

Enhancing English as a Foreign Language (EFL) Learners' Writing with ChatGPT: A University-Level Course Design

Yu-Ching Tseng¹ and Yi-Hsuan Lin²

¹Department of English, Tamkang University, Taiwan

²Department of English Language and Literature, Chinese Culture University, Taiwan

ychtseng@mail.tku.edu.tw (corresponding author)

lyx29@ulive.pccu.edu.tw (corresponding author)

<https://doi.org/10.34190/ejel.21.5.3329>

An open access article under [Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License](https://creativecommons.org/licenses/by-nc-nd/4.0/)

Abstract: This research explores the innovative integration of OpenAI's GPT-3.5 within a university-level English as a Foreign Language (EFL) writing course, illustrating a novel approach to academic instruction. The course follows the ADDIE instructional design model, encompassing five systematic stages: analysis, design, development, implementation, and evaluation. This model serves as the backbone of the course structure, ensuring a comprehensive educational experience. The incorporation of the Technological Pedagogical Content Knowledge (TPACK) framework in this course facilitates the effective integration of GPT-3.5 by enabling instructors to align advanced AI capabilities with appropriate pedagogical strategies, thereby enhancing the learning experience. TPACK guides educators in applying GPT-3.5's features in a manner that is contextually relevant and pedagogically sound, ensuring the technology's use complements the course content. The findings from this research are significant. They reveal that GPT-3.5 addresses three fundamental challenges often encountered in academic writing courses. Firstly, it enhances efficiency by providing immediate feedback and generating content ideas, accelerating the writing process. Secondly, GPT-3.5 ensures cohesive organization within students' writing, guiding them to structure their thoughts more logically. Lastly, it serves as a reliable substitute for traditional peer reviewers, offering critical and objective feedback that students can use to refine their drafts. As students engage with AI, they enter a dynamic partnership. This collaboration with GPT-3.5 fosters critical thinking and empowers students to develop a distinctive writing voice. Through this interaction, students are not merely passive recipients of knowledge but active participants in a learning process that is augmented by cutting-edge technology. This study not only provides insight into the potential of AI-augmented academic writing but also highlights GPT-3.5's role in promoting writing proficiency. It demonstrates that the application of AI in education can enhance the learning experience without compromising the individuality of student expression.

Keywords: ChatGPT, AI-assisted writing, English as a foreign language (EFL), TPACK, ADDIE

1. Introduction and Problem Statement

The struggle between ChatGPT and EFL writing is an intriguing encounter that brings to light the tension between traditional writing practices and the innovative capabilities of AI. Mastering writing skills poses challenges for EFL students, including difficulties in applying essay organization principles (Han and Huang, 2017), limited peer review support (Harutyunyan and Poveda, 2018; Li and Huan, 2022), and time constraints (Sogutlu and Veliaj-Ostrosi, 2022). In this context, the idea of translating organizational knowledge into practical application, as discussed by Lee (2002), becomes particularly pertinent. It reflects the complexities involved in adopting new technologies like ChatGPT in educational settings, which necessitate guidance and structured practice. While peer review remains an essential aspect of the writing process, the difficulty of finding available reviewers outside of class is a significant obstacle (Ahmed, 2019). Additionally, students struggle with time management due to distractions. To overcome these challenges, ChatGPT emerges as a valuable AI tool, providing real-time assistance in organizing ideas, structuring essays, and offering instant feedback, maximizing writing quality within a limited time.

While ChatGPT has advantages, such as availability, efficiency, instantaneous response, absence of human bias, and multilingual capabilities, it is essential to exercise caution in its utilization. Concerns regarding misinformation, limited contextual understanding, lack of empathy, and various ethical issues must be considered (Garg et al., 2023). The widespread adoption of ChatGPT in educational settings has generated interest in its potential applications across various disciplines. For example, studies in data visualization and medical education have explored ChatGPT's capabilities and limitations in enhancing learning experiences and knowledge assessment (Chen et al., 2023; Gilson et al., 2023; Skalidis et al., 2023; Tanaka et al., 2023). However, academic research on its effective integration into EFL curricula, particularly in writing settings, remains limited.

Therefore, the current study aims to optimize the utilization of ChatGPT, enhance students' writing experiences, and equip them with valuable skills to effectively incorporate AI technology into their writing process. The study applies the ADDIE model (Aldoobie, 2015) under the TPACK (Koehler and Mishra, 2008) framework to create a writing course that incorporates GPT to strike a balance that empowers students to unlock the benefits of AI while preserving their independence and autonomy as writers.

2. Background and Literature Review

The integration of technology in education has opened numerous opportunities to enhance the learning process, transforming the way English as a foreign language (EFL) is taught and learned.

2.1 Challenges in EFL Writing

In EFL education, technology integration is reshaping language classrooms, yet challenges persist, particularly in the domain of writing. Despite ongoing efforts, achieving significant improvements in students' abilities to organize content, develop ideas, and master grammatical structures remains notably challenging (Chen, 2022).

A pivotal aspect of addressing these challenges lies in recognizing the crucial role of feedback within the learning process. Pedagogical research in the EFL context underscores the profound significance of feedback in engaging students and fostering revision practices (Zhang and Hyland, 2022). Whether originating from instructors, peers (Ravand and Rasekh, 2011; Ruegg, 2015; Baker, 2016; Zhang, 2020; Zhang and Cheng, 2021), or automated systems (Xu, 2019; Zhang and Cai, 2019; Lin et al., 2020; Alharbi, 2022), such feedback substantially enhances writing skills (Li et al., 2010). However, the availability of constructive peer critique often remains limited in many learning environments, contributing to a notable gap in learning outcomes.

In today's digital landscape, students frequently navigate an array of information streams and distractions while writing. Traditional EFL writing classes frequently lack sufficient time and avenues for students to express their challenges or engage in meaningful idea exchange. To effectively address these issues, AI-driven technologies like ChatGPT emerge as innovative solutions, offering personalized and interactive writing assistance that can bridge existing gaps and provide students with valuable support in their writing endeavors.

2.2 Technological Advancements in EFL Instruction

ChatGPT extends beyond mere suggestions to generate human-like responses to user prompts, enabling dynamic conversations with users. This unique feature not only provides more personalized writing assistance but also serves as a virtual peer reviewer, fostering an environment conducive to continuous improvement in writing.

GPT models' potential extends beyond language learning, with Chen et al. (2023) recognizing their transformative role in data visualization and their potential contributions to computer science education. These capabilities have also been assessed in various medical licensing exams, such as the United States Medical Licensing Examination (Gilson et al., 2023), the European Exam in Core Cardiology (Skalidis et al., 2023), and the National Medical Licensing Examination in Japan (Tanaka et al., 2023), underscoring their significance in medical education and knowledge assessment. However, despite these advancements, understanding AI technologies' impact on students' autonomous learning in writing remains a challenge, as pointed out by Bouwmeester et al. (2019), who highlight the variability of students' autonomy based on the technological tools they use. While technology-mediated learning tools like ChatGPT have the potential to enhance autonomous learning, further investigation is required to determine the full extent of this impact.

As the role of technology in education continues to advance, both instructors and learners must adapt. Instructors need to adapt their teaching practices both inside and outside the classroom (Goldberg, 2003; Golonka et al., 2014), and learners must also adjust their self-learning processes to accommodate the use of different technological tools (Cancino and Panes, 2021). The shift is particularly salient in EFL writing, where technological advancement has reshaped the writing process and influenced cognitive strategy development (Cancino and Panes, 2021). It's therefore crucial for educators and learners to comprehensively utilize these technological advancements to enhance the EFL writing experience.

2.3 An Integration Model for ChatGPT in EFL Writing Courses

EFL students encounter difficulties in producing high-quality academic English writing, often facing challenges such as compromising grammatical structures needed for clarity, using incorrect or simpler vocabulary, and sacrificing organizational coherence. Therefore, it is essential to investigate how technology-mediated writing can aid students in producing high-quality academic writing (Xu et al., 2019; Ammade et al, 2020; Gayed et al.,

2022). Aspects such as linguistic complexity, grammar, and organizational structure are crucial in evaluating the quality of English writing (Xu et al., 2019).

The integration of ChatGPT into EFL writing offers an innovative application of technology in English language instruction. ChatGPT interacts with students' writing, offering feedback on grammar, usage, mechanics, style, organization, and content. Yet, despite ChatGPT's revolutionary potential, the extent of its validity in the context of EFL writing has not been sufficiently examined in prior studies. Future research is needed to ascertain the true potential and impact of ChatGPT as an aid in EFL writing instruction.

To bridge this gap, this research paper employs the ADDIE model (Aldoobie, 2015) in conjunction with the TPACK (Koehler and Mishra, 2008) framework, creating a systematic approach to integrate ChatGPT into a university-level English writing course. The ADDIE model structures the process, facilitating the analysis of learning needs, effective instructional design, strategy implementation, and evaluation of ChatGPT integration effectiveness (Allen, 2017; Muruganatham, 2015). While ADDIE ensures consistency, its inflexibility in the digital age has been noted (Bates, 2015). To address this, the study also incorporates the TPACK framework, which accommodates evolving content and technologies, providing a strong foundation for designing effective teaching and learning approaches. The TPACK framework ideally combines technological, pedagogical, and content knowledge to guide the use of technology in writing instruction (Putri, 2019), ensuring that the integration of AI technology is well planned and designed to meet the specific needs and challenges faced by EFL students in their writing development, prioritizing learning first, followed by the technologies supporting that learning (Schmidt et al., 2009). Accordingly, this study investigates two specific research questions:

Research Question 1. How can TPACK and ADDIE effectively integrate ChatGPT into EFL writing courses?

