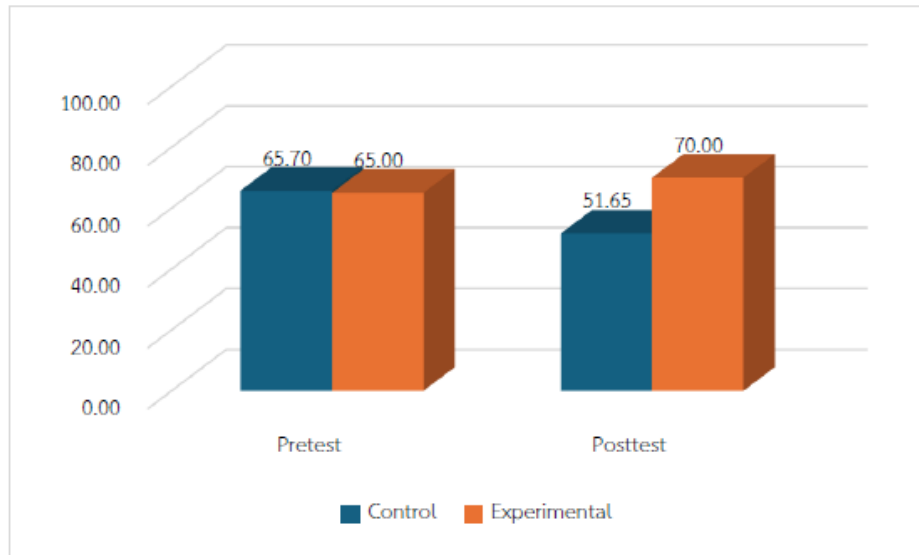
The analysis of the differences in mean comprehension scores between the experimental and control groups showed that, prior to the instruction, there was no statistically significant difference in comprehension scores between the two groups at the .05 level (t-test = .010, p = .912). This indicates that both groups had comparable comprehension abilities before the lessons. However, when examining the post-instruction scores, a statistically significant difference was observed between the groups at the .05 level (t-test = 3.067, p = .003). The experimental group had a higher mean comprehension score than the control group (Control group: Mean = 51.65, SD = 21.24; Experimental group: Mean = 70.00, SD = 22.70), suggesting that the treatment used in the experiment had a positive effect on enhancing students' reading comprehension. Table 2 and Figure 100 exhibited the aforementioned result interpretations.

**Table 2:** Results of the Analysis of Differences in Mean Comprehension Scores





Testing	Group				Levene's test		t-test	p	Result
	Control		Experimental		F	p			
	Mean	SD	Mean	SD					
Pretest	65.70	23.70	65.00	20.80	.186	.668	-.116	.908	-
Posttest	51.65	21.24	70.00	22.70	.010	.912	3.067	.003	E > C



**Figure 100:** Results of the Analysis of Differences in Mean Comprehension Scores

In summary, the analysis of both accuracy and comprehension scores revealed that there were no statistically significant differences between the experimental and control groups before the instruction, indicating similar baseline abilities. However, post-instruction results showed significant improvements in both accuracy and comprehension for the experimental group compared to the control group. Specifically, the experimental group outperformed the control group in accuracy (Mean = 77.16 vs. 64.64; t-test = 3.487, p = .001) and comprehension (Mean = 70.00 vs. 51.65; t-test = 3.067, p = .003), demonstrating that the speech-based reading instruction application had a positive impact on enhancing students' reading skills.

**Part 4: Promoting Positive Behavior and Student Engagement in Inclusive Classrooms: Key Indicators**

Since this report aims to examine the impact of integrating positive behavior practices and investigate how these practices enhance inclusive teaching practices in classrooms, clear indicators have been established to support evidence-based educational strategies. These indicators enable schools to implement more



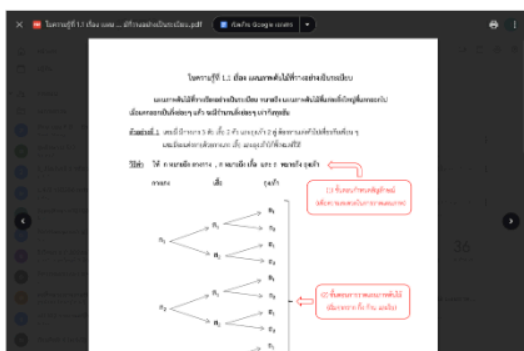


responsive and personalized interventions that effectively meet the varied needs of all learners. When integrated with the Positive Behavior Support (PBS) framework, they provide teachers with a structured, proactive approach that not only fosters academic achievement but also strengthens positive student behavior and emotional well-being.

