

ISSN (Online) 3057-1006

Liberal Arts and Social Studies

International Journal

Volume 2 Number 2

May-August 2026





Liberal Arts and Social Studies International Journal (LAASSIJ)

LAASSIJ is an interdisciplinary journal in the Thai-Journal Citation Index (TCI)

Online ISSN 3057-1006

Publisher

Faculty of Liberal Arts,
Rajamangala University of Technology Srivijaya (RUTS)

Editorial Advisory Board

President of Rajamangala University of Technology Srivijaya

Vice-president for Academic Affairs

Yunisrina Qismullah Yusuf

Muhammad Imran Qureshi

Universitas Syiah Kuala, Indonesia

Teesside University International Business School, UK

Editorial Advisors & Managing Editor

Boonyarit Omanee

Nohman Khan

Rajamangala University of Technology Srivijaya, Thailand

Connecting Asia Director, Johor Baharu, Johore, Malaysia

Editor in Chief

Patcharin Kangkha

Rajamangala University of Technology Srivijaya, Thailand

Associate Editor

Sofiazianti Saleh

Universiti Teknologi Malaysia (UTM), Johor, Malaysia

Editorial Board

Fitri Suraya binti Mohamad Hapni Joblie

Collin Jerome

Universiti Malaysia Sarawak, Malaysia

Universiti Malaysia Sarawak, Malaysia

Manjet Kaur Mehar Singh

University of Science Malaysia, Malaysia

Malini Ganapathy

University of Science Malaysia, Malaysia

Debbita Tan Ai Lin

University of Science Malaysia, Malaysia

Farrah Dina Binti Yusop

University of Malaya, Malaysia

TS. Siti Hajar Binti Halili

University of Malaya, Malaysia

Md Kamrul Hasan

United International University, Bangladesh

Phatchalin Jeennoon

Thaksin University, Thailand

Korkaew Jankingthong

Hatyai University, Thailand

Jittima Choopun

Rajamangala University of Technology Srivijaya, Thailand

Chamnong Kaewneam

Rajamangala University of Technology Srivijaya, Thailand

Bunyarat Duklim

Rajamangala University of Technology Srivijaya, Thailand

Ntapat Worapongpat

Eastern Institute of Technology Suvarnabhumi

Syed Muhammad Ahmad Hassan Gillani

Universiti Teknologi Malaysia (UTM), Malaysia

Hamad Raza

Universiti Teknologi Malaysia (UTM), Malaysia

Proofreading and Editorial Staff

Lauro Sadaran Dequina Jr.
Nalina Samarn
Mitchelle R. Juaban

Rajamangala University of Technology Srivijaya, Thailand
Rajamangala University of Technology Srivijaya, Thailand
Rajamangala University of Technology Srivijaya, Thailand

Layout Artists

Panithan Paensuk
Ryan Rommel M. Dominguez
Nureesun Chobngam

Rajamangala University of Technology Srivijaya, Thailand
Rajamangala University of Technology Srivijaya, Thailand
Rajamangala University of Technology Srivijaya, Thailand

Website Managing Staff

Kritsanaphong Muninnoppamat

Rajamangala University of Technology Srivijaya, Thailand

Secretary Managing and Coordinating Service

Warawood Duangsiri
Theerachai Choonoi
Sariya Khlaikhlai
Ladda Suwannasri

Rajamangala University of Technology Srivijaya, Thailand
Rajamangala University of Technology Srivijaya, Thailand
Rajamangala University of Technology Srivijaya, Thailand
Rajamangala University of Technology Srivijaya, Thailand

Language

English

Manuscript

Manuscripts submitted for consideration for publication must not have been previously published in any journal or publication (except research reports and dissertation) and is not under consideration and waiting for publication in other journals. The editorial team will submit articles in the relevant fields (peer-reviewed) at least three experts for scrutinizing a quality. However, the author must improve the article according to the recommendations of the experts and will receive approval from the editorial team before publication.

Article Processing Charges

There is **NO FEE**.

Publication Frequency

Three issues / year
The first issue: January – April
The second issue: May – August
The third issue: September- December

Focus and Scope

LAASSIJ publishes manuscripts on the fields of Arts and Humanities, Social and Administrative Sciences, and Applied Sciences

Arts and Humanities

Philosophy, Psychology and Religious Studies,
Sociology, Anthropology and History,
Archaeology and Heritage Management,
Literature, Language and Applied Linguistics

Social and Administrative Sciences

Accounting, Finance, Commerce & Economics,
Public Administration and Governance,
Political Science, Education

Applied Sciences

Aviation, Agriculture, Computer Science,
Food Science and Technology,
Service Industry (Tourism, Hospitality, Food and Restaurants)
Home Economics

Editorial Review Process

double-blind peer-review

Types of Manuscript Publication

The Editorial board is responsible for notifying errors/formatting issues. If no formatting corrections are necessary, articles will immediately be forwarded to experts in the relevant fields to further assess the article's viability and completeness. The accepted liberal arts and social science articles are divided into four categories as described below.

1) Academic Article: Academic articles typically present the core of assembled and analyzed academic content consisting of an introduction and a body that includes major, minor, and subordinate topics usually within a maximum of 20 pages.

2) Research article: Research articles typically arise from research studies conducted either individually or in collaboration with co-researchers. They usually contain a rationale of the study, objectives, hypothesis, scope, significance of the study, related research studies or other relevant literature, methodologies, data collection, data analysis, research conclusions, discussions, and recommendations; all of which is limited to a maximum of 25 pages.

3) Literature review: Literature reviews are based on an extensive review of relevant academic literature consisting of an author's constructive criticisms and opinions. Its format includes a title, an abstract, a preface, content, and references; all of which is limited to a maximum of 15 pages.

4) Book review: Book reviews provide a concise summary of key debates presented in a particular book or multiple books. They may also highlight weaknesses/strengths from theoretical, empirical and informative standpoints. Book reviews are intended for the books' prospective readers. For a book review, a maximum of 5 pages is strictly required.

Citations and References LAASSIJ follows the American Psychological Association (APA) 7th style. It uses the author-date method of citation, that is the name or surname of the author(s) and the year of publication inserted in the text at the appropriate point. If the name of the author appears as part of the narrative, cite only the year of publication in parentheses.

Otherwise, place both the name and the year separated by comma in parentheses. The page number(s) may be cited as a specific part of a source. All the works cited in text with an author-date citation system must be listed alphabetically in the reference section in APA style under a 'References' heading. Examples are given below:

Journal Article

Kangkha, P., Gomez, T., Choopun, J., & Boonto, S. (2023). Thai and American Perspectives Towards the Implementation of Instructional Design on the Contemporary Literature Course. *Asia Social Issues*, 16(6), e258992-e258992.

Online Magazine Article

Thomson, J. (2022, September 8). Massive, strange white structures appear on Utah's Great Salt Lake. *Newsweek*. <https://www.newsweek.com/mysterious-mounds-great-salt-lake-utah-explainedmirabilite-1741151>

Print Magazine Article

Nicholl, K. (2020, May). A royal spark. *Vanity Fair*, 62(5), 56–65, 100.

Online Newspaper Article

Roberts, S. (2020, April 9). Early string ties us to Neanderthals. *The New York Times*. <https://www.nytimes.com/2020/04/09/science/neanderthals-fiber-string-math.html>

Print Newspaper Article

Reynolds, G. (2019, April 9). Different strokes for athletic hearts. *The New York Times*, D4

Edited Book Chapter

Zelege, W. A., Hughes, T. L., & Drozda, N. (2020). Home-school collaboration to promote mind-body health. In C. Maykel & M. A. Bray (Eds.), *Promoting mind-body health in schools: Interventions for mental health professionals* (pp. 11–26). American Psychological Association. <https://doi.org/10.1037/0000157-002>

Conference Session

Davidson, R. J. (2019, August 8–11). Well-being is a skill [Conference session]. APA 2019 Convention, Chicago, IL, United States. https://irp-cdn.multiscreensite.com/a5ea5d51/files/uploaded/APA2019Program_190708.pdf

Dissertation from a Database

Horvath-Plyman, M. (2018). *Social media and the college student journey: An examination of how social media use impacts social capital and affects college choice, access, and transition* (Publication No. 10937367). [Doctoral dissertation, New York University]. ProQuest Dissertations and Theses Global.

Editorial Office

2/5 Ratchadamnoenok Rd. Boryang Mueang Songkhla 90000

Tel. +660899203319

E-mail: laassij.libarts@rmuts.ac.th

Website: <https://so18.tci-thaijo.org/index.php/laassij>

Facebook: <https://www.facebook.com/groups/1855341608327926>

Editorial Note

It is with great pleasure that we present **Volume 2, Number 2 of the Liberal Arts and Social Studies International Journal (LAASSIJ)**. This issue reaffirms the journal's commitment to rigorous, accessible, and socially relevant scholarship across the liberal arts, language education, educational technology, and community development. The six articles collected here are united by a shared concern: how carefully designed tools, methods, and local innovations can improve learning, strengthen research practice, and create meaningful value for communities. We are pleased to introduce the authors whose scholarship elevates this issue:

Mitchelle R. Juaban and **Ryan Rommel Dominguez** are lecturers in the Foreign Languages Department, Faculty of Liberal Arts, Rajamangala University of Technology Srivijaya (RUTS), Songkhla, Thailand. Their study, *"Mode of Delivery: Paper-pen versus Mobile-Based Testing. Are They Comparable?"* draws on a counterbalanced within-subject design involving 126 university students to examine performance differences and score equivalence across paper-based and mobile-based testing. Their findings indicate higher performance in the mobile condition but weak correspondence between the two modes, emphasizing that technological convenience does not establish assessment interchangeability and that responsible adoption requires careful validation and cautious score interpretation.

Jantira Suwanmanee, **Nunthikan Songsangrak**, **Nutchanat Chaimut**, and **Palachai Khaonuan** are researchers associated with the Faculty of Liberal Arts, RUTS, Songkhla, Thailand. Their pilot study develops and evaluates *an electronic student portfolio for enhancing English vocabulary learning among engineering undergraduates*. Integrating vocabulary from songs, films, and social media through Google Sites, the project combines expert validation, embedded assessment, pre-post measurement, and learner feedback. The reported gains and positive attitudes demonstrate the promise of multimedia e-portfolios as learner-centered resources, while the authors appropriately interpret the findings as preliminary evidence because of the small purposive sample and absence of a comparison group.

Chamnong Kaewneam, **Thanya Pakpoom**, and **Piyarat Pipattarasakul** represent the Foreign Languages for Communication Program at the Faculty of Liberal Arts, RUTS, Songkhla, and the English for International Communication Program at Rajamangala University of Technology Krungthep, Bangkok, Thailand. Their article, *"Effective Author Guidelines for Successful Research Articles: Feedback from a Thai EFL Teaching and Learning Context,"* addresses the challenge of transforming research knowledge into a coherent, publishable manuscript. Their 17-element guideline spans the complete writing process from titles and literature reviews to ethics, analysis, citation, language, and presentation providing a practical framework for novice researchers and teachers of research writing.

Pongsri Sobpol is an educator at Bangsaaiwithaya School, Phra Nakhon Si Ayutthaya, Thailand. The featured article examines *the development of computer-assisted instruction for teaching English modal verbs to Grade 9 students*. Organized around communicative functions and delivered through an interactive multimedia environment, the instructional package was evaluated through achievement testing, learner satisfaction, and staged try-outs. The substantial pre-post improvement and high satisfaction support the potential of curriculum-aligned digital grammar instruction. The article's transparent acknowledgement of inconsistent efficiency estimates and the limitations of a one-group design also models the methodological candor essential to educational research.

Suwijak Hansriwijit, Sirinat Srionnual, Saowanee Chaipech, Jareewan Chankong, and Thanikan Thorasin bring together expertise from the Food Technology Program, Faculty of Science and Technology, Kanchanaburi Rajabhat University, and the Faculty of Agro-Industry, RUTS, Nakhon Si Thammarat Campus, Thailand. Their community-based research presents *an integrated pathway for enhancing Sago flour and products in Khoksaba Community, Trang Province*. By connecting process standardization, product quality, sensory evaluation, packaging and storage, economic analysis, technology transfer, and community-innovator development, the study demonstrates how locally grounded food research can create value while preserving cultural and livelihood significance. Its careful distinction between formulation findings and untested health claims strengthens responsible functional-food research.

Ruttikan Sopikun, Saranrach Poltham, Supparat Sriprapai, Thitinart Khamyod Wharmby, and Chamnong Kaewneam are affiliated with the Foreign Languages for Communication Program, Faculty of Liberal Arts, RUTS, Songkhla, Thailand. Their study investigates *an interactive e-book designed to raise learners' awareness of vowel and consonant differences in British and American English*. By combining concise explanations, audio examples, and practice activities, the e-book supports autonomous and multimodal pronunciation learning. The marked improvement between pre-test and post-test scores, together with very high learner satisfaction, highlights the pedagogical value of making language variation visible, audible, and accessible to beginning English majors.

Taken together, these contributions illuminate several priorities for contemporary scholarship: assessment validity in technology-mediated environments; thoughtful instructional design; transparent reporting of evidence and limitations; support for novice researchers; and collaboration with communities in creating sustainable local value. The collection also demonstrates that innovation is most meaningful when it is evaluated carefully, communicated honestly, and adapted to the learners and communities it is intended to serve.

On behalf of LAASSIJ, we extend sincere appreciation to all authors for entrusting their work to the journal. We also thank our reviewers and editorial board members for their scholarly judgment, constructive recommendations, and commitment to publication quality. Their collective efforts enable LAASSIJ to continue serving as an international forum for interdisciplinary dialogue and research with educational and social impact.

We invite readers to engage critically with the studies in this issue, apply their insights in relevant contexts, and continue the conversations they initiate. May Volume 2, Number 2 encourage further inquiry, responsible innovation, and collaboration across disciplines and communities.

Conflicts of Interest: The authors declare no conflict of interest.

Publisher's Note: The LAASSIJ Team remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Assoc. Prof. Patcharin Kangkha, Ph.D.

Editor-in-Chief

<https://so18.tci-thaijo.org/index.php/laassij/>

LAASSIJ Information	i
Editorial Note	v
Contents	viii
Research Articles	
Mode of Delivery: Paper-pen versus Mobile-Based Testing. Are they Comparable?	1-12
Mitchelle Juaban, and Ryan Rommel Dominguez	
<i>Foreign Languages Department, Faculty of Liberal Arts, Rajamangala University of Technology Srivijaya Songkhla, THAILAND</i>	
Using an Electronic Student Portfolio as a Learning Tool for Enhancing the English Vocabulary Skills for Undergraduate Students	13-31
Jantira Suwanmanee, Nunthikan Songsangra, Nuchanat Chaimut and Palachai Khaonua	
<i>Self-employed, Muang, Nakhonsrithammarat, THAILAND</i>	
Effective Author Guidelines for Successful Research Articles: Feedback from a Thai EFL Teaching and Learning Context	32-45
Chamnong Kaewneam, Thanya Pakpoom, Piyarat Pipattarasakul and Boonyarit Omanee	
<i>Program in Foreign Languages for Communication, Faculty of Liberal Arts, Rajamangala University of Technology Srivijaya, Songkhla THAILAND</i>	
The Development of Computer-Assisted Instruction (CAI) for Modal Verbs in English Language Learning for Grade 9 Students	46-63
Pongsri Sobpol	
<i>Bang Sai Witthaya School, Phra Nakhon Si Ayutthaya, THAILAND</i>	
Research and Development for Enhancing Sago Flour and Products in Khoksaba Community, Nayong District, Trang Province	64-84
Suwijak Hansriwijit	
<i>Program in Food Technology, Faculty of Science and Technology, Kanchanaburi Rajabhat University Nong Bua Subdistrict Mueang Kanchanaburi District, Kanchanaburi, THAILAND</i>	
Raising Awareness of two Varieties of English via an Interactive E-book: Vowel and Consonant Pronunciation in British and American English	85-93
Ruttikan Sopikun, Saranrach Poltham, Supparat Sriprapai, Thitinart Khamyod Wharmby, and Chamnong Kaewneam	
<i>Program in Foreign Languages for Communication, Faculty of Liberal Arts, Rajamangala University of Technology Srivijaya, Songkhla THAILAND</i>	
LAASSIJ MANAGEMENT TEAM	94-98



Mode of Delivery: Paper-pen versus Mobile-Based Testing. Are they Comparable?

Mitchelle R. Juaban^{1*} and Ryan Rommel Dominguez²

^{1*2}Foreign Languages Department, Liberal Arts Faculty, Rajamangala University of Technology Srivijaya, Songkhla 90000, THAILAND

*Corresponding Author E-mail: *mitchelle.j@rmutsv.ac.th

(Article history) Received: 2026-08-06, Revised: 2026-08-12, Accepted: 2026-08-23

Abstract

The ubiquity of mobile technologies in education has brought concerns regarding comparability between paper-based (PBT) and mobile-based testing (MBT) formats. This study examined: (1) the effects of test mode on student performance and (2) the score equivalence obtained via paper-based and mobile-based testing. Participants (126) from a university in the south of Thailand completed two quantitative within-subject counterbalanced tests administered via PBT and MBT through the participants' personal smartphones with a two-week interval between administrations. Descriptive statistics, paired-samples t-tests, Pearson product-moment correlation, and Spearman rank-order correlation were used to analyze the data. Findings showed a statistically significant difference between modes favoring mobile testing indicating a strong mode effect. Moreover, correlation analyses revealed negligible relationships between the two modes, suggesting weak score equivalence and limited rank-order consistency. This research contributes to the growing literature on assessment formats by providing evidence on mode effect and interchangeability. The study provides evidence that MBT may influence student performance and score interpretation; and underscore the necessity for careful validation.

Keywords: Mobile-based Testing (MBT), Mode of delivery, Paper-based Testing (PBT), Score equivalence, English language assessment

1. INTRODUCTION

Post-COVID-19, online testing (frequently referred to as computer-based Test, CBT) has become a widely, if not preferably, used form of assessment. Not surprisingly so, as many have experienced its benefits including: the automated marking, the ease of editing, the comfort of not having to walk to the printing shop and collate papers one by one, and most importantly reduced testing cost. Or, if not all these, then just to continue using the technology to get the most of what it's paid for. In reality though, mobile-based testing (also known as MBT) seems the most practical recourse considering time constraints, insufficient school computers, and availability of mobile devices with internet connections. According to a report made by Dr. KC Dipendra and Dr. Mongkhonvanit Jomphong (2022) to the International Telecommunication Union, there is a 1-to-17 computer to student ratio Thailand, and that 75% of households depend on mobile broadband to access the internet. With the ubiquity of mobile devices, using it for possible testing means increases. However, is it comparable to paper-pen assessment?

After the pandemic, periodic examinations were administered through online testing - specifically mobile phones. This is done via the Learning Management System (LMS) and Google Forms - the versions available did not include lockdown features that could restrict access to browser menus, toolbar options, other applications, right-click functions, keyboard shortcuts, or task switching. After some time, the testing format was modified: midterm examinations continued to be conducted through mobile-based testing, while final examinations were administered using the paper-and-pen format or the paper-based testing (PBT, hereafter). Quizzes and unit tests were oftentimes conducted via MBT.

Teachers, however, have observed that: students score substantially higher on MBT. In fact, memes depicting students' performance discrepancy had made rounds on the internet. On the surface they seem funny but on a closer look, particularly on the assessment level, many critical questions loom.

With this current trend, this study seeks to investigate if delivery mode affects students' academic performance, as well as determine if both assessment deliveries are comparable in terms of equivalence and rank-order. Counterbalanced English achievement tests were constructed to obtain the data. This research provides theoretical and practical significance on mode effect and score equivalence across the two types of assessment delivery.

2. RELATED LITERATURE

The vast advancements in mobile technologies have led to its adoption in education as an alternative tool for testing. Mobile-based testing refers to assessments completed using smartphones or other mobile devices, allowing learners to access tests anytime and anywhere. With the growing popularity of MBT in educational assessment practices, its effects on student performance and if the scores obtained from it are comparable with the PBT in terms of equivalence are being investigated by researchers. However, while there are numerous papers tackling comparability between PBT and CBT, studies on the equivalence of PBT and MBT are scarce, especially for EFL and English language learning contexts.

In alignment with the current study, two major themes will be examined on PBT and MBT: (1) the effects of testing mode on student performance and (2) the equivalence of scores across testing modes.

2.1 Effects of PBT and MBT on Student Performance

Researches on the effects of the employment of MBT as an assessment tool on student performance have revealed mixed results. While some reported no significant differences between PBT and MBT assessments, others suggest that MBT may enhance student performance.

A research conducted by Whattananong (2004) was one of the earliest studies investigating MBT. He compared PBT with two forms of MBT: (1) students listened to questions and answers were submitted via SMS, (2) students viewed questions on a screen and responded through their mobile phones. This study found no significant differences in scores obtained between PBT and MBT. Having no negative effects on performance he proposed that MBT could be an alternative assessment instrument.

In the same way, Gordon's (2015) investigation on PBT and MBT among Korean university students enrolled in English as a Foreign Language (EFL) courses revealed no statistically significant differences, indicating that MBT garnered comparable levels of achievement as PBT. In this study, students completed an equivalent multiple choice test in both PBT and MBT. For the MBT, Socrative mobile application that students can download to their smartphones was used. Gordon additionally reported that there was a general preference for MBT among the participants and that they did not perceive it as more difficult than PBT.

Contrarily, a positive influence between MBT and student performance was found by Nikou and Economides (2013). In the study, 203 students at the Department of Economic Sciences of a Greek university were randomly assigned a 30-item multiple choice test to PBT, CBT, and MBT conditions. The participants took the test in only one mode; and were not rotated through the different modes. The results revealed that students scored significantly higher in MBT than in the PBT. This was accounted for by familiarity with smartphones, reduced anxiety, and increased engagement which may have contributed to the improved performance in the mobile testing condition.

Moreover, Nikou (2018) reviewed 43 studies on MBT, and has given additional support for the potential benefits of MBT. From this review he concluded that MBT often enhances learner motivation, engagement, and achievement. He further mentioned that mobile devices provide flexible assessment practices and encourage positive attitude toward testing. However, he noted that the effects of MBT may vary with conditions like context, subjects, and assessment designs.

Abdillah (2016), similarly reported that students have positive perceptions towards MBT. They found this mode convenient, efficient, and accessible. The study mainly focused on student perceptions, the findings however show that increased comfort and familiarity with this technology may have affected testing behavior and potentially the performance outcomes.

On the whole, the data on MBT suggests that the mode may either be comparable to or slightly higher than the achievement outcomes observed in PBT. But factors such as test design, device characteristics, student familiarity with technology, and testing conditions may greatly influence the magnitude and direction of these effects.

2.2 Equivalence Between PBT and MBT

Aside from the mean score, determining whether PBT and MBT are equivalent measures of the same construct is another important aspect to look into. Equivalence refers not only to similar average scores but also to the consistency of score interpretations across modes. There are a number of studies supporting the equivalence of PBT and MBT.

Whattananarong (2004) reported strong correlations between PBT and MBT, with correlation coefficients ranging from .887 to .910. These indicate that students had similar performance rankings regardless of the testing mode, suggesting a high degree of score equivalence. This finding was corroborated by Gordon (2015) who further suggested that PBT and MBT could be used interchangeably in EFL contexts. The lack

of significant differences in the mean scores was interpreted as comparability between PBT and MBT in measuring the underlying abilities.

Computer-based assessment has reached similar conclusions. Studies by Bergstrom (1992), Boo and Vispoel (2012), Bugbee (1996), Chin and Donn (1991), Choi and Tinkler (2002), and Evans, Tannehill, and Martin (1995) generally reported minimal differences in scores obtained via PBT and MBT. These studies proposed that mode of delivery to a large extent does not affect performance when conducted in controlled settings.

On the other hand, researchers such as Dorans, Pommerich, and Holland (2007) warned against assuming equivalence across modes. They argued that empirical validation through linking, scaling, or equating procedures may be required as scores from different testing modes are not inherently equivalent. For them, score equivalence relies heavily on test design, administration conditions, and contextual factors. In the same way, Yu and Iwashita (2021) underscore the significance of not assuming comparability even when mean differences are minute. Seemingly insignificant differences like screen presentation, navigation, and test-taker interaction may have a slight impact on performance that affect the interpretation of scores.

The findings of Nikou and Economides (2013) also cast doubts on the equivalence of PBT and MBT. Even though the mean scores of the participants were significantly higher in MBT but by reason of lack of rank-order consistency examination across modes; it remains unclear if the scores were reflection of students' improved learning outcomes or mode-related factors unrelated to the construct being measured.

Nowadays, as the adoption of digital assessment in education is rapidly growing, it is essential to examine not only the mean score differences but also the score comparability and validity across delivery modes. Mobile devices are becoming a ubiquitous aid in learning, thus establishing equivalence between PBT and MBT is critical if we are to extend its usefulness to educational assessments.

3. METHODOLOGY

3.1. Research Questions

- 1. Does test mode significantly affect students' English test performance?*
- 2. Are paper-based and mobile-based online test scores comparable in terms of rank-order consistency and score equivalence?*

3.2. Research Participants

One hundred twenty-six non-English majors from Business Administration and Industrial Education were this study's research participants. They were enrolled in the course Communication Skills in English, thus making this population a convenient participant for the study. They first completed a paper-pen test and after a two-week interval, they completed a counterbalanced parallel form via online delivery.

3.3. Research Instruments

The instrument consisted of two counterbalanced tests (version A, paper-pen and version B, online test). Each test comprised 4 sections: Vocabulary in context, Agreement structures, Present perfect vs. past tense usage, and Reading comprehension. Originally a 20-item test was later cut down to 14 to achieve an acceptable internal consistency, Cronbach's $\alpha = .71$.

To maintain construct comparability, the tests were designed to measure similar constructs and contained identical item structure. Although they differ in item and lexical contents, the cognitive demands were equivalent.

Version A was administered in the classroom via paper-pen mode while Version B via Google Forms and conducted in the classroom through participants' mobile phones. Both tests were supervised by the teacher and had the same time limit, instructions, and classroom conditions. It should be noted that during the online delivery, no technical, technological, or log-in detail problems were encountered.

3.4 Data Analysis

Descriptive statistics like mean and standard deviation were used for both modes to identify the mean difference. A paired-samples t-test was conducted to examine whether the difference between PPT and mobile-based test scores was statistically significant. And to examine the consistency across modes the Pearson's r and Spearman's ρ were employed.

4. FINDINGS

4.1. RQ 1: Is there a statistically significant difference in students' English test performance between paper-based and mobile-based online modes of delivery?

Table 1: Paper-pen and Mobile-Based Testing means and standard deviations

Mode	Mean (M)	Standard Deviation (SD)
Paper-pen	6.5	2.9
Online	13.2	2.8

Table 2: Delivery Modes Paired-samples t-Test Results

Parameter	Value
P-value	0
t	18.2256
Sample size (n)	126
Average of differences ($\bar{x}_d$)	6.6587
SD of differences (S_d)	4.101
Normality p-value	0.002454
A priori power	0.9998
Post hoc power	1
Skewness	-0.4205
Skewness Shape	 Potentially Symmetrical (pval=0.051)
Excess kurtosis	-0.4794
Kurtosis Shape	 Potentially Mesokurtic , normal like tails (pval=0.263)
Outliers	

Table 1 shows the mean and standard deviation of PPT (M=6.5, SD=2.9) and mobile-based test (M=13.5, SD=2.8), while **Table 2** presents the results of the paired t- test. It indicated that there is a significant large difference between participants' PPT and mobile-based test scores, $t(125) = 18.2$, $p < .001$.

At a closer look, the magnitude of the difference (Mean difference = 6.7 points, Pooled SD ≈ 2.85), an approximate Cohen's $d \approx 2.3$ suggests an extremely large mode-of-delivery effect.

4.2. RQ 2: Are paper-based and mobile-based online test scores comparable in terms of rank-order consistency and score equivalence?

Table 3: Delivery Modes Correlation Results

Parameter	Value	Parameter	Value
Pearson correlation coefficient (r)	-0.002636	Spearman's rank correlation coefficient (r_s)	-0.03892
r^2	0.000006949	r^2	0.001515
P-value	0.9766	P-value	0.6653
Covariance	-0.0221	Covariance	-50.916
Sample size (n)	126	Sample size (n)	126
Statistic	-0.02935	Statistic	-0.4337

Table 3 presents the results of the Pearson's correlation ($r(124) = .00264$, $p = .977$) and the Spearman's rank correlation ($r(124) = .0389$, $p = .665$). Both indicated that there is a non-significant, very small negative relationship between Paper-pen and online.

5. DISCUSSION

5.1. RQ1: Does test mode significantly affect students' English test performance?

The participants' mean scores in MBT is by far higher than the PBT. Considering that this research design has the same construct (English communication skills), same students, different modes (paper vs online), counterbalanced content, and a 2-week interval that minimizes memory effects, the large increase in scores implies that mode delivery exerts a strong influence on the test performance. This finding aligns with Nikou and Economides (2013) where participants modestly scored higher in MBT (1.827 points mean difference) than in PBT and CBT (1.19 points mean difference). Similar to the current study, the whole test was completed using a mobile phone, but Nikou's and Economides' MBT was conducted via a dedicated Android Quiz Application which had a highly controlled interface, questions were presented one at a time, limited distractions, and most likely prevented easy switching among resources.

Although many researches suggest that CBT and PPT yield equivalent results such as early studies made by Mead and Drasgow (1993) - comparable results between CBT and PBT with minimal differences overall in participants' cognitive ability test; and corroborative studies made by Bergstrom, 1992; Boo & Vispoel, 2012; Bugbee, 1996; Chin & Donn, 1991; Choi & Tinkler, 2002; Evans, Tannehill, & Martin, 1995, Wang et al., 2008 supporting score equivalence between CBT and PBT citing similarity in mean scores, and small and statistically insignificant differences. On a closer look though, the interpretations indicate that such equivalence is conditional - that is under a strictly controlled environment.

On the other hand, other studies observe the two modes are not always directly interchangeable (Godwin and Godwin, 1999; Pommerich & Burden, 2000). The significant mean difference observed in this study provides strong empirical support for this position, indicating that online testing may systematically raise scores or alter performance conditions. This is backed up by Bachman and Adrian (2010, cited by Clark-Gareca, 2010), who argued that test performance is influenced not only by language ability but also by test method facets. In this case, the online mode may have brought in additional variables like the device used, testing environment, students digital skills, or possible external access.