Research Question 2. What are students' reflections on using ChatGPT in their writing process?

3. Method

This study employs a qualitative research methodology to explore the integration of the TPACK framework and GPT-3.5 in an EFL writing course designed according to the ADDIE model. The qualitative nature of this study is primarily focused on understanding students' subjective experiences and perceptions regarding the use of AI in their writing process. To collect data, the study utilizes two primary methods: analysis of students' written works and their reflective writings. These methods were chosen to gather rich, descriptive data about how students interact with and perceive the integration of GPT-3.5 in their writing process. The course structure comprises five sections that align with the ADDIE model: analyzing learning needs, designing instructions and prompts, implementing ChatGPT strategies and techniques, evaluating the writing process, and assessing effectiveness through student reflections.

3.1 Participants

This qualitative study is conducted within a university-level EFL writing course, English Composition III, specifically targeting non-native English-major students at a prominent private university in Taiwan. Affiliated with the Department of English at this university, the researcher has both designed and taught this course. The study involved 15 participants (F=10, M=5) in academic year 2022-2023, all of whom were junior or senior students majoring in English. All these participants were Taiwanese, non-native English speakers around the age of 20-22. They were selected based on their academic progress and their current enrollment in the English Composition III course. They had completed two years of prerequisite courses, English Composition I and II, during their freshman and sophomore years, equipping them with a solid foundation in academic essay writing. The participants willingly joined the research, giving consent through a signed form and understanding data collection.

3.2 Procedure

The course design was framed under the Technological Pedagogical Content Knowledge (TPACK) framework (Fig. 1), which aligns with the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model. The integration of these two models guided the design and implementation of a university-level English writing course that incorporates GPT-3.5 as an assisting tool.

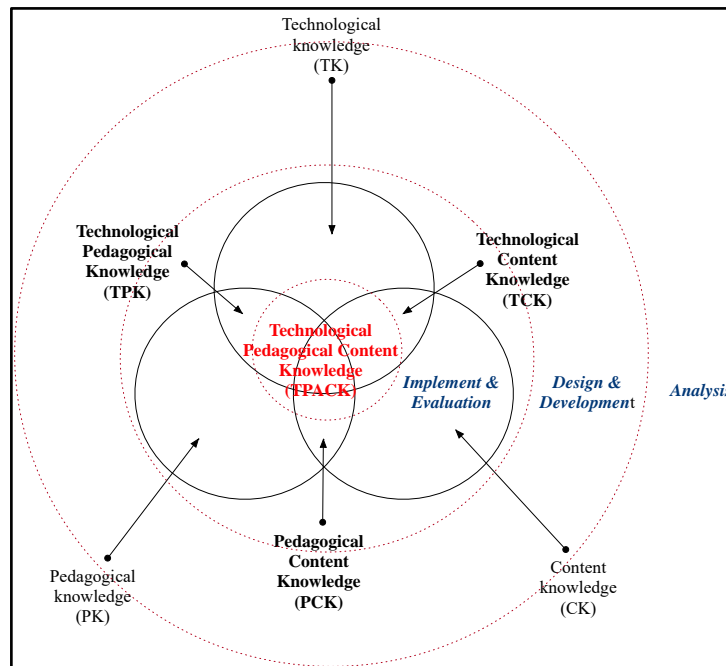


Figure 1: The ADDIE-incorporating TPACK framework

The course design procedure begins with an understanding of three types of knowledge. These foundational elements collectively form the basis of the Technological Pedagogical Content Knowledge (TPACK) framework.

- **Technological Knowledge (TK):** Comprehension of various technologies, including digital tools and resources (Davis and Thompson, 2005). Within this course design, TK involves the use of GPT-3.5.
- **Content Knowledge (CK):** The instructor's grasp of the subject matter to be learned or taught (Mishra and Koehler, 2006). Here, it refers to the knowledge related to essay organization and writing skills.
- **Pedagogical Knowledge (PK):** Understanding methods and strategies for teaching and learning (Shulman, 1986). In this course, PK includes integrating AI-assisted peer reviews and utilizing interactive exercises with GPT-3.5 prompts to enhance students' essay organization and writing skills.

3.3 Analysis Phase

The analysis phase examines students' writing skills, needs, and areas for improvement in terms of CK and PK in writing. The primary objective is to gain insights into the specific challenges students face during the writing process. Through a combination of instructor evaluations and self-assessment, students' strengths and weaknesses are identified, enabling the effective integration of GPT-3.5 to enhance their learning experiences in the most-needed areas. During this phase, the instructor reviews the basic components and principles of organization in academic writing to ensure that all students have a solid foundation in composing well-structured academic essays (Almelhi, 2021). The students engage in various writing exercises and assignments without AI assistance. The instructor gains an understanding of the student's writing abilities, which serves as a basis for designing the subsequent stages of the course. The instructor assesses students' needs (West, 1994; Richards and Rodgers, 2001; Richards, 2013), identifying how GPT-3.5 can be integrated as a valuable tool to enhance their writing skills.

3.4 Design/Development Phases

In the design and development phases, the course is structured to integrate GPT-3.5 into the students' writing process, incorporating technological pedagogical knowledge (TPK), technological content knowledge (TCK), and pedagogical content knowledge (PCK). TPK involves the strategic integration of technology tools like GPT-3.5 into writing instruction, aligned with effective pedagogical approaches. TCK focuses on the instructor's understanding of how AI tools could enhance specific content knowledge related to writing skills, while PCK guides the instructor in designing instructional strategies that effectively merge content and pedagogical knowledge with technology integration. In the design phase, the instructor develops a framework outlining how GPT-3.5 will be incorporated effectively into the course, selecting appropriate writing topics based on insights from the analysis phase and ensuring alignment with students' needs. The development phase involves creating and refining course materials to facilitate GPT-3.5 integration, including instructions on formulating prompts,

interacting with GPT-3.5 to refine prompts and maintain control over writing organization, and revising writing based on GPT-3.5's assistance.

3.5 Implementation Phase

During the implementation phase, the integrated knowledge of TPK, TCK, and PCK is applied to effectively integrate AI tools like GPT-3.5 in the writing instruction. The instructor monitors students' engagement with AI integration and provides guidance to ensure a productive experience. Students actively engage with GPT-3.5 as a writing tool, integrating AI assistance into their writing process by applying the instructions and techniques acquired throughout the course to their writing practice. This phase involves utilizing GPT-3.5 to assist in developing and improving the overall quality of their written works.

3.6 Evaluation Phase

In the evaluation phase, the study assesses the effect and impact of integrating TPK, TCK, and PCK to form TPACK in the EFL writing course. This evaluation process encompasses both objective measures, such as improved grammar and coherence in written work, and subjective measures, including students' reflective writing. Through student reflections, the instructor gains valuable insights into struggles and challenges faced during the AI integration process, enabling them to gauge the effectiveness of AI integration and make informed adjustments to optimize the learning process. In this phase, students engage in self-evaluation, reflecting on their growth as writers and technology's role in the writing process. As part of their final exam, students write a reflective essay describing their development as writers while considering the impact of technology. This self-reflective exercise deepens their understanding of AI tools like GPT-3.5 in writing education and raises awareness of the potential risks associated with overreliance on AI during writing.

4. Results

RQ1: Developing an AI-Integrating Writing Course

Throughout the course, the researcher employs the ADDIE model as a systematic framework to integrate TK, CK, and PK into TPACK (Fig. 2).

ADDIE	Course Plan	TPACK in writing instruction
Analysis Phase	The essay writing process involves teaching essay organization principles, analyzing examples, brainstorming, drafting, peer review, instructor feedback, and revisions, culminating in a well-crafted essay that reflects significant effort.	The process involves assessing students' needs and determining the optimal use of technology (GPT-3.5) to enhance their learning experiences within the course.
Design & Development Phase	The design and development phase integrates GPT-3.5 into the writing curriculum, offering scaffolding techniques for the "self-introduction" and "revision" topics.	The process integrates TK with PK and CK to teach students how to develop prompts and use them step-by-step to enhance the organization of their writing.
Implement Phase	During the Implement phase, students utilize GPT-3.5 as an assisting tool in the writing process, combining their knowledge of essay organization principles with AI support to draft, revise, and refine their essays.	The successful implementation of TPACK empowers students to achieve improved writing skills through effective utilization of technology.
Evaluation Phase	The evaluation phase involves assessing the impact of AI integration on students' writing performance and their reflections on the learning experience.	In the evaluation phase, TPACK integration informs the development of AI-enhanced writing curricula for future courses.

Figure 2: ADDIE model and TPACK writing instruction

4.1 A Need for Revision

During the analysis phase, students' academic writing requires extensive revisions. Traditional essay writing methods, such as structured outlines, handwritten drafts, and standard peer reviews, while valuable, come with limitations such as time constraints and a lack of personalized attention. Ideally, students would receive feedback from knowledgeable reviewers, but such resources are often scarce. ChatGPT offers a promising solution to these challenges. It provides immediate feedback and constructive suggestions, enabling students to refine their work continuously without time restrictions. It serves as a virtual reviewer, offering personalized

guidance and effectively increasing the available reviewing resources. This integration augments traditional writing methods and empowers students to improve their writing.

Without the support of AI technology, the students' essays are examined by the two researchers before and after the review process. Figure 3 presents the improvements made in terms of grammar, coherence, and clarity following the review. However, some lingering issues in the revised versions are highlighted in red, possibly requiring additional revision.