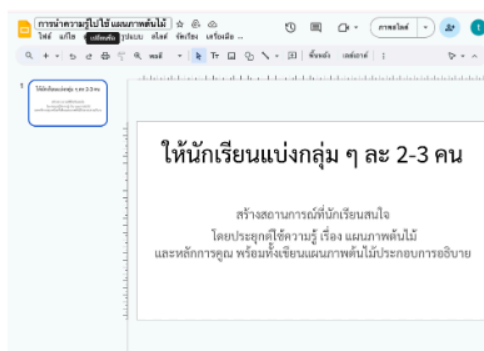
The following results illustrate the effective application of inclusive education practices aligned with these indicators, contributing significantly to the development of a supportive and behaviorally positive classroom environment.

### Mathematic - Grade 10

The course incorporated a deductive learning approach combined with Team Game Tournament (TGT) strategies. Figure 101 comprises a digital slide deck and worksheet examples used during a math class, focusing on probability through tree diagrams. These materials were prepared and accessed through Google Slides and a digital learning platform, indicating an ICT-supported instructional design.



Indicator 1.1: Creating an inclusive learning environment.



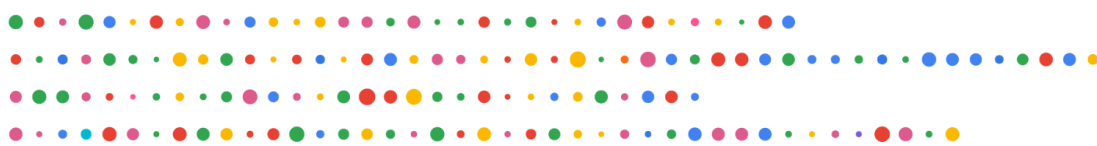
Indicator 1.2: Encouraging student participation



Indicator 2.3: Using formative assessment to track progress.

Figure 101: Mathematic - Grade 10 digital slide deck and worksheet examples

**Indicator 1.1: Creating an inclusive learning environment.** This indicator is evident in the design and presentation of the digital learning materials, particularly through the use of clear visual scaffolding and structured group activities. The assignment materials embody the principle of creating learning environments where all students can participate equally. By incorporating visual elements and structured prompts into both the presentation and worksheets, the lesson ensures accessibility and engagement for all students, thereby fostering an inclusive and supportive



learning environment. This approach directly aligns with the indicator's emphasis on activities that highlight what students can do rather than what they cannot do.

**Indicator 1.2: Encouraging student participation** and autonomy is clearly demonstrated through the slide instruction, which assigns students to small groups of 2–3 members to foster collaboration and peer learning. Each group is tasked with creating a unique scenario and constructing a corresponding tree diagram. The open-ended nature of the task — allowing students to determine both the context and structure of their tree diagrams. The document acknowledges that different students may approach the group work differently but still frames participation in a way that values diverse contributions, fostering a sense of autonomy while ensuring everyone remains engaged in the collective learning experience.

**Indicator 2.3: Using formative assessment to track progress.** This indicator is reflected in the instructional sequence that concludes with group presentations and a class-wide summary discussion. Students are encouraged to collaboratively present their tree diagram scenarios, followed by a teacher-facilitated synthesis of key concepts. This approach allows the teacher to gather real-time evidence of student understanding, identify misconceptions, and provide timely feedback. By integrating assessment directly into the learning process rather than treating it as a separate end-point activity, this material supports the continuous monitoring of student development while respecting their emotional and social needs beyond just academic outcomes.

### Guidance - Grade 10

The Guidance course implemented a collaborative learning framework that integrated the Jigsaw technique with the Think-Pair-Share strategy to enhance student engagement and deepen knowledge acquisition. Figure 102 illustrates the integration of digital platforms such as Padlet, Quizizz, and interactive digital worksheets to support this approach.