In a real-world testing scenario (real classroom + mobile phone) as in this present study's case such equivalence may not hold. MBT and CBT are both digital technologies, and although many studies found comparability between PBT and CBT in a well-controlled environment, not the same can be said about PBT and MBT. The differences in size, interface, user experience, and other technological distinctness may affect performance. So, the impact of these differences need to be examined since mobile devices are fast becoming a ubiquitous tool in education.

5.2. RQ2: Are paper-based and mobile-based online test scores comparable in terms of rank-order consistency and score equivalence?

The present study shows lack of significant correlation and low rank-order stability between modes which raise concerns regarding score comparability. This

suggests that students who performed well in one mode may not necessarily perform well in the other.

Contrarily, Whattananarong (2004) reported a strong correlation between PBT and MBT. The likely explanation for this contrasting finding is the considerably different implementation of the MBT. Whattananarong's study used the SMS feature of the phone to submit answers. Questions were either read from a projector screen or played from an audio recorder. The current study, on the other hand, employed smartphones as a complete testing platform where questions and answers were presented; and students had to read, navigate, and respond directly to it. This may have presented mode-related factors such as screen reading, navigation, interface interaction, and potential access to online resources that could have influenced the large mode effect and the lack of score equivalence between PBT and MBT. Further, differences in the research design could have also influenced the equivalence result. Whattananarong employed a control and experimental design, whereas the current study used within-subject counterbalanced design and the same group of participants took both the PBT and MBT, which may keep individual differences under control.

Dorans, Pommerich, and Holland (2007) revealed that scores from tests administered through different modes are not inherently comparable. The lack of correlation in the present study indicates that: the test scores were affected by delivery modes and it changes the relative ranking of students. Thus, PBT and MBT are not comparable in terms of rank-order stability and score equivalence.

5.3 Construct-irrelevant Variance

The combination of large mean difference and non-significant correlation, despite the counterbalanced construct, is a strong indication that factors unrelated to language ability may have influenced test performance. According to Messick (1989) construct validity is compromised when unrelated variables affect the test scores. Looking at the present study, the MBT and the PBT may not measure the construct of English Communication in the same way. This is further supported by Kane (2006, as cited by Chapelle 2022), who reported that for test scores to be valid they must be supported by evidence across testing conditions. A generalized interpretation of the scores obtained across the modes may not be possible, thereby weakening the validity argument. Hence, in a blended assessment it can be said that scores obtained may not measure the intended construct in absolute sense unless careful validations have been done prior.

5.4 Practical Implications

In the classroom the reality is, employing MBT is an easy and convenient go-to especially if faced with heavy workload, time and deadline constraints. Another reality is that not all schools and universities are equipped with facilities that can handle a strictly controlled CBT environment, thus most resort to classroom and mobile phone set up. Looking at the current situation, it would seem that this multi-dollar technology is a fixture that is shaping the present's and future's educational arena.

In light of this, the decision by educational institutions and its stakeholders to use digital technologies in terms of what, when, and in what manner is critical. The

notion that it is there for the taking should be re-thought as its impacts on educational settings are not straight-forward.

The findings of this current study are relevant considerations for educators and educational institutions employing mix-method assessment or for those who are thinking of transitioning to pure CBT or MBT. Careful preparations and validation are needed; and in doing so will aid in weighing options that ensure fair and appropriate assessment.

Classrooms that lack facilities for a stricter CBT controlled setting and utilize students' mobile phones instead may have to think twice of using this assessment mode. Switching between tabs and apps during exams, browser search, and peer collaboration (Huynh Thi Trang, et, 2022) are some forms of dishonesty during online tests. Through an online survey, a little over 60% of this current study's participants revealed that they perceived it easier to cheat during online tests. This may be the case if the conditions for a conducive CBT/ MBT are not met: one invigilator, classroom setting, and using students' personal mobile phones.

Thus, the decision to employ MBT or mixed methods should come with intensive prior preparations of test constructions, test validity and reliability for both modes of delivery. Furthermore, the following can also be done to ensure fair assessment: (1) adapting test items and layout for mobile-based testing rather than copying PBT into online format and (2) consider a separate benchmark for each mode.

6. CONCLUSION, LIMITATION, RECOMMENDATION

Assessment is an essential part in education, thus choosing the appropriate mode of delivery is critical. In the classroom, it is easy to opt for MBT over PBT for both convenience and practical reasons. This study shows that the scores obtained through MBT and PBT are not equivalent, thus they are not interchangeable. Therefore; prior preparations in terms of test construction, test reliability and validity are needed.

This study has three major limitations. One is limited generalizability. The number and representation of participants - 126 and EFL context, non-English majors, university students - are minimal in quantity and scope to draw generalization. Two, the two-week interval between tests may be too close to address memory effects. Lastly, the test, although counterbalanced may be limited in length and reliability. Results of future research that addresses the mentioned limitations would be significant contributions to the limited literature on PBT and MBT equivalence.

Further, it is recommended that factors impacting mode effects, mitigating factors, MBT dishonesty preventions, and elements that may contribute to MBT reliability and validity be considered for future research.

REFERENCES

- Abdillah, L.A. (2016). Ujian Online Mahasiswa Ilmu Komputer Berbasis Smartphone. *ArXiv, abs/1701.06428*.
- Bergstrom, B. (1992). Ability measure equivalence of computer adaptive and pencil and paper tests: A research synthesis. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA. Retrieved from <https://eric.ed.gov/?id=ED377228>
- Boo, J., Vispoel, W. (2012). Computer versus Paper-and-Pencil Assessment of Educational Development: A Comparison of Psychometric Features and Examinee Preferences. *Psychological reports*. 111. 443-60. 10.2466/10.03.11.PR0.111.5.443-460.
- Bugbee, A. C. (1996). The equivalence of paper-and-pencil and computer-based testing. *Journal of Research on Computing in Education*, 28, 282-299. Retrieved from Education Research Complete, Accession Number: 9605221096
- Chapelle, C. (2022). Argument-Based Validation in Testing and Assessment. *Sage Research Methods*. DOI: <https://doi.org/10.4135/9781071878811>
- Chin, C. H. L., & Donn, J. S. (1991). Effects of computer-based tests on the achievement, anxiety, and attitudes of grade 10 science students. *Educational and Psychological Measurement*, 51, 735. doi: 10.1177/0013164491513025
- Choi, S. W., & Tinkler, T. (2002). Evaluating comparability of paper-and-pencil and computer based assessment in a K-12 setting. Paper presented at the annual meeting of the National Council on Measurement in Education, New Orleans, LA. 148.
- Coiro, J. (2007). Exploring changes to reading comprehension on the Internet: Paradoxes and possibilities for diverse adolescent readers. (Doctoral dissertation). Retrieved from <http://ctell1.uconn.edu/coiro/coiropencer.pdf>
- Dorans, N. J., Pommerich, M., & Holland, P. W. (Eds.). (2007). Linking and aligning scores and scales. *Springer Science + Business Media*. [https://DOI:.org/10.1007/978-0-387-49771-6](https://doi.org/10.1007/978-0-387-49771-6)
- Clark-Gareca, Beth. (2010). Language Assessment in Practice. Working Papers in Applied Linguistics and TESOL. 10. 10.7916/D8CV4HB8.
- Evans, L. D., Tannehill, R., & Martin, S. (1995). Children's reading skills: A comparison of traditional and computerized assessment. *Behavior Research Methods, Instruments, & Computers*, 27(2), 162-165. DOI: 10.3758/BF03204723
- International Telecommunication Union (2022). *E-learning in Thailand: Mapping the digital divide*. Retrieved from <https://www.itu.int/hub/publication/d-pref-them-28-2022/>

- Goodwin, L. D., & Goodwin, W. L. (1999). Measurement myths and misconceptions. *School Psychology Quarterly*, 14(4), 408–427. <https://doi.org/10.1037/h0089017>
- Gordon, A. (2015). “Paper Based Testing vs. Mobile Device Based Testing in an EFL Environment: What’s the Difference?”. *Culminating Projects in English*. 38. https://repository.stcloudstate.edu/engl_etds/38
- Huynh Thi Trang, Tran Kha Han, Phuong Thi Cam Loan. (2022). Cheating Behaviours in Online Exams, *International Journal of Science and Management Studies (IJSMS)*, v5(i6), 32-37. DOI: 10.51386/25815946/ij sms-v5i6p103
- Mazzeo, J., & Harvey, A. L. (1988). The equivalence of scores from automated and conventional educational and psychological tests: A review of the literature (College Board Rep. No. 88-8, ETS R RNo. 88-21). Princeton, NJ: Educational Testing Service. <https://onlinelibrary.wiley.com/doi/epdf/10.1002/j.2330-8516.1988.tb00277.x>
- Mead, A. D., & Drasgow, F. (1993). Equivalence of computerized and paper-and-pencil cognitive ability tests: A meta-analysis. *Psychological Bulletin*, 114 (3), 449–458. <https://doi.org/10.1037/0033-2909.114.3.449>.
- Messick, S. (1989). Validity. In R. L. Linn (Ed.), *Educational measurement* (3rd ed., pp. 13-104). New York, NY: American Council on Education and Macmillan.
- Naznean, A. (2021). Cheating during Online Examinations– Literature Review. *Journal of Pedagogy*. LXVIII (2):7-21 DOI:10.26755/RevPed/2021.2/7
- Nikou, S., Economides, A. (2013). Student achievement in paper, computer/web and mobile based assessment. *CEUR Workshop Proceedings*. 1036.
- Nikou, S., Economides, A. (2018). Mobile-based assessment: A literature review of publications in major referred journals from 2009 to 2018. *Computers & Education*, vol. 125, 2018, Pages 101-119, ISSN 0360-1315, <https://doi.org/10.1016/j.compedu.2018.06.006>.
- Pommerich, M., & Burden, T. (2000). From simulation to application: Examinees react to computerized testing. Paper presented at the annual meeting of the National Council on Measurement in Education, New Orleans, LA. <https://eric.ed.gov/?id=ED442813>
- Wang, S., Jiao, H., Young, M. J., Brooks, T., & Olson, J. (2008). Comparability of computer-based and paper-and-pencil testing in K-12 reading assessments: A meta-analysis of testing mode effects. *Educational and Psychological Measurement*, 68(1), 5-24.
- Whattananarong, K. (2004). An experiment in the use of mobile phones for testing at King Mongkut’s Institute of Technology North Bangkok, Thailand. In *Proc. International Conference on Making Education Reform Happen: Learning from the Asian Experience & Comparative Perspectives*, Bangkok, Thailand.

Yu, W., Iwashita, N. (2021). Comparison of test performance on paper-based testing (PBT) and computer-based testing (CBT) by English-majored undergraduate students in China. *Lang Test Asia* **11**, 32. <https://doi.org/10.1186/s40468-021-00147-0>



Using an Electronic Student Portfolio as a Learning Tool for Enhancing the English Vocabulary Skills for Undergraduate Students

Jantira Suwanmanee^{1*} · Nunthikan Songsangrak² · Nuchanat Chaimut³
Palachai Khaonuan⁴

¹⁻⁴English for International Communication Program, Faculty of Liberal Arts,
Rajamangala University of Technology Srivijaya, Songkhla, THAILAND

⁵General Education Program, Faculty of Liberal Arts, Rajamangala University of
Technology Srivijaya, Songkhla, THAILAND

*Corresponding Author E-mail: nick.jantira41@gmail.com

(Article history) Received: 2025-04-22, Revised: 2026-04-23, Accepted: 2026-05-16

Abstract

Electronic portfolios can integrate multimedia resources, learner-controlled access, assessment, and evidence of progress, but the strength of an e-portfolio intervention depends on both the quality of its instructional design and the quality of its content. Evidence is especially limited for small, carefully validated vocabulary-learning tools developed for non-English-major engineering students. This study developed and evaluated an electronic student portfolio for English vocabulary learning, with vocabulary drawn from songs, films, and social media, and examined expert validation, instructional efficiency, pre-post vocabulary change, and learner attitudes. The completed study used a one-group pretest-posttest design with seven engineering students purposively selected from RUTS Test performance bands (two high, three medium, and two low). The Google Sites/Google Drive e-portfolio was reviewed independently by three media/design experts and three content experts. A 30-item vocabulary test and three 10-item embedded lesson tests were used. Reported analyses included descriptive statistics, Wilcoxon signed-rank testing, E1/E2 efficiency, an E-post-E-pre-effectiveness index, and attitude ratings in PSPP. Secondary reanalysis was limited to quantities derivable from the published participant-level scores. Design quality was rated $M = 4.53$ ($SD = 0.26$) and content quality $M = 4.83$ ($SD = 0.29$). Pre-test scores ($M = 19.71$, $SD = 2.69$) increased to $M = 26.43$ ($SD = 2.70$); the report gave Wilcoxon Asymp. Sig. (two-tailed) = .017. Efficiency was $E1/E2 = 80.0/88.1$ and $E\text{-post-E-pre} = 22.39$ percentage points. Overall learner attitude was $M = 4.66$ ($SD = 0.44$). A secondary calculation from the seven published score pairs yielded a mean gain of 6.71 points, $SD = 3.20$, 95% CI [3.76, 9.67], and paired Cohen's $d_z = 2.10$. The findings support the feasibility of a validated multimedia e-portfolio as a vocabulary-learning tool in this small engineering-student sample. Because the study had only seven purposively selected participants and no control group or delayed post-test, the results should be interpreted as pilot evidence rather than causal proof of superiority.

Keywords: Electronic Portfolio; E-portfolio; Vocabulary learning; Engineering students; Technology-enhanced language learning; Instructional design; Expert validation

1. INTRODUCTION

Vocabulary knowledge is a central resource for comprehension and communicative performance in a second or foreign language. Pedagogical research has repeatedly shown that vocabulary development benefits from deliberate attention, repeated encounters, meaningful contextualization, and opportunities to connect form and meaning (Nation, 2013; Schmitt, 2008). At the same time, a substantial portion of learners' English exposure now occurs through digitally mediated and audiovisual environments. Songs and television or film can create repeated, contextualized encounters with lexical items, and empirical studies demonstrate that vocabulary can be acquired incidentally from such sources, although learning depends on exposure frequency, prior knowledge, and characteristics of the input (Pavia et al., 2019; Peters & Webb, 2018; Webb & Rodgers, 2009). These observations provide a rationale for instructional designs that organize multimedia vocabulary resources rather than treating entertainment media as unstructured enrichment.

Electronic portfolios are well suited to this purpose because they can assemble texts, images, audio, video, learner tasks, and evidence of progress in one digital space. Earlier e-portfolio research has emphasized reflection, learner engagement, self-regulation, and the capacity to organize evidence of learning (Barrett, 2007; Beckers et al., 2016; Lin, 2008). In higher education, e-portfolios have also been associated with knowledge-management performance and opportunities for authentic or sustained assessment (Chang et al., 2013). However, reviews have cautioned that theoretical enthusiasm for e-portfolios has often exceeded the amount and quality of empirical evidence, particularly when studies do not report the design and validation of the digital instrument in sufficient detail (Bryant & Chittum, 2013). This concern is especially relevant for language-learning interventions: a gain in scores cannot be interpreted well unless readers also know whether the learning content, navigation, media, instructions, and assessment alignment were judged suitable.

The completed research underlying this article addressed that problem through a multimedia electronic student portfolio designed for engineering students at Rajamangala University of Technology Srivijaya (RUTS), Songkhla. The e-portfolio organized English vocabulary from three familiar sources—songs, films, and social media—and was implemented as a web-based learning environment using Google Sites with files and links managed through Google Drive. Rather than relying solely on a learner outcome test, the project incorporated two independent expert-validation tracks: one for media/design quality and one for vocabulary-content quality. The intervention then followed a pretest–learning–posttest sequence with embedded lesson tests and a post-use attitude questionnaire.

This article is deliberately positioned as a pilot development-and-evaluation study rather than a definitive efficacy trial. The sample contained only seven students and there was no comparison group. Accordingly, the principal scientific contribution is not a claim that the e-portfolio is superior to alternative teaching methods. Instead,

the paper integrates four forms of evidence already present in the completed report: (a) design-quality validation, (b) content-quality validation and test congruence, (c) process and pre-post learning indicators, and (d) learner attitudes. This emphasis blends the outcome-oriented original study with the second publication proposal, which foregrounded the development and validation of the multimedia instrument.

Research Gap and Novelty

Three gaps motivate the focused journal reconstruction. First, e-portfolio studies often report learner outcomes without a transparent audit trail showing how the instructional tool was reviewed and revised before use. Second, vocabulary-learning research frequently separates multimedia input research from e-portfolio design; the present project combines a portfolio architecture with vocabulary drawn from songs, films, and social media. Third, non-English-major engineering students are less prominent in the e-portfolio language-learning literature than language majors, teacher-education students, or writing-focused cohorts. The study therefore offers a small but unusually well-documented case of a dual-validated multimedia vocabulary tool used with a technically oriented student population.

Research Objectives and Research Questions

The article addresses four questions using only the completed study and secondary calculations that are directly reproducible from its published tables:

- RQ1. What levels of design quality and content quality did expert panels assign to the developed multimedia e-portfolio, overall and by reported design/content domains?*
- RQ2. Did students' vocabulary scores increase from pre-test to post-test, and what magnitude of within-participant change can be derived from the published score pairs?*
- RQ3. Did the e-portfolio meet the study's 80/80 instructional-efficiency criterion, and what did the lesson-level process scores indicate?*
- RQ4. How did students evaluate the e-portfolio after use, and which aspects received the strongest and weakest ratings?*

2. CRITICAL LITERATURE REVIEW

2.1 Electronic Portfolios as Learning and Assessment Environments

An e-portfolio is more than a digital storage container when it is intentionally designed to support learning. Barrett (2007) distinguished portfolio uses that merely document achievement from uses that support learning through reflection, learner ownership, and engagement. Lin (2008), in a year-long study of preservice teachers constructing e-portfolios online, similarly showed that the process of building a portfolio can become a learning experience in its own right. Lopez-Fernandez and Rodriguez-Illera (2009) examined university students' adaptation to a digital learner course portfolio and highlighted that successful use requires attention to learner

adaptation and the design of the digital environment, not simply the availability of technology.

Evidence from higher education is nevertheless mixed in strength and purpose. Chang et al. (2013) reported that university students learning with e-portfolios outperformed a non-portfolio group on several dimensions of knowledge management, demonstrating that e-portfolios can structure the acquisition, accumulation, application, innovation, and sharing of knowledge. By contrast, Bryant and Chittum's (2013) review concluded that the empirical case for e-portfolio effectiveness was less robust than the popularity of the technology suggested. This tension is important: an e-portfolio should be evaluated as an instructional system whose quality, use, and outcome measures are all documented.

Systematic work has also linked e-portfolios to self-directed learning when the design balances autonomy with adequate support. Beckers et al. (2016) identified multiple factors influencing self-directed learning through e-portfolios, suggesting that design choices, guidance, feedback, and learner agency interact. Poole et al. (2018), examining e-portfolio integration in education, likewise emphasized implementation challenges and supports. Together, this literature suggests that a strong e-portfolio study should report not only outcome scores but also design validation, usability, instructions, and the fit between assessment and learning objectives.

2.2 E-portfolios in Second Language Learning

Second-language e-portfolio research has often concentrated on writing and assessment. Ngui et al. (2020), for example, used an ADDIE-oriented development process to design an e-portfolio for second-language learners in higher education and reported generally positive student responses to the tool. Pourdana and Tavassoli (2022) found that electronic portfolio assessment could support engagement and writing development among university EFL learners, while also documenting the complexity of how feedback and task design affect different components of performance. More recent work continues to report generally favorable learner perceptions of e-portfolios while also highlighting implementation conditions and the need for context-sensitive design (Rezadoust Siah Khaleh Sar et al., 2024).

The present study differs from much of this literature in two respects. It treats the e-portfolio primarily as a vocabulary-learning tool rather than as a writing dossier or speaking-assessment record, and it builds the vocabulary around popular-media domains that are familiar to students. This shifts the portfolio from a retrospective collection of completed work toward a curated multimedia learning space that combines exposure, practice, progress checks, and post-use evaluation.

2.3 Vocabulary Learning through Multimedia and Popular Culture

Vocabulary learning requires repeated and meaningful encounters with lexical items. Nation (2013) argues that effective vocabulary development combines deliberate learning with rich input and opportunities for use. Schmitt (2008) likewise emphasizes that no single method is sufficient; vocabulary growth requires repeated attention across contexts. The task-induced involvement framework of Laufer and Hulstijn

(2001) further predicts deeper lexical processing when tasks create need, search, and evaluation demands.

Popular audiovisual media can provide such contexts. Webb and Rodgers (2009) quantified the lexical demands of television, showing why lexical coverage is central to comprehension. Peters and Webb (2018) demonstrated incidental vocabulary acquisition through viewing L2 television and identified frequency, prior vocabulary knowledge, and cognateness as influential factors. Pavia et al. (2019) showed that listening to songs can also produce vocabulary learning and that repeated listening and exposure frequency improve gains. Captioning research similarly indicates that audiovisual support can facilitate language processing and vocabulary-related learning (Winke et al., 2010). These findings do not prove that any specific multimedia e-portfolio will be effective; rather, they justify the design principle of embedding vocabulary within contextualized, repeated, multimodal materials.

2.4 Need for Development and Validation Evidence

An instructional tool can produce attractive screens and still be pedagogically weak. For that reason, the most distinctive feature of the present report is its separation of media/design validation from content validation. Three design specialists evaluated presentation, visual/interface design, learning media, instructions, and the student manual; three content specialists evaluated vocabulary appropriateness, alignment, and interest. The pre/post assessment was additionally reviewed for item-objective congruence. This layered validation strategy provides evidence about whether the digital environment is usable, whether the vocabulary content is suitable, and whether the test items align with intended objectives.

The current article therefore treats validation results as substantive evidence rather than as a procedural footnote. It also re-aggregates the appendix item means by domain as a secondary analysis. These calculations introduce no new observations; they simply make the validation profile more interpretable for instructional designers.

3. MATERIALS AND METHODS

3.1 Study Design

The completed study used a one-group pretest–posttest design, represented in the report as $E \rightarrow T1 \rightarrow X \rightarrow T2$, where E denotes the study group, T1 the pre-test, X the e-portfolio vocabulary-learning intervention, and T2 the post-test. Although one sentence in the methodology chapter labels the study 'qualitative research,' the implemented design, instruments, statistical procedures, and results are quantitative and pre-experimental. For this manuscript, the design is therefore described according to the procedures actually reported: a quantitative, pre-experimental one-group pretest–posttest pilot study.

3.2 Setting and Participants

The study was conducted at Rajamangala University of Technology Srivijaya, Songkhla, in Academic Year 2019 (B.E. 2562). Seven engineering students were purposively selected using RUTS Test performance information to represent three

proficiency bands: two students from a high-scoring band, three from a middle-scoring band, and two from a low-scoring band. The report does not publish the participant-level mapping between the seven IDs and these proficiency bands; therefore, no subgroup outcome analysis by RUTS proficiency is attempted.

A terminology inconsistency remains unresolved. The English title and English abstract identify the participants as undergraduate engineering students, while several Thai sections use wording that translates as graduate-level students. The underlying report does not provide independent enrollment records that allow this discrepancy to be resolved. Because the confirmed manuscript title specifies undergraduate students, that wording is retained in the title, while the Methods and Discussion use the neutral term 'engineering students' and explicitly disclose the inconsistency.

Table 1: Participant Sampling Structure Reported in the Full Study

Sampling characteristic	Reported	Use in this manuscript
High RMUTSV Test band	2	Describes purposive sampling only; participant IDs not linked to bands
Middle RMUTSV Test band	3	Describes purposive sampling only; no subgroup inference
Low RMUTSV Test band	2	Describes purposive sampling only; no subgroup inference
Total	7	All seven participants contributed pre-test, post-test, embedded-test, and attitude data

Remark: The study used purposive rather than random sampling. No class-distribution concept applies because this was not a classification or machine-learning study.

3.3 E-portfolio Platform and Learning Content

The electronic student portfolio was constructed as a website using Google Sites. The report documents the use of Google Drive for uploading, storing, and sharing files and links, with shared links incorporated into the e-portfolio website. The learning environment used text, images, sound, and video as core media. Vocabulary was organized into three thematic lessons based on songs, films, and social media. The retained process-assessment data show one 10-item embedded test for each lesson, giving 30 possible process points across the three lessons.

The report does not specify computing hardware, browser versions, operating-system versions, Google Sites release numbers, or network specifications. Those details are therefore not invented. Reproduction of the original platform can be conceptual rather than software-version identical: a web-based portfolio capable of displaying multimedia content, linking to shared resources, and presenting vocabulary practice and assessment.

3.4 Instrument Development and Expert Validation

Development proceeded through document/content analysis, selection of vocabulary judged interesting and appropriate for the target group, multimedia design, expert review, and revision. The e-portfolio was reviewed by separate panels of three experts for media/design quality and three experts for content quality. The report's

appendix contains item-level ratings, permitting a more detailed validation profile than the overall means alone.

The media/design panel evaluated five domains: presentation, visual/interface design, learning media, instructions, and the student manual. Inspection of the appendix establishes 20 design-quality items, not 15 as stated in the subsequent proposal document. The content panel evaluated three domains—appropriateness, alignment, and interest—across 10 items, not nine. The appendix counts are used because they are directly auditable from the full report.

The pre/post vocabulary test contained 30 multiple-choice items, corresponding to three 10-item parts. The methods narrative states that the test achieved IOC = 1.00, but the appendix item-level table shows that item 12 received two +1 ratings and one 0 rating, producing IOC = 0.67; the remaining 29 items have IOC = 1.00. All 30 items therefore exceeded the report's stated acceptance threshold of 0.50, but the manuscript does not repeat the unsupported claim that every item achieved 1.00.

3.5 Data Collection Procedure

Data collection followed four steps. First, participants completed the pre-test. Second, they learned English vocabulary through the developed e-portfolio and completed a 10-item embedded test after each of the three lessons. Third, participants completed the post-test. Fourth, they responded to a 10-item attitude questionnaire on a five-point Likert scale. The report states that the e-portfolio, tests, and evaluation forms were accessible through shared links after expert review and revision.

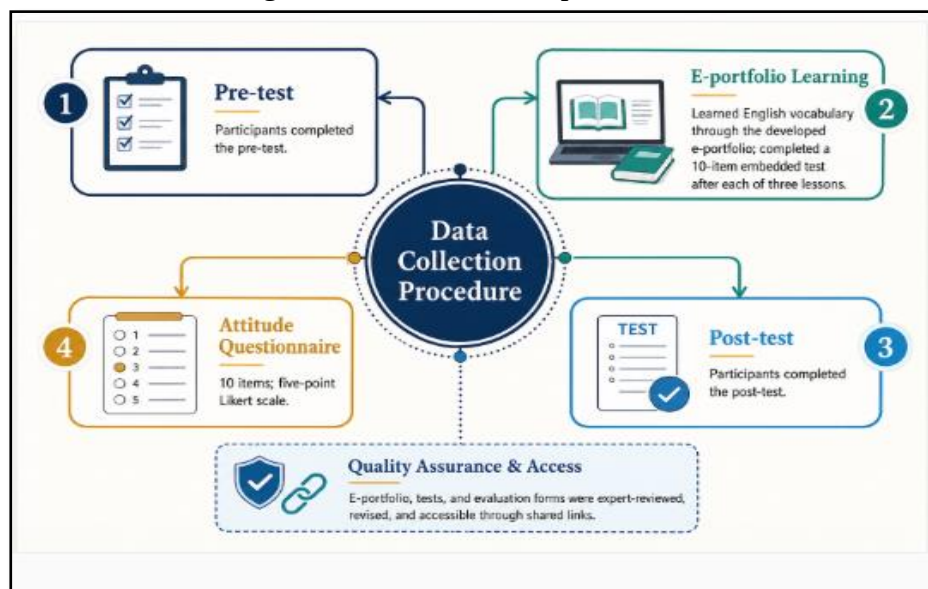


Figure 1: Study and Instrument Development Workflow

3.6 Outcome Measures and Original Statistical Analysis

The primary learning outcome was the 30-point pre/post vocabulary score. The report analyzed the paired scores using the Wilcoxon signed-rank procedure in PSPP and reported the asymptotic two-tailed significance value. Instructional efficiency was quantified using E1/E2. E1 was the percentage of available points obtained across the

three embedded lesson tests; E2 was the percentage of available points obtained on the post-test. The prespecified benchmark was 80/80. The report also calculated an effectiveness index as $E\text{-post} - E\text{-pre}$, where E-pre and E-post were pre-test and post-test percentages. Learner attitudes and expert ratings were summarized with means, standard deviations, and percentage distributions.

3.7 Secondary Analyses Performance

Secondary analyses were restricted to transparent calculations from values already published in the full report. No new participant, test administration, treatment, or outcome was introduced. From the seven published pre/post score pairs, the manuscript recalculated the mean gain and its sample standard deviation, a 95% confidence interval for the mean gain, paired Cohen's d_z (mean of paired differences divided by the standard deviation of paired differences), and an exact two-sided Wilcoxon signed-rank p value as a consistency check on the report's asymptotic PSPP result. Because $N = 7$, these statistics are descriptive/sensitivity supplements rather than grounds for strong generalization.

For instrument validation, item means printed in the appendix were arithmetically re-aggregated into the five design domains and three content domains. These domain means are explicitly labeled secondary reaggregations because the original report emphasized the overall panel means rather than presenting all domain averages in one table.

3.8 Computational Terminology, Comparison Methods, Hardware, and Reproducibility

The user-requested reporting template includes data preprocessing, model architecture, class distributions, cross-validation, ablation, calibration, unseen-dataset evaluation, and hardware. None of these concepts formed part of the completed educational study. There was no machine-learning or statistical-prediction model, no training/validation/test partition, no class label, no feature preprocessing, no hyperparameter optimization, no cross-validation, no ablation study, and no unseen external dataset. The only comparison was within-participant pre-test versus post-test, supplemented by the study's E1/E2 criterion and expert/attitude ratings. Hardware specifications were not reported. PSPP was the stated analysis software, but the version was not given.

Reproducibility is strongest for the reported numerical analyses because participant-level pre/post scores and lesson-level process scores are printed in the report. The original Google Sites/Drive implementation details are partly documented through screenshots, but no archived code repository, permanent data repository, software version, or persistent public URL is supplied. Accordingly, this manuscript supports numerical reanalysis from published outputs and conceptual replication of the instructional design, not byte-for-byte reconstruction of the original website.