V1 (Before Review)	V2 (After Review)	Advancements
For the purpose of living a better life, most parents will ask their children to concentrate on their studies <u>whatever they inhabit in which area.</u>	For the purpose of living a better life, most parents will ask their children to concentrate on their studies wherever they live.	V2 improves grammar and clarity compared to V1 by using a more concise and grammatically correct sentence, stating that parents encourage their children to concentrate on studies regardless of where they live, aiming for a better life.
First, <u>both Mac and Windows</u> offer visually appealing designs. <u>However,</u> Mac is known for its sleek and consistent appearance. <u>On the other hand,</u> Windows provides a more customizable and versatile interface.	First, they offer visually appealing appearances. Mac's users are always attracted by its sleek appearances. It is known for its one-piece alloy computer body and the minimalist design. On the other hand, Windows provides several kinds of visually appearances. Customers can find their favorite one in the numerous Windows computers.	V2 significantly enhances grammar, clarity, and coherence by using concise language, providing specific details about Mac's sleek appearance, and presenting a better flow of ideas compared to Version 1, which had some repetition and less descriptive language.
<u>First, If You constantly buy products you don't need, the purchase is typically followed by negative feelings such as guilt or regret, advertisement and marketing strategies are pushing the new products to cause this problem.</u> It will let us immerse in those platforms. what's more, many people will buy something new that doesn't useful, it is a very to gratify our vanity. <u>Shopping becomes an addiction, impulse shopping will result in wasting money on the merchandise which we didn't really need.</u>	First, shopping becomes an addiction if you constantly buy products you don't need, and the purchase is typically followed by negative feelings such as guilt or regret. The two main reasons for this problem are the producer's marketing strategies and the consumers' never-ending desire to collect new products. Exaggerated advertising methods can make consumers buy impulse purchases and buy a lot of unnecessary items. Shopping addiction will result in wasting money on merchandise which we don't need.	V2 demonstrates improved grammar, clarity, and coherence with its well-structured and concise explanation, presenting shopping as an addiction when constantly buying unnecessary products, followed by negative emotions like guilt or regret, primarily influenced by producers' marketing strategies and consumers' desire for new items.

Figure 3: Example of student's writing before and after review

4.2 A Scaffolding Approach to Developing Prompts

The design and development phase employs a scaffolding strategy to enhance students' writing skills through the focused tasks of self-introduction (autobiography) and revision. The autobiography task stresses both organization and authenticity. It encourages students to structure their narratives logically while expressing their unique identities and experiences. This task serves a practical purpose, preparing students for real-world situations where they need to introduce themselves in a compelling and organized manner. Meanwhile, the revision task utilizes GPT-3.5 as a substitute for traditional peer reviewers. It releases teachers and peers from the reviewing role and capitalizes on the AI's capacity to provide immediate feedback, allowing students to revise and refine their work autonomously. Both tasks help students improve writing quality and efficiency, providing a balanced approach to mastering different facets of the writing process. The two tasks break down the writing process into manageable steps.

4.3 Self-Introduction

The objective of the task is to develop students' skills in utilizing GPT for organization while preserving their individuality and originality. In the task, students begin by providing a list of their advantages and strengths. Using prompts, students direct GPT-3.5 to follow their planned organization, facilitating a step-by-step transformation of their points into well-structured essays (Fig. 4).

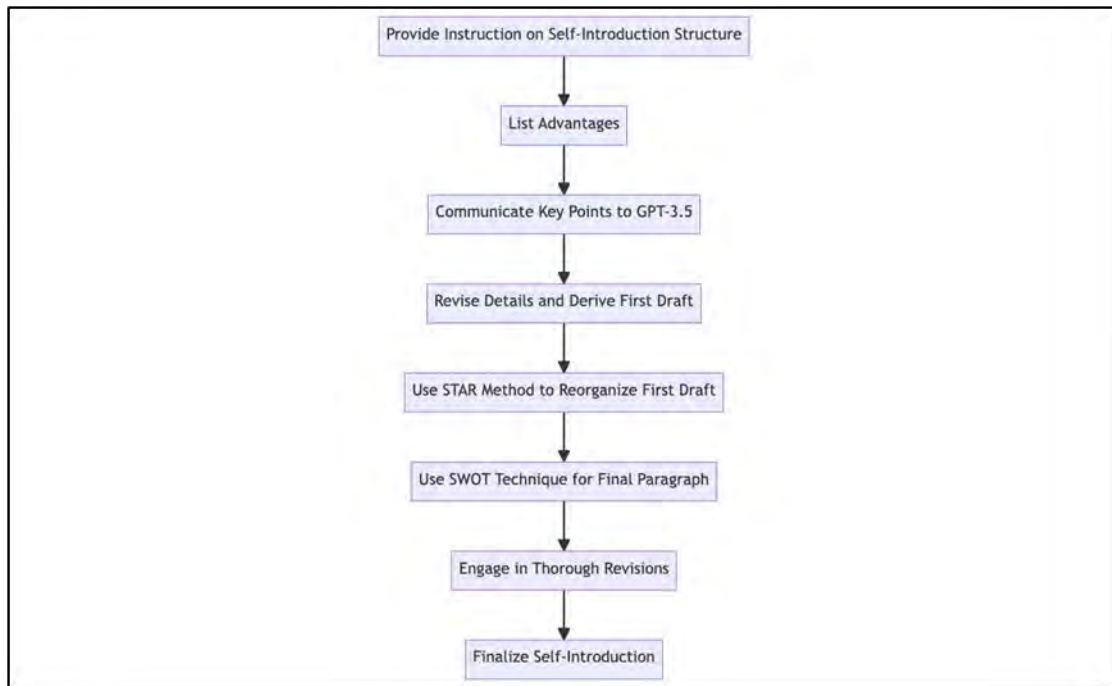


Figure 4: A scaffolding approach for self-introduction

- The instructor begins by providing instruction on the basic structure of a self-introduction, offering students a solid foundation for their writing.
- Building upon this knowledge, students proceed to list their advantages, identifying their unique strengths and attributes (Fig. 5).

Purpose: I want to apply for a master's degree in English teaching at NTNU.

Advantages:

1. My grades are in the top 1% of my class.
2. My GPA score is 4.0.
3. I am a student in the teaching training program and honor program.
4. I am a tutor in a remote elementary, using distance learning to teach English. It's a project of the Ministry of Education.
5. I took several courses about English teaching, including Introduction to English Language Teaching, Language Learning Strategies From Theory and Research.
6. I am a cram school teacher, teaching 9th-grade students.
7. I am also a cram school teacher teaching GEPT. There are 40 people in the class, and I work at Hsinchu Kuang-Fu Senior High School.
8. Additionally, I have received 4 Presidential Awards so far.

Figure 5: Student's advantage list

- Students communicate these key points to GPT-3.5, ensuring that the AI model is informed about the purpose of the autobiography and the intended content for each paragraph (Fig. 6).

I am applying for a master's program of **(PROGRAM NAME)** in **(UNIVERSITY NAME)**, This is a list of my advantages; write a self-introduction for me: **(PROVIDING THE LIST)**.
 In the first paragraph, state the reason why I want to be a teacher and summarize my strength with a strong hook sentence. In the second paragraph, summarize my past experiences in academic learning. In the third paragraph, focus on my research ability. In the fourth paragraph, focus on my teaching ability. In the fifth paragraph, show my potential to be an excellent student in the program. Finally, close the self-introduction with a strong statement.

Figure 6: Prompt for the first draft

- Students revise the details and derive the first draft of their self-introduction. This step allows them to fine-tune their writing, ensuring that their ideas are well-articulated and coherent.
- Students employ the strategic use of the STAR (situation, task, action, and result) method (Cook, 2009) for reorganizing first drafts and the SWOT (strengths, weaknesses, opportunities, and threats) technique (Misbah and Mahboob, 2017) for crafting final paragraphs, enhancing the quality and impact of their self-introductions (Fig. 7). The integration of GPT-3.5 further enhances the effectiveness of these techniques because GPT-3.5 can understand the prompts, analyze the original text, and follow the instruction to accurately generate text based on these methods, leading to more impactful self-introductions.

Use the STAR method to describe my experiences in each paragraph of my self-introduction. Don't make a list; write it into a cohesive piece. Mark (S, T, A, R) after every single sentence.

Use SWOT to rewrite the final paragraph. Don't make a list. Write a cohesive piece.

Figure 7: Prompts for using STAR and SWOT

The following examples show the contrasting organization of paragraphs using the STAR method (Fig. 8). Applying this method ensures a systematic and engaging presentation of the applicant's situation, task, actions, and results, effectively highlighting strengths and capturing readers' attention.

Without STAR

My dedication to teaching extends beyond research, as I have been actively involved in practical teaching experiences. As a tutor in the Ministry of Education's "English Learning Buddies" project, I have had the opportunity to support young learners in their English language journey through distance learning. Additionally, my roles as a cram school teacher for 9th-grade students and GEPT preparation instructor at Hsinchu Kuang-Fu Senior High School have allowed me to hone my teaching skills and connect with a diverse range of students.

Apply STAR

(S) Beyond research, I actively sought practical teaching experiences to complement my academic knowledge. (T) The objective was to apply theoretical concepts in real classroom settings. (A) As a tutor in the Ministry of Education's "English Learning Buddies" project and as a cram school teacher, I wholeheartedly engaged with my students, fostering their language development and guiding them on their learning journey. (R) Through these experiences, I witnessed the positive impact of my teaching on students' language proficiency and overall confidence.