**Indicator 2.1: Employing a variety of instructional methods**

**Indicator 1.2: Encouraging student participation**

**Figure 102:** Guidance - Grade 10 digital slide deck and worksheet examples



**Indicator 1.1: Creating a learning environment that supports all students.** The Google Classroom task labeled "1. ชั้นสำรวจความสนใจ" (Exploring Interests) demonstrates intentional grouping strategies based on personality types such as introverts and extroverts, and encourages grouping students by shared interests (Home Group). This promotes inclusivity by recognizing diverse social interaction preferences and tailoring classroom dynamics to individual comfort levels. Such grouping allows all students to feel safe, valued, and supported within the learning community.

**Indicator 1.2: Encouraging student participation and autonomy in choosing their own learning pathways.** In the lower-right image of the figure, students are shown engaging with a self-directed worksheet titled "กิจกรรมสะท้อนตนเอง" (Self-reflection Activity). The format allows learners to reflect personally and independently, promoting self-awareness and choice in learning direction. Autonomy is further emphasized by the focus on individual values, interests, and emotional states, empowering students to take ownership of their guidance journey.

**Indicator 2.1: Employing a variety of instructional methods.** The top-left and bottom-left sections of the figure show the use of multiple digital resources. Padlet is used for collaborative idea-sharing and distributing PDFs (e.g., on "Emotions & Feelings" and "Time Management"). Quizizz, a gamified platform, engages students with interactive quizzes for formative feedback. This diversity in instructional methods—combining text, visuals, interactivity, and self-paced components—addresses various learning styles and supports differentiated instruction, making guidance content more accessible and engaging.

### **Biology - Grade 11**

This course applies Inquiry-Based learning with the "Think-Pair-Share" technique for teaching Biology to grade 10 students. This series of instructional materials shown in Figure 103 demonstrates a well-rounded approach to inclusive education through the integration of varied digital tools, structured group activities, and assessment strategies.



**ภาพไดอะแกรมและสัตว์ตัวเต็มวัย**  
2 points

นักเรียนศึกษาภาพไดอะแกรมเกี่ยวกับสัตว์ตัวเต็มวัย

Attachments

**Indicator 1.1: Creating an inclusive learning environment.**

**2. ชั้นสำรวจและค้นหา**

นักเรียนใช้ใบงาน หรือ สไลด์นำเสนอ ที่ออกแบบมาไว้สำหรับนักเรียนที่มีความสามารถแตกต่างกัน และใช้แพลตฟอร์ม Google Classroom เพื่อจัดกิจกรรมการเรียนรู้

Attachments

**Indicator 1.2: Encouraging student participation**

**ใบงาน เรื่อง Gemini (เจริญของสัตว์)**  
10 points

ให้นักเรียนเลือกคำตอบที่ดีที่สุด

Attachments

**Indicator 2.1: Employing a variety of instructional methods**

กลุ่ม	จำนวนนักเรียน	จำนวน Correct
1. นักเรียนกลุ่ม A		
2. นักเรียนกลุ่ม B		
3. นักเรียนกลุ่ม C		

**แบบทดสอบก่อนเรียน เรื่อง การเจริญเติบโตของสัตว์**  
10 points

ให้นักเรียนเลือกคำตอบที่ถูกต้องที่สุดเพียงข้อเดียว

Attachments

**Indicator 2.3: Using formative assessment to monitor student progress**

**2. ชั้นสำรวจและค้นหา**

นักเรียนและคุณครู ศึกษา เนื้อหาการเจริญเติบโตของมนุษย์ที่จัดทำขึ้นไว้ และจัดทำรายงานบน Google Slide การเรียนแบบของนักเรียนใช้ใบงานและสไลด์ที่ออกแบบไว้

กลุ่มที่ 1 นาย 1 สมภาร กลุ่มที่ 2 นาย 2 สมภาร กลุ่มที่ 3 นาย 3 สมภาร กลุ่มที่ 4 นาย 4 สมภาร  
 กลุ่มที่ 5 นาย 5 สมภาร กลุ่มที่ 6 นาย 6 สมภาร กลุ่มที่ 7 นาย 7 สมภาร กลุ่มที่ 8 นาย 8 สมภาร  
 กลุ่มที่ 9 นาย 9 สมภาร กลุ่มที่ 10 นาย 10 สมภาร กลุ่มที่ 11 นาย 11 สมภาร กลุ่มที่ 12 นาย 12 สมภาร