Table 2: Source-data Verification and Resolution Decisions

Issue	Evidence in full report	Decision for this manuscript
Student level	English title/abstract: undergraduate; several Thai sections: graduate-level	Unresolved; confirmed title retained, body uses 'engineering students' and discloses conflict
Research-design label	One sentence says qualitative; design and all main analyses are quantitative one-group pre/post	Describe as quantitative pre-experimental pilot
Design-panel item count	Appendix contains 20 items; proposal document summarized 15	Use 20 appendix items
Content-panel item count	Appendix contains 10 items; proposal document summarized 9	Use 10 appendix items
Test IOC	Narrative says 1.00; appendix: item 12 = 0.67 and 29 items = 1.00	Report item-level appendix result; all exceed 0.50 threshold
Post-test mean	One table prints 26.42; raw total 185/7 and narrative give 26.43	Use 26.43
Gain-score SD	Table prints 0.01, inconsistent with published gains 3,5,10,5,12,5,7	Do not use 0.01; secondary recalculation SD = 3.20
Total embedded-test mean	Table prints 18.95 despite total 168/7 = 24.00	Do not use 18.95; report lesson means and E1 = 80.0

Note: Where arithmetic from participant-level or appendix data can resolve a discrepancy, the auditable value is used. Unresolvable inconsistencies are disclosed rather than silently corrected.

4. RESULTS

4.1 Expert Validation of the E-portfolio

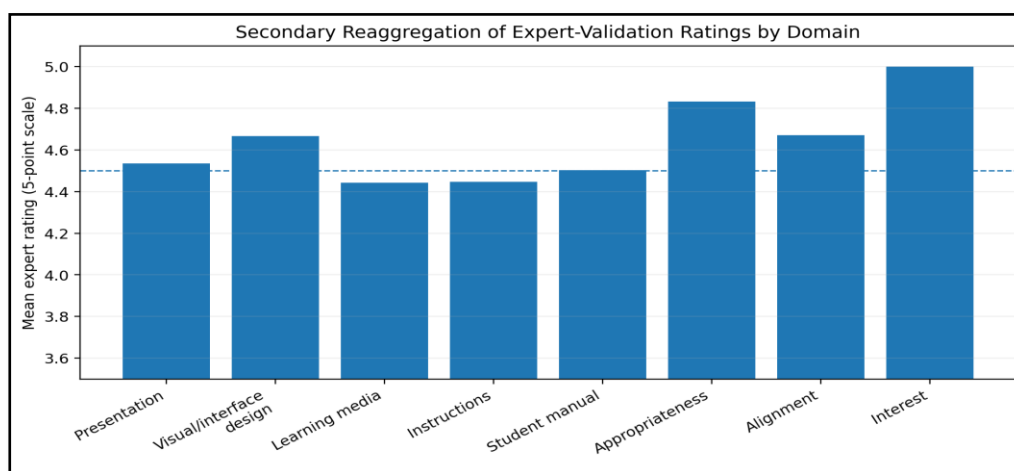
The report rated the overall media/design quality of the e-portfolio as very good ($M = 4.53$, $SD = 0.26$) based on three design/media experts. Across the 20 appendix items, several features reached the ceiling rating of 5.00, including access speed, correspondence between illustrations/video and vocabulary, clarity of illustrations, video image clarity, video sound clarity, support for self-directed learning, and the sequencing guidance in the student manual. The lowest design item concerned whether assessment was sufficiently comprehensive and aligned with objectives ($M = 3.67$, $SD = 0.58$), although this still fell within the report's 'good' band.

Content quality was rated even more strongly ($M = 4.83$, $SD = 0.29$) by three content experts. Vocabulary-objective appropriateness, vocabulary accuracy, category accuracy, vocabulary interest, vocabulary variety, and the ability of activities to support rapid learning were all rated at 5.00. The lowest content item concerned the ordering of vocabulary within lessons ($M = 4.33$, $SD = 1.15$). The instrument therefore showed a very strong content profile while revealing specific design and sequencing elements that could be targeted in later refinement.

Table 3: Expert-validation Results

Validation domain	Mean rating	Status
Design: Presentation	4.53	Secondary reaggregation of appendix item means
Design: Visual/interface design	4.67	Secondary reaggregation of appendix item means
Design: Learning media	4.44	Secondary reaggregation of appendix item means
Design: Instructions	4.45	Secondary reaggregation of appendix item means
Design: Student manual	4.50	Secondary reaggregation of appendix item means
Content: Appropriateness	4.83	Secondary reaggregation of appendix item means
Content: Alignment	4.67	Secondary reaggregation of appendix item means
Content: Interest	5.00	Secondary reaggregation of appendix item means
Overall design quality	4.53 (SD 0.26)	Reported
Overall content quality	4.83 (SD 0.29)	Reported

Remark: Domain means are secondary arithmetic reaggregations of reported item means. Overall panel means and SDs are reported findings.

**Figure 2: Secondary Reaggregation of Expert-validation Ratings by Domain.**

4.2 Test Content Congruence

All 30 pre/post vocabulary-test items met the report's stated IOC acceptability criterion (> 0.50). Twenty-nine items had IOC = 1.00. Item 12 had IOC = 0.67 because one of the three experts assigned a neutral (0) rating while the other two assigned +1. This appendix-based result supersedes the report's more general narrative statement that the test achieved IOC = 1.00 throughout. No coefficient of internal consistency for the 30-item test is reported, so no reliability coefficient is supplied or imputed.

4.3 Vocabulary Achievement

Every participant obtained a higher post-test score than pre-test score. The seven reported score changes were +3, +5, +10, +5, +12, +5, and +7 points. The pre-test mean was 19.71 (SD = 2.69) out of 30 and the post-test mean was 26.43 (SD = 2.70). The report's Wilcoxon signed-rank analysis gave Asymp. Sig. (two-tailed) = .017 and interpreted the pre/post difference as statistically significant at the .05 level.

Table 4: Participant-level Pre-test and Post-test Vocabulary Scores

Participant	Pre-test	Post-test	Gain
1	22	25	3
2	20	25	5
3	17	27	10
4	22	27	5
5	17	29	12
6	17	22	5
7	23	30	7
Mean	19.71	26.43	6.71

Note: Scores are reported in the full research report. The maximum score was 30. The report's printed gain SD of 0.01 is inconsistent with these seven gain values and is not used.

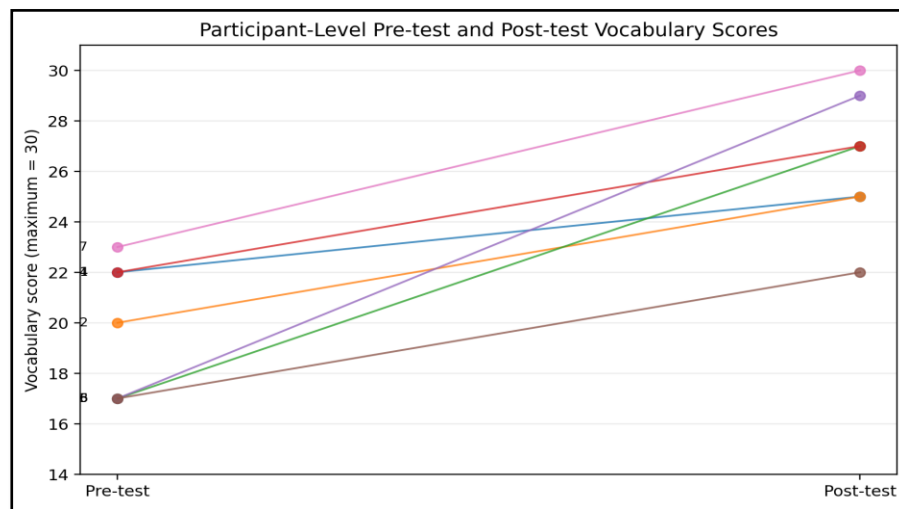


Figure 3: Participant-level Pre-test and Post-test Vocabulary Scores

4.4 Secondary Magnitude and Robustness Analysis of the Pre–Post Change

Using only the seven published score pairs, the mean gain was 6.71 points with a recalculated gain SD of 3.20. The corresponding 95% confidence interval for the mean gain was [3.76, 9.67] points. Paired Cohen's d_z was 2.10, indicating a large within-participant standardized change. Because the design lacks a control group, this effect size quantifies the magnitude of observed change within this sample; it does not identify the e-portfolio as the sole causal source of that change.

As a sensitivity check, an exact two-sided Wilcoxon signed-rank calculation from the published pairs produced $p = 0.01562$. This is close to the report's PSPP asymptotic value of .017 and leads to the same inferential conclusion at $\alpha = .05$. The

exact calculation is reported as a secondary consistency check rather than as a replacement for the original analysis.

Table 5: Reported and Secondary Pre–Post Statistics

Metric			Value	Status / interpretation
Pre-test			M = 19.71, SD = 2.69	Reported
Post-test			M = 26.43, SD = 2.70	Reported; 26.43 matches raw total 185/7
Wilcoxon (2-tailed)	Asymp.	Sig.	.017	Reported PSPP result
Mean gain			6.71 points	Reported mean; confirmed from score pairs
Gain SD			3.20	Secondary recalculation; replaces internally inconsistent printed 0.01 for analysis
95% CI for mean gain			[3.76, 9.67]	Secondary calculation
Paired Cohen's dz			2.10	Secondary standardized magnitude
Exact Wilcoxon p			0.01562	Secondary robustness check

Note: Secondary statistics use only the seven participant-level pairs printed in the original report.

4.5 Instructional-process Performance, Efficiency, and Effectiveness

The three embedded 10-item lesson tests yielded total scores of 57, 58, and 53 across the seven students, corresponding to lesson means of 8.14 (SD = 1.07), 8.29 (SD = 0.95), and 7.57 (SD = 1.51). The third lesson therefore had the lowest mean and the greatest dispersion, suggesting that its content or task demands may have been relatively more difficult or variable for this small group. This is a descriptive interpretation; no lesson-by-lesson significance test was reported.

The total embedded-test score was 168 out of a possible 210, giving $E1 = 80.0\%$. The post-test total was 185 out of 210, giving $E2 = 88.1\%$. Thus, the reported efficiency was $E1/E2 = 80.0/88.1$, meeting the prespecified 80/80 benchmark exactly on $E1$ and exceeding it on $E2$. Pre-test performance expressed as a percentage was $Epre = 65.71\%$, while post-test performance was $Epost = 88.1\%$; the report's effectiveness measure $Epost - Epre$ was therefore 22.39 percentage points.

Table 6: Lesson-level Process Performance and Efficiency Indicators

Indicator	Lesson 1	Lesson 2	Lesson 3	Overall / post
Embedded-test total	57	58	53	168
Mean (out of 10)	8.14	8.29	7.57	—
SD	1.07	0.95	1.51	—
E1 process efficiency	—	—	—	80.0%
E2 post-test efficiency	—	—	—	88.1%
E1/E2	—	—	—	80.0/88.1
Epre	—	—	—	65.71%
Epost – Epre	—	—	—	22.39 percentage points

4.6 Learner Attitudes

Overall post-use attitude toward the electronic portfolio was very positive ($M = 4.66$, $SD = 0.44$), corresponding to the report's highest qualitative band. Three items reached a mean of 5.00: vocabulary appropriateness for learners, the ability of exercises

to check understanding, and ease of access. The lowest-rated item concerned the quality and suitability of images and videos ($M = 4.14$, $SD = 0.69$), which remained within the report's 'good' range but provides a concrete target for future redesign. Vocabulary continuity across lessons had $M = 4.43$ ($SD = 0.79$), and lesson/exercise sequencing had $M = 4.57$ ($SD = 0.79$), indicating more disagreement than the ceiling-rated items.

Table 7: Learner Attitude Ratings After Use of the E-portfolio

Item	Mean	SD
1. Can enhance vocabulary knowledge	4.57	0.53
2. Vocabulary is interesting and engaging	4.71	0.49
3. Learners can sequence the lessons	4.57	0.53
4. Vocabulary knowledge can be applied in varied ways	4.57	0.53
5. Vocabulary is appropriate for learners	5.00	0.00
6. Vocabulary is continuous across lessons	4.43	0.79
7. Lesson and exercise sequence is appropriate	4.57	0.79
8. Exercises can check learner understanding	5.00	0.00
9. Lessons are easy to access and uncomplicated	5.00	0.00
10. Image/video quality is appropriate, clear, interesting	4.14	0.69
Overall	4.66	0.44

Note: Reported results from the 10-item, five-point post-use attitude questionnaire.

4.7 Requested Analyses That Were Not Part of the Completed Study

No ablation findings, k-fold cross-validation results, calibration analysis, unseen-dataset evaluation, external validation, or model-comparison benchmarks exist in the source report. These are not omitted accidentally; they are inapplicable to the study's pre-experimental educational design. Creating such results would require new data or new experimental procedures and would violate the evidence boundary of this manuscript.

5. DISCUSSION

5.1 Interpreting the Combined Development and Outcome Evidence

The principal strength of the study is the convergence of multiple evidence streams. The e-portfolio was not evaluated solely by whether learners liked it or whether post-test scores were higher. Instead, separate expert panels evaluated its media/design quality and its content quality before the student intervention, the test was reviewed for item-objective congruence, students completed process assessments during the three lessons, vocabulary performance was measured before and after learning, and learner attitudes were recorded after use. This sequence makes the case for feasibility more credible than a single post-use satisfaction measure would.

The validation pattern is also informative. Content specialists rated the vocabulary package more highly overall ($M = 4.83$) than design specialists rated the media/interface package ($M = 4.53$). That difference should not be treated as a statistical panel comparison because each panel contained only three experts and the original study did not test the panels inferentially. Descriptively, however, the pattern suggests that the lexical content was a particular strength, whereas assessment alignment, some aspects of presentation, and learner support could still be refined. This

interpretation is consistent with the development-centered logic of Ngui et al. (2020), who emphasized the importance of systematically designing and evaluating an e-portfolio rather than treating the platform itself as the intervention.

5.2 Why Vocabulary Performance May Have Improved

The observed pre–post improvement is compatible with several mechanisms, although the design cannot isolate them causally. First, the e-portfolio offered repeated exposure: learners encountered vocabulary in multimedia materials and then completed embedded tests. Repetition is central to vocabulary learning, and studies of songs and audiovisual input show that frequency of exposure is associated with stronger lexical gains (Pavia et al., 2019; Peters & Webb, 2018). Second, the content was contextualized within songs, films, and social media rather than presented only as decontextualized word lists. Multimedia contexts may support form–meaning associations by providing semantic, visual, and auditory cues.

Third, the e-portfolio supported self-paced access. The report explicitly describes the e-portfolio as an online resource that learners could enter and navigate, and the design panel rated support for self-directed learning at the maximum score. This is compatible with the broader literature in which e-portfolios can promote learner ownership and self-directed learning when sufficient structure and guidance are present (Barrett, 2007; Beckers et al., 2016). Fourth, the embedded exercises created retrieval opportunities. Vocabulary learning is strengthened when learners must retrieve and evaluate lexical knowledge rather than merely re-view content, a principle that aligns with involvement-based accounts of lexical learning (Laufer & Hulstijn, 2001).

5.3 Interpretation of the Magnitude of Change

The secondary standardized effect size ($dz \approx 2.10$) indicates that the within-student score change was large relative to the variability of individual gains. However, the number should be interpreted with substantial caution. With only seven participants, standardized effects are unstable; and in a one-group pretest–posttest design, the effect incorporates not only the intervention but also possible testing effects, maturation, outside exposure, and regression-related influences. The appropriate conclusion is therefore that a large within-sample change was observed after the e-portfolio learning period—not that the e-portfolio caused a two-standard-deviation improvement compared with conventional teaching.

The exact Wilcoxon sensitivity calculation ($p = .01563$) is useful because it confirms that the report's asymptotic $p = .017$ was not an artifact of the PSPP asymptotic approximation. Yet statistical significance with $N = 7$ should not be confused with generalizability. The unanimous direction of change (all seven post-test scores exceeded pre-test scores) is descriptively notable, but replication with a larger controlled sample is necessary.

5.4 Lesson-level Variation

The third embedded lesson had the lowest mean (7.57/10) and the largest SD (1.51), compared with 8.14 (SD = 1.07) and 8.29 (SD = 0.95) for the first two lessons.

The report identifies the three thematic areas as songs, films, and social media; the third lesson corresponds to social-media vocabulary. Because the source report does not provide item difficulty indices, exposure counts, timing data, or a controlled comparison of lesson content, the cause of this pattern cannot be established. It may reflect differences in word difficulty, media quality, task construction, or simple sampling variation. The result nevertheless demonstrates how process data can identify a specific lesson for future qualitative and item-level review.

5.5 Learner Attitudes and Design Implications

Learners' overall attitude score ($M = 4.66$) supports the acceptability of the e-portfolio in this small cohort. Importantly, attitudes were not uniformly at ceiling. The strongest items concerned vocabulary appropriateness, exercise-based understanding checks, and ease of access, while image/video quality was rated lowest. This pattern is useful for design because it separates perceived pedagogical value from media-production quality. An instructional tool can be easy to access and useful for learning while still benefiting from higher-resolution, more consistently edited, or more carefully selected audiovisual resources.

The learner pattern partially converges with the expert validation. Experts rated video image and audio clarity at ceiling in the version they reviewed, whereas learners gave the broader image/video quality item 4.14. This divergence should not be interpreted as a contradiction: experts and learners answered different items from different perspectives, and the sample sizes were extremely small. Rather, it suggests that expert technical judgments and end-user experience are complementary evidence sources. Contemporary e-portfolio research similarly emphasizes that implementation quality includes both instructional design and the user experience of learners (Poole et al., 2018; Rezadoust Siah Khaleh Sar et al., 2024).

5.6 Comparison with Previous E-portfolio and Multimedia Vocabulary Research

The results are broadly consistent with studies that report positive learning or engagement outcomes from e-portfolios, but the present design is too small to claim equivalence with controlled studies. Chang et al. (2013) used a substantially larger sample and a non-portfolio comparison group, whereas the current project lacks a control condition. Pourdana and Tavassoli (2022) likewise analyzed a larger university EFL sample and connected portfolio use to writing development and engagement across repeated tasks. The current study contributes a different, narrower case: vocabulary learning in an engineering cohort, with dual expert validation and entertainment-related content.

The popular-media focus also aligns with audiovisual vocabulary research. Pavia et al. (2019) demonstrated vocabulary learning through songs and the benefit of repeated listening; Peters and Webb (2018) demonstrated learning from television viewing; Webb and Rodgers (2009) described the lexical demands that learners face in television programs; and Winke et al. (2010) showed how captioning can affect foreign-language video learning. The present report did not manipulate media type, captions, repetition counts, or exposure frequency, so it cannot test these mechanisms. Its contribution is instead to show a practical way of curating multiple media sources

inside one portfolio environment and evaluating that environment through content, design, process, achievement, and attitude evidence.

6. CONTRIBUTIONS

6.1 Theoretical Contribution

The study connects two bodies of theory that are often treated separately: e-portfolio learning environments and multimedia vocabulary acquisition. The e-portfolio provides a structure for learner-controlled access, organization, repeated practice, and evidence of progress; popular-media content provides contextualized lexical input. By integrating these functions, the study illustrates how portfolio technology can serve not only as an assessment archive but also as an active lexical-learning environment.

6.2 Methodological Contribution

The most transferable methodological contribution is the dual-track validation model. Media/design quality and content quality were evaluated by separate expert panels, and test-objective congruence was evaluated independently. This separation makes it possible to identify whether weaknesses lie in the learning content, the interface/media, the learner guidance, or the assessment system. The journal reconstruction further demonstrates how legacy educational reports can be audited against participant-level and appendix evidence before publication, preventing internal inconsistencies from being silently propagated.

Computational and Digital-design Contribution

The study is not computational in the sense of machine learning or predictive modeling. Its computational contribution is limited to the deployment of a web-based multimedia e-portfolio using Google Sites and Google Drive and the reproducible calculation of learning/validation metrics from retained scores. The platform architecture demonstrates a low-code approach to integrating multimedia vocabulary resources, shared files, embedded assessments, and learner access. No claim is made about algorithmic intelligence, adaptive sequencing, or automated analytics because none was implemented or evaluated.

Practical Contribution

For English instructors working with non-English-major students, the study provides a concrete design template: select contextually relevant vocabulary, organize it into thematic multimedia lessons, validate content and interface separately, include short embedded retrieval tests, measure pre/post learning, and collect end-user feedback. The expert and learner ratings also identify practical priorities for future versions: maintain easy access and clear guidance, strengthen assessment-objective alignment, review vocabulary sequencing, and improve the perceived quality of images and video.

6.3 Limitations and Future Research

The most important limitation is sample size. With $N = 7$, estimates of means, standard deviations, effect sizes, and attitudes are imprecise and susceptible to the influence of individual observations. The purposive sampling strategy further restricts generalizability. The pre-experimental one-group design lacks a control or comparison group, so the observed improvement cannot be attributed uniquely to the e-portfolio.

The study also lacks a delayed post-test, preventing any conclusion about long-term retention. The published report does not provide participant-level links to the high/middle/low RMUTSV Test sampling bands, so proficiency-moderation analysis cannot be reconstructed. No item-level pre/post response matrix is available in the report, which prevents formal item difficulty, discrimination, distractor, or internal-consistency analysis. Likewise, time-on-task, navigation traces, media exposure counts, and learning analytics were not recorded or reported.

Several reporting inconsistencies required explicit resolution. These included undergraduate versus graduate-level terminology, a qualitative label applied to a quantitative pre/post design, differing item counts in the proposal summary, the narrative IOC = 1.00 claim despite one appendix item at 0.67, a post-test mean printed once as 26.42, an implausible gain SD of 0.01, and an incorrect total process mean. These issues highlight the importance of preserving raw or participant-level outputs and auditing tables before journal submission.

Future work should retain the validated development process but evaluate a larger sample with an appropriate comparison condition and preferably random or matched assignment where feasible. A delayed post-test would address retention. Item-level data would support reliability and diagnostic analyses. Process analytics could test whether frequency of media exposure, lesson order, or time-on-task predicts vocabulary gain. The e-portfolio could also be migrated to a contemporary learning-management or mobile-responsive environment while preserving the core design principles. Critically, these are future-study recommendations; no such experiments are claimed in the present paper.

7. CONCLUSION

This study developed a multimedia electronic student portfolio for English vocabulary learning and evaluated it through independent expert review, pre-post testing, process efficiency, and learner attitudes. The instrument received very high content-quality ratings and high-to-very-high design-quality ratings, with specific improvement targets identified in assessment alignment and media experience. In the seven-student pilot, all participants scored higher after the intervention; the reported Wilcoxon analysis was significant, E1/E2 met the 80/80 criterion, and post-use attitudes were strongly positive.

The most defensible interpretation is that the e-portfolio was feasible, well validated for its intended instructional use, and associated with substantial within-sample vocabulary gains. The evidence does not establish superiority over conventional instruction because there was no control group, the sample was very small, and retention was not measured. By integrating dual expert validation with learner

outcomes and by transparently reconciling source-report inconsistencies, the manuscript offers a reproducible framework for developing and evaluating small-scale technology-enhanced vocabulary interventions in higher education.

REFERENCES

- Barrett, H. C. (2007). Researching electronic portfolios and learner engagement: The REFLECT initiative. *Journal of Adolescent & Adult Literacy*, 50(6), 436–449. <https://doi.org/10.1598/JAAL.50.6.2>
- Beckers, J., Dolmans, D., & Van Merriënboer, J. J. G. (2016). E-portfolios enhancing students' self-directed learning: A systematic review of influencing factors. *Australasian Journal of Educational Technology*, 32(2), 32–46. <https://doi.org/10.14742/ajet.2528>
- Bryant, L. H., & Chittum, J. R. (2013). ePortfolio effectiveness: A(n ill-fated) search for empirical support. *International Journal of ePortfolio*, 3(2), 189–198.
- Chang, C.-C., Tseng, K.-H., Liang, C., & Chen, T.-Y. (2013). Using e-portfolios to facilitate university students' knowledge management performance: E-portfolio vs. non-portfolio. *Computers & Education*, 69, 216–224. <https://doi.org/10.1016/j.compedu.2013.07.017>
- Laufer, B., & Hulstijn, J. (2001). Incidental vocabulary acquisition in a second language: The construct of task-induced involvement. *Applied Linguistics*, 22(1), 1–26. <https://doi.org/10.1093/applin/22.1.1>
- Lin, Q. (2008). Preservice teachers' learning experiences of constructing e-portfolios online. *The Internet and Higher Education*, 11(3–4), 194–200. <https://doi.org/10.1016/j.iheduc.2008.07.002>
- López-Fernández, O., & Rodríguez-Illera, J. L. (2009). Investigating university students' adaptation to a digital learner course portfolio. *Computers & Education*, 52(3), 608–616. <https://doi.org/10.1016/j.compedu.2008.11.003>
- Nation, I. S. P. (2013). *Learning vocabulary in another language* (2nd ed.). Cambridge University Press.
- Ngui, W., Pang, V., & Hiew, W. (2020). Designing and developing an e-portfolio for second language learners in higher education. *International Journal of Information and Education Technology*, 10(5), 362–366. <https://doi.org/10.18178/ijiet.2020.10.5.1390>
- Pavia, N., Webb, S., & Faez, F. (2019). Incidental vocabulary learning through listening to songs. *Studies in Second Language Acquisition*, 41(4), 745–768. <https://doi.org/10.1017/S0272263119000020>
- Peters, E., & Webb, S. (2018). Incidental vocabulary acquisition through viewing L2 television and factors that affect learning. *Studies in Second Language Acquisition*, 40(3), 551–577. <https://doi.org/10.1017/S0272263117000407>

- Poole, P., Brown, M., McNamara, G., O'Hara, J., O'Brien, S., & Burns, D. (2018). Challenges and supports towards the integration of ePortfolios in education: Lessons to be learned from Ireland. *Heliyon*, 4(11), e00899. <https://doi.org/10.1016/j.heliyon.2018.e00899>
- Pourdana, N., & Tavassoli, K. (2022). Differential impacts of e-portfolio assessment on language learners' engagement modes and genre-based writing improvement. *Language Testing in Asia*, 12, Article 7. <https://doi.org/10.1186/s40468-022-00156-7>
- Rezadoust Siah Khaleh Sar, H., Khalili Sabet, M., Mahdavi Zafarghandi, A., et al. (2024). Iranian teachers' and learners' attitudes towards the use of e-portfolio in second language speaking assessment. *Language Testing in Asia*, 14, Article 61. <https://doi.org/10.1186/s40468-024-00335-8>
- Schmitt, N. (2008). Review article: Instructed second language vocabulary learning. *Language Teaching Research*, 12(3), 329–363. <https://doi.org/10.1177/1362168808089921>
- Webb, S., & Rodgers, M. P. H. (2009). Vocabulary demands of television programs. *Language Learning*, 59(2), 335–366. <https://doi.org/10.1111/j.1467-9922.2009.00509.x>
- Webb, S., & Rodgers, M. P. H. (2009). The lexical coverage of movies. *Applied Linguistics*, 30(3), 407–427. <https://doi.org/10.1093/applin/amp010>
- Winke, P., Gass, S., & Sydorenko, T. (2010). The effects of captioning videos used for foreign language listening activities. *Language Learning & Technology*, 14(1), 65–86. <https://doi.org/10.64152/10125/44203>



Effective Author Guidelines for Successful Research Articles: Feedback from a Thai EFL Teaching and Learning Context

Chamnong Kaewneam^{1*} Thanya Pakpoom² Piyarat Pipattarasakul³ Boonyarit Omanee⁴

^{1*4} Program in Foreign Languages for Communication, Faculty of Liberal Arts, Rajamangala
University of Technology Srivijaya, Songkhla 90000, THAILAND

^{2,3} Program in English for International Communication, Faculty of Liberal Arts, Rajamangala
University of Technology Krungthep, Bangkok 10120, THAILAND

*Corresponding Author E-mail: chamnong.k@rmutsv.ac.th

(Article history) Received: 2025-08-07, Revised: 2026-08-11, Accepted: 2026-08-23

Abstract

This study investigated author guidelines for research conduction and research article writing in the area of English communication. It examined the success of students' research articles using the guidelines by three reviewers. It also assessed the effectiveness of the guidelines when used to evaluate the students' articles by experienced students. The research was carried out after a methodology course offered to a group of 51 Thai undergraduate students who completed 17 research articles altogether. A set of author guidelines was developed by three present and former course lecturers. It was concerned with 17 elements, that is, title, abstract, keywords, introduction, objective(s), literature review, data collection methods, research ethics, data analysis methods, findings, discussion, conclusion, contribution, citing and referencing, plagiarism, English use, and tidiness and neatness. The articles' success scores fell into a successful category, the second-highest level. The effectiveness of the guidelines was also placed into an effective category, i.e., the second-highest level. This study encouraged student and novice researchers to employ the author guidelines as well as other frameworks and offer their manuscripts for consideration in international journals so that fruitful results from Thai EFL contexts can be observed.

Keywords: Author guideline, Research article, Student research, EFL, Thai

1. INTRODUCTION

Research promotes educational sustainability by instilling individuals with systematic, logical, critical, creative, and evidence-based ways of thinking. Therefore, educational institutions worldwide encourage their staff and students to conduct and publish research papers in prestigious journals. Research publications also influence academic advancement and employment, as well as university world rankings such as QS World University Rankings and Times Higher Education's World University Rankings. Thai universities keep up with the global movement and teach their students research methodologies. However, Thai scholars most probably have not published their research to the fullest extent. The observation is based on the author's survey of EBSCO Discovery Service in October 2025. An exploration found that Thais have contributed 0.72% of the world's research publications on English and related topics in

the past five years. Although English is primarily used only in specific contexts within Thailand's foreign language learning environment (EFL), this study believes that researchers majoring in English-related fields can increase their research publications when they have access to effective guidelines, become more confident, and offer more manuscripts to international journals.