Figure 8: Contrast with/without STAR

The two concluding paragraphs below (Fig. 9) exemplify how the SWOT method shapes the structure. Implementing this method offers a comprehensive assessment of strengths, weaknesses, opportunities, and threats, leading to a more balanced and insightful portrayal of the applicant's qualifications.

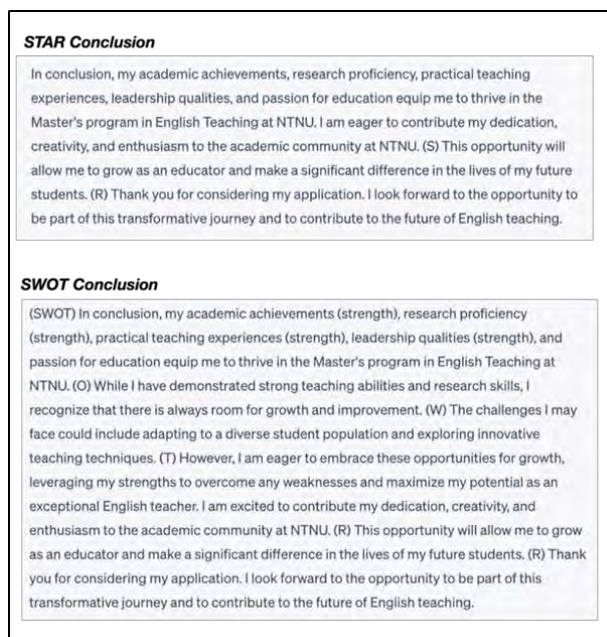


Figure 9: Contrast with/without SWOT

In the "self-introduction" assignment, students progressively fine-tune their ideas into coherently structured essays, utilizing GPT-3.5 to follow their outlined organization. They adopt both STAR and SWOT techniques to restructure their initial drafts and craft compelling conclusions. These systematic methods not only improve their organizational skills but also enhance the persuasive power of their writing.

4.4 Revision

The "revision" task is designed to bolster students' skills in employing GPT as a peer reviewer, simultaneously enhancing their capacity for self-evaluation. The task aims to equip students with a deeper understanding of their writing problems, fostering their ability to identify these issues independently.

In the "revision" task, the scaffolding approach helps students transition from an existing article to outlining essential points for improvement, allowing them to focus on specific aspects of their writing.

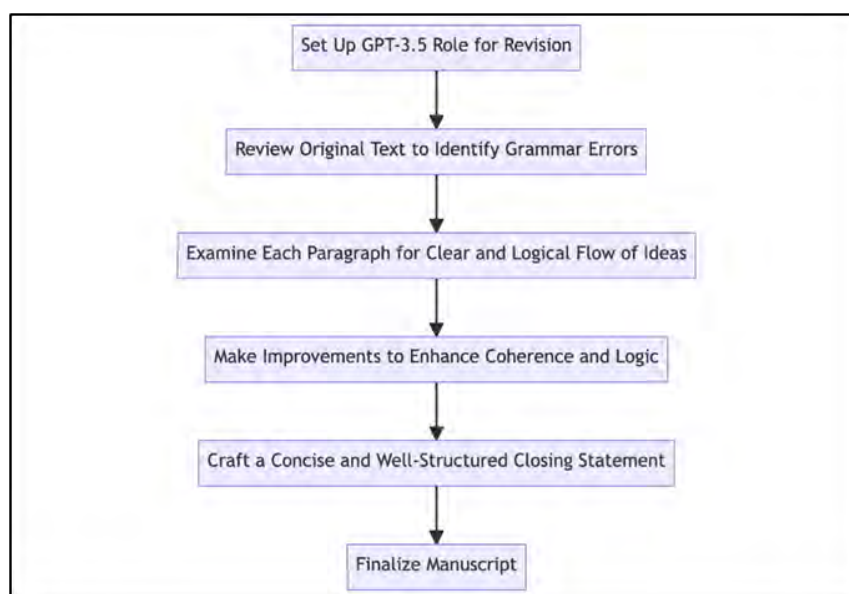


Figure 10: A scaffolding approach to revision

The proofreading process employs systematic step-by-step scaffolding (Fig. 10), ensuring a thorough review of the manuscript. The step-by-step scaffolding ensures that each stage of the proofreading process builds upon the previous one. By following this structured approach, the proofreader can effectively address grammatical errors, enhance clarity and coherence, and deliver a well-structured and logically presented composition:

- As shown in Figure 11, students establish GPT-3.5's role as a proofreader for non-native English compositions, involving the review of manuscripts submitted by Taiwanese college students majoring in English.
- The original text is carefully examined to identify grammatical errors. This step focuses specifically on grammatical errors, avoiding distractions that may otherwise arise during the process. The grammar check serves as the foundation for improving the manuscript's clarity, laying the groundwork for the following steps.
- Each paragraph is scrutinized to ensure a clear and coherent structure. Checking the overall structure ensures the manuscript is well organized. Examining the presence of clear topic sentences and well-supported arguments helps to establish a coherent and logical flow of ideas.
- The application of general-to-specific organization further strengthens the manuscript's coherence. Applying general-to-specific organization allows the main points to be presented logically and cohesively.
- Crafting a closing statement offers a concise summary of the main points discussed throughout the article.

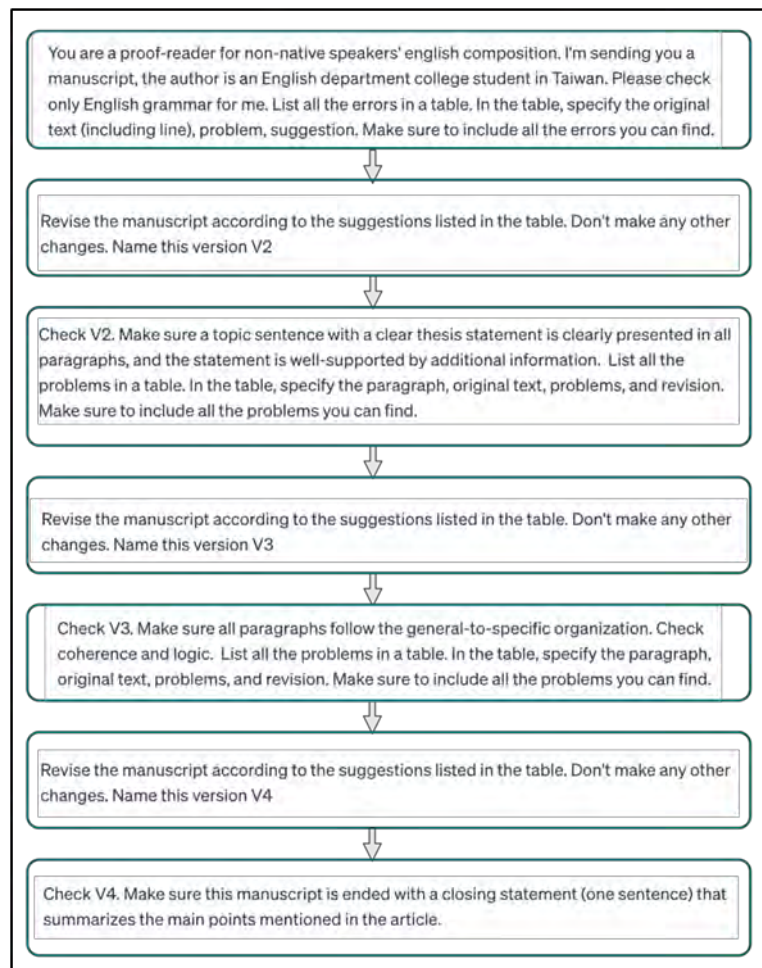


Figure 11: Prompts for revision

It is crucial to note that a table is created in each step to list all the identified issues along with their specific locations in the text, providing a clear overview for students to address each error systematically (Fig. 12). This table presentation makes it easier to pinpoint areas requiring improvement, serving as a valuable tool for students to gain a deeper understanding of their writing issues. Visually displaying errors and their specific locations equips students with a clearer picture of the weak spots in their writing. Thus, the table presentation

not only aids in correcting current mistakes but also contributes to the development of students' self-assessment abilities, fostering a deeper understanding and awareness of their writing strengths and weaknesses. The table below, generated by GPT-3.5, exemplifies this approach:

Check V2. Make sure a topic sentence with a clear thesis statement is clearly presented in all paragraphs, and the statement is well-supported by additional information. List all the problems in a table. In the table, specify the paragraph, original text, problems, and revision. Make sure to include all the problems you can find.