**\*\*หมายเหตุ** 1. นักเรียนเลือกเรียนในกลุ่มก่อนและกลุ่มละ 3 คน 8 กลุ่ม กลุ่มละ 2 คน 4 กลุ่ม  
 2. จัดทำรายงานบน Google Slide จำนวน 1 สไลด์ โดยให้นักเรียนตอบข้อสงสัยเกี่ยวกับภาพ หรือวิดีโอ ตามความเหมาะสม  
 3. ส่งงานกลุ่มและรายงานจำนวนสไลด์เพื่อนำกลุ่ม แล้วส่งงานแก่คุณครู

Attachments

**Indicator 3.1: Promoting teamwork and collaborative learning**

**Figure 103: Biology - Grade11 Instructional Materials**

**Indicator 1.1: Creating a learning environment that supports all students.** In the section titled "ภาพไดอะแกรมสัตว์เลี้ยงลูกด้วยนม" (Diagram of Mammals), students are provided with diagram-based resources and multimedia attachments to accommodate different learning needs. By using visuals and simplified language through platforms like Google Forms, the teacher creates a universally accessible environment. These multimodal inputs support students with



different abilities, language proficiencies, and cognitive styles, reflecting a commitment to inclusive practice.

**Indicator 1.2: Encouraging student participation and autonomy in choosing their own learning pathways.** The activity “ชั้นทำงานคนเดียว” (Individual Work Stage) presents students with multimedia content, including embedded YouTube videos and colorful slides, followed by individualized reflections. Learners are given autonomy to process the content and express their understanding independently. This format empowers students to engage at their own pace and choose how they interact with the lesson materials, promoting self-direction and agency.

**Indicator 2.1: Employing a variety of instructional methods.** The task titled “ใบงาน เพื่อน Gemini” (Worksheet: Gemini Partner) utilizes text-based worksheets, comparison tables, and digital submission formats to diversify instruction. Students interact with materials that require categorization, analysis, and critical thinking, paired with opportunities for digital collaboration. The use of Google Forms, embedded documents, and visual aids demonstrates a strategic blend of instructional techniques tailored to multiple learning styles.

**Indicator 2.3: Using formative assessment to track progress.** The course implemented a pre-post assessment design to track students’ progress. The matching structure of these assessments suggests they’re designed to be used at different points in the learning process, enabling teachers to track progress over time. Having two complementary assessment tools provides teachers with comparative data to make informed instructional decisions based on student performance trends.

**Indicator 3.1: Promoting teamwork and collaborative learning.** The worksheet from this Biology class aligns well with the indicator as it emphasizes group-based investigation and shared responsibilities. Students are divided into 12 groups, each assigned a different developmental stage of a human embryo, encouraging them to explore biological content collaboratively. Each group, composed of 2–3 members, must create and present a Google Slide as a team. This fosters mutual respect and inclusion, encourages students to support one another’s learning, and mirrors how real professional teams function.

### **Guidance - Grade 11**

The Grade 11 Guidance course adopts a collaborative learning framework that integrates the Jigsaw Technique with the Think-Pair-Share strategy, aiming to foster student engagement, knowledge exchange, and cooperative problem-solving. As illustrated in Figure 104, the instructional design is purposefully aligned with the relevant educational indicators to support inclusive and active learning environments.





คำสั่ง แยกย้ายไปรวมกับสมาชิกกลุ่มอื่นซึ่งได้รับเนื้อหาเดียวกัน ตั้งเป็นกลุ่มผู้เชี่ยวชาญ (expert group) ขึ้นมา และร่วมกันทำความเข้าใจ ในเนื้อหาสารบัญชอย่างละเอียด และร่วมกันอภิปรายหาคำตอบประเด็นที่ผู้สอนมอบหมาย ให้และบันทึกความรู้ด้วย Google Docs โดยให้นักเรียนเรียนรู้และคิดหาคำตอบในประเด็นปัญหาที่ผู้สอนมอบหมายให้ แล้วจึงใช้เทคนิคเพื่อนคู่คิด ในการปรึกษากับ Gemini และบันทึกสิ่งที่ค้นพบด้วย Google Docs จากนั้น