At a Thai university, undergraduate students majoring in English for communication are taught an independent study (IS) course. The course requires the students to complete a small-scale research project in the form of a research article. It is recommended that the completed research articles be offered for consideration at international conferences or academic journals. A survey conducted before the present study found that, among the 27 research projects completed in three consecutive semesters, three of the students' research articles have been published in an international conference proceeding run by the students' university (Inyok et al., 2024; Mana et al.; Petkhong et al., 2024), and the findings of one project contributed to a paper published in a Thai Citation Index (TCI) journal (Kaewneam, 2025). The four publications make up approximately 15% of all the students' articles. The publication percentages could have been greater when everyone was confident in their research articles and submitted the manuscripts to international journals. In this scenario, it was considered that more effective guidelines could accelerate the process of research conduction and writing up research articles and could bring about more submissions and publications.

While author guidelines can cover information beyond research conduction, for instance, aims, scope, and formatting (System, 2025), the present study focuses on recommended research components by journals. Research interest in such author guidelines can be found from Wu et al.'s (2016) study, where the researchers finalized author guidelines as benchmarks for developing qualitative manuscripts. The guidelines were described in five categories: 1) introduction/background, 2) literature review, 3) methods, including approach, recruitment and sampling, data collection, analysis, and human subjects, 4) results/findings, and 5) discussion. More recent research is interested in how plagiarism, systematic reviews, meta-analyses, and the use of artificial intelligence are addressed in research papers (e.g., Javed & Ahmed, 2025; Sun, 2021; Goldberg et al., 2022; Rosen et al., 2024; Goyanes et al., 2025). Similar to Wu et al. (2016), the present research aimed to achieve effective guidelines for developing manuscripts for peer-reviewed journals. Such direct guidelines are hard to find in contemporary journals, most probably because they are regarded as the authors' job. In this situation, availability of author guidelines is even more desirable for novice researchers.

This study assigns weights to novice researchers, particularly student researchers. Although new researchers can learn about research from books and classes on research methodologies, the contents are often too overwhelming for them. Although training in research methodology has shown improvement in research competencies (Siribhon & Nicharee, 2025), a study that has extended to a publication attempt is hard to find. Accurate and dependable author guidelines are significant for novice researchers. Furthermore, manuscripts in general will go through rigorous peer-review processes of individual journals before publication. Therefore, apart from effective author guidelines, this study also invited three reviewers to examine the students' research articles to better understand the nature of the student research. This

study aimed at author guidelines that would be valid for both quantitative and qualitative studies in the area of English communication. More recent issues were taken into account as the investigation prevailed. It is anticipated that knowledge learned from this study will also be useful for novice researchers outside the research context, inside or outside Thailand, and in other research fields in the social sciences.

Research Objectives

The objectives of the study were to 1) develop author guidelines for research conduction and writing research articles in the area of English communication; 2) investigate the success of the students' research articles using the guidelines; and 3) evaluate the effectiveness of the author guidelines.

2. LITERATURE REVIEW

Research is a logical and systematic way of finding answers to questions (Neuman, 2006). Evans & Gruba (2005) point out that in research, a problem arises before a question: "Research is nearly always an attempt to find a solution to a problem that you have identified". You believe that the present way of doing things is inadequate in some way or that existing theory does not explain the observable behavior of a system satisfactorily" (pp. 58–59). Therefore, researchers seek new information or new understanding by way of research (Cambridge University Press, 2025) to have more comfortable environments, more efficient transportation, and healthier food options, to name just a few.

Researchers publish their research work so that the knowledge will reach out and be beneficial for the public and the whole world (Evans & Gruba, 2005). Two common channels of dissemination of research include academic journals and conferences. Generally speaking, the first channel is more influential than the second when the journals are stored in high-stakes indexes such as ScienceDirect, Scopus, and Web of Science because they are disseminated on a global scale. It will take quite some time for research articles to be accepted for publication when they go through the journals' peer-review processes. The second channel, or conferences, is usually organized by educational institutions. Research work presented there is usually published in conference proceedings after oral presentation sessions. The conferences may be run annually, and the peer review of the research articles less intense, and it will take less time for publication.

Although the depth and length of the research articles published in journals and conference proceedings may differ, they are based on the same absolute research components. For example, a research article published in The New English Teacher journal is built on a title, information about authors and affiliations, the article info, an abstract, keywords, and these sections: introduction (including literature review); methodology (including instruction, participants, research instruments, data collection, and analysis); results and discussion; conclusion; references; and appendices (Sirijanchuan & Tangkiengsirisin, 2025). In an article published in the proceedings of an international conference, the paper's components include a title, authors and affiliations, an abstract, keywords, and sections on introduction, research objectives, research methods (including population and sample, data collection, and data analysis),

research results, discussion, conclusion, acknowledgment, and references (Petkhong et al. 2024). As observable from the two articles, The absolute components of research comprise: 1) title, 2) abstract, 3) keywords, 4) introduction, 5) objective(s), 6) literature review, 7) data collection and analysis methods or methodology, 8) results/findings, 9) discussion, 10) conclusion, and 11) references.

An exploration of author guidelines of 20 international journals publishing research articles on English communication and related areas found that the majority of them, except for three, are not concerned with the characteristics of the absolute research components but other important matters, for instance, the article length and the submission platform. The first journal is the International Journal of TESOL & Education (2025), in which the author's guidelines are given through video tutorials on how to identify the research problems and research gaps and how to write the introduction, the literature review, and the methodology and how to present the results. The other two journals are Arab World English Journal (2025), or AWEJ, and Liberal Arts and Social Studies International Journal (2025), or LAASSIJ. AWEJ identifies seven of the eleven absolute components reported above, except for title, keywords, objective(s), and references. LAASSIJ identifies ten of the eleven absolute components, except for the objective(s). Like the majority of journals, references are detailed in relation to one referencing style, such as APA 7th edition. Objectives are incorporated into the introductions in the journals without specifications of their characteristics. The characteristics of the other nine components as identified in AWEJ and LAASSIJ can be presented as follows.

1. The title is brief, clear, and appropriate to the contents and objective(s) of the research, summarizing the main ideas of the study.
2. The abstract covers the research objective(s)/question(s)/aim(s)/purpose(s), methodology/methods/research design, and key findings. It may also include the significance of the study, the research problem, and conclusions/recommendations.
3. The keywords are those representing key concepts.
4. The introduction contains the research problem, the rationale for choosing the problem (background and context), the significance of the study, the research scope, and a brief methodology. The objective(s)/purpose(s)/research question(s)/hypothesis(es) are presented at the end of the introduction. The organization of the contents moves from a general subject area to a specific topic of inquiry.
5. The literature review presents how the study fits within the larger field of the study and includes previous studies, views, and approaches related to the research problem(s) being investigated. Key concepts are defined. The related literature is described, synthesized, summarized, and critically evaluated. As a result of the literature review, a research gap should emerge, and a conceptual and theoretical framework or model should be established.
6. The data collection and analysis methods/methodology address the research objective(s) and are concerned with how research is conducted, including details about research materials, participants, instruments, data collection procedures, and analysis. The contents are presented in subsections. The methods/methodology is described to the extent that it can be replicated by other interested researchers. Justifications of the research materials and participants

are reported. Confirmation of the validity and reliability of the instruments has taken place.

7. The results/findings are reported objectively in a logical sequence, making use of numbers, tables, and figures.
8. The discussion explains new understanding or insights emerging based on the problem investigated. It presents discussion, explanation, and interpretation of the findings. It gives a combination of the findings and support from previous studies and scholars' views and arguments that are included in the literature review. When the findings are different from previous studies/views/arguments/theories, reasons for the differences are explained. The discussion engages the reader to think critically about the research problem and the findings. It can acknowledge the limitations of the study, return to explain the research problem, and highlight the significance of the study and how it contributed to the understanding of the research problem and filling the research gap.
9. The conclusion is drawn on the research findings. It gives readers ideas about the practical implications of the findings and provides roadmaps for future research on the subject.

(Arab World English Journal, 2025; Liberal Arts and Social Studies International Journal, 2025)

Knowledge about the characteristics of the research components is critical for novice researchers, because the quality of research manuscripts before they are accepted for consideration at academic journals is influenced by the features. In fact, both acknowledgment of the limitations of the study and ways to fill more research gaps, as identified in numbers 8 and 9, can be reported in the conclusion section, where ideas for future research are recommended.

3. METHODS

3.1 Context

The present research commenced after an IS course. The course is offered to 4th-year undergraduate students majoring in English for communication at a Thai university. The course is completed within 15 weeks, with three hours of class contact in each. The students are asked to conduct a research project in the field of English communication. The course is lectured on by one member of the program staff at a time. The students work out a research project with two or three team members, and the program lecturers choose to supervise the students' projects based on their mutual interest. It has been four consecutive semesters where complete research is presented in the form of research articles of about 5,000–7,000 words and built on 13 components (cf. 4.2 Materials). It is also recommended, but not made compulsory, that the completed research articles be offered for publication at international conferences or in academic journals.

3.2 Materials

Two kinds of materials were investigated in the study. That is, an old set of author guidelines and students' research articles. The author guidelines were employed to teach, supervise, and evaluate students' research articles that were built on 13

components: title, author(s) and affiliation(s), abstract, keywords, introduction, objective(s), literature review, research method(s)/methodology, findings, discussion, conclusion, references, and appendices. These guidelines can be found in Table 1. The other kind of materials were the students' research articles that were completed as part of the recent IS course. Topics of the 17 research articles included the use of English social media across generations, the cultural interest in motivating English learning, enhancing vocabulary through the Cake application, struggles in studying English literature, using an e-book to enhance knowledge of idioms, the cultural influence on aspirations in learning English, the effect of VALORANT, an online game, on English-speaking skills, the development of English vocabulary through a short movie, the development of knowledge of parts of speech through an e-book, local vs. international customers' satisfaction with hotel services, using ChatGPT to learn English, self-directed learning through online resources, using TikTok to enhance abbreviations and slang in workplace communication, factors affecting the English-speaking ability of engineering students, the impact of social media use on the attention span of Gen Zs, and the use of Bingo games and Domino games to develop English vocabulary.

3.3 Participants

Three groups of people were invited to participate in the study: former lecturers of the IS course, former students of the IS course, and reviewers in effect in the field of English communication. The first group of participants were two of the four program lecturers who used to teach the IS course and the present course lecturer. The two former lecturers were invited to validate the author guidelines with the course lecturer. The insider perspectives of the two former course lecturers and the participatory observation of the present course lecturer were necessary in this study. Insider perspectives and participatory observations are encouraged when descriptive and objective data are expected to provide a firm ground for insightful, interpretive, and reflective data (Lynch, 2003). The second group of participants comprised 59 students who completed 21 projects while taking the IS course before this study. After the course, the students were asked to contribute their research articles and to evaluate the effectiveness of the guidelines together with their team members. They were contacted through the course's online group that was created during the course. All in all, 17 groups agreed to participate in the study and returned the evaluation form. The research materials made up 81% of all the research projects and 86% of the research participants. The third group of participants were three reviewers in effect in the field of English communication. They were lecturers in English for Communication: one from the research site and the other two from other universities. They were invited because they had published research articles in international journals, and they have experience reviewing research articles for international journals. The reviewers' knowledge and experience were valuable for the reviewing process conducted to imitate the real steps done in academic journals.

3.4 Instrument

The author guidelines developed in this study became a research instrument when they were employed to examine the success of the students' research articles. The original guidelines were based on the latest version employed in the IS course (cf. 4.2 Materials). These guidelines were compared against recent interest in author guidelines, including plagiarism, systematic reviews, meta-analyses, the use of

artificial intelligence, and the emphasis on new knowledge in research conduction (Javed & Ahmed, 2025; Sun, 2021; Goldberg et al., 2022; Rosen et al., 2024; Goyanes et al., 2025; Cambridge University Press, 2025). The guidelines finalized by the three course lecturers (cf. 4.3 Participants) were concerned with 17 research article components: 1) title, 2) abstract, 3) keywords, 4) introduction, 5) objective(s), 6) literature review, 7) data collection methods, 8) research ethics, 9) data analysis methods, 10) findings, 11) discussion, 12) conclusion, 13) contribution, 14) citing and referencing, 15) plagiarism, 16) English use, and 17) tidiness and neatness (see Table 1).

The guidelines were checked by the course lecturers for accuracy to the research conventions, suitability for the real teaching and learning context, and capability to prepare the students to conduct research and write up research articles for publication. They were also tested for practicality with a research article by three former students who were not the research participants. The lecturers scored the article on a scale of four: 1, not successful; 2, moderately successful; 3, successful; and 4, very successful. The lecturers individually examined the article first and brought the results to a discussion. The final version of the author guidelines was agreed upon by consensus. The author guidelines also built up the effectiveness evaluation form. The form asked respondents to evaluate the guidelines on a scale of four: 1, not effective; 2, moderately effective; 3, effective; and 4, very effective. In addition, the owners of the trailed article were asked to check the comprehensibility of the guidelines. They chose one of the options: -1, incomprehensible; 1, comprehensible; and 0, not sure. They returned a score of 1 for all items. The results ensured the practicality of the evaluation form.

4. FINDINGS

The analyses yielded findings on an updated set of author guidelines, the success of the students' research articles, and the effectiveness of the author guidelines.

4.1 The Author Guidelines

The author guidelines comprised 17 elements of research conduction and research article writing, as shown in Table 1. They were originally from an old set of author guidelines employed in the IS course.

Table 1: Old vs. Updated Author Guidelines

Old Author Guidelines		Updated Author Guidelines
Elements	Elements	Characteristics
1. Title	1. Title	The title fits the body of research and is attention-grabbing.
2. Author(s) and affiliation(s)	2. Abstract	The abstract covers the research objective(s), data collection methods and analysis, main findings, and key conclusions.
3. Abstract	3. Keywords	The keywords are correct and appropriate.
4. Keywords	4. Introduction	The introduction covers the research context, problem, gap, rationale for the study, and

		important concepts. A brief overview of the research method is given.
5. Introduction	5. Objective(s)	The objective(s) emerge from the introduction. They are clearly presented.
6. Objective(s)	6. Literature review	Key related literature is included. The review provides the research framework.
7. Literature review	7. Data collection methods	The data collection methods address the research objective(s). They are described and validated.
8. Research methods/methodology	8. Research ethics	There are no traces of ethical misconduct.
9. Findings	9. Data analysis methods	The analyses are correct.
10. Discussion	10. Findings	The findings cater to the research objective(s) and are adequately described.
11. Conclusion	11. Discussion	Important findings are discussed. Previous research findings and related literature are cited.
12. References	12. Conclusion	Recommendations on the applicability of the research findings and suggestions on future research are given.
13. Appendices	13. Contribution	New knowledge/understanding is produced and can be contributed to the area in which the research is based.
	14. Citing and referencing	The citations are correct and appropriate. The typing style is consistent.
	15. Plagiarism	There are no traces of plagiarism.
	16. English use	The report is presented in academic English. The English usage is correct.
	17. Tidiness and neatness	The paper is tidy and neat.

Most of the elements, nine of them, were kept as in the old version; that is, title, abstract, keywords, introduction, objective(s), literature review, findings, discussion, and conclusion. Two elements were omitted from the updated scope, that is, author(s) and affiliation(s) and appendices. The three course lecturers considered that adding details about author(s) and affiliation(s) was an easy job for the students, needing no special attention. The appendices section was considered to be important because original calculations or examples of materials, for example, could be presented there. However, because it was identified as optional for most research articles, it should not be among the criteria for evaluating research articles. Two of the elements were improved to highlight their existence. First, the methods section was separated into two, that is, data collection methods and data analysis methods. Second, the referencing heading was changed to citing and referencing. Three new elements were added to address important concerns in research. These are research ethics, contribution, and plagiarism. In addition, to encourage publications in international journals, English use and the tidiness and neatness of research manuscripts should also be emphasized.

4.2 The Success

The reviewers' scores on the success of the student's research articles were calculated for means (M) and standard deviation (SD), and the means were interpreted (I) as follows: 1.00–1.44 not successful (n. successful), 1.45–2.44 moderately

successful (m. successful), 2.45–3.44 successful, and 3.45–4.44 very successful (v. successful), as shown in Table 2.

Table 2: Success of the Research Articles and Effectiveness of the Author Guidelines

Elements	Success			Effectiveness		
	M	SD	I	M	SD	I
1. Title	3.59	1.00	V. Successful	3.24	0.66	Effective
2. Abstract	2.82	0.81	Successful	3.12	0.70	Effective
3. Keywords	3.29	0.69	Successful	3.24	0.97	Effective
4. Introduction	2.35	0.79	M. successful	3.29	0.69	Effective
5. Objective (s)	2.41	1.00	M. successful	3.12	0.86	Effective
6. Literature review	2.35	0.70	M. successful	2.94	0.83	Effective
7. Data collection methods	2.12	0.86	M. successful	2.88	0.99	Effective
8. Research ethics	1.24	0.75	N. successful	3.12	0.93	Effective
9. Data analysis methods	3.18	1.01	Successful	3.18	0.81	Effective
10. Findings	2.59	1.00	Successful	3.18	0.95	Effective
11. Discussion	2.53	0.87	Successful	3.18	0.81	Effective
12. Conclusion	1.88	0.86	M. successful	2.94	0.75	Effective
13. Contribution	2.29	0.77	M. successful	3.00	0.87	Effective
14. Citing and referencing	3.29	0.99	Successful	3.18	0.81	Effective
15. Plagiarism	3.94	0.24	V. successful	2.94	1.14	Effective
16. English use	2.47	0.94	Successful	3.24	0.75	Effective
17. Tidiness and neatness	3.35	0.61	Successful	2.88	0.99	Effective
Grand M	2.69	0.68	Successful	3.10	0.14	Effective

At the overall level, the success of the students' research articles when evaluated by the three reviewers fell into the successful level (Grand M = 2.69). The scores of the majority of the elements were spread around the successful and moderately successful levels (8 and 6 elements, respectively). A few elements fell into the not successful and very successful levels (1 and 2 elements, respectively). The elements receiving the highest mean scores included plagiarism (M = 3.94), title (M = 3.59), and tidiness and neatness (M = 3.35). The first two fell into the very successful levels, and the third one was at the successful level. The elements receiving the bottommost mean scores included research ethics (M = 1.24), conclusion (M = 1.88), and data collection methods (M = 2.12).

4.3 The Effectiveness

The former students' scores on the effectiveness of the author guidelines were also calculated for means and standard deviation, and the means were interpreted as follows: 1.00–1.44 not effective (n. effective), 1.45–2.44 moderately effective (m. effective), 2.45–3.44 effective, and 3.45–4.44 very effective (v. effective), as shown in Table 2.

At the overall level, the effectiveness of the author guidelines in preparing the student researchers for research conduction and research article writing according to the experienced students' feedback was considered to be at the effective level (Grand M = 3.10). The topmost elements were found to be in the identification of the characteristics of the introduction (M = 3.29), title, keywords, and English use, all of which received the same mean scores (M = 4.24). The bottommost elements were those

in the literature review, conclusion, and plagiarism, which received the same mean score, that is, $M = 2.94$.

5. DISCUSSION

The author guidelines developed in this study share similarities with those offered by the Arab World English Journal (2025) and the Liberal Arts and Social Studies International Journal (2025), because all are concerned with research conduction and research articles. The similarities are in the absolute components, that is, title, abstract, keywords, introduction, objective(s), literature review, research methodology, findings, discussion, conclusion, and references. The author guidelines investigated in this study, however, reflect more of what should be highlighted arising from the teaching and learning perspectives, that is, data collection methods, data analysis methods, research ethics, contribution, plagiarism, English use, and tidiness and neatness.

When looking into the characteristics of each of the elements, slight differences between the author guidelines investigated in this study and the others can be observed. For example, the ability to grab a potential audience's attention is visibly emphasized in the guidelines investigated in this study. The existence of the rationale for the study is not necessary in the abstract investigated in this study. However, many real research papers also present the component, for example, in a paper analyzing Italian and Japanese companies' investor relations communication policies (Camiciottoli, 2020). In the study, the rationale of the study is presented first at the beginning of the abstract. The guidelines developed in this study recommend including a research gap in the introduction, while the element may be presented in the literature review in other frameworks. The characteristics of discussion as recommended in Arab World English Journal (2025) and Liberal Arts and Social Studies International Journal (2025) are described in more detail than the guidelines developed in this study. That is, this part can discuss the research problem and gaps stated from the start of the research. It can also acknowledge the limitations of the study.

As for the success of the student research articles, it is deemed to be similar to a normal situation. When the students had completed their research articles, the overall mean scores fell to only the second-highest levels. The mean scores were also distributed in the middle, including the moderately successful and successful levels combined. At the successful level in this study, the element that reflected most success was plagiarism. This is most probably because the concern was emphasized in the course; it was a requirement that the research articles be checked through a Thai plagiarism check program called Akarawisut, according to the course lecturer. The success, as reflected in the titles and tidiness and neatness, was probably a result of the supervision process. When examining the first bottommost element, research ethics, it was found that it was more because of the lack of reports on ethical considerations in the articles. In fact, ethical procedures or considerations should always be reported to ensure that the pursuit of knowledge nurtures the rights of the research participants (Neuman, 2006). The other two bottommost elements were the data collection methods and the conclusions. This is because they were missing information about the measurements of the reliability of the research instruments and recommendations for future research. Measurement of research instruments is another important procedure that should be reported in research articles. In 2024, Kaewneam explored 21 research

papers on English communication and found that 14 of them included information about the reliability of their research instruments. Furthermore, recommendations for future research are highly recommended because they can be future agendas for the area of knowledge investigated (Costa, 2024).

Like the level of success, the student researchers' feedback on the author's guidelines in preparing for research conduction and writing up research articles also fell to the second-highest level, that is, the effective level. The feedback is quite satisfactory considering the fact that the reflection was based on real experiences approximately a month after the course, not influenced by the course grades, while the author's guidelines remained fresh in their memories. On the one hand, the means of all the elements falling into the effective levels, indicating that the identification of the characteristics was sufficiently understandable for the student researchers. On the other hand, the literature review and conclusion, receiving the lowest mean scores, may be the two most challenging parts during the research conduction and when writing up the research report. When writing the literature review, researchers will have to inspect the accumulation of knowledge that underpins the study that also demonstrates an area where the present research should be conducted, build the present research on the previous studies, and present the credibility of the research and researchers (Evans & Gruba, 2005; Neuman, 2006). The complexity of literature review writing was also observable during the trial of the author guidelines in this study, when the varieties of the scores given by the three course lecturers were mainly found in the literature reviews. When writing the conclusion, complex procedures have to take place; for example, presenting a summary of the whole project; suggesting practical implications and directions for future research; returning to the research problem; and reporting on the limitations of the studies (Stephen & Velmurugan, 2020). The student researchers may not have fully comprehended the concept of plagiarism either. However, they learned to avoid the action of plagiarism by not using sources without citations. They may also have used state-of-the-art technology, such as paraphrase AI programs, during the writing up.

6. CONCLUSION

It is believed in this study that systematic, logical, critical, creative, and evidence-based thinking can be promoted through the process of research conduction and reporting. It is also anticipated that the publication of research will increase when novice researchers are provided with a set of effective guidelines. This study has unpacked the nature of research conduction and reports completed by the student researchers from a real teaching and learning environment. It is also anticipated that the findings from this study could enhance understanding of research instruction, conduction, and dissemination through research articles. It is most probable that the guidelines are applicable to other EFL contexts. When manuscripts written based on them are offered for journal's consideration. They will have to go through the peer-review process and may be asked for minor or major revisions, but the guidelines can be a good effective start for the manuscripts. While an evaluation of other kinds of academic writing is done through rubrics and categorized into bands, an assessment of research article manuscripts is like checklists for quality that are later officially examined by the journal's reviewers. Using the recommended guidelines can pinpoint certain elements for improvement before submission.

In addition, the major limitation of this study lies in the possibility of collecting the data from the students' research articles after the course. The students completed the course as part of an undergraduate program in their fourth year. A longitudinal research project is needed to understand and prove more about the effectiveness of the author guidelines developed in the present study or any other principles. The research should possibly follow the student researchers' publications a few years after a master's degree graduation, in spite of the peer review and publication processes. An investigation into careful use of artificial intelligence (AI) to evaluate manuscripts of research articles using author guidelines updated in this study or other frameworks before submission might be of some help in promoting more publications.

REFERENCES

- Arab World English Journal. (2025). Author guidelines. 15 October 2025. <https://awej.org/author-guidelines/>
- Cambridge University Press. (2025). Research. 15 October 2025. <https://dictionary.cambridge.org/dictionary/english/research>.
- Camiciottoli, B. C. (2020). Using English as a lingua franca to engage with investors: an analysis of Italian and Japanese companies' investor relations communication policies, *English for Specific Purposes*, 58(6) , 90– 101. <https://doi.org/10.1016/j.esp.2020.01.003>
- Costa, P.D. (2024). Publishing in SSCI journals: An editor's, reviewer's, and author's perspective. Special lecture. 7 March 2024. Faculty of Liberal Arts, Prince of Songkhla University.
- Evans, D., & Gruba, P. (2005). *How to write a better thesis*. Melbourne University Press.
- Goldberg, J., Boyce, L. M., Soudant, C., & Godwin, K. (2022). Assessing journal author guidelines for systematic reviews and meta-analyses: Findings from an institutional sample. *Journal of the Medical Library Association*, 110(1), 63–71. <https://doi.org/10.5195/jmla.2022.1273>
- Goyanes, M., Lopezosa, C., & Pineiro-Naval, V. (2025). The use of artificial intelligence (AI) in research: A review of author guidelines in leading journals across eight social science disciplines, *Scientometrics*, 130, 3725–3741. <https://doi.org/10.1007/s11192-025-05377-0>
- International Journal of TESOL & Education. (2025). Guide for authors. 15 October 2025. <https://i-cte.org/international-journal-of-tesol-education/>
- Inyok, K., Jaidee, N., Thongpradabetch, A., & Komol, T. (2024, March 30). Improving aviation vocabulary knowledge among undergraduate students via a YouTube video. *Proceedings of the 4th Liberal Arts International Conference (LAIC 2024)*, 147–157.

- Javed, F., & Ahmed, Z. U. (2025). Examining plagiarism policies in submission guidelines of dental journals. *Journal of Academic Ethics*, 23(4), 2599–2609. <https://doi.org/10.1007/s10805-025-09668-2>
- Kaewneam, C. (2024). *Independent Study*. Program in Foreign Languages for Communication, Faculty of Liberal Arts, Rajamangala University of Technology Srivijaya.
- Kaewneam, C. (2025). Integrating student-developed strategy-based tutoring video to enhance TOEIC reading comprehension among Thai EFL undergraduates. *RMUTK Journal of Liberal Arts*, 7(3), 100 –120. <https://so02.tci-thaijo.org/index.php/larts-journal/article/view/278199>
- Liberal Arts and Social Studies International Journal (2025). Author guidelines. 15 October 2025. <https://so18.tci-thaijo.org/index.php/LAASSIJ/about/submissions>
- Lynch, B. K. (2003). *Language assessment and programme evaluation*. Edinburgh University Press.
- Mana, N., Danbenchakun, T., Krueaman, N., & Duklim, B. (2024, March 30). The effectiveness of using e-book in improving affixes (prefixes and suffixes) among Thai EFL undergraduates and their satisfaction toward this platform. *Oral Presentation Schedules of the 4th Liberal Arts International Conference (LAIC 2024)*.
- Neuman, W. L. (2006). *Social research methods: Qualitative and quantitative approaches*. Pearson Education.
- Petkhong, S., Kuedeck, T., Putong, N., & Kangkha, P. (2024). Developing the English homographs and homophones skill for undergraduates through the TikTok application. *Proceedings of the 4th Liberal Arts International Conference (LAIC 2024)*. Faculty of Liberal Arts, Rajamangala University of Technology Srivijaya, 22–30.
- Rosen, D., Reiter, N., Vogel, B., & Prill, R. (2024). The use of systematic reviews for conducting new studies in physiotherapy research: A meta-research study comparing author guidelines of physiotherapy-related journals. *Systematic Review*, 13(1), 1–6. <https://doi.org/10.1186/s13643-023-02427-7>
- Siribhon, B., & Nicharee, P. (2025). The results of research competencies developed for learning development of Nakhon Sawan Rajabhat University's student researchers. *Shanlax International Journal of Education*, 13(2), 27–37. <https://doi.org/10.34293/education.v13i2.8500>
- Sirijanchuan, N., & Tangkiengsirisin, S. (2025). Effects of the global Englishes-informed instruction on Thai university students' attitudes towards English language learning. *The New English Teacher*, 19(1), 17–88.
- Stephen, V., & Velmurugan, T. (2020). *Research methodology for beginners*. Skyfox Publishing Group.

- Sun, U. (2021). Do journals' author guidelines tell us what we need to know about plagiarism? *Journal of Scholarly Publishing*, 52(3), 156–172. <https://doi.org/10.3138/jsp.52.3.03>
- System. (2025). Guide for authors. 15 October 2025. <https://www.sciencedirect.com/journal/system/publish/guide-for-authors>
- Wu, S., Wyant, D. C., & Fraser, M. W. (2016). Author guidelines for manuscripts reporting on qualitative research. *Journal of the Society for Social Work & Research*, 7(2), 405–425. <https://doi.org/10.1086/685816>



The Development of Computer-Assisted Instruction (CAI) for Modal Verbs in English Language Learning for Grade 9 Students

Pongsri Sobpol

Bangsaaiwithaya School, Bangsaai Pranakornsri Ayuthaya, THAILAND

*Corresponding Author E-mail: suppholpongsri@gmail.com

(Article history) Received: 2025-08-21, Revised: 2026-08-22, Accepted: 2026-08-24

Abstract

Background: Modal verbs encode functions such as ability, possibility, permission, obligation, prohibition, advice, requests, and suggestions, and their context-dependent meanings can present difficulties in secondary English learning. This study developed an interactive Computer-Assisted Instruction (CAI) package for Grade 9 students and evaluated learning achievement and learner acceptance. Methods: The source research used a one-group pretest–posttest design with 41 Grade 9 students at Bangsaaiwithaya School in the 2025 academic year. The intervention comprised four functionally organized modal-verb units delivered through a Flash-based multimedia environment. Instruments were a 40-item multiple-choice achievement test and a 20-item five-point satisfaction questionnaire. The report also documented one-to-one, small-group, and field try-outs. Results: The reported pretest mean was 12.45 (SD = 3.21) and the posttest mean was 25.87 (SD = 2.98), with $t = 15.62$ and significance reported at the .05 level. A secondary calculation from these reported aggregates yielded a mean gain of 13.42 points (95% CI 11.68–15.16), $d_z = 2.44$, and normalized gain = 0.49. Overall satisfaction was high ($M = 4.35$, $SD = 0.56$). Efficiency results were internally inconsistent: Chapter 4 reported $E1/E2 = 86.75/82.35$, whereas the appendix reported 79.85/81.77 for the field trial; direct recalculation from the 40 displayed field-trial rows yielded 79.50/81.63. Because the report does not provide evidence sufficient to reconcile these values, no single final efficiency estimate is asserted here. Conclusion: The available evidence supports substantial within-group improvement following CAI use and positive learner acceptance, but the absence of a control group prevents causal claims of superiority over conventional instruction. The study contributes a transparent, curriculum-aligned account of interactive digital grammar instruction and identifies reporting requirements for stronger future evaluations.