Here is the review of V2 manuscript, identifying the problems related to topic sentences and thesis statements in each paragraph, along with suggested revisions:

Paragraph	Original Text	Problems	Revision
1	Annoying teachers won't benefit your academic career in the long run, we have all angered the teacher more or less.	Lack of clear topic sentence and thesis statement.	Topic Sentence: The negative consequences of annoying teachers in the long run. Thesis Statement: Annoying teachers can have detrimental effects on students' academic career and create a disruptive learning environment.
2	First, Aspects of teaching in the classroom, keep chatting loudly in class. The teacher will be interrupted; this is the most direct. Then, you can eat strong-smelling food in class, fill the classroom with a strong smell, and disrupt the teaching.	Lack of a clear topic sentence and thesis statement.	Topic Sentence: Disruptive behaviors in the classroom can negatively impact the teaching and learning experience. Thesis Statement: Engaging in disruptive behaviors like chatting loudly and consuming strong-smelling food during class can disrupt the teaching process and create a distracting environment for both the teacher and students.
3	When teachers ask students questions, ignore the teacher's questions. Everyone stays quiet and refuses to answer. This will greatly reduce the level of participation in the classroom.	Lack of a clear topic sentence and thesis statement.	Topic Sentence: Lack of student participation hinders the effectiveness of classroom learning. Thesis Statement: Ignoring teachers' questions and refusing to participate in classroom discussions significantly diminishes the overall learning experience and interaction within the classroom.
4	It's worth mentioning, never submit assignments on	Lack of a clear topic	Topic Sentence: The impact of late submissions and incorrect answers

Figure 12: An example generated by ChatGPT

With GPT-3.5 acting as a virtual proofreader in the revising process, students can carefully examine grammatical errors, improve paragraph coherence, and enhance overall organization. This innovative approach reduces the need for extensive peer review and the instructor's traditional role in the proofreading process.

4.5 Integration of AI into the Writing Process

During the implementation phase, students engage with GPT-3.5 in two tasks. In the "self-introduction" task, they employ GPT-3.5 to enhance essay structure. Students provide specific prompts, guiding the AI to craft autobiographies with distinct elements, such as engaging hooks and compelling conclusions (Fig. 13). This skill enables students to retain their autonomy while utilizing AI's assistance, ensuring the generated content reflects their individual voices and preferences.

Write an autobiography **with six paragraphs** based on the experiences I had. **The autobiography needs to be natural which means that others can't tell it's written by AI. Start with an attraction hook** in the first paragraph. It should include my academic score, my research experiences, and my teaching experiences. **The second paragraph** focuses on my academic learning. How it benefits my future learning in XXX. **The third paragraph** focuses on my research experiences. **The fourth paragraph** focuses on my teaching experiences. **The fifth paragraph** focuses on describing my personality which includes self-disciplines, leadership, and being willing to help others. Show my strong potential of being a graduate student in XXX. **Finally, close the autobiography impressively.**

Figure 13: Student's prompt 1

As the process unfolds, students refine each paragraph through follow-up prompts (Fig. 14). Through these prompts, they demonstrate critical thinking and authorship, directing GPT-3.5 to produce an autobiography that genuinely captures their unique experiences.

Revise the second paragraph. Add what I have learned in the courses and how I maintain my good grades.
 Revise the third paragraph. Add what I have learned in the research. Connect it with my expected teaching strategy "CALL."
 Revise the fourth paragraph. Add what I have learned in the teaching experiences. How I apply what I have learned in academic learning and the research I did in my teaching.

Figure 14: Student's prompt 2

Students use GPT-3.5 as a tool to refine and optimize their writing. For instance, they might initially instruct GPT-3.5 to rewrite a self-introduction using specific techniques. If the generated content doesn't meet expectations, they refine their prompts for a more satisfactory output. The iterative process fosters effective communication with the AI. Figure 15 illustrates their intention to communicate more effectively with GPT-3.5 to receive the expected result on the first attempt, reflecting their adaptive approach to utilizing AI technology in the writing process.

PLEASE Rewrite the self-introduction. Use STAR to strengthen the act and result in each paragraph. Use SWOT to close the article. Make it less than 2000 words.

I don't want a list, I want something like "Tamkang Times... (Situation) Hone writing skills... (Task) Wrote 100 news... (Action) Won Prizes... (Result)"

If I want you to do these at first, what signal you could understand?

Figure 15: Student's prompt 3

Throughout the task, students evaluate and potentially disagree with GPT-3.5's outputs, emphasizing the importance of critical thinking and independent decision-making in AI-assisted writing. The examples below (Fig. 16) highlight the collaborative nature of the human-AI interaction in the writing process, where students actively engage with GPT-3.5 to refine their compositions and uphold their unique voices.

Nobody would use "in conclusion" in the first paragraph.	"In addition, I had the privilege of participating in a Graduate Speech program, which sharpened my public speaking and presentation skills." This paragraph is incorrect. "Lastly, I have experience in competing for results in a college degree program." This sentence is wrong.
In the last paragraph, don't use "to conclude" at the beginning and make it sound more natural. Add more benefits that the company will get if they give me the position.	In fourth paragraph, I don't fluent in Spanish, can your revise that?
It is a little bit off the topic. That activity is a two-day activity and it is minor. However, when I face an urgent situation, I can resolve it with a clam attitude.	Can you replace "proud" in the first paragraph?
Make it sound literal	Can you be simpler?
The fifth paragraph needs an example: I had helped visually impaired students to go to their classrooms.	Understanding others' needs should be written with summer club experience.

Figure 16: Student's prompt 4

In the revision task, students skillfully utilize GPT-3.5 as a tool to optimize their writing. By crafting personalized prompts that effectively guide the AI, they instigate considerable improvements in their compositions. This is manifested in heightened coherence, enriched vocabulary usage, and more refined sentence structures (Fig. 17). The process not only results in enhanced text quality but also augments their own understanding and mastery of effective writing techniques.

V1 (Without GPT)	V2 (With GPT)	Advancements
<p>The number of teachers is one of the obvious gaps between urban and rural schools. In big cities, every teacher in the school can perform their own duties. The Chinese teacher only needs to teach Chinese well and does not have to worry about other subjects. However, it is very common that one teacher wears more than one hat in the country schools. For instance, an English teacher teaches not only English but also civics because there are no other teachers. Another situation is that even though there are substitute teachers for other subjects, there is high teacher turnover rate, and students have to constantly adapt to new substitute teachers. Either way, both can adversely affect students learning.</p>	<p>A notable disparity between urban and rural schools is evident in the number of teachers available. Urban schools benefit from a sufficient number of specialized educators, with each teacher focusing on their specific subject area. In contrast, rural schools often face the challenge of one teacher handling multiple subjects due to limited resources. Additionally, high turnover rates and the constant adaptation to new substitute teachers further hinder the learning experience for rural students.</p>	<p>Grammar: In V1, the phrase "only needs to teach Chinese well" is grammatically correct but could be more concise and specific. In V2, the sentence is rephrased to include "each teacher focusing on their specific subject area," providing a clear and concise description of specialized educators in urban schools.</p> <p>Clarity: In V1, the phrase "one teacher wears more than one hat" is somewhat vague and could be clearer. In V2, the sentence is rephrased to specifically state that one teacher handles multiple subjects in rural schools due to limited resources, providing a clearer understanding of the situation.</p> <p>Coherence: In V1, the sentence includes multiple points without clear connections, making it less coherent. In V2, the sentence is rephrased to present the related ideas in a more cohesive manner, emphasizing how high teacher turnover rates and constant adaptation to new substitute teachers impact the learning experience for rural students.</p>
<p>User continuity is one of the places where Mac beats Windows. Apple has the whole Apple family (Apple Watch, iPhone, Mac) as support and all they need to do is airdropping which is a built-in App that you can exchange data between different Apple devices. On the other hand, when Windows users wish to exchange data from other devices with their computers, Windows users need to download extra applications. In short, Mac users may leverage the built-in integration system to boost job productivity and make their life easier. Thus, when it comes to user continuity, Macs should be your only choice without any considerations.</p>	<p>Another area where Mac surpasses Windows is user continuity. Mac provides seamless integration across its devices, including Apple Watch, iPhone, and Mac, through built-in apps like AirDrop. This built-in integration system enhances productivity and convenience, allowing users to effortlessly exchange data between their Apple devices. In contrast, Windows users need to download additional applications to achieve similar functionality, resulting in a less streamlined user experience. Mac users can leverage this built-in integration system to boost job productivity and make their lives easier. Therefore, when it comes to user continuity, Macs should be the preferred choice without any hesitation.</p>	<p>Grammar: In V1, there is a grammar error in the phrase "all they need to do is airdropping," which should be "all they need to do is use AirDrop." In V2, the sentence is rephrased with proper grammar, using "through built-in apps like AirDrop" to describe the seamless integration across Mac devices.</p> <p>Clarity: In V1, the statement "Mac users may leverage the built-in integration system" lacks specificity in describing the advantages of the integration system. In V2, the sentence is rephrased to explicitly state that "This built-in integration system enhances productivity and convenience," providing a clearer explanation of the benefits for users.</p> <p>Coherence: In V1, the transition word "Thus" does not create a strong logical connection between the previous and following sentences. In V2, the transition word "Therefore" is used, which creates a more coherent flow and reinforces the conclusion that Macs should be the preferred choice for user continuity.</p>

Figure 17: Comparison of students' writing before and after applying ChatGPT

The successful integration of GPT-3.5 into the writing process exemplifies the effective combination of TK, PK, and CK within the context of TPACK. In the implementation phase, students skillfully employ TK by crafting personalized prompts and refining instructions to direct GPT-3.5 in generating desired content. Their adept use of PK is evident in their communication with the AI, seeking clarifications and adjustments to maintain their autonomy as writers and effectively follow the instructor's step-by-step scaffolding approach. As students integrate GPT-3.5 into their writing process, they apply their pedagogical knowledge to understand and implement the instructor's guidance, which includes crafting personalized prompts, refining instructions, and seeking clarifications for effective communication with the AI. Additionally, their CK is showcased as they structure written work and ensure the intended focus for coherent compositions. This harmonious integration of TK, PK, and CK results in significant improvements in their writing, demonstrating the successful application of TPACK principles to enhance writing instructions.