- ให้นักเรียนอ่านข้อมูลใน เพื่อเข้าใจระบบและวิธีการสมัครเข้าศึกษาต่อ
- ให้นักเรียนศึกษา เพื่อทราบแนวทางการเตรียมตัวที่เหมาะสม
- ศึกษา เพื่อเข้าใจความต้องการและความนิยมในแต่ละสาขา
- ศึกษาข้อมูล เพื่อรู้จักคณะที่ได้รับความนิยมสูง
- ให้นักเรียนบันทึกข้อมูลสำคัญและแนวความคิดเพื่อใช้ในการอภิปรายในชั้นเรียน

**ม.5 เตรียมตัว tcas อย่างไร.docx**  
Microsoft Word

**สรุป TCAS คืออะไร? เหมาะกับ...**  
วิดีโอ YouTube • 5 นาที

**10 คณะการแพทย์ชั้นสูงม.บ.รอบ...**  
Image

**10 อันดับคณะยอดนิยม ม.ขอนแก่น...**  
Image

**Indicator 2.3: Using formative assessment to monitor student progress**

**คำสั่ง**

- ให้นักเรียนทบทวนข้อมูลที่ได้จาก และ รวมถึงข้อมูลเกี่ยวกับคณะ ในมหาวิทยาลัยขอนแก่นที่เรียนรู้อีกก่อนหน้านี้
- กลับไปสู่กลุ่มบ้านของเรา แต่ละกลุ่มช่วยสอนเพื่อนในกลุ่ม ให้เข้าใจสาระที่ตนได้ศึกษาร่วมกับกลุ่มผู้เชี่ยวชาญในการ ใ้ตรวจสอบ และสรุป พร้อมบอกเหตุผล
- ให้นักเรียนตอบคำถามในใบงาน TCAS ที่เกี่ยวกับการเตรียมตัวสอบ TCAS โดยใช้ข้อมูลที่ศึกษาและสรุปไว้ลงในไฟล์ Google Docs (สร้างสำเนาสำรอง)

**ใบงาน TCAS.docx**  
Microsoft Word

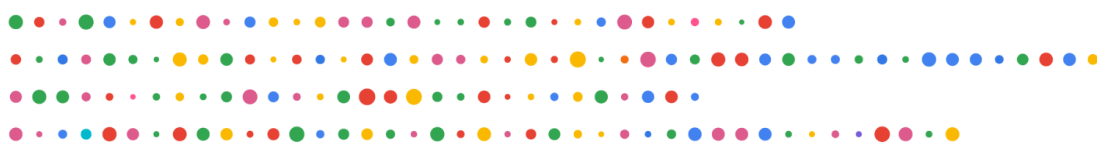
**Indicator 3.1: Promoting teamwork and collaborative learning**

Figure 104: Guidance-Grade 11 Learning Materials and Digital Worksheet

**Indicator 2.3: Using formative assessment to monitor student progress.**

The activity incorporates multiple formative elements that allow both students and teachers to monitor progress in understanding the TCAS system. Students are required to engage with documents and video resources to build background knowledge. Tasks involve reflection, synthesis, and summary writing. This formative process is supported by a Word document assignment, where students must organize their understanding and plan next steps.

**Indicator 3.1: Promoting teamwork and collaborative learning.** The lesson begins by dividing students into expert groups, where each group becomes familiar with a different part of the TCAS system. Students then reassemble into mixed groups (Jigsaw method) to teach one another and share synthesized insights. Tools such as Google Docs are used for collaborative writing and group documentation. This strategy promotes mutual accountability, peer teaching, and communication skills, core competencies for both academic success and real-world collaboration.





## 8. Summary

The project was conducted at Phattharaborphit School in Thailand and included 74 students and 22 teachers. A subgroup of 50 students was used for the Read Along application intervention (25 experimental, 25 control). The project incorporated various technological tools such as Google Workspace (Docs, Slides, Forms, Classroom), Chromebooks, AI tools including Google Gemini and the Read Along application

As part of the project, teachers underwent a comprehensive professional development program guided by the Teaching with Technology Upskill Model. This model provided a hands-on learning experience that included one-on-one coaching, group workshops, collaborative brainstorming sessions, and classroom observation. These activities were designed to build teachers' confidence and competence in integrating digital tools into their daily teaching practices.