Keywords: Computer-Assisted Instruction; Modal verbs; English grammar; Grade 9; Technology-enhanced language learning; Learner achievement; Learner satisfaction

1. INTRODUCTION

English modal verbs are a compact grammatical system with substantial communicative load. Forms such as can, could, may, might, must, shall, should, will, and would can express ability, possibility, permission, obligation, advice, prediction, volition, requests, and interpersonal stance. Because the same form may serve more than one semantic or pragmatic function, mastery requires more than memorizing isolated rules. Descriptions of English modality emphasize the interaction among

grammatical form, speaker stance, context, and degrees of commitment or necessity (Palmer, 2001; Biber et al., 1999). For school-age EFL learners, this many-to-many relation between form and function can create a persistent instructional challenge, particularly when grammar is presented as decontextualized rules rather than as resources for communication.

The Thai Basic Education Core Curriculum B.E. 2551 (A.D. 2008) positions foreign-language learning within communicative goals and expects learners to use language to exchange information, express feelings and opinions, and participate appropriately in real situations. The curriculum therefore creates a pedagogical rationale for teaching grammatical structures not as ends in themselves but as means of communication. The source research responded to this curriculum context by organizing modal-verb instruction around four functional units: ability and possibility; permission and obligation; prohibition and advice; and requests and suggestions. This functional organization is pedagogically relevant because contemporary accounts of modality likewise treat modal auxiliaries as form–meaning pairings whose interpretation depends on construction and context (Palmer, 2001; Torres-Martínez, 2019).

Computer-Assisted Language Learning (CALL) has long offered tools for linking form-focused practice with learner control, multimodal presentation, and immediate response. Early and contemporary CALL scholarship emphasizes that technology is educationally useful when it creates conditions for language processing and practice that are difficult to sustain through static materials alone (Warschauer & Healey, 1998; Chapelle, 2001). However, technology should not be treated as intrinsically effective. Meta-analytic and review evidence indicates an overall positive role for technology-supported language instruction, while simultaneously showing considerable heterogeneity in intervention quality, research design, outcome measures, and evidential strength (Grgurović et al., 2013; Golonka et al., 2014). Consequently, the relevant question is not whether computers improve language learning in the abstract, but how a specific instructional design is structured, how it is evaluated, and how confidently the observed outcomes can be attributed to that design.

The source report developed a Flash-based CAI package for Grade 9 modal-verb instruction, incorporating content explanations, examples, exercises, multimedia presentation, self-paced navigation, and feedback. It also documented an iterative development process consisting of one-to-one, small-group, and field try-outs before the main pretest–posttest evaluation. These features create two potentially important contributions. First, the study provides a school-based example of functionally organized digital grammar instruction in a Thai EFL setting. Second, it contains multiple layers of evidence—formative efficiency data, achievement data, and satisfaction data—that can be analyzed together rather than treated as isolated outcomes.

At the same time, converting the full research report into a journal article requires careful treatment of its internal inconsistencies. The report gives more than one final E1/E2 efficiency value, contains an unresolved discrepancy in field-trial sample size, describes three questionnaire domains in the methods but four in the results, and mentions both Flash and more modern platforms in ways that can blur what was actually implemented. A publication-ready article should not silently choose

among conflicting values. The present manuscript therefore follows a source-constrained approach: findings explicitly reported in the research report are distinguished from secondary calculations that can be reproduced from reported aggregates or appendix-level individual scores, and unresolved inconsistencies are stated directly.

The study had three primary objectives: (1) to develop a CAI lesson for English modal verbs and evaluate it against the report's 80/80 efficiency criterion; (2) to compare Grade 9 students' achievement before and after completing the CAI; and (3) to examine learner satisfaction with the CAI. In addition, the present article conducts only those secondary analyses that are mathematically derivable from the retained data: a confidence interval and standardized effect size for the reported pre-post change, a normalized gain estimate, verification of efficiency calculations shown in the appendix, descriptive unit-level field-trial performance, and a process-posttest correlation using the displayed field-trial rows. No new experiment, participant, outcome, or primary measurement is introduced.

2. CRITICAL LITERATURE REVIEW

2.1 Modal Verbs as a Form-function Learning Problem

Modality concerns how speakers qualify propositions in relation to possibility, necessity, commitment, permission, obligation, prediction, and related meanings. Palmer (2001) describes modality as a grammatical category that is realized through multiple systems, including modal verbs. Corpus-based grammar similarly shows that central modals differ in frequency, register distribution, and pragmatic function (Biber et al., 1999). From a pedagogical perspective, these properties mean that a learner cannot reliably map one modal verb onto one fixed meaning. Can and could, for example, participate in ability and permission meanings; may and might are associated with possibility but also interact with interpersonal meanings; must and should can express different strengths and sources of obligation or advice. A functionally organized curriculum can therefore help learners attend to semantic contrasts that are easily obscured when instruction is organized only by lexical item.

Torres-Martínez (2019) argues that English modal auxiliaries are better understood through patterned form-meaning relations than through isolated lexical definitions. Although the source study did not test a construction-grammar model, its four-unit organization is compatible with the broader pedagogical principle that modal meaning should be linked to communicative function and context. This is particularly pertinent in lower-secondary EFL, where students must move from recognition of forms toward contextually appropriate use.

2.2 Computer-assisted Language Learning and Grammar Instruction

CALL has evolved from tutorial and drill-based applications toward networked, adaptive, mobile, and data-rich environments, but tutorial CALL remains relevant for structured grammar practice when it provides meaningful interaction, feedback, and learner control. Warschauer and Healey (1998) characterized the development of CALL as a movement from behavioristic drill toward more integrative uses of

computers. Chapelle (2001) subsequently emphasized that CALL evaluation should connect technological features to language-learning processes rather than assume that digital delivery itself produces learning.

Evidence syntheses provide a cautiously positive picture. Grgurović et al. (2013), reviewing 37 studies and 52 effect sizes, found a small but positive overall advantage for technology-supported second- and foreign-language pedagogy, with stronger results in more rigorous designs. Golonka et al. (2014), reviewing more than 350 studies across technology types, concluded that the volume of technology research exceeds the amount of strong efficacy evidence, highlighting the importance of design quality and appropriate comparison. These reviews support the relevance of CAI while also cautioning against causal overstatement from weak designs.

Research on technology-mediated grammar learning also suggests that specific affordances matter. Sagarra and Zapata (2008) reported positive learner perceptions of an online workbook and improvements in grammar-related assessment, with accessibility, user-friendliness, and immediate error feedback among valued features. Ai (2017) showed that computer-mediated corrective feedback can be designed to support learner uptake and positive perceptions, although the intervention, target language, and feedback architecture differed substantially from those in the present study. At the secondary-school level, Moon and Oh (2018) demonstrated that technology-supported, data-driven grammar work could yield both cognitive and affective benefits. Collectively, these studies suggest that engagement, feedback, and structured practice are plausible mechanisms, but they do not establish that any multimedia grammar package will be effective in every context.

2.3 Multimedia, Feedback, and Learner Control

The source CAI combined text, sound, animation, exercises, and feedback. Multimedia-learning research provides a framework for understanding why such combinations can help when they are designed to guide rather than overload attention. Mayer (2021) argues that people can learn more deeply from appropriately coordinated verbal and visual representations than from words alone, while Clark and Mayer (2016) stress that multimedia elements should serve instructional processing rather than decoration. This distinction is directly relevant to the source report, because early try-outs led to revisions in graphic relevance, animation timing, audio clarity, and explanatory wording. Those revisions are consistent with reducing extraneous processing, although the study did not experimentally isolate or test cognitive-load mechanisms.

Learner control is another important design feature. The report describes the CAI as self-paced, allowing repeated access to explanations and exercises. CALL research has long treated learner control and individualized pacing as potential advantages, but their effectiveness depends on learners' ability to use them productively. Similarly, immediate feedback may support correction and retrieval, but the optimal specificity and sequencing of feedback remain empirical questions. The source study's formative revisions therefore constitute an instructional-development contribution, but not an ablation test of which component was responsible for achievement gains.

2.4 Research Gap and Article Contribution

The gap addressed by this article is narrower than the general question of whether educational technology improves language learning. First, there is value in documenting how a functionally organized modal-verb CAI performs in an authentic Thai Grade 9 context. Second, many school-based reports emphasize statistical significance without reporting effect magnitude, uncertainty, or data-integrity checks. Third, the source report includes formative try-out tables that allow partial verification of the stated efficiency values but were not fully exploited in the original interpretation. The present article therefore contributes a source-faithful synthesis that combines learning outcomes, learner acceptance, iterative design evidence, and transparent secondary verification while explicitly limiting causal claims.

3. MATERIALS AND METHODS

3.1 Study Design and Setting

The research report characterizes the study as experimental research using a One Group Pretest–Posttest Design. Students completed a pretest, learned through the CAI, completed a posttest, and then responded to a satisfaction questionnaire. Because no concurrent control or comparison group was included, the design is more precisely interpreted as a single-group pre–post intervention evaluation. Such a design can estimate within-group change but cannot rule out alternative explanations such as testing effects, maturation, history, or other time-linked influences (Shadish et al., 2002). The study was conducted at Bang Sai Witthaya School, Phra Nakhon Si Ayutthaya, Thailand, during the 2025 academic year.

3.2 Participants and Sample-size Reporting

The main analysis reports 41 Grade 9 students, selected by cluster sampling from a Grade 9/1 classroom. The methodology section also states that the Grade 9 population comprised 41 students, which makes the population–sample relationship unclear: if the entire population was 41, cluster sampling would not reduce the population. The appendix creates a second inconsistency by describing a field try-out with 41 students who were not the main sample, while the displayed field-trial table contains 40 numbered cases. These inconsistencies cannot be resolved from the available report and are not silently corrected in this manuscript. The main achievement and satisfaction analyses are therefore reported with $n = 41$ because that number is explicitly attached to those results; secondary field-trial calculations use $n = 40$ because 40 individual rows are visible in the appendix.

3.3 CAI Intervention and Instructional Content

The CAI focused on nine modal verbs: can, could, may, might, must, shall, should, will, and would. It addressed meaning and function, affirmative/negative/interrogative structures, examples, practice, and assessment. Content was organized into four functional units: Unit 1, ability and possibility; Unit 2, permission and obligation; Unit 3, prohibition and advice; and Unit 4, requests and

suggestions. The report describes interactive, self-paced learning with text, sound, animation, exercises, and immediate feedback. The source definition states that the implemented lesson was delivered through Flash. A later methods passage mentions “Flash (or Adobe Animate/HTML5),” and the discussion recommends migration to HTML5 or web/mobile formats. Because no evidence shows that Adobe Animate or HTML5 was used in the completed experiment, this article treats Flash as the implemented platform and HTML5/Adobe Animate only as future or transferable alternatives.

Instructional development was informed by the general sequence of attention, structured content, guided practice, assessment, and feedback associated with systematic instructional design (Gagné et al., 2005). However, the original report cited an earlier Gagné and Briggs formulation and did not provide a detailed screen-by-screen instructional script. The article therefore describes only the components explicitly reported rather than inferring a complete nine-event implementation.

3.4 Iterative Development and Try-out Phases

Three formative stages were documented. In the one-to-one try-out, three students completed four during-lesson components and a posttest. The report then revised menu instructions, guidance, graphics, animation–audio alignment, motion timing, and explanatory wording. The small-group try-out involved nine students; subsequent revisions targeted graphic–content correspondence, narration clarity, font size, and visual salience. A field try-out followed before the main evaluation. The report’s field-trial narrative states 41 participants, but the appendix table displays 40 cases. These stages were formative evaluations of successive versions rather than randomized comparisons; therefore, changes in efficiency across stages cannot be attributed causally to any single revision.

3.5 Instruments

The achievement test was a 40-item four-option multiple-choice instrument administered before and after the intervention. Content validity was reviewed by three experts using an Item–Objective Congruence criterion of at least 0.50. The methods state that KR-20 reliability was used, but the numerical KR-20 coefficient is not reported in the available results; no reliability value is therefore supplied here.

The satisfaction questionnaire contained 20 items rated on a five-point Likert scale. The methods describe three domains—content, presentation, and usability—whereas the results report four domains: content and accuracy, presentation style, ease of use, and interest/engagement. Because the instrument itself is not reproduced item-by-item in the available report, the domain structure cannot be independently reconciled. The manuscript retains the four-domain result table because those numerical outcomes are explicitly reported, while noting the discrepancy.

3.6 Data Collection Procedure

For the main evaluation, students first completed the 40-item pretest, then learned with the CAI, completed the 40-item posttest, and finally completed the

satisfaction questionnaire. The report does not state the intervention duration, number of sessions, device specifications, operating system, or whether students worked individually or in a supervised laboratory. These details are therefore not inferred.

3.7 Primary Analysis and Evaluation Metrics

The report specified three primary analytic procedures: E1/E2 efficiency analysis, a dependent-samples t-test for pretest–posttest achievement, and descriptive means and standard deviations for satisfaction. E1 represents average process performance during the CAI relative to the maximum available process score, and E2 represents average posttest performance relative to the maximum posttest score. The target criterion was stated as 80/80. The report did not define an explicit tolerance rule for values slightly below 80, which is relevant because one appendix value was reported as 79.85 for E1 but described as meeting the criterion.

3.8 Secondary Analyses

No new experiment was conducted. Secondary analyses were restricted to quantities derivable from the report. From the main pretest/posttest aggregates, the mean gain was calculated as posttest minus pretest. The standard error of the paired difference was recovered from the reported t statistic, allowing a 95% confidence interval for the mean gain. The standardized paired effect size was calculated as $d_z = t/\sqrt{n}$, following standard effect-size reporting principles (Lakens, 2013). A normalized gain was calculated as $(\text{posttest mean} - \text{pretest mean})/(\text{maximum possible score} - \text{pretest mean})$, using the reported maximum of 40.

The appendix-level try-out tables were independently recomputed from displayed scores. For the 40 visible field-trial cases, unit means, total process mean, posttest mean, E1, and E2 were recalculated. Pearson's correlation was also computed between total process score and posttest score. These analyses are explicitly labeled “secondary” because they were not reported as inferential results in the original research report. No secondary analysis was performed where the necessary individual-level data were unavailable; in particular, the main 41-student pretest and posttest raw scores were not present in the reviewed materials, preventing distributional diagnostics or non-parametric paired sensitivity testing.

3.9 Machine-learning-specific Reporting Items and Reproducibility

The study was an educational intervention, not a machine-learning classification or prediction study. Consequently, there were no class labels or class distributions, data preprocessing pipeline, predictive model architecture, training/validation/test split, cross-validation, ablation study, calibration analysis, or unseen-dataset evaluation. No computational hardware specifications were reported. These items are therefore not applicable and are not fabricated to satisfy a generic computational template. Reproducibility is instead supported by reporting the available scoring rules, sample sizes, aggregate statistics, and secondary formulas, and by separating source-reported values from values recalculated directly from appendix rows.

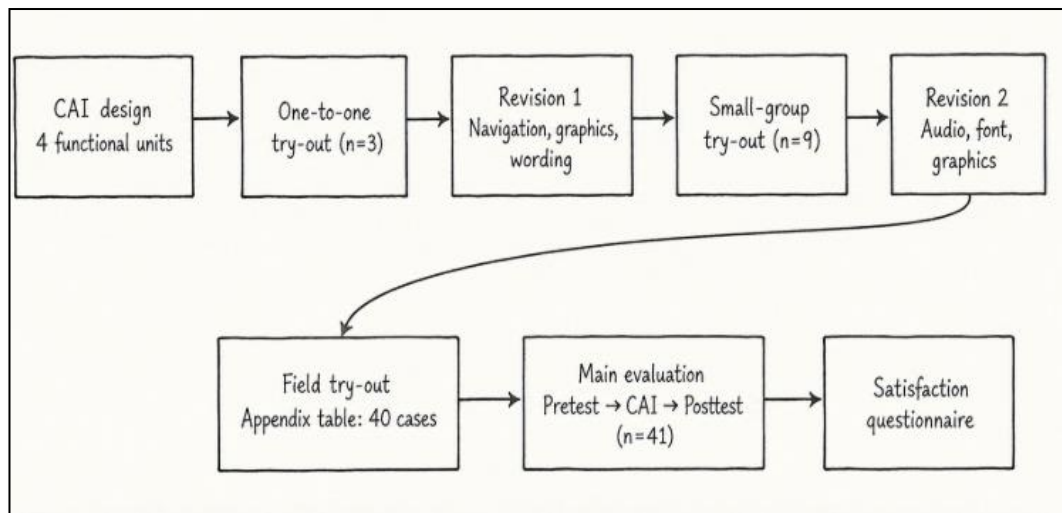


Figure 1: CAI Development and Evaluation Workflow

4. RESULTS

4.1 Data-stream Verification and Unresolved Inconsistencies

The report contains five analytically distinct data streams: one-to-one try-out scores, small-group try-out scores, field-trial process/posttest scores, main pretest/posttest achievement aggregates, and satisfaction aggregates. Recalculation shows that some efficiency summaries do not exactly match the displayed appendix rows. Table 1 therefore distinguishes source-reported values from independently reproducible values before substantive interpretation.

Table 1: Data Streams Available

Data stream	Cases shown/reported	Variables available	Role in this article
One-to-one try-out	3 displayed cases	Four process components + posttest	Formative development; E1/E2 verification
Small-group try-out	9 displayed cases	Four process components + posttest	Formative development; E1/E2 verification
Field try-out	40 displayed cases; narrative states 41	Four process components + posttest	Secondary row-level reanalysis
Main achievement study	41 reported participants	Pretest and posttest aggregate mean/SD; t	Primary learning-outcome analysis
Satisfaction study	41 implied by main sample	Overall and domain means/SDs	Primary learner-acceptance analysis

Note. "Displayed cases" refers to individual rows visible in the appendix. The main-study raw pretest/posttest scores were not available in the reviewed report.

Table 2: Verification of Reported CAI Efficiency Values

Stage/source	Source-reported E1/E2	Recalculated from displayed rows	Interpretation
One-to-one try-out	65.83 / 75.00	65.83 / 75.00	Exact agreement.
Small-group try-out	72.22 / 77.44	72.22 / 77.50	E2 differs by 0.06 percentage points.
Field try-out appendix	79.85 / 81.77	79.50 / 81.63	Both E1 and E2 differ from displayed-row recalculation; 40 rows are shown.
Chapter 4 final efficiency	86.75 / 82.35	Not independently verifiable from an accompanying row-level table	Conflicts with the appendix field-trial efficiency; no evidence in the report resolves the difference.

Note: Recalculated E1 and E2 use the displayed integer scores and a maximum of 40. Because the report contains incompatible final-efficiency values

The one-to-one value is internally consistent. The small-group E2 summary differs slightly from the displayed data. More importantly, the 40 field-trial rows yield an average process score of 31.80/40 (79.50%) and an average posttest score of 32.65/40 (81.63%), whereas the appendix states 79.85/81.77. Chapter 4 separately states 86.75/82.35. The latter value cannot be reconstructed from the appendix field table and is therefore retained only as a source-reported figure, not as an independently verified estimate. This handling follows the user-specified requirement to identify unresolved inconsistencies rather than choose an unsupported value.

4.2 Main Pretest–Posttest Achievement

The main study reported a pretest mean of 12.45 (SD = 3.21) and a posttest mean of 25.87 (SD = 2.98) for 41 students. The reported dependent-samples *t* statistic was 15.62, with significance reported as .000 and interpreted at the .05 level. The raw mean increase was therefore 13.42 points on a 40-point scale.

Table 3: Main Achievement Results and Source-derivable Secondary Statistics

Statistic	Pretest	Posttest / change	Status
Mean score	12.45	25.87	Reported
Standard deviation	3.21	2.98	Reported
Scale percentage	31.13%	64.68%	Secondary descriptive calculation
Mean paired gain	—	13.42 points	Secondary calculation from reported means
95% CI for mean gain	—	11.68 to 15.16	Secondary calculation from reported <i>t</i> and <i>n</i>
Dependent-samples <i>t</i>	—	<i>t</i> (40) = 15.62	Reported <i>t</i> ; <i>df</i> derived from <i>n</i> = 41
Standardized paired effect	—	<i>dz</i> = 2.44	Secondary calculation: $t/\sqrt{n}$
Normalized gain	—	<i>g</i> = 0.49	Secondary calculation using maximum score = 40

Note: Secondary quantities were calculated only from reported aggregates; no participant-level main-study scores were available. The large standardized effect describes within-group pre–post change and must not be interpreted as a controlled treatment effect.

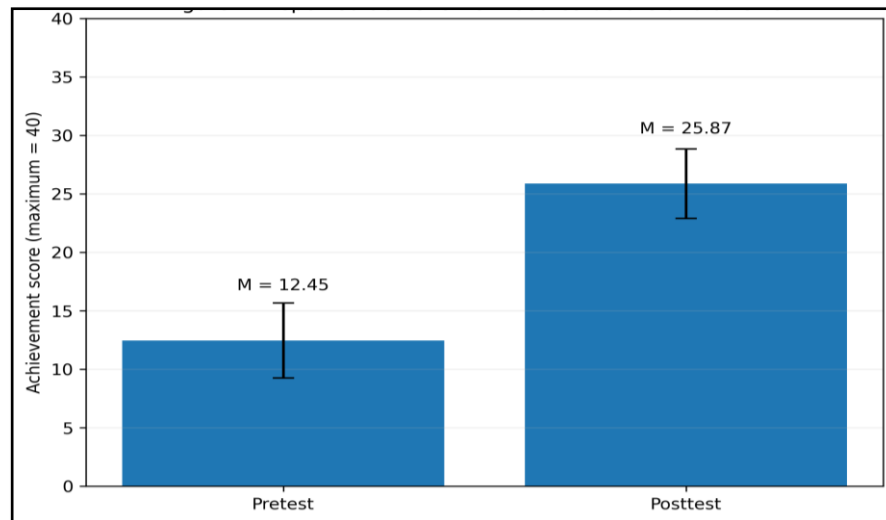


Figure 2: The Achievement Scores Before & After Using CAI

The secondary effect-size calculation indicates that the pre–post shift was large relative to the standard deviation of the paired differences. However, because the study had no control group, this effect size quantifies change within the observed cohort rather than the causal effect of CAI relative to alternative instruction. The normalized gain of 0.49 likewise describes the proportion of the available score improvement realized at the group-mean level; it is not a comparative treatment effect.

4.3 Student Satisfaction

Overall satisfaction was reported as high, with a mean of 4.35 and SD of 0.56 on a five-point scale. Domain-level results were also uniformly high. Content and accuracy received the highest mean (4.40), followed by interest and engagement (4.38), presentation style (4.33), and ease of use (4.28).

Table 4: Reported learner satisfaction with the CAI

Dimension	Mean	SD	Reported level
Content and accuracy	4.40	0.52	High
Presentation style	4.33	0.60	High
Ease of use	4.28	0.57	High
Interest and engagement	4.38	0.55	High
Overall	4.35	0.56	High

Note: The methods describe three questionnaire domains, whereas the results report four. The numerical results above reproduce the four-domain outcome table without inferring the underlying item allocation.

4.4 Secondary Reanalysis of the Field Try-out

The appendix provides sufficient individual-level field-trial data for a limited secondary analysis of 40 displayed cases. Mean unit performance decreased across the four units: Unit 1 = 8.50/10 (85.00%), Unit 2 = 8.20/10 (82.00%), Unit 3 = 7.73/10 (77.25%), and Unit 4 = 7.38/10 (73.75%). Because these were repeated components administered within the same formative trial and no inferential unit-comparison procedure was specified in the report, the pattern is interpreted descriptively only. It

suggests that later or functionally different content areas may have been more demanding, but the available data do not identify why.

Table 5: Secondary Descriptive Analysis of the 40 Displayed Field-trial Cases

Measure	Mean	SD	Percentage of maximum / association
Unit 1 process score	8.50	0.72	85.00%
Unit 2 process score	8.20	0.72	82.00%
Unit 3 process score	7.73	0.72	77.25%
Unit 4 process score	7.38	0.49	73.75%
Total process score	31.80	1.51	79.50% (= recalculated E1)
Field posttest score	32.65	1.17	81.63% (= recalculated E2)
Process–posttest correlation	—	—	$r = .616$; 95% CI [.377, .778]; $p < .001$

Note: All values in this table are secondary calculations from the 40 individual field-trial rows displayed in the appendix. They are not new primary data. The correlation is descriptive of the formative field sample and does not establish causality.

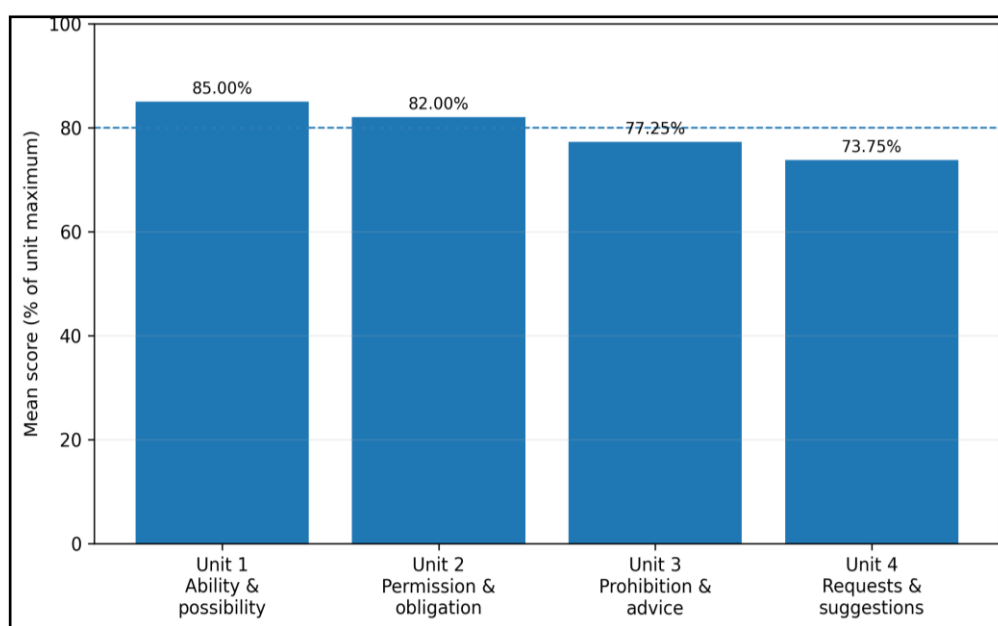


Figure 3: Secondary Re-analysis of Field-try-out Unit Performance

Process performance and field-trial posttest performance were moderately to strongly positively associated ($r = .616$, $p < .001$; secondary analysis), with approximately 38% shared variance ($r^2 = .379$). This association is compatible with the idea that students who performed better during CAI practice also tended to perform better on the immediate posttest. It does not determine whether process performance caused posttest performance, because both measures may reflect common underlying proficiency or engagement.

4.5 Comparisons, Ablation, Cross-validation, and Unseen-data Evaluation

The only comparison supported by the main study is the within-group pretest–posttest comparison. The report contains no conventional-teaching control group,

randomized comparator, alternative CAI version, or between-group benchmark. Likewise, no ablation analysis was performed to isolate the contribution of animation, audio, self-pacing, feedback, or any individual modal-verb unit. Because the intervention was not a predictive computational model, cross-validation, calibration, and unseen-dataset evaluation are not applicable. Reporting such analyses as though they existed would introduce fabricated evidence; accordingly, they are explicitly absent from the results.

5. DISCUSSION

5.1 Interpretation of Learning Achievement

The clearest empirical finding is the large increase in the cohort's mean achievement score after CAI use. The mean rose from 12.45 to 25.87 out of 40, and the reported paired *t* statistic was 15.62. The secondary *d_z* estimate of 2.44 indicates that the observed mean change was large relative to the variability of within-person differences. This is substantively meaningful as a description of learning change, but it should not be interpreted as evidence that CAI was superior to conventional instruction. In a one-group pre–post design, the intervention is temporally associated with the improvement, yet other factors cannot be excluded. A high-impact journal presentation therefore benefits from replacing causal language such as “CAI caused superior achievement” with the more defensible conclusion that achievement improved substantially following the CAI experience.

The magnitude of the score change is consistent with the pedagogical architecture of the intervention. Students received focused exposure to a limited grammatical domain, repeated practice, and immediate post-instruction assessment. Such conditions can support short-term acquisition through repeated retrieval, immediate feedback, and multiple representations. CALL literature supports these mechanisms in principle: technology-mediated environments can increase opportunities for practice and feedback, while the effectiveness of those opportunities depends on how they are designed and integrated (Chapelle, 2001; Sagarra & Zapata, 2008; Ai, 2017). Nevertheless, because the study did not include delayed retention measures, the results concern immediate learning achievement rather than durable acquisition.

5.2 Learner Acceptance and the Role of Multimedia Design

The satisfaction findings complement the achievement results. Students evaluated all reported dimensions positively, with content/accuracy and interest/engagement receiving the highest means. The pattern is compatible with the study's design emphasis on multimedia presentation and interaction. Importantly, the formative try-outs did not simply add more multimedia; they led to refinement of navigation, graphic relevance, audio clarity, text concision, and font readability. This distinction matters because multimedia-learning theory does not predict that more visual or auditory material is always beneficial. Learning is more likely to benefit when representational elements are coordinated and when unnecessary processing is reduced (Mayer, 2021; Clark & Mayer, 2016).

The satisfaction pattern also resembles findings from computer-assisted L2 learning studies in which learners value accessibility, usability, and rapid feedback (Sagarra & Zapata, 2008). Yet satisfaction should not be treated as a proxy for learning. A lesson can be enjoyable without producing achievement, and a demanding lesson can produce learning despite lower satisfaction. The present study is stronger because both outcome types moved in a favorable direction, but the correlation between main-study satisfaction and individual learning gains cannot be tested because participant-level linked data were not available.