RQ2: Exploring Students' Complex Perceptions of AI in Writing

In the evaluation phase, students reflect on their experiences with integrating GPT-3.5 into their writing process through an introspective essay. Students also delve into their emotions, expressing their reservations about AI's efficiency. This introspective process empowers students to become thoughtful writers, fostering a harmonious relationship between human creativity and AI assistance in the writing process.

4.6 GPT Makes Writing Efficient

In the evaluation phase, students recognized GPT-3.5's efficiency, noting its role in time-saving and simplifying the writing process. They reported that GPT-3.5's rapid generation of information expedited their research of points, and its capabilities for refining compositions and structuring pieces saved them considerable time.

*The most impressive part of ChatGPT is that **it can give us a lot of information in a short time**. From Taiwan to the whole country, all things can be found in it.*

*Technology has influenced my writing in several ways. **ChatGPT has provided me with a wide range of information. Researching and finding many data has become much easier ... with just a few clicks.***

The students' reflections confirmed that GPT-3.5's time-saving efficiency was critical to their improved writing process. This newfound efficiency not only sped up their writing but also empowered them to maintain a high quality of work within the time constraints. While this newfound efficiency accelerated their writing, it was crucial to maintain a balance between using AI tools and developing their own writing abilities. The course was designed not to create dependency on AI but to use it as a supplement to enhance students' writing skills and critical thinking.

*At the beginning of this semester, I was a student who wrote an article very slowly. ... **After trying this tool, I found that my writing efficiency improved. I can just input my points and ask for recombination.** Also, after finishing my essays, I can feed my writing drafts to ask for some suggestions of reversion.*

*Throughout the course, **I have witnessed significant development in my writing abilities. ... I now spend only 30 minutes on an essay compared to the 2-3 hours I used to spend before.** These tools have provided creative suggestions and fresh ideas, enabling me to develop my writing more efficiently and achieve better results.*

*At the beginning of this course, I spent countless hours on homework and writing. However, as the course progressed, I realized the impact that technology brings to the writing process. **The accessibility of information, editing, and the ability to connect information have all expanded my perspectives and my writing ability.***

The reflections consistently highlight enhanced efficiency as GPT-3.5 accelerates writing, optimizes research, and streamlines editing, revolutionizing the writing experience. This transformative AI efficiency becomes invaluable, maximizing writing quality within limited time frames.

4.7 GPT Makes Organization Easier

In the evaluation phase, students' reflective essays reveal how GPT-3.5 serves as a valuable aid in organizing their essays, ensuring coherence and logical flow throughout the text. The integration of GPT-3.5 revolutionizes their writing approach.

Students stated how GPT-3.5 assisted them in generating well-structured essays by providing accurate and relevant responses to their prompts, thus improving the overall quality of their writing.

*Take my own experiences as an example. I used ChatGPT to help me write my personal statement. **I believe that what ChatGPT wrote is better than what I wrote because the prompts I gave it are accurate.***

*Traditionally, people have to think about everything when writing. For instance, wording, grammar, structure, etc. **However, with the help of ChatGPT, people can produce an essay simply by giving instructions.***

Beyond its immediate benefits, students found that AI's ability to handle the mechanical aspects of writing freed them to focus on developing cogent arguments and thoughtful organization. The use of AI effectively shifted their focus from the granular task of writing to the higher-level task of reasoning and structuring. This delegation of labor to GPT-3.5, a proficient tool for grammar and structure, allowed students to fine-tune their arguments, fostering their critical thinking skills.

*It is no more necessary to create an article word by word on one's own. Instead, **people should pay attention to the organization, which might be one of the points that humans could perform better than AI.***

***Technology lets us pay more attention to our thinking logic.** ...What those digital tools are really good at is the structure, formulaic writing performance. **We don't need to worry about if the essays we wrote by using online tools have huge grammatical errors.** We can use them to make double confirmation on structure and grammar in our writing works.*

Throughout their reflective essays, students highlighted the transformation in their writing process, where GPT-3.5 and other digital writing tools acted as indispensable partners in ensuring coherence and logical flow in their compositions. By taking on the organizational aspects, these AI tools allowed students to explore the depth of their ideas and strengthen their argumentation, leading to enhanced writing skills and more effective communication.

4.8 GPT Replaces Peer Reviewers

In the evaluation phase, the use of GPT-3.5 as an effective tool for immediate feedback and revision became a recurring theme in students' reflective essays. The AI not only detected errors but also facilitated a comprehensive understanding of their writing problems. By delivering a clear overview of errors and suggestions, GPT-3.5 enabled students to gain a deeper insight into their areas for improvement.

*In the early stages, word processors and spelling and grammar checkers **provided immediate feedback, helping me refine my work. These digital tools not only corrected errors but also highlighted areas where I could improve clarity, coherence, and conciseness.** Additionally, access to online resources allowed me to delve deeper into research, broadening my understanding and enriching the depth of my writing.*

*AI helped me improve my writing skills because **it can detect my problems in the essay, for example, my coherence problems, or gives better word usage. It can also review my paragraph and tell me the problem I had and the ways to revise it ... and you can see its difference with the essay you wrote so that you can understand the problems in your grammar. It can list all the errors for you with one click.***

Students also mentioned how the integration of GPT-3.5 had reshaped their editing process, making it more collaborative and efficient. This transformation underscored GPT-3.5's role in providing critical writing support and guidance, especially for students without immediate access to extensive writing resources.

*With the advent of digital tools, the revision and editing process has become more efficient and effective. **Features like track changes and comments allow for collaborative editing, enabling me to receive feedback from peers and instructors seamlessly.***

*AI can serve as an accessible learning tool, offering writing guidance and resources **to individuals who may not have immediate access to extensive writing support. It can provide real-time assistance and feedback, allowing students to independently improve their writing skills, especially in cases where immediate outside resources may not be readily available.***

Throughout their reflections, students emphasized how GPT-3.5's language checks and organizational support enhanced the writing process, providing valuable feedback and suggestions similar to peer reviewers.

4.9 Perplexity toward GPT

In reflective essays, students highlighted their growth as thoughtful writers and the complexities they faced when integrating AI into their writing process. They recognized both the efficiency of AI and the importance of maintaining their authorial identity. While a few students' reflections have been highlighted for their illustrative value, these perspectives are representative of broader sentiments expressed by the group.

One student recounted using ChatGPT for a presentation, yet the AI fell short in crafting a satisfactory conclusion. The student realized the need for human input and the importance of critical thinking.

*I use ChatGPT to prepare my presentation. ... I also ask the ChatGPT to come to a conclusion for me. Unfortunately, on the presentation day, the conclusion is not as good as the summary and analysis. ... **ChatGPT is good, but never totally rely on it. You are the master of it. I still need to think critically on my own. That's the importance of critical thinking ability for everyone.***

Another student nostalgically looked back on the past when writing was done using a dictionary and pen before the advent of technology. The nostalgic sentiment underscored the emotional depth and personal connection inherent in traditional writing, acknowledging the trade-offs between traditional and technologically assisted methods.

*Look back at the past, I appreciated that I was born in a changing era. **When I first started writing, the only thing I had was a dictionary. No ChatGPT, no Joplin, no Google translation but my pen.** I still miss the feeling of writing on a tight new white paper without any limits. It was the place where I could share my feelings and stories and basically, another me in another chapter.*

In navigating the balance between AI's convenience and maintaining their individual voice, students grappled with ethical considerations. One student questioned whether it is reasonable to consider AI-generated sentences as their own writing. This internal debate demonstrated their sensitivity to issues of originality and artistic expression. Their thoughtful consideration of this ethical dilemma showcased their growth as conscientious writers willing to navigate the complexities of using AI technology while maintaining their authentic integrity as writers.

Nonetheless, the question still remains at the bottom of my heart. However good the sentences AI generates, is it reasonable to just mark them as the users' writings? As a writer, I highly disagree with this. But the fact that AI is an effective reversion tool is doubtless.

These individual reflections are part of a larger group of student experiences. The collective insights indicate that while students recognized the practical advantages of AI, they also remained critically aware of the importance of maintaining their authorial identity and the need for thoughtful engagement with technology. Throughout their reflections, students experienced a transformation in their perceptions of AI's role in writing. They recognized the advantages of AI in content generation and revision while simultaneously acknowledging the importance of their own critical thinking and creativity. Their complex understanding of AI's potential and limitations showcases the multifaceted nature of their experiences, demonstrating a mature and critical relationship with the technology and contributing to the ongoing discourse on the integration of AI in the writing process.

5. Discussion

5.1 GPT in Writing: Efficiency, Structure, Peer Review

The incorporation of GPT-3.5 into writing practices has emerged as a transformative strategy for addressing several issues outlined in the introduction. Firstly, by quickly generating content and creative suggestions, GPT-3.5 reduced the time allocated for research and content generation. Secondly, GPT-3.5 provided precise and relevant responses to prompts and aided in structural organization. GPT-3.5 ensured consistency and logical progression in students' compositions, which is exactly what they need at this stage of learning to write (Xu et al., 2019). Furthermore, students recognized GPT-3.5's potential as a dependable replacement for peer reviewers, acknowledging the crucial role peer reviewers play in achieving good writing (Harutyunyan and Poveda, 2018). The AI's thorough language evaluations and feedback provided students with critical insights into their writing, allowing them to independently identify areas for refinement (Gayed et al., 2022).

5.2 GTP, ADDIE, and TPACK in Writing Enhancement

The integration of GPT-3.5 within the writing framework demonstrated the practical application of both the ADDIE model and the TPACK framework.