In the classroom, educators applied a variety of active learning strategies, such as Inquiry-Based Learning, Problem-Based Learning, Scenario-Based Learning, and the Think-Pair-Share technique. These methods were adapted across a wide range of subjects, including Chemistry, English, Thai, Web Development, Art, Biology, and Physical Education, enabling students to engage in more dynamic and interactive learning experiences.

To assess the impact of these interventions, the project implemented a robust evaluation framework. Teachers and students participated in pre- and post-intervention surveys, which helped measure changes in perceptions and usage of technology. In addition, students were evaluated using rubric-based assessments that focused on key 21st-century skills such as critical thinking, creativity, collaboration, and ICT literacy. The project also included an AI literacy assessment, which measured students' understanding and ethical awareness of artificial intelligence, along with a student happiness scale to gauge overall well-being and engagement in the learning process.

The project yielded significant and encouraging results across multiple dimensions of teaching, learning, and classroom behavior:

- **Improvement in Teaching and Learning:**
  - Teachers' familiarity and confidence with Google tools improved significantly.
  - Increased teacher satisfaction with technology integration and instructional effectiveness.
  - 46.15% of teachers reported saving over 5 hours per week.
- **Student Learning Outcomes:**
  - Marked improvement in 21st-century skills: critical thinking, collaboration, creativity, and ICT literacy.
  - Enhanced AI literacy (Mean rose from 3.05 to 3.89).
  - Students showed greater engagement, enjoyment, and academic performance.





- **Reading Skill Enhancement:**

- Students using the Read Along app showed improvement in pronunciation, reading fluency, and comprehension.
- Real-time AI feedback contributed to personalized and adaptive learning.

Another central aspect of the project was the focus on **positive behavior support**. By implementing the School-wide Positive Behavioral Interventions and Supports (SWPBIS) framework, classrooms became more structured, respectful, and conducive to learning. Teachers observed better classroom management and noted that students displayed more proactive and emotionally regulated behavior.

In conclusion, the integration of technology-enhanced tools alongside the structured support of the SWPBIS framework, highlights the critical role of fostering positive behavior and inclusive classroom environments. The observed improvements in student engagement, emotional regulation, and academic performance underscore the importance of creating learning spaces that are both supportive and responsive to diverse student needs. This holistic approach not only enhances literacy outcomes but also promotes a culture of empathy, equity, and lifelong learning.

## 9. Challenge and Opportunity

### 9.1 Inclusive classroom and positive behavior

These findings were particularly impactful in the context of creating a more inclusive classroom environment. The combination of PBS strategies and AI-driven tools played a key role in supporting students' emotional well-being and participation. The use of tiered behavioral interventions allowed teachers to differentiate support, accommodating the needs of students with behavioral challenges or special needs. However, several challenges and limitations emerged. Implementing these strategies required significant time and professional development for teachers, and not all educators felt equally confident using AI-driven tools. These limitations highlight the importance of ongoing training, careful monitoring, and a balanced approach to integrating technology and behavioral supports in the classroom.

### 9.2 Read Along application

There is strong potential for future implementation of the Read Along application to enhance reading skills in broader educational contexts, given the statistically significant improvements observed in both reading accuracy and comprehension among students using the application. However, several challenges and limitations must be considered. Effective use of the application requires reliable access to digital devices and stable internet connectivity, which may not be available in all educational settings. To maximize the application's effectiveness, future implementations should be accompanied by carefully designed lesson plans that incorporate differentiated reading assignments tailored to students' individual





proficiency levels, learning needs, and personal interests, while also addressing these potential barriers to equitable access and use.