5.3 Iterative Development as an Underused Contribution

One of the more distinctive features of the report is its iterative development process. The initial one-to-one try-out fell clearly below the 80/80 target. Revisions were made, followed by a higher small-group result and then a higher field-trial result. Although the stages used different participants and therefore do not constitute a controlled longitudinal improvement test, the sequence documents a practical cycle of prototype evaluation, diagnosis, revision, and retesting. In design terms, this is more informative than presenting only the final software package because it identifies concrete usability and instructional issues that emerged during development.

The secondary field-trial reanalysis adds a further layer. Process scores were positively correlated with field posttest scores, and performance was descriptively lower in Units 3 and 4 than in Units 1 and 2. This pattern could inform future revision priorities, particularly for prohibition/advice and requests/suggestions. However, the current evidence cannot determine whether the lower unit means reflect greater conceptual difficulty, item difficulty, instructional sequencing, or differences in scoring. Item-level psychometric analysis would be useful if the original response data remain available.

5.4 Relationship to Prior CALL Evidence

The present findings fit within, but should not be overstated relative to, the broader CALL evidence base. Grgurović et al. (2013) found an overall positive effect of technology-supported pedagogy but emphasized differences in research design and instructional conditions. Golonka et al. (2014) similarly warned that a large literature does not automatically translate into strong causal evidence. The current study exemplifies both sides of that literature: it provides encouraging achievement and acceptance evidence in a real school context, but its single-group design and incomplete reporting of reliability and implementation details limit causal and generalizable conclusions.

Grammar-specific technology research further supports the plausibility of the observed pattern. Sagarra and Zapata (2008) linked positive attitudes toward online language work with grammar gains and valued immediate feedback. Moon and Oh (2018) reported cognitive and affective benefits from technology-supported grammar work among secondary EFL learners, though their data-driven approach differed markedly from tutorial CAI. Heift and Vyatkina (2017) review multiple technology-based approaches to L2 grammar and underscore that tutorial CALL, intelligent CALL, data-driven learning, and computer-mediated communication offer different affordances. The present CAI belongs most clearly to the tutorial/multimedia tradition

and should be evaluated on that basis rather than compared directly with adaptive or intelligent systems that were not implemented here.

5.5 Modal-verb Pedagogy and Curriculum Alignment

The study's organization around communicative functions is theoretically important. Modal verbs are not simply a list of irregular auxiliaries; they encode stance and interpersonal relations. Organizing practice around ability/possibility, permission/obligation, prohibition/advice, and requests/suggestions creates a bridge between grammar and communicative intention. This organization aligns with the Thai curriculum's emphasis on using language in context and with linguistic accounts of modality as a system of meaning rather than a set of isolated word forms (Ministry of Education, 2008; Palmer, 2001). Future versions could strengthen this contribution by adding contextualized production tasks and by separating epistemic, deontic, and dynamic meanings where appropriate for the learners' level.

5.6 Data Integrity and Research-reporting Lessons

A central methodological finding of the present reconstruction is that the report's efficiency statistics are not fully internally consistent. Transparent reporting requires acknowledging this rather than selecting the most favorable value. The inconsistency does not invalidate the independently reported main pre-post achievement and satisfaction results, but it weakens any strong claim that a particular final E1/E2 value has been verified. For future studies, raw scoring tables, exact sample membership for each development stage, instrument reliability coefficients, intervention duration, and a clearly defined 80/80 decision rule should be preserved alongside the manuscript. Such practices would improve auditability and facilitate cumulative evidence synthesis.

6. CONTRIBUTIONS

6.1 Theoretical Contribution

The study contributes to grammar pedagogy by operationalizing English modality through communicative functions rather than treating modal verbs only as isolated forms. The results are consistent with the proposition that technology-supported grammar practice can connect explicit form-focused learning with contextualized meaning, although the study did not experimentally compare alternative theoretical organizations of the content.

6.2 Methodological contribution

Methodologically, the article demonstrates how a school-based CAI report can be strengthened without collecting new data: effect magnitude and confidence intervals can be derived from reported paired statistics; appendix tables can be recalculated for integrity checks; formative-development data can be analyzed separately from main-study outcomes; and causal language can be aligned with the actual design. The explicit

separation of reported findings and secondary calculations improves reproducibility and reduces the risk of retrospective overclaiming.

Computational and Digital-Instruction Contribution

The contribution is digital-instructional rather than machine-learning computational. The CAI implemented an interactive multimedia lesson with self-paced navigation, practice, feedback, and assessment. No predictive model, adaptive algorithm, artificial-intelligence component, or automated decision-support engine was reported. The computational contribution therefore lies in the structured delivery of instructional content through an interactive computer environment and in the transferable design logic that could be reimplemented using current web technologies. Any claim of AI, personalization, or intelligent adaptation would exceed the evidence.

Practical Contribution

Practically, the CAI offers a supplementary route for repeated grammar explanation and practice, potentially allowing classroom time to be used for discussion, group work, or communicative application. The report itself recommends combining the CAI with group activities, discussion, and conversational practice. Its iterative revisions also provide concrete design lessons: instructions should be unambiguous, graphics should correspond to content, narration should be clear, text should be concise, and typography should support readability.

Limitations and Future Research

The most important limitation is the one-group pretest–posttest design. Without a control or comparison group, the observed learning gain cannot be attributed exclusively to CAI. Future evaluations should use a randomized or well-matched quasi-experimental comparison where feasible, with identical pretest/posttest timing and transparent reporting of instructional exposure.

Second, the study was conducted in a single school with a small Grade 9 cohort and one grammar topic. Generalization to other schools, proficiency levels, age groups, or grammar domains is therefore uncertain. Replication across classes and schools would improve external validity.

Third, the main-study raw pretest/posttest data were not available in the reviewed report. Retaining participant-level scores would permit distributional checks, robust/non-parametric sensitivity analyses, learner-level gain analysis, and exploration of whether lower- and higher-proficiency learners benefit differently.

Fourth, instrument reporting is incomplete. Although IOC procedures, KR-20, and Cronbach's alpha are mentioned, numerical reliability coefficients are not reported. The satisfaction domain structure also differs between the methods and results. Future work should provide the complete instrument blueprint, item-to-objective mapping, item difficulty and discrimination where available, reliability estimates with confidence intervals, and the exact allocation of questionnaire items to domains.

Fifth, the technology platform is obsolete. Flash is no longer a practical deployment environment for contemporary browsers. The report itself recommends migration to HTML5 or mobile/web applications. Such migration should preserve the tested instructional structure while allowing accessibility, device compatibility, analytics, and security to be evaluated afresh. A new platform implementation should not be assumed equivalent to the original CAI without usability and learning validation.

Sixth, the study measured immediate post-instruction achievement and satisfaction but did not report delayed retention or transfer to communicative production. Future research should add delayed posttests and performance tasks requiring students to choose and use modal verbs in contextualized speaking or writing.

Finally, the iterative development stages should be documented with stable version numbers and separate participant rosters so that efficiency changes can be traced accurately and the sample-size inconsistencies identified in the present report do not recur.

7. CONCLUSION

This study developed a functionally organized, interactive CAI package for Grade 9 English modal verbs and evaluated it in a Thai secondary-school context. The main evidence shows a substantial increase in achievement from pretest to posttest and high learner satisfaction. Secondary analysis of the reported aggregates yielded a mean gain of 13.42 points, a 95% confidence interval of 11.68–15.16, $d_z = 2.44$, and normalized gain = 0.49. The appendix also documents a meaningful iterative design process and, in a secondary reanalysis of 40 displayed field-trial cases, a positive association between during-lesson process performance and posttest performance.

The study's contribution is strongest when framed as evidence of substantial within-group improvement and positive learner acceptance following a carefully refined CAI intervention. It should not be framed as proof that CAI is superior to conventional teaching because no control group was included. Equally important, the report contains unresolved inconsistencies in efficiency values and field-trial sample reporting. By making those discrepancies explicit rather than selecting an unsupported value, the present manuscript preserves the evidential boundary of the completed research. The resulting account supports CAI as a promising supplementary approach to modal-verb instruction while identifying the design, reporting, and replication steps needed for stronger future evidence.

REFERENCES

- Ai, H. (2017). Providing graduated corrective feedback in an intelligent computer-assisted language learning environment. *ReCALL*, 29(3), 313–334. <https://doi.org/10.1017/S095834401700012X>
- Biber, D., Johansson, S., Leech, G., Conrad, S., & Finegan, E. (1999). *Longman grammar of spoken and written English*. Longman.

- Chapelle, C. A. (2001). *Computer applications in second language acquisition: Foundations for teaching, testing and research*. Cambridge University Press. <https://doi.org/10.1017/CBO9781139524681>
- Clark, R. C., & Mayer, R. E. (2016). *e-Learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning* (4th ed.). Wiley. <https://doi.org/10.1002/9781119239086>
- Gagné, R. M., Wager, W. W., Golas, K. C., & Keller, J. M. (2005). *Principles of instructional design* (5th ed.). Wadsworth/Thomson Learning.
- Golonka, E. M., Bowles, A. R., Frank, V. M., Richardson, D. L., & Freynik, S. (2014). Technologies for foreign language learning: A review of technology types and their effectiveness. *Computer Assisted Language Learning*, 27(1), 70–105. <https://doi.org/10.1080/09588221.2012.700315>
- Grgurović, M., Chapelle, C. A., & Shelley, M. C. (2013). A meta-analysis of effectiveness studies on computer technology-supported language learning. *ReCALL*, 25(2), 165–198. <https://doi.org/10.1017/S0958344013000013>
- Heift, T., & Vyatkina, N. (2017). Technologies for teaching and learning L2 grammar. In C. A. Chapelle & S. Sauro (Eds.), *The handbook of technology and second language teaching and learning* (pp. 26–44). Wiley Blackwell. <https://doi.org/10.1002/9781118914069.ch3>
- Hockly, N. (2013). Mobile learning. *ELT Journal*, 67(1), 80–84. <https://doi.org/10.1093/elt/ccs064>
- Lakens, D. (2013). Calculating and reporting effect sizes to facilitate cumulative science: A practical primer for t-tests and ANOVAs. *Frontiers in Psychology*, 4, 863. <https://doi.org/10.3389/fpsyg.2013.00863>
- Levy, M. (1997). *Computer-assisted language learning: Context and conceptualization*. Oxford University Press.
- Mayer, R. E. (2021). *Multimedia learning* (3rd ed.). Cambridge University Press.
- Ministry of Education, Thailand. (2008). *Basic Education Core Curriculum B.E. 2551 (A.D. 2008)*. Office of the Basic Education Commission.
- Moon, S., & Oh, S.-Y. (2018). Unlearning overgenerated be through data-driven learning in the secondary EFL classroom. *ReCALL*, 30(1), 48–67. <https://doi.org/10.1017/S0958344017000246>
- Nagata, N. (1996). Computer vs. workbook instruction in second language acquisition. *CALICO Journal*, 14(1), 53–75.
- Palmer, F. R. (2001). *Mood and modality* (2nd ed.). Cambridge University Press. <https://doi.org/10.1017/CBO9781139167178>

- Sagarra, N., & Zapata, G. C. (2008). Blending classroom instruction with online homework: A study of student perceptions of computer-assisted L2 learning. *ReCALL*, 20(2), 208–224. <https://doi.org/10.1017/S0958344008000621>
- Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Houghton Mifflin.
- Torres-Martínez, S. (2019). Taming English modals: How a Construction Grammar approach helps to understand modal verbs. *English Today*, 35(2), 50–57. <https://doi.org/10.1017/S0266078418000081>
- Trapsaphon, P. (2025). The development of computer-assisted instruction for Modal Verbs for Grade 9 students [Unpublished research report]. Bang Sai Witthaya School.
- Warschauer, M., & Healey, D. (1998). Computers and language learning: An overview. *Language Teaching*, 31(2), 57–71. <https://doi.org/10.1017/S0261444800012970>



Research and Development for Enhancing Sago Flour and Products in Khoksaba Community, Nayong District, Trang Province

Suwijak Hansriwijit^{1*}, Sirinat Srionnual², Saowanee Chaipech³,
Jareewan Chankong⁴, Thanikan Thorasin⁵

^{1*} Program in Food Technology, Faculty of Science and Technology, Kanchanaburi Rajabhat University Nong Bua Subdistrict Mueang Kanchanaburi District, Kanchanaburi, THAILAND

²⁻⁵ Faculty of Agro-Industry, Rajamangala University of Technology Srivijaya, Nakhon Si Thammarat Campus, THAILAND

*Corresponding Author E-mail: suwijak1111@kru.ac.th

(Article history) Received: 2025-08-20, Revised: 2026-08-21, Accepted: 2026-08-23

Abstract

Traditional Sago processing in Southern Thailand has economic and cultural value but faces product-quality inconsistency, hygiene risks, limited packaging, and low value capture at community level. This study integrated process standardization, physicochemical and microbiological characterization, product formulation, sensory screening, packaging/storage assessment, economic evaluation, and community innovation to enhance Sago flour and products in Khoksaba Community, Nayong District, Trang Province. A community-based research-and-development design was implemented. A socioeconomic survey described 30 respondents. Traditional flour was assessed for color, water activity, moisture, pH, proximate composition, and microbial counts. Sago granules, pearls, and noodles were formulated with oligofructose, inulin (2%, 4%, 6%), or banana flour (5%, 10%, 15%); 30 consumers evaluated products using a 9-point hedonic scale under a completely randomized design with three replications and one-way ANOVA. Pearl formulation additionally compared 0–30% tapioca starch. Selected 6% inulin products were stored for three months in foil-zip and polyethylene packages. Cost–return analysis, technology transfer, and community-innovator development completed the value-chain evaluation. Baseline annual income was 26,460 baht/person, net profit 7,296.48 baht/person, and ROI 38.07%. Traditional flour moisture (12.34%) and pH (6.90) met the report's stated limits, whereas yeast/mold (5.73×10^2 CFU/g) exceeded the stated 100-CFU/g limit. Six-percent inulin gave the highest reported overall liking for granules (8.05/9) and noodles (8.05/9); 20% tapioca starch gave the highest pearl overall liking (8.05/9). The selected products showed generally small compositional changes during three-month storage, although one noodle ash value was internally inconsistent. Post-upgrading Sago pearls were valued at 200 baht/kg with net profit 60.86 baht/kg and ROI 43.74%. Twelve community innovators and three learning/innovation activities were reported. The project demonstrates an integrated local-food upgrading pathway linking food quality, consumer acceptance, packaging, economic value, and community capability. Evidence supports feasibility and local value creation, but not clinical prebiotic effects, microbiological shelf-life confirmation, or broad causal generalization.

Keywords: Sago palm; Metroxylon Sagu; Inulin; Functional food development; Sensory evaluation; Community innovation; Value addition

1. INTRODUCTION

Sago palm (*Metroxylon Sagu* Rottb.) is a starch-producing palm adapted to humid tropical and wetland environments and has long supported food, material, and livelihood systems in Southeast Asia and the Pacific. Its pith starch has distinctive processing functionality and has been reviewed as a potentially important industrial carbohydrate resource for foods and non-food applications (Karim et al., 2008; Singhal et al., 2008). More recent work has emphasized the scope for modification and diversification of Sago starch beyond traditional uses (Zhu, 2019). In southern Thailand, however, much of the local value remains tied to small-scale extraction and direct sale of flour or simple products.

The completed community research report identified a specific upgrading problem in Khoksaba, Na Yong District, Trang Province. Traditional production was associated with inconsistent product appearance, contamination risks from equipment and handling, losses during processing, weak packaging, and limited capacity to transform flour into higher-value products. The report also documented a value-chain problem: community flour could be sold at a much lower unit price than repacked or further processed products, leaving substantial value outside the producer community.

Food-product upgrading in this context requires more than a single formulation experiment. It requires simultaneous attention to raw-material quality, hygienic processing, product diversification, sensory acceptance, packaging and storage, economic feasibility, and the capacity of local producers to reproduce and transmit the technology. This is especially important for Sago because international and regional standards distinguish genuine palm-derived Sago flour from tapioca and specify essential quality criteria for edible Sago flour (Codex Alimentarius Commission, 2011).

A second development opportunity is the incorporation of ingredients described as prebiotic ingredients, particularly inulin and oligofructose. The prebiotic concept originated in work on selective modulation of host-associated microbiota (Gibson & Roberfroid, 1995) and has subsequently been refined to require a substrate that is selectively utilized by host microorganisms and confers a health benefit (Gibson et al., 2017). This distinction is important for the present study. The project used inulin and oligofructose as formulation ingredients and evaluated sensory and storage characteristics; it did not measure microbiota or health outcomes. Accordingly, the manuscript uses the term “inulin-enriched” or “prebiotic-ingredient formulation” rather than claiming that physiological prebiotic efficacy was established.

Research Gap, Novelty, and Objectives

The principal research gap is the lack of an integrated, community-level R&D model that links Sago-flour quality control with functional-ingredient product development, packaging/storage, economic upgrading, and local innovation capability within one field-to-market workflow. Many starch studies focus on physicochemical properties or isolated processing technologies, whereas this project followed the product system from baseline community economics and traditional processing through three prototype product families and community technology transfer.

The objectives were to (1) improve management of Sago-flour production and commercialization; (2) develop production technology and innovations capable of generating higher-quality Sago flour and products; and (3) upgrade products and marketing in ways that strengthen local identity and value. For the journal manuscript, these objectives are organized into four analytical questions: What baseline quality and economic constraints characterized community Sago production? Which product formulations achieved the strongest sensory acceptance? How stable were the selected products during three months of storage in the reported packages? And to what extent did the integrated intervention translate into economic and community-capacity outcomes?



Figure 1: Integrated Sago Flour Research & Development Pathway

2. CRITICAL LITERATURE REVIEW

2.1 Sago Starch as a Local and Industrial Resource

Sago starch is obtained from the pith of *Metroxylon* palms and has a long history as a staple and processing starch. Karim et al. (2008) reviewed its composition, granule structure, gelatinization behavior, functionality, and industrial prospects, while Singhal et al. (2008) surveyed production, processing, and product utilization. These reviews emphasize that Sago can support a much wider range of foods and industrial applications than traditional community markets alone. Zhu (2019) further reviewed physical, chemical, enzymatic, and other modification approaches that can broaden Sago-starch functionality.

The present study addresses a different but complementary problem: how to translate Sago's technical potential into reproducible, marketable products under community production conditions. That translation depends on hygiene, moisture control, color consistency, packaging, and practical process control. The project therefore evaluated traditional flour against physicochemical and microbial indicators before proceeding to product development.

2.2 Product Quality, Moisture, Microbiology, and Packaging

Water activity and moisture are central to the stability of dried foods because they influence chemical changes, texture, and microbial growth. The project used

AOAC-based measurements and referenced Thai community standards for moisture, pH, total microbial count, and yeast/mold. Internationally, Codex CXS 301R-2011 defines edible Sago flour from *Metroxylon* spp. and provides regional quality requirements. Standardized analytical methods such as AOAC methods improve comparability across food-product development studies (AOAC International, 2000). Packaging must be interpreted as part of a preservation system rather than merely as product decoration. Barrier properties, sealing integrity, environmental humidity, and product composition interact during storage (Robertson, 2013). The project compared foil-zip and polyethylene packages for selected inulin-enriched dried Sago products over three months. Because the report publishes proximate-composition trajectories but not monthly microbial results, the evidence supports compositional stability over the observed interval more strongly than it supports a microbiologically validated shelf life.

2.3 Prebiotic Ingredients and Responsible Functional-food Claims

Inulin and fructo-oligosaccharides are widely discussed in the prebiotic literature, but current consensus requires demonstrated selective utilization by host microorganisms and a health benefit before a substrate is claimed to be prebiotic in a physiological sense (Gibson et al., 2017). The present project did not conduct microbiome, gastrointestinal, metabolic, or clinical testing. Its contribution is therefore formulation-based: it shows that inulin can be incorporated at reported levels while maintaining or improving sensory acceptance in specific Sago products. This is a food-development finding, not evidence of a health effect.

2.4 Sensory Evaluation and Consumer-centered Product Selection

Consumer acceptance is essential when a traditional staple is repositioned as a higher-value product. Hedonic testing is designed to quantify liking rather than analytical intensity, and the 9-point hedonic scale remains widely used in consumer food research (Lawless & Heymann, 2010). The project used 30 consumers, a completely randomized design, three replications, and one-way ANOVA to screen multiple formulations. This approach is suitable for developmental ranking, although the report does not describe consumer recruitment, blinding, serving order, or the named post-hoc procedure used to generate letter groupings.

2.5 Community Innovation and Value Capture

The distinctive contribution of the project lies in joining laboratory/product evidence to community economics. Rather than stopping after formulation, the project calculated costs, revenues, net profit, profit above cash cost, and return on investment, then transferred product and management knowledge to community innovators. This provides a value-capture perspective: the relevant outcome is not only whether a product is liked but also whether local producers can make it, price it, market it, and retain more of the value generated by the resource.

3. MATERIALS AND METHODS

3.1 Research Design and Study Setting

The project used an integrated research-and-development design in Khoksaba and related Sago-processing communities in Na Yong District, Trang Province, Thailand. Activities combined community socioeconomic assessment, traditional-process diagnosis, laboratory characterization, food-product formulation and sensory testing, packaging/storage assessment, economic analysis, marketing development, technology readiness assessment, and community-innovator training.

3.2 Populations, Samples, and Data Streams

The report contains several distinct samples rather than one unified dataset. The baseline socioeconomic tables describe 30 respondents. The methods section identifies a Khoksaba farmer group with 9 members and a women's Sago group in Na Khao Sia with 10 members, whereas the community-context chapter earlier describes both groups as having 10 members. Six one-kilogram bags of community Sago flour were collected for initial color characterization and then pooled for other flour-quality tests. Consumer sensory tests used 30 consumers. Community-innovator outcomes ultimately list 12 trained innovators. These samples serve different purposes and should not be treated as a single cohort.

Table 1: Study Components; Reported Data Streams and Primary Output

Component	Reported sample / unit	Primary outputs
Socioeconomic baseline	30 respondents	Demographics, cost, revenue, profit, ROI
Target processing groups	9 + 10 members in Methods; earlier context states 10 + 10	Process diagnosis and technology transfer
Traditional flour quality	6 × 1-kg bags; pooled for most analyses	Color, aw, moisture, pH, proximate indicators, microbial counts
Sensory evaluation	30 consumers; 9-point hedonic scale	Color, aroma, taste, texture, overall liking
Formulation experiment	CRD; 3 replications	Prebiotic-ingredient levels and tapioca substitution
Storage study	2 package types × 4 time points (0–3 months)	Protein, fat, ash, moisture, fiber; planned microbial tests
Community innovators	12 final innovators	Innovation skills and technology-transfer capacity

Note: These datasets; each component is interpreted within its stated analytical purpose.

3.3 Baseline Socioeconomic Survey

A questionnaire developed around the research objectives collected quantitative and qualitative information in three sections: socioeconomic status, costs and returns of Sago production, and perceived economic/social/environmental impacts. The report used descriptive percentages for the socioeconomic data. Production economics distinguished cash and non-cash costs, calculated total revenue as price multiplied by quantity, and reported net profit, profit above cash cost, and ROI.

3.4 Traditional Sago-flour Quality Characterization

Traditional flour quality was examined before product upgrading. The color was measured as L*, a*, and b* values using a HunterLab UltraScan Vis instrument. The water activity was measured at 25 °C in triplicate following the report's AOAC-based procedure. The moisture was measured by an AOAC method. For pH, flour was ground, passed through a 0.5-mm sieve, and a 25-g sample was dispersed in 50 mL before measurement with a pH meter. Total aerobic microorganisms and yeast/mold were measured using the report's cited microbiological method (Maturin & Peeler, 2001). The equipment list also mentions a hot-air oven, HPLC, and spectrophotometer, but the results section does not separately report HPLC- or spectrophotometer-derived endpoints.

3.5 Process Standardization

Researchers compared existing post-harvest and processing practices from cutting and collection through grinding, drying, granulation, and packaging. Control measures included improved cleanliness and personal hygiene, stainless-steel or easier-to-clean equipment, controlled drying, cleaner storage, improved packaging, shelving, and better product labeling. The report is primarily descriptive for these process changes and does not present a controlled before–after microbial trial of the revised process.

3.6 Sago Granule Formulation

Three ingredients described in the report as prebiotic ingredients were screened: oligofructose and inulin at 2%, 4%, and 6%, and banana flour at 5%, 10%, and 15%, together with a Sago control. Thirty consumers rated color, aroma, taste, texture, and overall liking using a 9-point hedonic scale. The report states that a completely randomized design with three replications and one-way ANOVA was used to select the best treatment.

3.7 Sago Pearl Formulation

Pearl development occurred in two stages. First, tapioca-starch addition was screened using Sago: tapioca ratios equivalent to 100:0, 90:10, 80:20, and 70:30. Consumer acceptance was evaluated with the same 9-point hedonic procedure (n=30). Second, the selected pearl system was evaluated with the same oligofructose, inulin, and banana-flour levels used for granules.

3.8 Sago Noodle Formulation

The reported base noodle formula contained 68 g rice flour, 29 g Sago flour, and 200 g water. The process included mixing flour, prebiotic ingredient and water, steaming a 100-g layer for 5 min in an 8×12-inch tray, resting the sheet overnight, cutting, drying or sun-drying for two days, and packaging in 100-g units. The same three ingredient types and concentration levels were evaluated by 30 consumers.

3.9 Storage and Packaging Study

The report selected the preferred 6% inulin formulation for granules, pearls, and noodles and stored each in two packages: a foil-zip type and a polyethylene zip/plastic package, heat sealed and kept under normal ambient conditions. Samples were assessed every month for three months. The methods intended chemical/physical and microbial testing. The published result tables, however, provide monthly protein, fat, ash, moisture, and fiber values but not monthly microbial counts. The manuscript therefore reports only the endpoints that are numerically documented.

3.10 Lod Chong Packaging, Economic Analysis, and Community Innovation

Lod Chong Sago with coconut milk was upgraded to a plastic cup with film lid selected for strength, appearance, sealing, suitability for placement on ice, and ease of opening. Economic analysis was repeated after product upgrading, with a specific cost-return table for Sago pearls. The project also developed marketing activities, trained community innovators in observation, thinking, occupational, and management skills, and created learning-and-innovation activities including a hands-on training course/manual, a researcher-community dialogue activity, and a Sago-pearl technology demonstration.

3.11 Statistical Analysis, Comparison Methods, and Reporting Limits

The report states that socioeconomic data were summarized using descriptive percentages. Sensory data were analyzed using one-way ANOVA under a CRD with three replications. Some sensory tables contain superscript letter groupings and 'ns' notations, but the report does not name the post-hoc multiple-comparison procedure or provide F statistics, degrees of freedom, exact p values, or confidence intervals. No unsupported post-hoc method is therefore assigned in this manuscript.

No machine-learning model, class label, feature-preprocessing pipeline, model architecture, hyperparameter optimization, training/validation/test partition, cross-validation, ablation experiment, calibration analysis, or unseen-dataset evaluation was used. These terms are inapplicable to the completed food R&D study. The laboratory 'hardware' explicitly reported comprises the HunterLab UltraScan Vis colorimeter, hot-air oven, HPLC, spectrophotometer, pH meter, and water-activity meter; model numbers and software versions were not reported. These omissions are stated rather than filled by assumption.

3.12 Secondary Analyses

Secondary calculations were limited to arithmetic transformations of reported values. They include (i) the factor by which baseline yeast/mold exceeded the stated community standard, (ii) absolute and relative changes in per-kilogram revenue, cost, profits, and ROI between the report's comparable before/after economic table, (iii) absolute endpoint changes from month 0 to month 3 for reported storage composition, and (iv) direct contrasts in reported overall-liking means between selected treatments and controls. These calculations introduce no new observations and are explicitly labeled as secondary analyses.

3.13 Source-data Verification and Inconsistency Audit

Table 2: Verified Inconsistencies

Issue	What the report contains	Handling in this article
Target-group membership	Methods: Khoksaba 9 and Na Khao Sia 10; context chapter: 10 and 10	Retain the conflict; do not infer a corrected membership
Socioeconomic income categories	Counts $8 + 17 + 3 = 28$ although survey $n=30$	Report as printed and flag two unaccounted observations
Experience percentage	Table: $10/30 = 33.33\%$; narrative states 30.33%	Use table/arithmetic value 33.33%
Baseline ROI	Annual per-person table: 38.07%; comparable per-kg table: 32.89%	Treat as different accounting bases; do not merge
Noodle foil ash, month 1	$0.29 \rightarrow 0.89 \rightarrow 0.28 \rightarrow 0.27\%$	Retain 0.89 as printed, flag as internally inconsistent, avoid ash-trend inference
Storage microbiology	Methods specify microbial tests; result tables publish only composition	Do not claim microbiological shelf-life validation
TRL/TcRL/SRL	Overall summary indicates progression toward level 3; product-specific pearl subsection reports lower values	Report project-level level-3 conclusion cautiously; do not assign unsupported final pearl-specific readiness
Community innovator targets	Planning table contains 5 and 9; final results and abstract report 12	Use 12 as achieved output; describe planning figures as ambiguous

Note: No inconsistency was resolved by importing external data; only arithmetic checks or explicit report sections were used.

4. RESULTS

4.1 Socioeconomic Baseline

The socioeconomic survey described 30 respondents. Women comprised 56.67% and men 43.33%. The largest age category was 51–60 years (36.67%), 93.33% were married, 50.00% had primary education, and all respondents were reported as Buddhist. Agriculture was the main occupation for 80.00%. Two-thirds (66.67%) reported household debt. Production experience was 1–5 years for 53.33%, 6–10 years for 13.33%, and more than 10 years for 33.33%.