5.2.1 Analysis/design: Laying foundation

During the analysis stage, the course designers recognized the need to establish a strong grasp of essay structure before introducing AI-generated content. Therefore, fundamental principles of organization and coherence were reinforced to provide students with a solid basis for proficient writing.

In the design stage, a scaffolded approach was developed to guide students through diverse writing tasks. The autobiography task aimed to improve students' self-introduction skills by highlighting their strengths, employing a structured method to communicate with GPT-3.5, and facilitating the creation of well-structured essays. The STAR and SWOT techniques further enhanced the self-introductions. The revision task utilized a methodical proofreading process with GPT-3.5 to address grammar, paragraph structure, coherence, and concise closing statements, resulting in a refined outcome. Tables were employed for efficient assessment, streamlining the revision process.

Through a step-by-step systematic approach, students were conscientiously guided to interact with AI technology in their writing process (Ammade et al., 2020). Each decision made, from listing their advantages to refining their compositions, was done thoughtfully and with purpose. This approach instilled in them a heightened sense of consciousness and critical thinking, enabling them to utilize AI's capabilities while retaining full control, cultivating a new generation of mindful and skillful writers (Yot-Domínguez, 2017).

5.2.2 Development/implementation: encouraging authenticity

During the development stage, course materials were carefully crafted to encourage authenticity. The selection of the autobiography writing topic prompted students to draw from personal experiences, fostering originality and discouraging plagiarism. By promoting personal narratives, the course nurtured a strong sense of authorship, underlining the significance of individual creativity in their work.

In the implementation stage, students adeptly incorporated GPT-3.5 into their writing process by creating personalized prompts to guide the AI. Improvements were evident through enhanced coherence, enriched vocabulary, and refined sentence structures. Throughout their interaction with GPT-3.5, students skillfully preserved their unique authorial voice and ownership, ensuring the AI-generated content harmonized with their viewpoints and preferences.

As students interacted with GPT-3.5, there was a noticeable effort to retain their unique authorial voice. This was visible as they guided the AI's input to align with their personal perspectives and preferences, thereby indicating their control over the final work. This behavior could be seen as a subtle shift towards becoming more reflective writers who can utilize advanced technology without compromising personal insight or creativity.

5.2.3 Evaluation: Cultivating conscientious writers

The evaluation phase provided intriguing insights into the effectiveness of the systematic integration of GPT-3.5. Notably, it showcased the symbiosis between the ADDIE and TPACK models, which was apparent in the students' ability to effectively utilize GPT-3.5 to enhance their writing. This successful implementation demonstrated that the fusion of ADDIE's rigorous instructional design process with TPACK's intricate understanding of the intersection between technology, pedagogy, and content can offer a structured yet flexible approach to AI integration in education (Ammade et al., 2020). More specifically, the students' ability to craft personalized prompts and refine the AI's outputs illustrated their technological and pedagogical proficiency, a cornerstone of TPACK. This shows that students were not just passively using technology but actively and thoughtfully engaging with it to better their learning experience and outcome. Simultaneously, their efforts to retain their authorial writing style underscored the critical reflection inherent in the ADDIE process. Students were critically reflecting on their work, an action promoted by the ADDIE model, and this reflection aided in the development of their authorial voice and overall writing skills. Thus, the findings shed light on a promising strategy for facilitating conscientious authorship and critical thinking, intertwining technological advancements with traditional pedagogical approaches in writing education.

5.2.4 Fostering authorship and critical thinking

The students in this study articulated feelings of complexity and internal debate surrounding the utilization of GPT-3.5 in writing. This reaction reflected their growing cognizance of ethical considerations and the importance of authorship conscience. Their thoughtful consideration of whether AI-generated sentences truly constituted their own writing exemplified their sensitivity to issues of originality and artistic expression.

The course facilitated the development of conscientious writers by encouraging students to navigate these complexities with care and critical thinking. The course's integration of AI fostered critical thinking among students by presenting a complex task: blending their unique voices with the AI's suggestions while preserving authorship. They were prompted to critically assess the AI's inputs and their work, fostering a deeper understanding of their narratives. Simultaneously, the course nurtured conscientious writers, as students grappled with AI's implications in terms of originality and artistic integrity. By negotiating this intricate task, students developed a balanced approach to AI, upholding their authorship and demonstrating thoughtful use of technology, an essential skill for the modern writer.

5.3 Assessing AI-Assisted Writing: Balancing Technology and Human Input

In response to queries regarding the assumptions about AI-generated content and its comparison to human texts, it is important to clarify that this study does not posit AI-generated results as superior or perfect compared to student texts. Rather, the study views AI as a tool that complements and enhances students' writing process.

- **AI versus Human Texts:** The study recognizes that while AI, such as GPT-3.5, can offer valuable assistance in terms of generating ideas, structuring content, and providing language suggestions, it does not replace the complex nature of human thought and expression. The goal is not to create a dependency on AI but to utilize it as a supplement that aids in the development of students' writing skills.

- **Instructor's Role in Testing AI Results:** As part of the course, the instructor plays a crucial role in evaluating the AI-assisted work submitted by students. This evaluation is not solely focused on the quality of the AI-generated content but also on how effectively students integrate this content into their writing while maintaining their unique voice and critical thinking. The instructor assesses whether the students are using AI as a tool for improvement, ensuring that the final output reflects their understanding and creativity.
- **Encouraging Critical Engagement with AI:** The course encourages students to critically engage with AI outputs. Students are taught to scrutinize the AI-generated content, evaluate its relevance and accuracy, and modify it to suit their purpose and style. This approach fosters a balanced relationship with technology, where students learn to employ AI's strengths while being mindful of its limitations.

In sum, this study emphasizes a balanced approach to AI in writing education, advocating for its use as an aid in the creative and critical process rather than as a substitute for human ability. The objective is to train writers who can blend technology with their own unique insights and skills, thus advancing their writing in the context of evolving digital tools.

6. Conclusion

In utilizing ChatGPT as an instructional tool for writing, the study's findings underscore the positive impact of the combined TPACK and ADDIE approach on students' writing abilities. This research aligns with the findings of Ammade et al. (2020), Gayed et al. (2022), and Xu et al. (2019), specifically emphasizing how the incorporation of technology can assist students in generating better academic writing. Students exhibited significant improvement in their writing quality, validating the effective integration of ChatGPT into writing instruction under the thoughtful guidance of the TPACK framework and the structured approach of the ADDIE model.

For the wider EFL teacher community, these findings suggest that AI tools like ChatGPT can be effectively integrated into writing instruction, provided they are used within a structured and pedagogically sound framework. This can lead to improvements in students' writing quality and foster a more engaging and interactive learning environment. However, while GPT-3.5's integration into the writing process offers various benefits, this study acknowledges its limitations. First, there is a potential for further research to explore its personalized application in generating diverse writing types, accommodating individual writing styles and requirements. Additionally, conducting in-depth qualitative studies, such as interviews or think-aloud protocols, could provide valuable insights into students' experiences with AI integration, potentially revealing underlying reasons for their writing challenges. Furthermore, it's important to note the limitation posed by this study's small sample size. While the qualitative data from the 15 participants provides valuable initial insights, a larger sample would allow for more generalized conclusions and a broader understanding of AI's impact on writing education. Finally, quantitative assessments measuring time savings and comparing AI-assisted writing to traditional methods could provide concrete insights into the practical advantages of AI in the writing process.

Future research plans include expanding the sample size and exploring ChatGPT's application in diverse writing contexts to accommodate individual styles and needs. Additionally, employing quantitative methods and in-depth qualitative approaches like interviews will provide a more holistic understanding of AI's role in writing education. Regarding validity and reliability, the study employed rigorous methodological approaches within its scope, as the collected data were scored and validated by two researchers who also teach academic writing. Future experiments will aim to enhance both the validity and reliability of the findings through varied and more extensive data collection methods.

Despite these constraints, this study provides crucial insights into the potential of AI integration to enhance writing education and foster critical thinking skills, paving the way for comprehensive future investigations.

Acknowledgements

This work was partially supported by the Ministry of Education (MOE) in Taiwan [PED1121084].

References

- Ahmed, P.H., 2019. Major writing challenges experienced by EFL learners in Soran University. *Journal of University of Human Development*, 5(3), pp.120-26.
- Aldoobie, N., 2015. ADDIE model. *American International Journal of Contemporary Research*, 5(6), pp.68-72.
- Alharbi, M.A., 2019. Exploring the potential of Google Doc in facilitating innovative teaching and learning practices in an EFL writing course. *Innovation in Language Learning and Teaching*, 14(3), pp.227-42.
<https://doi.org/10.1080/17501229.2019.1572157>.