## 10. References

- Agbenyega, J. S., Lane, D., & Klibthong, S. (2022). Exploring Thai teachers' perspectives on evidence-informed practices in inclusive early childhood education. *Australian Journal of Teacher Education (Online)*, 47(11), 54-72.
- Agbenyega, J.S., Klibthong, S. (2015). Transforming Thai preschool teachers' Knowledge on inclusive practice: A collaborative inquiry. *Australian Journal of Teacher Education*, 40 (7), 57-69. <https://doi.org/10.14221/ajte.2015v40n7.5>
- Carr, E. G., Dunlap, G., Horner, R. H., Koegel, R. L., Turnbull, A. P., Sailor, W., ... & Fox, L. (2002). Positive behavior support: Evolution of an applied science. *Journal of positive behavior interventions*, 4(1), 4-16.
- Chu, S. K. W., Reynolds, R. B., Tavares, N. J., Notari, M., & Lee, C. W. Y. (2021). 21st century skills development through inquiry-based learning from theory to practice. Springer International Publishing.
- Chu, S. K. W., Reynolds, R. B., Tavares, N. J., Notari, M., & Lee, C. W. Y. (2021). 21st century skills development through inquiry-based learning from theory to practice. Springer International Publishing.
- Davenport, T. H., & Ronanki, R. (2018). Artificial intelligence for the real world. *Harvard business review*, 96(1), 108-116.
- Google. Google for education: A solution built for teachers and students.
- Google. Our next-generation model: Gemini 1.5. Introducing Gemini 1.5, Google's next-generation AI model (blog.google)
- Hawken, L. S., Sandra MacLeod, K., & Rawlings, L. (2007). Effects of the behavior education program (BEP) on office discipline referrals of elementary school students. *Journal of Positive Behavior Interventions*, 9(2), 94-101.
- Horner, R. H., Sugai, G., & Anderson, C. M. (2010). Examining the evidence base for school-wide positive behavior support. *Focus on Exceptional Children*, 42(8).
- Horner, R. H., Sugai, G., & Anderson, C. M. (2010). Examining the evidence base for school-wide positive behavior support. *Focus on exceptional children*, 42(8).
- Khlaisang, J. & Koraneekij, P. (2019). Open online assessment management system platform and instrument to enhance the information, media, and ICT literacy skills of 21st century learners. *International Journal Of Emerging Technologies In Learning (IJET)*, 14(07), 111-127. <http://dx.doi.org/10.3991/ijet.v14i07.9953>
- Khlaisang, J., & Koraneekij, P. (2019). Open Online Assessment Management System Platform and Instrument to Enhance the Information, Media, and ICT Literacy Skills of 21st-Century Learners. *International Journal of Emerging Technologies in Learning*, 14(7).
- McIntosh, K., & Goodman, S. (2016). *Integrated multi-tiered systems of support: Blending RTI and PBIS*. Guilford Publications.
- Mol, S. E., & Bus, A. G. (2011). To read or not to read: a meta-analysis of print exposure from infancy to early adulthood. *Psychological bulletin*, 137(2), 267.
- National Institute of Educational Testing Service.(2023).Test results statistics .<https://catalog.niets.or.th/group/examresult?tags=การศึกษา&tags=การทดสอบ&tags=O-NET>
- OECD. (2022). PISA 2022 Results: Reading Performance of Students in Thailand





Palphai, P. (2018). An Electronic Storybook Design System Using Digital Storytelling in a Gamification Environment to Promote Creativity and Joy in Learning. Doctor of Education Dissertation, Chulalongkorn University.

Park, E. K., & Suh, J. K. (2021). Active Learning Using Google Suites for Education to Promote 21st-Century Skills. Leadership, 2022.

Rasinski, T. V., Blachowicz, C. L., & Lems, K. (2012). Fluency instruction: Research-based best practices. Guilford Press.

Tantixalerm, C. (2018). The effects of academic and behavior intervention plan on classroom behaviors for primary grade students at-risk for learning problems. Ratchaphruek Journal, 16(1), 15-29.

United Nations Educational, Scientific and Cultural Organization (2020) Ensuring effective distance learning during COVID-19 disruption: Guidance for teachers.UNESCO Education Sector

Waasdorp, T. E., Bradshaw, C. P., & Leaf, P. J. (2012). The impact of schoolwide positive behavioral interventions and supports on bullying and peer rejection: A randomized controlled effectiveness trial. Archives of pediatrics & adolescent medicine, 166(2), 149-156.

We Are Social and Meltwater (2024). Digital 2024. <https://www.meltwater.com/en/global-digital-trends>

Yuan, T., Wang, Z., & Rau, P. L. P. (2023, July). Design of intelligent real-time feedback system in online classroom. In International Conference on Human-Computer Interaction (pp. 326-335). Cham: Springer Nature Switzerland.