Table 3: Selected Socio-economic Characteristics of the 30-person Baseline Survey

Characteristic	n	%
Sex: Female	17	56.67
Sex: Male	13	43.33
Age: 1–30	2	6.67
Age: 31–40	5	16.67
Age: 41–50	8	26.67
Age: 51–60	11	36.67
Age: >60	4	13.33
Marital status: Married	28	93.33
Marital status: Single	2	6.67
Education: No formal schooling	5	16.67

Education: Primary	15	50.00
Education: Secondary	4	13.33
Education: Vocational	5	16.67
Education: Bachelor's	1	3.33
Religion: Buddhist	30	100.00
Household size: 1–2	5	16.67
Household size: 3–4	16	53.33
Household size: 5–6	8	26.67
Household size: ≥7	1	3.33
Main occupation: Agriculture	24	80.00
Main occupation: Government/state	1	3.33
Main occupation: Other	5	16.67
Household debt: Yes	20	66.67
Household debt: No	10	33.33
Production experience: 1–5 years	16	53.33
Production experience: 6–10 years	4	13.33
Production experience: >10 years	10	33.33

Note: Monthly-income categories are shown separately because their reported counts total 28 rather than 30.

Table 4: Reported Monthly-income Categories

Monthly income category	n	%
<10,000 baht/month	8	26.67
10,001–30,000 baht/month	17	56.67
>30,000 baht/month	3	10.00

Note: The three reported counts sum to 28 (93.34%), leaving two survey observations unaccounted for in this item. No missing category is invented.

Before the project, total production cost was 19,163.52 baht/person/year and total revenue was 26,460.00 baht/person/year. Average net profit was 7,296.48 baht/person/year, profit above cash cost was 14,299.17 baht/person/year, and ROI was 38.07%. These annual-per-person figures describe the baseline production system and should not be conflated with the later per-kilogram comparison.

Table 5: Baseline Annual Production Economics

Indicator	Reported value
Total production cost (baht/person/year)	19,163.52
Total revenue (baht/person/year)	26,460.00
Net profit (baht/person/year)	7,296.48
Profit above cash cost (baht/person/year)	14,299.17
ROI (%)	38.07%

Note: Reported annual-per-person accounting. ROI = return on investment.

4.2 Quality of Traditional Community Sago Flour

The six flour bags showed substantial between-bag color variation: L* ranged from 64.74 to 71.53, a* from 7.35 to 10.87, and b* from 17.06 to 20.25. The pooled

flour had aw 0.56 ± 0.03 , moisture $12.34 \pm 0.55\%$, and pH 6.90. Under the standard thresholds reproduced in the report, moisture, pH, and total microorganisms complied, while yeast/mold did not.

Table 6: Color Values of Community Sago Flour

Sample	L*	a*	b*
Sample 1	66.48 ± 0.21	10.87 ± 0.01	19.23 ± 0.14
Sample 2	67.80 ± 0.90	10.44 ± 0.28	19.09 ± 0.03
Sample 3	66.41 ± 0.52	10.73 ± 0.11	19.15 ± 0.10
Sample 4	64.74 ± 0.08	8.35 ± 0.04	20.25 ± 0.18
Sample 5	68.06 ± 0.12	7.35 ± 0.04	17.06 ± 0.23
Sample 6	71.53 ± 0.04	8.27 ± 0.02	18.90 ± 0.06
Pooled sample	67.06 ± 0.12	9.55 ± 0.02	19.36 ± 0.18

Table 7: Baseline Physicochemical and Microbiological Quality of Pooled Community Flour

Indicator	Reported value	Threshold stated in report
Water activity (aw)	0.56 ± 0.03	Not specified in report standard
Moisture (%)	12.34 ± 0.55	$\leq 13\%$
pH	6.90	4.5–7.0
Protein (%)	0.175	No threshold stated
Fat (%)	0.214	No threshold stated
Ash (%)	0.383	No threshold stated
Total microorganisms (CFU/g)	1.18×10^4	$\leq 1 \times 10^6$ CFU/g
Yeast and mold (CFU/g)	5.73×10^2	≤ 100 CFU/g

Note: Secondary calculation: 5.73×10^2 CFU/g yeast/mold is 5.73 times the report's stated 100-CFU/g limit. This finding concerns the traditional baseline sample; post-intervention microbial counts were not reported.

4.3 Process-quality Upgrading

The process audit identified controllable risks across raw-material handling, equipment hygiene, personal hygiene, drying, storage, packaging, and product presentation. Reported corrective directions included cleaner and stainless-steel equipment, protective clothing, better drying control including solar-dryer concepts, improved storage on shelves, smaller retail packaging, foil or thicker zip bags, and labels/branding. The report documents these as development actions but does not provide a numerical controlled comparison of microbial counts before and after process standardization.

4.4 Sensory Development of Inulin-/Oligofructose-/Banana-flour Sago Granules

The strongest granule result was the 6% inulin formulation, with reported means of 7.59 for color, 6.92 for aroma, 7.90 for taste, 7.95 for texture, and 8.05 for overall liking. Its overall-liking mean exceeded the Sago control (6.75) by 1.30 hedonic points. The report's letter groupings indicate that multiple sensory dimensions differed among treatments at the stated significance criterion, although the named post-hoc procedure is not reported.

Table 8: Sensory Acceptance of Sago Granules with Different Added Ingredients

Treatment	Color	Aroma	Taste	Texture	Overall liking
Banana flour 5%	7.65 ± 0.75 ^a	6.25 ± 1.02 ^b	6.99 ± 0.89 ^b	6.91 ± 0.95 ^b	6.95 ± 0.93 ^b
Banana flour 10%	7.65 ± 0.81 ^a	6.50 ± 1.03 ^b	7.15 ± 0.83 ^b	7.00 ± 0.91 ^b	6.95 ± 0.88 ^b
Banana flour 15%	7.75 ± 0.73 ^a	7.15 ± 0.88 ^a	7.55 ± 0.82 ^a	7.65 ± 0.73 ^a	7.65 ± 0.78 ^a
Inulin 2%	7.15 ± 0.88 ^b	6.65 ± 1.05 ^b	7.15 ± 0.88 ^b	6.95 ± 0.91 ^b	7.05 ± 0.89 ^b
Inulin 4%	7.05 ± 0.93 ^b	6.65 ± 0.98 ^b	7.55 ± 0.82 ^a	7.44 ± 0.81 ^a	7.55 ± 0.82 ^a
Inulin 6%	7.59 ± 0.89 ^a	6.92 ± 1.22 ^a	7.90 ± 0.81 ^a	7.95 ± 0.73 ^a	8.05 ± 0.73 ^a
Oligofructose 2%	6.65 ± 1.02 ^b	6.81 ± 1.05 ^a	6.85 ± 0.90 ^b	7.01 ± 0.89 ^b	7.05 ± 0.92 ^b
Oligofructose 4%	6.65 ± 1.08 ^b	6.85 ± 1.02 ^a	7.12 ± 0.91 ^a	7.33 ± 0.85 ^a	7.55 ± 0.83 ^a
Oligofructose 6%	6.99 ± 0.95 ^b	6.95 ± 1.01 ^a	7.45 ± 0.83 ^a	7.65 ± 0.82 ^a	7.79 ± 0.79 ^a
Sago control	7.35 ± 0.85 ^a	7.15 ± 0.88 ^b	6.99 ± 0.91 ^b	7.11 ± 0.87 ^b	6.75 ± 0.95 ^b

Note: Reported mean ± SD values. Superscript letters and ns notation are reproduced from the report where available; no post-hoc method is inferred.

4.5 Sago Pearl Optimization

For Sago pearls, the 20% tapioca-starch formulation had the highest overall liking (8.05), with taste 7.20 and texture 7.55. The color and aroma columns were marked non-significant in the report. The subsequent ingredient screen reported overall liking of 7.70 for 6% inulin compared with 6.95 for the Sago control. Because the extracted prebiotic-pearl table does not provide inferential annotations, this 0.75-point contrast is descriptive.

Table 9: Sensory Acceptance of Sago Pearls at Different Tapioca-starch Levels

Treatment	Color	Aroma	Taste	Texture	Overall liking
10% tapioca starch	6.85 ± 0.73 ns	6.65 ± 0.85 ns	6.75 ± 0.77 ^b	6.65 ± 0.85 ^b	6.80 ± 0.85 ^b
20% tapioca starch	6.80 ± 0.93 ns	6.60 ± 0.92 ns	7.20 ± 0.81 ^a	7.55 ± 0.73 ^a	8.05 ± 0.74 ^a
30% tapioca starch	6.60 ± 0.97 ns	6.60 ± 0.92 ns	6.70 ± 0.78 ^b	6.75 ± 0.82 ^b	6.85 ± 0.83 ^b
100% Sago / 0% tapioca	6.50 ± 1.12 ns	6.65 ± 0.86 ns	6.69 ± 0.77 ^b	6.65 ± 0.77 ^b	6.75 ± 0.77 ^b

Note: Reported mean ± SD values. “ns” and superscript letters are reproduced from the report.

Table 10: Sensory Acceptance of Sago Pearls with Different Added Ingredients

Treatment	Color	Aroma	Taste	Texture	Overall liking
Banana flour 5%	6.95	6.65	6.75	7.00	7.05
Banana flour 10%	7.05	6.70	6.95	7.20	7.25
Banana flour 15%	7.05	6.90	7.10	7.25	7.25
Inulin 2%	7.20	6.45	7.15	7.45	7.20
Inulin 4%	7.25	6.55	7.50	7.65	7.60
Inulin 6%	7.20	6.50	7.55	7.55	7.70

Oligofructose 2%	7.40	6.35	7.20	7.10	7.25
Oligofructose 4%	7.40	6.60	7.35	7.30	7.40
Oligofructose 6%	7.45	6.60	7.55	7.40	7.60
Sago control	7.15	7.15	7.09	7.01	6.95

Note: Means are reported in the source table. SDs/inferential annotations were not available in the extracted numerical table and are not fabricated.

4.6 Sago Noodle Optimization

For Sago noodles, 6% inulin produced the highest reported overall liking of 8.05, compared with 6.99 for the Sago control. The same treatment had taste 7.80 and texture 7.85. Banana flour at 15% and oligofructose at 6% also received relatively high overall-liking means of 7.75 and 7.90, respectively. These comparisons are descriptive because the report's noodle table, as extracted, does not publish complete inferential annotations.

Table 11: Sensory Acceptance of Sago Noodles with Different Added Ingredients

Treatment	Color	Aroma	Taste	Texture	Overall liking
Banana flour 5%	7.55	6.55	6.90	6.90	6.90
Banana flour 10%	7.65	6.60	7.05	7.00	6.95
Banana flour 15%	7.85	7.05	7.65	7.75	7.75
Inulin 2%	7.15	6.75	7.05	6.85	7.00
Inulin 4%	7.25	6.60	7.45	7.40	7.45
Inulin 6%	7.30	6.90	7.80	7.85	8.05
Oligofructose 2%	6.75	6.80	6.95	7.00	7.05
Oligofructose 4%	6.75	6.95	7.30	7.40	7.50
Oligofructose 6%	6.90	6.95	7.65	7.75	7.90
Sago control	7.34	6.95	6.99	7.15	6.99

Note: No unreported SD or significance values are added.

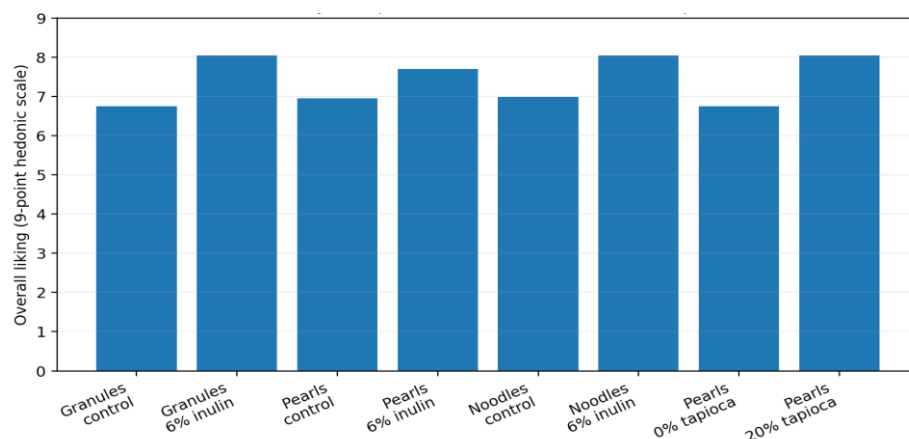


Figure 2: The Selected Sensory Comparisons without Added Inferential Claims

4.7 Three-month Storage of Selected 6% Inulin Products

Across the three products, the reported protein, fat, moisture, and fiber values changed only modestly over the three-month observation period in both packages. For granules, foil-pack protein decreased from 1.88% to 1.78%, while polyethylene-pack

protein changed from 1.85% to 1.84%. Pearl protein in foil declined from 1.67% to 1.51%, whereas polyethylene changed from 1.65% to 1.64%. Noodle moisture remained close to 4.3% in both packages.

One value prevents an unqualified ash-stability conclusion for noodles: foil-packed noodle ash is reported as 0.29% at month 0, 0.89% at month 1, 0.28% at month 2, and 0.27% at month 3. The isolated 0.89% value is inconsistent with the surrounding trajectory and is retained as printed rather than silently corrected. In addition, although the methods proposed monthly microbial testing, no monthly microbial values appear in the result tables. The report's statement that products could be stored for at least three months is therefore supported by the published compositional data and observation interval, but microbiological shelf-life validation cannot be independently confirmed from the retained results.

Table 12: Sago Granule Composition During Storage

Package	Month	Protein %	Fat %	Ash %	Moisture %	Fiber %
Foil zip	0	1.88	0.51	0.84	7.23	8.33
Foil zip	1	1.87	0.50	0.82	7.35	8.30
Foil zip	2	1.87	0.50	0.84	7.38	8.27
Foil zip	3	1.78	0.50	0.84	7.42	8.27
Polyethylene	0	1.85	0.52	0.83	7.11	8.47
Polyethylene	1	1.84	0.52	0.83	7.10	8.43
Polyethylene	2	1.84	0.52	0.83	7.10	8.40
Polyethylene	3	1.84	0.52	0.83	7.10	8.40

Note: Reported values for the selected 6% inulin product.

Table 13: Sago Pearl Composition During Storage

Package	Month	Protein %	Fat %	Ash %	Moisture %	Fiber %
Foil zip	0	1.67	0.39	0.69	7.38	7.36
Foil zip	1	1.66	0.39	0.67	7.31	7.36
Foil zip	2	1.55	0.38	0.67	7.22	7.34
Foil zip	3	1.51	0.38	0.67	7.22	7.34
Polyethylene	0	1.65	0.38	0.70	7.38	7.37
Polyethylene	1	1.65	0.37	0.69	7.38	7.37
Polyethylene	2	1.64	0.37	0.69	7.36	7.35
Polyethylene	3	1.64	0.37	0.69	7.36	7.35

Note: Reported values for the selected 6% inulin product.

Table 14: Sago Noodle Composition During Storage

Package	Month	Protein %	Fat %	Ash %	Moisture %	Fiber %
Foil zip	0	1.27	0.26	0.29	4.37	3.85
Foil zip	1	1.25	0.26	0.89	4.30	3.84
Foil zip	2	1.25	0.25	0.28	4.28	3.84
Foil zip	3	1.24	0.23	0.27	4.27	3.82
Polyethylene	0	1.28	0.27	0.29	4.33	3.86
Polyethylene	1	1.27	0.27	0.29	4.33	3.85
Polyethylene	2	1.27	0.26	0.29	4.32	3.84
Polyethylene	3	1.27	0.26	0.29	4.32	3.84

Note: Reported values for the foil month-1 ash value (0.89%) which is internally inconsistent with adjacent values and is not corrected.

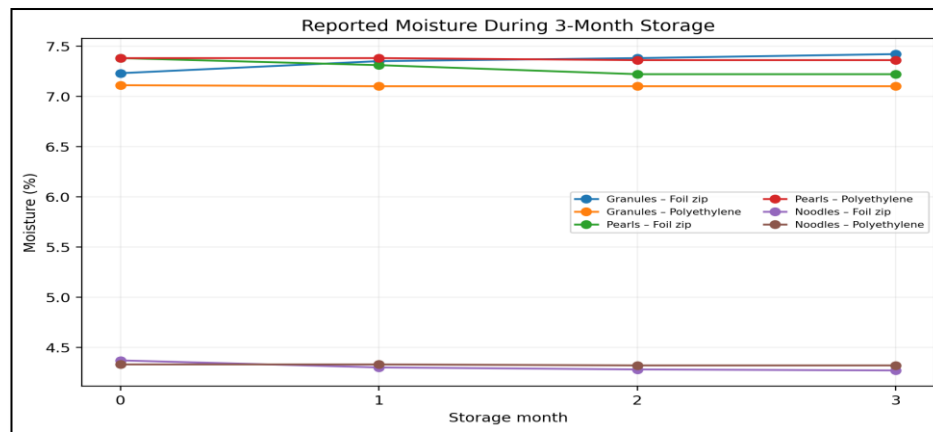


Figure 3: Moisture Values Reported Over Three Months for Selected 6% Inulin Sago Products in Foil-zip and Polyethylene Packages

Table 15: Secondary Endpoint Changes from the 1st Month to the 3rd Month

Product	Package	Δ Protein	Δ Fat	Δ Ash	Δ Moisture	Δ Fiber
Granules	Foil zip	-0.10	-0.01	+0.00	+0.19	-0.06
Granules	Polyethylene	-0.01	+0.00	+0.00	-0.01	-0.07
Pearls	Foil zip	-0.16	-0.01	-0.02	-0.16	-0.02
Pearls	Polyethylene	-0.01	-0.01	-0.01	-0.02	-0.02
Noodles	Foil zip	-0.03	-0.03	Not interpreted	-0.10	-0.03
Noodles	Polyethylene	-0.01	-0.01	+0.00	-0.01	-0.02

Note: Secondary arithmetic from reported the 1st month and the 3rd month values. Units are percentage points of composition. Noodle foil ash is not interpreted because of the internally inconsistent month-1 value.

4.8 Packaging and Prototype Outputs

The project reported three principal product innovations: Andaman Sago pearls enriched with the selected ingredient system, semi-finished Sago granules, and semi-finished Sago noodles. Packaging/label development accompanied these products. Lod Chong Sago in coconut milk was packaged in a plastic cup sealed with a film lid, enabling cleaner handling and a more market-oriented presentation.

4.9 Economic Value Upgrading

The post-project economic table for Sago pearls reported a selling price/revenue of 200 baht/kg, total production cost 139.14 baht/kg, net profit 60.86 baht/kg, profit above cash cost 82.48 baht/kg, and ROI 43.74%. The directly comparable before-project per-kilogram table reported cost 60.20 baht/kg, revenue 80.00 baht/kg, net profit 19.80 baht/kg, profit above cash cost 41.69 baht/kg, and ROI 32.89%.

Table 16: Comparable Per-kilogram Economics Before and After Upgrading

Period	Total cost	Revenue	Net profit	Profit above cash cost	ROI (%)
Before	60.20	80.00	19.80	41.69	32.89
After	139.14	200.00	60.86	82.48	43.74

Reported Table 4.14 values, baht/kg except ROI.

Secondary arithmetic shows that revenue increased by 150.0%, total cost by 131.1%, net profit by 207.4%, and profit above cash cost by 97.8%. ROI increased by 10.85 percentage points, equivalent to a 33.0% relative increase. These are arithmetic comparisons of the report's before/after per-kilogram values and do not constitute an independent causal impact estimate.

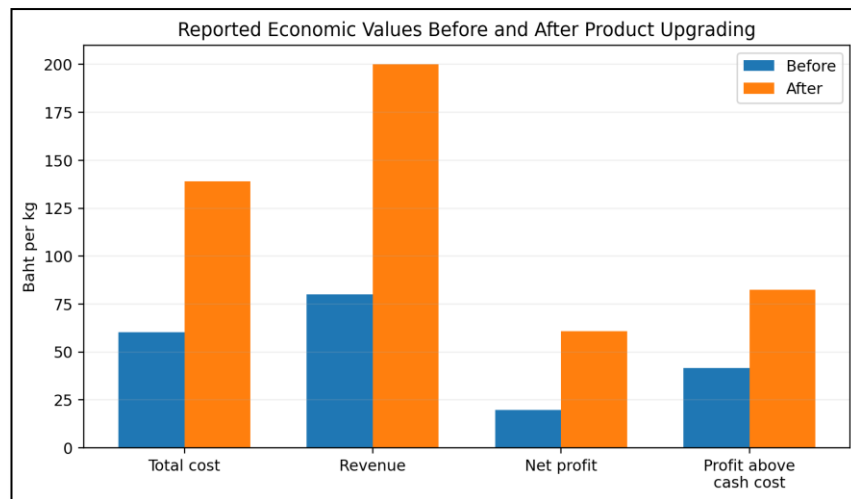


Figure 4: Reported Per-kilogram Economic Values Before & After Sago-pearl Upgrading

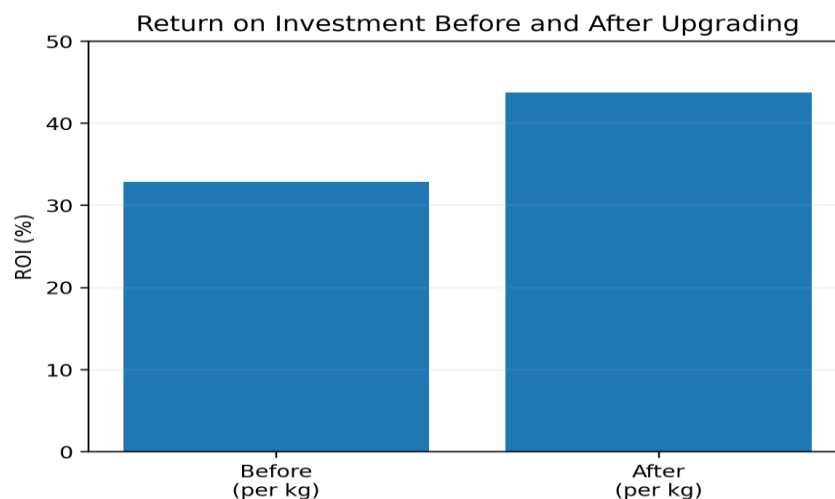


Figure 5: Reported Per-kilogram ROI Before & After Product Upgrading

4.10 Community Innovators, Learning Platforms, and Readiness

Final project outputs report 12 community innovators. The community-innovator table divides them into seven individuals at a problem-solving innovation level and five at a knowledge-transfer level. Training addressed four skill areas—observation, thinking, occupational skills, and management—and the report describes three learning/innovation activities: a practical training course with supporting documentation, a researcher-community knowledge-exchange program, and a Sago-pearl technology demonstration.

Table 17: Community-innovation Outputs

Output	Reported achievement
Community innovators	12 total: 7 at problem-solving level and 5 at knowledge-transfer level
Prototype product innovations	3: Andaman Sago pearls, semi-finished granules, semi-finished noodles
Learning/innovation activities	3 activities: practical course/manual; dialogue platform; technology demonstration
Project-level readiness	Concluding material describes progression from TRL 2 toward TRL 3 and summary table at level 3; product-specific readiness entries are internally inconsistent

Note: Readiness labels are reported conservatively because the source contains conflicting product-specific TRL/TcRL/SRL entries.

4.11 Analyses not Present in the Completed Study

No ablation experiment, cross-validation analysis, unseen-dataset evaluation, predictive-model comparison, calibration test, or algorithmic interpretability analysis exists for this study. They are not meaningful extensions of the reported experimental design without new data or a new modeling objective. Consequently, no such results are presented.

5. DISCUSSION

5.1 From Baseline Quality Problems to an Integrated Upgrading Strategy

The baseline results substantiate the need for process upgrading. Moisture and pH fell within the limits cited in the report and total microorganisms were below the stated maximum, but yeast/mold reached 5.73×10^2 CFU/g—5.73 times the stated 100-CFU/g limit. Combined with visible variation in flour color, this indicates that the development problem was not merely one of marketing. Process consistency, drying, hygiene, and storage were legitimate technical constraints. This aligns with the broader Sago literature, which has emphasized that industrial expansion depends on standardized processing and quality control, not simply on starch availability (Karim et al., 2008; Singhal et al., 2008).

The report's process recommendations—cleaner equipment, improved personal hygiene, better controlled drying, cleaner storage, and more protective packaging—are therefore coherent responses to the observed baseline. However, because post-upgrading microbial counts were not published, the manuscript cannot claim that the revised process reduced yeast/mold by a quantified amount. This distinction is central to publication-quality interpretation.

5.2 Consumer Acceptance and Formulation Logic

The sensory experiments show that Sago can accommodate meaningful formulation changes without sacrificing consumer acceptance. Six-percent inulin was the report's preferred formulation for granules and was also the highest overall-liking

treatment for noodles. In pearls, 20% tapioca starch improved taste, texture, and overall liking relative to the 100% Sago formulation, and the subsequent ingredient screen showed a favorable overall-liking mean for 6% inulin.

These results are consistent with the general principle that starch-based foods can be reformulated to alter texture and functionality while preserving consumer liking. Sago starch has distinctive gelatinization and rheological characteristics and can be blended or modified for different applications (Karim et al., 2008; Zhu, 2019). Yet the results should not be overgeneralized. The study used a local 30-consumer panel, and the report does not document blinding, random serving order, demographic composition of the sensory panel, or a named post-hoc test. The findings are therefore best understood as product-development screening evidence.

5.3 Inulin Enrichment without Overstating Prebiotic Efficacy

The selection of 6% inulin is commercially interesting because the ingredient did not merely remain acceptable; it achieved the highest reported overall-liking scores in two product families. Nevertheless, modern prebiotic definitions require more than ingredient identity. A prebiotic substrate must be selectively utilized by host microorganisms and confer a health benefit (Gibson et al., 2017). The project measured neither microbiota composition nor health outcomes. Thus, the appropriate scientific claim is that the products were inulin-enriched and developed using ingredients commonly discussed in the prebiotic literature, not that the finished foods were proven to exert prebiotic health effects.

5.4 Packaging and Storage Evidence

The three-month composition tables show small changes for most measured components, particularly in polyethylene packages. This suggests that both package systems were technically feasible over the reported observation interval. Packaging theory supports the importance of moisture and oxygen barriers for dried food stability (Robertson, 2013). However, the storage dataset has two limitations that materially affect interpretation. First, monthly microbial counts planned in the method are absent from the results. Second, one noodle ash value is internally inconsistent. Consequently, the most defensible conclusion is compositional stability over three months, not validated microbiological shelf life.

5.5 Economic Upgrading and Local Value Capture

The economic results provide a second axis of success. The upgraded pearl product generated 200 baht/kg revenue and 60.86 baht/kg net profit, compared with 80 baht/kg revenue and 19.80 baht/kg net profit in the report's comparable pre-project table. Although production cost also more than doubled, the higher selling value produced a larger absolute profit and increased ROI from 32.89% to 43.74%. The central economic mechanism was therefore not cost minimization; it was value addition and improved value capture through a differentiated product.

This interpretation is consistent with the project's original community problem: raw or simply packaged Sago flour was sold cheaply while downstream transformation captured a much larger price. By developing pearls, granules, noodles, packaging,

labels, and marketing capability within the community, the project sought to retain a greater share of that value locally. The observed before/after accounting is encouraging but should not be treated as a causal econometric impact estimate because market conditions, production scale, and product mix were not experimentally controlled.

5.6 Community Innovation as Part of Technology Transfer

The creation of 12 community innovators and three learning/innovation activities indicates that the intervention went beyond laboratory prototyping. This is important for translation: a technically acceptable formulation has limited development value if producers cannot reproduce it, troubleshoot it, manage costs, and transfer the knowledge. The project's skill framework—observation, thinking, occupational, and management competencies—connects technical food processing to community capability.

Readiness reporting, however, is not fully consistent. The overall project narrative describes movement from TRL 2 toward TRL 3 and later summary material indicates level 3, while a product-specific pearl section reports lower readiness values. The safe interpretation is that the project advanced prototype readiness at an early community-demonstration stage; precise final readiness for every product cannot be harmonized from the report.

5.7 Comparison with Sago and Starch Literature

At a scientific level, the study complements rather than duplicates laboratory-oriented Sago research. Reviews by Karim et al. (2008), Singhal et al. (2008), and Zhu (2019) document the material and processing potential of Sago starch. The present contribution is translational: it operationalizes that potential in a Thai community value chain, integrating baseline safety/quality indicators, consumer product development, packaging, economics, and human capability. This integrated local-to-market design is the principal novelty of the work.

6. CONTRIBUTIONS

6.1 Theoretical contribution

The study supports a value-chain view of local-food innovation in which product quality, consumer acceptance, economic value, and community capability are interdependent rather than separate outcomes. It also reinforces a responsible distinction between use of an ingredient associated with prebiotic research and demonstration of a physiological prebiotic effect.

6.2 Methodological contribution

Methodologically, the project combines a baseline needs/economic assessment with product characterization, multi-treatment sensory screening, short-term packaging/storage observation, and post-development economic analysis. The manuscript adds an explicit source-data audit, showing how inconsistent legacy-report values can be flagged without fabricating corrections.

Computational contribution

There was no predictive computation, machine learning, automated optimization, or intelligent decision system. The computational component was limited to standard descriptive/inferential statistics and arithmetic cost-return metrics. Consequently, the paper's computational contribution is reproducible data organization and secondary arithmetic verification, not a new algorithm.

Practical and community contribution

Practically, the project yielded three market-oriented Sago prototypes, improved packaging, a clear process-hygiene agenda, a documented economic case for higher-value Sago pearls, and a community training structure. For small producers, these outputs offer a pathway from bulk flour sales toward branded, differentiated products with greater unit value.

Limitations and Future Research

The study is geographically specific and several samples are small or incompletely described. The socioeconomic survey includes 30 respondents, but the reported target-group membership differs across chapters. Sensory tests involved 30 consumers, but consumer recruitment, demographics, serving order, masking, and blinding are not documented. The statistical report omits ANOVA tables, F statistics, degrees of freedom, exact p values, and the identity of the multiple-comparison procedure.

The storage study is limited to three months and the published tables contain proximate-composition indicators only. Although microbial tests were planned, longitudinal microbial results are not reported. The noodle foil-pack ash value at month 1 is internally inconsistent and should be checked against laboratory records before any future submission focused on storage kinetics. Packaging barrier properties, storage temperature/humidity profiles, and replicate-level raw data are also absent.

The report calls ingredients such as inulin and oligofructose prebiotics, but it does not evaluate selective microbial utilization or a host health benefit. Future functional-food research should quantify the relevant fiber/inulin content after processing, establish its stability, and, if a physiological prebiotic claim is intended, test microbiome/health outcomes under an appropriate design.