- Allen, M., 2017. Designing online asynchronous information literacy instruction using the ADDIE model. In T. Maddison and M. Kumaran, eds. *Distributed learning*. Witney, UK: Chandos Publishing. pp.69-91. <https://doi.org/10.1016/B978-0-08-100598-9.00004-0>.
- Almelhi, A.M., 2021. Effectiveness of the ADDIE model within an e-learning environment in developing creative writing in EFL Students. *English Language Teaching*, 14, pp.1-20. <http://doi.org/10.5539/elt.v14n2p20>.
- Ammade, S., Mahmud, M., Jabu, B., and Tahmir S., 2020. TPACK model based instruction in teaching writing: an analysis on TPACK literacy. *International Journal of Language Education*, 4(2), p.129. <https://doi.org/10.26858/ijole.v4i2.12441>.
- Baker, K.M., 2016. Peer review as a strategy for improving students' writing process. *Active Learning in Higher Education*, 17(3), pp.179-92.
- Bates, T., 2015. *Teaching in a digital age*. Vancouver, BC: Tony Bates Associates Ltd.
- Bouwmeester, R.A., de Kleijn, R.A., van den Berg, I.E., ten Cate, O.T.J., van Rijen, H.V., and Westerveld, H.E., 2019. Flipping the medical classroom: effect on workload, interactivity, motivation, and retention of knowledge. *Computers and Education*, 139, pp.118-28. <http://doi.org/10.1016/j.compedu.2019.05.002>.
- Cancino, M., and Panes, J., 2021. The impact of Google Translate on L2 writing quality measures: evidence from Chilean EFL high school learners. *System*, 98, 102464. <https://doi.org/10.1016/j.system.2021.102464>.
- Chen, A.H., 2022. The effects of writing strategy instruction on EFL learners' writing development. *English Language Teaching*, 15(3), 29. <https://doi.org/10.5539/elt.v15n3p29>.
- Chen, Z., Zhang, C., Wang, Q., Troidl, J., Warchol, S., Beyer, J., Gehlenborg, N., and Pfister, H., 2023. *Beyond generating code: Evaluating GPT on a data visualization course*. Preprint arXiv:2306.02914. <https://doi.org/10.48550/arXiv.2306.02914>.
- Cook, S., 2009. *Coaching for high performance: How to develop exceptional results through coaching*. Ely, UK: IT Governance Ltd.
- Davis, N., & Thompson, A., 2005. The evaluation of technology-related professional development, Part 2. In C. Crawford et al., eds. *Proceedings of Society for Information Technology and Teacher Education International Conference 2005*. Chesapeake, VA: AACE. pp.825-30.
- Garg, R.K., Urs, V.L., Agrawal, A.A., Chaudhary, S.K., Paliwal, V., and Kar, S.K., 2023. *Exploring the role of Chat GPT in patient care (diagnosis and Treatment) and medical research: a systematic review*. medRxiv, 2023.06.13.23291311. <https://doi.org/10.1101/2023.06.13.23291311>.
- Gayed, J.M., Carlon, M.K.J., Oriola, A.M., and Cross, J.S., 2022. Exploring an AI-based writing assistant's impact on English language learners. *Computers and Education: Artificial Intelligence*, 3, Article 100055. <https://doi.org/10.1016/j.caeai.2022.100055>.
- Gilson, A., Safranek, C., Huang, T., Socrates, V., Chi, L., Taylor, R., and Chartash, D., 2023. How does ChatGPT perform on the United States Medical Licensing Examination? The implications of large language models for medical education and knowledge assessment. *JMIR Medical Education*, 9, e45312. <https://doi.org/10.2196/45312>.
- Goldberg, A., Russell, M., and Cook, A., 2003. The effect of computers on student writing: a meta-analysis of studies from 1992 to 2002. *The Journal of Technology, Learning and Assessment*, 2(1), pp.1-20. Available at: <<https://ejournals.bc.edu/index.php/jtla/article/view/1661>>.
- Golonka, E.M., Bowles, A.R., Frank, V.M., Richardson, D.L., and Freynik, S., 2014. Technologies for foreign language learning: a review of technology types and their effectiveness. *Computer Assisted Language Learning*, 27, pp.70-105. <https://doi.org/10.1080/09588221.2012.700315>.
- Han, T., and Huang, J., 2017. Examining the impact of scoring methods on the Institutional EFL Writing Assessment: A Turkish perspective. *PASAA: Journal of Language Teaching and Learning in Thailand*, 53, pp.112-47.
- Harutyunyan, L., and Poveda, M.F., 2018. Students' perception of peer review in an EFL classroom. *English Language Teaching*, 11(4), pp.138-51. <https://doi.org/10.5539/elt.v9n9p36>.
- Koehler, M.J., and Mishra, P., 2008. Introducing TPACK. In AACTE Committee on Innovation and Technology, ed. *The handbook of technological pedagogical content knowledge (TPCK) for educators*. Mahwah, NJ: Lawrence Erlbaum Associates. pp.3-29.
- Lee, I., 2002. Teaching coherence to ESL students: a classroom inquiry. *Journal of Second Language Writing*, 11(2), pp.135-59. [https://doi.org/10.1016/S1060-3743\(02\)00065-6](https://doi.org/10.1016/S1060-3743(02)00065-6).
- Li, J., and Huang, J., 2022. The impact of essay organization and overall quality on the holistic scoring of EFL writing: perspectives from classroom English teachers and national writing raters. *Assessing Writing*, 51, Article 100604. <https://doi.org/https://doi.org/10.1016/j.asw.2021.100604>.
- Li, L., Liu, X and Steckelberg, A., 2010. Assessor or assessee: how student learning improves giving and receiving feedback. *British Journal of Educational Technology*, 41(3), pp.525-36.
- Lin, C.A., Lin, Y.L., and Tsai, P.S., 2020. Assessing foreign language narrative writing through automated writing evaluation: a case for the web-based Pigai system. In Serpil Meri Yilan, ed. *ICT-based assessment, methods, and programs in tertiary education*. Hershey, PA: IGI Global. pp.100-119. <http://doi.org/10.4018/978-1-7998-3062-7.ch006>.
- Misbah, S., and Mahboob, U., 2017. Strengths, weaknesses, opportunities, and threats analysis of integrating the World Health Organization patient safety curriculum into undergraduate medical education in Pakistan: a qualitative case study. *Journal of Educational Evaluation for Health Professions*, 14, p.35.
- Muruganatham, G., 2015. Developing of e-content package by using ADDIE model. *International Journal of Applied Research*, 1(3), pp.52-54.

- Putri, S.E., 2019. The implementation of TPACK in teaching writing recount text in a senior highschool level. *RETAIN Journal*, 7(2), pp.156-63.
- Ravand, H., and Rasekh, A.E., 2011. Feedback in ESL writing: toward an interactional approach. *Journal of Language Teaching and Research*, 2(5), pp.1136-45. <https://doi.org/10.4304/jltr.2.5.1136-1145>.
- Richards, J.C., and Rodgers, T.S., 2001. *Approaches and methods in language teaching*. Cambridge University Press.
- Richards, J.C., 2013. Curriculum approaches in language teaching: forward, central, and backward design. *RELC Journal*, 44(1), pp.5-33.
- Ruegg, R., 2015. The relative effects of peer and teacher feedback on improvement in EFL students' writing ability. *Linguistics and Education*, 29, pp.73-82. <https://doi.org/10.1016/j.linged.2014.12.001>.
- Schmidt, D.A., Baran, E., Thompson, A.D., Mishra, P., Koehler, M.J., and Shin, M.J., 2009. Technological pedagogical content knowledge (TPACK): the development and validation of an assessment instrument for pre-service teachers. *Journal of Research on Technology in Education*, 42(2), pp.123-49.
- Shulman, L.S., 1986. Those who understand: knowledge growth in teaching. *Educational Researcher*, 15(2), pp.4-14.
- Skalidis, I., Cagnina, A., Luangphiphat, W., Mahendiran, T., Muller, O., Abbe, E., and Fournier, S., 2023. ChatGPT takes on the European Exam in Core Cardiology: an artificial intelligence success story? *European Heart Journal—Digital Health*, 4(3), pp.279-81. <https://doi.org/10.1093/ehjdh/ztad029>.
- Sogutlu, E., and Velaj-Ostrosi, M., 2022. EEL learners' challenges in essay writing: the case of a non-public high school in Albania. *Journal of Positive School Psychology*, 6(4), pp.3958-81.
- Tanaka, Y., Nakata, T., Aiga, K., Etani, T., Muramatsu, R., Katagiri, S., Nomura, A., 2023. *Performance of generative pretrained transformer on the National Medical Licensing Examination in Japan*. Preprint from medRxiv. <http://doi10.1101/2023.04.17.23288603>.
- West, R., 1994. Needs analysis in language teaching. *Language Teaching*, 27(1), pp.1-19.
- Xu, Z., Banerjee, M., Ramirez, G., Zhu, G., and Wijekumar, K., 2019. The effectiveness of educational technology applications on adult English language learners' writing quality: a meta-analysis. *Computer Assisted Language Learning*, 32, pp.132-62. <https://doi.org/10.1080/09588221.2018.1501069>.
- Yot-Domínguez, C., and Marcelo, C., 2017. University students' self-regulated learning using digital technologies. *International Journal of Educational Technology in Higher Education*, 14(1), pp.38. <https://doi.org/10.1186/s41239-017-0076-8>.
- Zhang, L.J., and Cheng, X.L., 2021. Examining the effects of comprehensive written corrective feedback on L2 EAP students' performance: a mixed-methods study. *Journal of English for Academic Purposes*, 54(101043), pp.1-15. <https://doi.org/10.1016/j.jeap.2021.101043>.
- Zhang, W., and Cai, W., 2019. Research on English writing feedback based on online automatic evaluation and reform. *Education Research*, 2019(3), pp.102-103.
- Zhang, Z.V., 2020. Engaging with automated writing evaluation (AWE) feedback on L2 writing: student perceptions and revisions. *Assessing Writing*, 43, 100439. <https://doi.org/10.1016/j.asw.2019.100439>.
- Zhang, Z.V., and Hyland, K., 2022. Fostering student engagement with feedback: an integrated approach. *Assessing Writing*, 51, 100586. <https://doi.org/10.1016/j.asw.2021.100586>.