Economic improvement is based on accounting comparisons rather than a controlled impact evaluation. Future work could standardize production scale, follow sales and costs longitudinally, compare matched enterprises, and report uncertainty around ROI. Product research would benefit from larger consumer panels, external-market validation, shelf-life microbiology, water-vapor/oxygen transmission data for packages, and replication across production batches and seasons.

All future studies should preserve raw datasets, laboratory metadata, instrument models, statistical scripts, sensory randomization details, and technology-readiness evidence in a versioned repository. That would permit robust reanalysis and reduce the inconsistencies identified in the final report.

9. CONCLUSION

Research and development in Khoksaba Community converted a local-resource problem into an integrated food-innovation program. The baseline identified variability in traditional Sago flour and a yeast/mold count above the report's stated community standard. Product development then demonstrated strong consumer acceptance for selected formulations, particularly 6% inulin in granules and noodles and 20% tapioca starch in pearls. Three-month storage tables showed generally small changes in measured composition, although microbiological shelf-life evidence was not published and one ash value was internally inconsistent.

The economic and community outcomes broaden the significance of the food-science results. The upgraded pearl product reached reported revenue of 200 baht/kg, net profit of 60.86 baht/kg, and ROI of 43.74%, while 12 community innovators and multiple learning/innovation activities were developed. The study therefore provides credible pilot evidence for a community-centered Sago upgrading model that integrates quality, product design, packaging, value addition, and knowledge transfer. Its strongest contribution is translational and place-based; broader claims require replication, more complete analytical metadata, and stronger controlled designs.

REFERENCES

- AOAC International. (2000). Official methods of analysis of AOAC International (17th ed.; W. Horwitz, Ed.). AOAC International.
- Codex Alimentarius Commission. (2011). Regional standard for edible Sago flour (Asia) (CXS 301R-2011; as subsequently amended). FAO/WHO.
- Gibson, G. R., Hutkins, R., Sanders, M. E., Prescott, S. L., Reimer, R. A., Salminen, S. J., Scott, K., Stanton, C., Swanson, K. S., Cani, P. D., Verbeke, K., & Reid, G. (2017). Expert consensus document: The International Scientific Association for Probiotics and Prebiotics (ISAPP) consensus statement on the definition and scope of prebiotics. *Nature Reviews Gastroenterology & Hepatology*, 14, 491–502. <https://doi.org/10.1038/nrgastro.2017.75>
- Gibson, G. R., & Roberfroid, M. B. (1995). Dietary modulation of the human colonic microbiota: Introducing the concept of prebiotics. *The Journal of Nutrition*, 125(6), 1401–1412. <https://doi.org/10.1093/jn/125.6.1401>
- Karim, A. A., Tie, A. P.-L., Manan, D. M. A., & Zaidul, I. S. M. (2008). Starch from the Sago (*Metroxylon sago*) palm tree—Properties, prospects, and challenges as a new industrial source for food and other uses. *Comprehensive Reviews in Food Science and Food Safety*, 7(3), 215–228. <https://doi.org/10.1111/j.1541-4337.2008.00042.x>
- Lawless, H. T., & Heymann, H. (2010). Sensory evaluation of food: Principles and practices (2nd ed.). Springer.
- Maturin, L., & Peeler, J. T. (2001). Aerobic plate count. In *Bacteriological Analytical Manual* (Chapter 3). U.S. Food and Drug Administration.

- McClatchey, W., Manner, H. I., & Elevitch, C. R. (2006). *Metroxylon amicarum*, *M. paulcoxii*, *M. sagu*, *M. salomonense*, *M. vitiense*, and *M. warburgii* (Sago palms). In C. R. Elevitch (Ed.), *Traditional trees of Pacific Islands: Their culture, environment, and use* (pp. 491–512). Permanent Agriculture Resources.
- Robertson, G. L. (2013). *Food packaging: Principles and practice* (3rd ed.). CRC Press.
- Singhal, R. S., Kennedy, J. F., Gopalakrishnan, S. M., Kaczmarek, A., Knill, C. J., & Akmar, P. F. (2008). Industrial production, processing, and utilization of Sago palm-derived products. *Carbohydrate Polymers*, 72(1), 1–20. <https://doi.org/10.1016/j.carbpol.2007.07.043>
- Thai Industrial Standards Institute. (2004). *Community Product Standard: Sago flour* (TCPS 308/2547). Ministry of Industry, Thailand.
- Zhu, F. (2019). Recent advances in modifications and applications of Sago starch. *Food Hydrocolloids*, 96, 412–423. <https://doi.org/10.1016/j.foodhyd.2019.05.035>



Raising Awareness of Two Varieties of English via an Interactive E-book: Vowel and Consonant Pronunciation in British and American English

Ruttikan Sopikun^{1*} Saranrach Poltham² Supparat Sriprapai³

Thitinart Khamyod Wharmby⁴ Chamnong Kaewneam⁵

^{1*5} Program in Foreign Languages for Communication, Faculty of Liberal Arts,
Rajamangala University of Technology Srivijaya, Songkhla 90000, THAILAND

*Corresponding Author Email: chamnong.k@rmutsv.ac.th

(Article history) Received: 2026-08-06, Revised: 2026-08-12, Accepted: 2026-08-27

Abstract

The purpose of the study was to investigate the effectiveness of an interactive e-book in raising English learners' awareness of the differences between British and American English. The e-book consisted of vowel variations as in 'tomato' /tə'ma:.təʊ/ or /tə'mei.təʊ/, consonant variations as in car /ka:/ (non-rhoticity) or /ka:r/ (rhoticity), and water /wa:tər/ or /wɔ:ɹə/ (flap /t/). The descriptions were integrated with audio examples, followed by a 10-item practice quiz. A total of 30 first-year students enrolled in the English for Communication program offered by a Thai university were selected as research participants. A pre-test–post-test design was employed to measure the learners' awareness of the differences between British and American English. A pre-test and a post-test were administered to measure the students' ability to recognize and understand the pronunciation differences. The results revealed an increase in the mean scores from M = 6.30 in the pre-test to M = 18.90 in the post-test. A paired-samples t-test confirmed that the improvement between the pre-test and post-test was statistically significant ($p < .001$). Furthermore, a satisfaction questionnaire was administered to examine students' satisfaction with the interactive e-book. The results indicated positive results with a mean score of M = 4.89 out of 5. It was concluded that the use of the interactive e-book significantly improved students' pronunciation awareness and effectively supported more understanding of the differences between British and American English.

Keywords: American English, British English, English accent, Pronunciation, Interactive e-book

1. INTRODUCTION

English has grown in popularity among younger generations who are communicating in English via countless types of social and mass media. Through the natural channels, English lovers engage in varieties of English, for instance, British English, American English, Indian English, and Singaporean English. Among the diversity, British English and American English remain the two most widely taught, referenced, and encountered in global education, media, and professional

communication (Trudgill & Hannah, 2021; Wells, 2020). This makes them benchmarks for pedagogical purposes for English for communication majors.

Limited awareness of British English and American English may result in pronunciation errors, misunderstandings, and reduced confidence in English speaking (Derwing & Munro, 2021; Jenkins, 2020). One of the most noticeable distinctions between the two varieties lies in their consonant and vowel sounds, word stress, intonation and pitch patterns (Wells, 2020; Trudgill & Hannah, 2021). At the Faculty of Liberal Arts, Rajamangala University of Technology Srivijaya, Thai students majoring in English for communication come from many areas of study and both vocational or academic backgrounds. They are offered a place to study because they passed basic performance in English interviews conducted by the program staff. Although some of these students are frequent users of English, many in their first years remain insufficiently aware of the systematic differences between British and American English. This observation is based on the first majoring course the students take, i.e., Introduction to Linguistics. A special treatment of the limitation becomes a small but crucial step in preparing the English majors for their study progression.

Research outside the research context has provided extensive phonological descriptions of British and American English (Trudgill & Hannah, 2021; Ladefoged & Johnson, 2021; Roach, 2020; Wells, 2020) and has advanced to the connection between accents with intelligibility, comprehensibility, and listener judgments (Darcy, 2020; Celce-Murcia et al., 2021; Derwing & Munro, 2022; Jenkins, 2020). Some student research carried out at the research site has investigated English pronunciation and accents, but none has focused on the differences between American and British English. Investigating the topic could be very useful for the beginning English majors at the research site, as well as English learners in general.

The present study focused on the very first step to becoming English majors, i.e., awareness of the differences between British and American accents, particularly that related to vowel and consonant sounds. It is anticipated that the results of this study will raise awareness of beginning English majors and self - learners of English regarding varieties of English. The study also presents a technique to use an e-book to assist in taking the very first and important steps in English communication via learner autonomy and the self-directed learning channel.

Research Objectives

- (1) To examine English for communication majors' awareness of British and American English before and after interacting with an e-book.
- (2) To measure the students' satisfaction with the interactive e-book that was designed to raise awareness of British and American English.

2. LITERATURE REVIEW

Among the many varieties of English, British English and American English have long served as pedagogical reference points for English learning (Wells, 2020; Trudgill & Hannah, 2021). British English and American English differ in several ways, such as pronunciation, stress, and speech rhythm (Ladefoged & Johnson, 2021; Roach, 2020). Phonological descriptions detail systematic segmental and

suprasegmental differences— such as rhoticity (post-vocalic /r/ realized in American but typically not in British English), vowel quality contrasts (e.g., ‘lot’–‘thought’ merger patterns in American varieties versus distinctions in many British accents), and lexical stress alternations (Roach, 2020; Ladefoged & Johnson, 2021). These contrasts extend to connected speech (linking /r/, flapping/tapping of /t/ in American English) and rhythm (both varieties are stress-timed but exhibit different reduction patterns). Clear descriptions of these contrasts can assist learners calibrate targets and interpret cross-varietal input (Wells, 2020; Trudgill & Hannah, 2021).

A substantial body of work links pronunciation to intelligibility, comprehensibility, and listener judgments. In spoken English, intelligibility refers to the degree to which a listener can accurately identify words, focusing on correct perception of sounds. Comprehensibility refers to the extent to which a listener understands the overall meaning of speech, even if some words are unclear. Listener judgments are evaluations made by listeners about the speaker, such as perceptions of accent, fluency, and credibility. These three concepts help determine how speech is understood and perceived, indicating that effective communication requires clarity, understanding, and social perception (Derwing & Munro (2021). Derwing and Munro (2021, 2022) distinguish between accentedness and intelligibility, noting that strongly accented speech can still be intelligible when segmental contrasts and prosodic cues are well controlled. In lingua franca settings, Jenkins (2020) emphasizes a “core” of pronunciation features crucial for mutual intelligibility (e.g., consonant contrasts, vowel length distinctions, and nuclear stress placement), suggesting that instruction should prioritize communicative outcomes over native-like norms. For these reasons, awareness of pronunciation varieties is crucial, particularly for English for communication majors.

In line with the trends in English varieties, research-informed pronunciation teaching has shifted from imitation toward targeted, intelligibility-oriented training. Celce-Murcia et al. (2021) advocate integrating segmental instruction (vowel/consonant inventories, phonotactics) with suprasegmental work (word and sentence stress, rhythm, intonation) because prosody strongly affects listener processing. Darcy (2020) further highlights perceptual training, feedback, and goal-setting as drivers of durable gains. In contexts where learners encounter multiple standards, focusing on contrasts that affect meaning (e.g., /ɑ:/ vs /æ/ in ‘palm’–‘trap’, ‘trap’, or rhotic vs non-rhotic linking): rhotic accents pronounce the “r” sound in all positions, including at the end of words (e.g., American English: car /kɑ:r/). Non-rhotic accents drop the “r” at the end unless followed by a vowel (e.g., British English: car /kɑ:/). This difference affects listening and the identity of English varieties can reduce communication breakdowns and boost confidence (Derwing & Munro, 2021; Jenkins, 2020).

Multimodal learning design supports phonological acquisition by aligning auditory, visual, and textual channels. Based on multimedia learning principles, well-designed materials reduce extraneous load and highlight essential cues (Mayer & Fiorella, 2021). In Computer-Assisted Language Learning (CALL) and Mobile-Assisted Language Learning (MALL) environments, interactive tasks, immediate feedback, and integrated audio–visual exemplars foster deliberate practice and self-monitoring (Godwin-Jones, 2022). Reinders and White (2020) consider that technology

can scaffold autonomy when resources are searchable, chunked into micro-tasks, and paired with self-assessment.

In particular, an interactive e-book, an innovative learning resource, can come with key benefits including convenience and portability, allowing learners to access the content anytime, anywhere on various electronic devices. It also promotes self-directed learning, a crucial skill in the modern world. The e-book empowers learners to take control of their learning process, set their own pace, and review content according to their personal needs (Benson, 2021; Reinders & White, 2020).

When it comes to English majors, awareness and mastering British and American accents have become crucial elements, because it links to intelligibility, comprehensibility, as well as listener judgments. Training in the two accents via CALL and MALL means such as an interactive e-book that juxtaposes British and American models with waveform/spectrogram visuals, mouth-position diagrams, and minimal-pair audio can possibly make abstract contrasts perceptible and actionable.

3. DATA COLLECTION AND ANALYSES

This study took a quantitative research design to examine the effectiveness of an interactive e-book designed to raise awareness of the differences between British and American accents. The effectiveness was evaluated by a pre-and post-test and a satisfaction questionnaire.

3.1 An Interactive E-book

An interactive e-book was developed by the first three authors using Heyzine Flipbook Maker to increase awareness of British and American English. Key contents included explicit explanations of key features in vowel and consonant variations using International Phonetic Alphabet (IPA) symbols, audio recordings of native speakers for listening perception, and interactive practice with immediate feedback. Vowel sounds included those for the word ‘tomato’: /təˈmaː.təʊ/ in British English and /təˈmeɪ.tou/ in American English. Consonant variations included those in the word ‘car’: /kɑː/ (non-rhoticity) in British English), /kɑːr/ (rhoticity) in American English, and ‘water’: /waː.tər/ in British English, and /wɔː.ʔə/ (flap /t/) in American English. The descriptions were followed by a 10-item practice quiz. The e-book was reviewed before data collection by three experts in the fields of English education and applied linguistics to validate the content validity and alignment with the research objective to improve learners’ awareness of American and British accents.

3.2 Participants

The participants of this study consisted of 30 first-year students in the Continuing Education program offered at Rajamangala University of Technology Srivijaya who were majoring in English for Communication. These learners were enrolled in the course English Pronunciation in Use, took the course Introduction to Linguistics simultaneously, and had not received systematic training in accent comparison before the data collection. The participants were selected through purposive sampling to ensure they represented a group likely to benefit from accent-focused instruction. They were also invited to take part in the study because they were at an early stage of learning English as a major subject. The researchers provided the

participants with an explanation of the research objectives, procedures, duration, and how their personal details would be kept as confidential – the researchers received consent from the students before data collection. After the consent getting process, the students completed a pre-test, engaged in the interactive e-book over a period of one week, as an out-of-class, self-directed learning tool. Finally, they sat in a post-test and completed a satisfaction questionnaire.

3.3 Pre-Test and Post-Test

Two identical tests were written to assess the research participants' awareness of the British and American English before and after interacting with the e-book. The first was used as a pre-test, and the other as a post-test. The tests measured both perception and production of the core phonological distinctions between British and American English. They consisted of two main parts: the first part asked the test takers to complete multiple-choice questions, and the second part required them to read aloud a word list, sentences, and short passages in which the words in the list were included. The tests were reviewed by a panel of three experts in English Education and Applied Linguistics. An Index of Item-Objective Congruence (IOC) table was utilized to verify the alignment between the tests with the research objectives. Only items achieving an IOC value of 0.67 or higher were included in the tests. The test scores were calculated for mean scores and a paired-sample t-test was carried out to compare the scores before and after the intervention.

3.4 Satisfaction Questionnaire

A satisfaction questionnaire was created to find perceptions of the research participants of the e-book. A five-point Likert scale was used to assess their satisfaction with the content, design, and usability of the e-book. The questionnaire was checked for suitability for the research by the same experts as the e-book, the pre-test and the post-test. The responses were analyzed using descriptive statistics, including mean scores and standard deviation. The scores gained from the respondents were interpreted as follows: 1.00–1.44 very satisfied, 1.45 – 2.44 satisfied, 2.45-3.44 neutral, 3.45-4 .44 satisfied, and 4.45-5 very satisfied.

4. FINDINGS

4.1 Awareness of British and American English

The awareness of the research participants before and after interacting with the e-book is shown in Table 2.

Table 1: Comparison of Pre-test and Post-test

Test	n	M	SD	t	df	p	Cohen's d
Pre-test	30	6.30	13.60	-16.91	58	< .001	4.37
Post-test	30	18.90	3.06				

The participants demonstrated improvement in their awareness after interacting with the e-book. The mean score increased from 6.30 in the pre-test to 18.90 in the post-test. The difference between the two groups was statistically significant ($p = < 0.001$). The effect size suggested a large effect on awareness (Cohen's $d = 4.37$).

4.2 Satisfaction with the Interactive E-book

The research participants' satisfaction after interacting with the e-book is shown in Table 2. The interpretation (I) of the mean scores (M) is also presented in the table.

Table 2: Satisfaction with the E-book

Item	Feature	M	SD	I
Content				
1.	The content on British and American accents is clear and easy to understand.	4.89	0.31	V. satisfied
2.	The content is appropriate for the students' level of knowledge and ability.	4.93	0.26	V. satisfied
3.	The vocabulary, sentence examples, and audio support help clarify the differences between the accents.	4.86	0.36	V. satisfied
4.	The content and audio enhance knowledge of English communication.	4.89	0.31	V. satisfied
5.	The content is accurate, up to date, and reliable.	4.96	0.19	V. satisfied
Design				
1.	The font style and size are appropriate and easy to read.	4.75	0.52	V. satisfied
2.	The layout and organization of the content are clear and well-structured.	4.82	0.39	V. satisfied
3.	The illustrations help enhance understanding of the content.	4.89	0.31	V. satisfied
4.	The colors and overall design are appropriate and visually comfortable.	4.93	0.26	V. satisfied
5.	The integration of text, images, and audio is consistent and harmonious.	4.96	0.19	V. satisfied
Usability				
1.	Students can study independently using the e-book.	4.93	0.26	V. satisfied
2.	The audio system (e.g., play/stop buttons) is easy and convenient to use.	4.86	0.36	V. satisfied
3.	The audio quality is clear and appropriate for learning accents.	4.89	0.31	V. satisfied
4.	The links between content and audio function properly.	4.93	0.26	V. satisfied
5.	The e-book is suitable for use as supplementary learning material.	4.89	0.31	V. satisfied
Overall		4.89		V. satisfied

The research participants were very satisfied with all three features of the e-book, i.e., the content, the design, the usability, with an overall mean of 4.89. They were particularly very satisfied with the content, which was accurate, up to date, reliable (M=4.96), and the integration of text, images, and audio that was consistent and harmonious (M=4.96). They were also very satisfied with the content, which was appropriate for the students' level of knowledge and ability (M=4.93), the overall design and the use of colors that were appropriate and visually comfortable (M=4.93). In addition, they were very satisfied with the e-book because they could study

independently using the e-book (M=4.93), and because the links between the content and the audio in the e-book functioned properly (M=4.93).

5. DISCUSSION

Unlike many studies whose focus were on phonological descriptions of British and American English (Trudgill & Hannah, 2021; Ladefoged & Johnson, 2021; Roach, 2020; Wells, 2020, this study investigated a small but crucial step in preparing the English majors for their study progression. The improvement in the research participants' awareness of the differences of British and American English before and after interacting with the e-book indicates the possibility to train beginning English majors and English lovers to acquire the knowledge in a short while. Nowadays, British English and American English remain regarded as benchmarks for English communication, because they are the two most widely taught and referenced in global communication (Trudgill & Hannah, 2021; Wells, 2020). Awareness of the two English varieties will prevent misunderstandings in communication, and reduce confidence in English speaking for English learners (Derwing & Munro, 2021; Jenkins, 2020). The investigation also yielded satisfactory results, most possibly because it highlighted core elements in the differences in British and American with the daily words such as 'tomato', car,' and 'water'.

The investigation demonstrates a positive effect on the use of multimedia such as videos, audio, and interactive content as teaching materials, because it can enhance English learning. Suleepron et al. (2026) also found a positive effect of the video clips designed to examine the effect of color-coded subtitles on vocabulary retention. The study did not seek the effectiveness of the media in detailed categories like in this study: content, design, and usability. The results of this study were in the same line with Mayer's (2009) who found that the use of social media could enhance students' engagement and understanding of pronunciation (Mayer, 2009). The research participants were very satisfied with the interactive e-book. The highest mean scores were found in the accurate, up-to-date, reliable, content, and the consistent and harmonious integration of text, images, and audio, suggesting that English learners possessed critical thinking useful for evaluating sources of knowledge, and they were knowledgeable of the characteristics of good social media. The students' satisfaction with the e-book also demonstrates the usefulness of technology-based learning tools (Gilakjani, 2016).

6. CONCLUSION

The effectiveness of the interactive e-book designed to raise awareness of the British and American English focuses and the satisfaction of the research participants with the e-book suggest that awareness of the two major accents as well as other varieties of English can be accessed through the use of digital learning tools. The tools can promote self-directed learning, because they allow learners to practice language skills independently and at their own pace (Stockwell, 2012; Benson, 2021). In pronunciation practice in particular, autonomy is crucial because improvement requires continuous and deliberate practice beyond classroom instruction (Reinders & White, 2020). Technology-enhanced environments can effectively foster autonomy by providing flexible access, multimodal input, and opportunities for self-assessment (Godwin-Jones, 2022). In the context of accent training, embedding autonomy features

into digital tools can empower learners to set accent-specific goals, monitor their progress, and transfer trained features into authentic communication.

In addition, future research should investigate an approach to developing British and American English including sound, stress, and intonation to a lengthier extent for more natural English use. Future studies may also investigate long-term effects of using interactive e-books on pronunciation development or explore their use with different groups of learners. Furthermore, future research can also advance the connection between accents with intelligibility, comprehensibility, and listener judgments in Thai EFL contexts, such as those done by Darcy (2020), Celce-Murcia et al. (2021) and Jenkins (2020).

REFERENCES

- Benson, P. (2021). *Teaching and researching autonomy in language learning*. Routledge.
- Celce-Murcia, M., Brinton, D. M., & Goodwin, J. M. (2021). *Teaching pronunciation: A course book and reference guide*. Cambridge University Press.
- Darcy, I. (2020). Intelligibility and pronunciation teaching in English as a global language. *Journal of Second Language Pronunciation*, 6(3), 247–269. <https://doi.org/10.1075/jslp.00040.dar>
- Derwing, T. M., & Munro, M. J. (2021). *Pronunciation fundamentals: Evidence-based perspectives for L2 teaching and research*. John Benjamins.
- Derwing, T. M., & Munro, M. J. (2022). Accent and intelligibility in world Englishes. *World Englishes*, 41(1), 45–61. <https://doi.org/10.1111/weng.12573>
- Gilakjani, A. P. (2016). English pronunciation instruction: A literature review. *International Journal of Research in English Education*, 1(1), 1–6.
- Godwin-Jones, R. (2022). Emerging technologies: Pronunciation learning and technology. *Language Learning & Technology*, 26(1), 1–10. <https://doi.org/10.10125/73477>
- Jenkins, J. (2020). *English as a lingua franca: Attitude and identity*. Routledge.
- Ladefoged, P., & Johnson, K. (2021). *A course in phonetics*. Cengage Learning.
- Mayer, R. E. (2009). *Multimedia learning*. Cambridge University Press.
- Mayer, R. E., & Fiorella, L. (2021). *Principles of multimedia learning*. Cambridge University Press.
- Reinders, H., & White, C. (2020). *Autonomy and technology in language learning*. Routledge.
- Roach, P. (2020). *English phonetics and phonology: A practical course*. Cambridge University Press.

- Suleepron, S., Noiprated, A., Pansuk, N., Petcharatmuni, W., & Kaewneam, C. (2026). The effect of color-coded subtitles on vocabulary retention. *Liberal Arts and Social Studies International Journal*, 2(1), 53–60.
- Stockwell, G. (2012). *Computer-assisted language learning: Diversity in research and practice*. Cambridge University Press.
- Trudgill, P., & Hannah, J. (2021). *International English: A guide to varieties of English around the world*. Routledge.
- Wells, J. C. (2020). *Accents of English*. Cambridge University Press.

FOUNDER



Name	Assistant Professor Dr. Boonyarit Omanee
Education	
PhD.	(Applied Linguistics) , Universiti Utara Malaysia (UUM), Malaysia
MA.	(Applied Linguistics) , Mahidol University (MU), Thailand
B.Ed.	(English) , Nakhon Si Thammarat Rajabhat University (NSTRU), Thailand
Experience	
2023-present	Dean of Faculty of Liberal Arts Rajamangala University of Technology Srivijaya (RUTS), Songkhla, Thailand
2020-2022	University Council Committee Rajamangala University of Technology Srivijaya (RUTS), Songkhla, Thailand
2008-2011	Head of Foreign Languages Programe Faculty of Liberal Arts, Rajamangala University of Technology Srivijaya (RUTS), Songkhla, Thailand
2005-present	Full-time Lecturer Department of Foreign Languages, Rajamangala University of Technology Srivijaya (RUTS), Songkhla, Thailand
1991-2004	Full-time Lecturer Department of Foreign Languages, Rajamangala Institute of Technology, Borpitpimuk Chakkawad Campus, Bangkok, Thailand

“Do Today the Best”

boonyarit.o@rmutsv.ac.th

EDITOR IN CHIEF



Name	Associate Professor Dr. Patcharin Kangkha
Education	
PhD.	(Sociolinguistics) , University Sains Malaysia (USM), Malaysia
MA.	(Applied Linguistics) , King Mongkut's University of Technology Thonburi (KMUTT), Thailand
B.Ed.	(English) , Srinakharinwirot University (SWU), Thailand
Experience	
2023-present	Deputy Dean for Academic and Research Faculty of Liberal Arts, Rajamangala University of Technology Srivijaya (RUTS), Songkhla, Thailand
2020-present	Chairman of Foreign Languages for Communication Program Faculty of Liberal Arts, Rajamangala University of Technology Srivijaya (RUTS), Songkhla, Thailand
2005-present	Full-time Lecturer Department of Foreign Languages, Rajamangala University of Technology Srivijaya (RUTS), Songkhla, Thailand
1995-2004	Full-time Lecturer Faculty of Agriculture Nakhon Si Thammarat, Rajamangala Institute of Technology Nakhon Si Thammarat, Thailand

“Never Give Up”

patcharin.k@rmutsv.ac.th

LAYOUT ARTIST

 	
Name	Panithan Paensuk
Education	
MA.	(Applied Linguistics) , Kasetsart University (KU), Bangkok Thailand
BA.	(Language for Development) Prince of Songkla University (PSU), Songkhla Thailand
Experience	
2024-present	Full-time Lecturer Department of Foreign Languages, Rajamangala University of Technology Srivijaya (RUTS), Songkhla, Thailand

“Nothing Is Impossible”

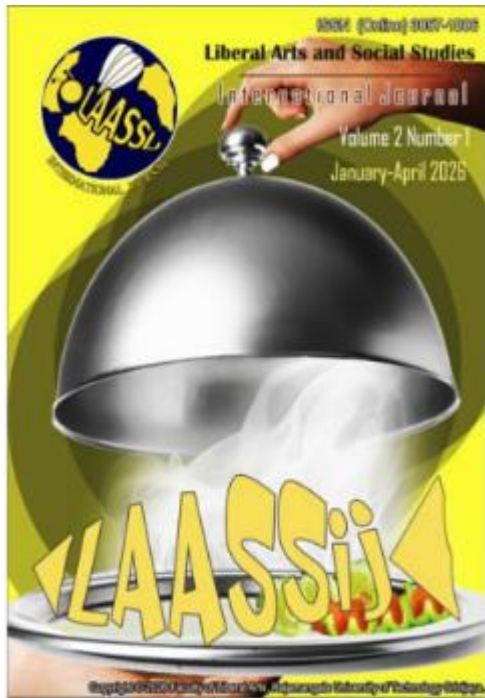
panithan.p@rmutsv.ac.th

WEBSITE MANAGING STAFF

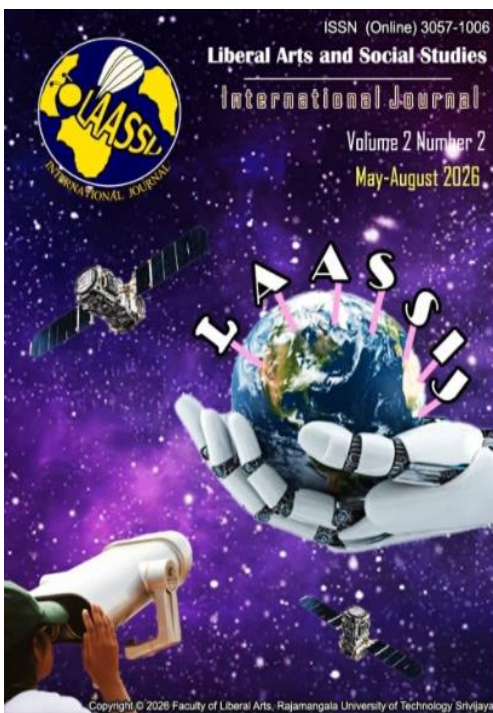
  	
Name	Kritsanaphong Muninnopphamat
Education	
BA.	Rajamangala University of Technology Srivijaya (RUTS)
Diploma	Yala Technical College
Experience	
2024-present	Computer Technical Officer , Faculty of Liberal Arts, Rajamangala University of Technology Srivijaya (RUTS), Songkhla, Thailand
2022-2024	Computer Technical Officer , Faculty of Industrial Education and Technology, Rajamangala University of Technology Srivijaya (RUTS), Songkhla, Thailand
October 2021 – March 2022	Computer Technician , Global205 (Thailand) Co., Ltd. (Online)
May 2017 – July 2017	Computer Technician , Advice Yala Co., Ltd.

“Keep Calm & Carry On”

kritsanaphong.m@rmuts.ac.th



Liberal Arts and Social Studies International Journal (LAASSIJ) (January-April 2026)
Vol. 2 No. 1 (2026)



Liberal Arts and Social Studies International Journal (LAASSIJ) (May-August 2026)
Vol. 2 No. 2 (2026)