The Effects of Design Thinking Activities on Learning Achievement and Innovative Thinking Skills Among Undergraduate English Major Students in Thailand

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Abstract

The purposes of this research were to compare undergraduate students' learning achievements and innovative thinking skills before and after learning through design thinking activities in English for communication in service industry course, and to study undergraduate students' self-perception on their innovative thinking skill after learning through design thinking activities. A one-group pretest–posttest design was employed. The sample group of this research was 59 undergraduate students majoring in English who enrolled in English for communication in service industry course in academic year 2024. Total population sampling was employed, representing 95.1% of the population. The research instruments included design thinking activity plans in English for communication in service industry course, a learning achievement test, an innovative thinking skills test and a self-perception of innovative thinking skills questionnaire. All instruments were validated by experts for content validity (IOC = 0.67–1.00). The internal consistency reliability of the instruments was examined using the Kuder–Richardson Formula 20 (KR-20) for the learning achievement test and the innovative thinking skills test, and Cronbach's alpha for the self-perceived innovative thinking skills questionnaire. The reliability coefficients were 0.74, 0.79, and 0.91, respectively. Data were analyzed using mean, standard deviation, t-test (dependent samples), and Cohen's d. The results indicated that post-test scores for learning achievement were significantly higher than pre-test scores at the .05 level, with a very large effect size (d = 2.57). Similarly, innovative thinking skills significantly improved, with a very large effect size (d = 2.14). Students' perceptions of their innovative thinking skills were rated at a high level after the intervention.

Keywords: Design thinking, Innovative thinking, Learning activity, English for communication, Learning achievement

Introduction

In today's rapidly changing society, innovative thinking skills are important skills for undergraduate students' lifelong development. Educational management in Thailand emphasizes the importance of cultivating undergraduate students who possess 21st-century skills as well as academic knowledge. Among 21st-century skills, innovative thinking skills are recognized as essential skills for success in an increasingly complex, dynamic, and innovation-driven global economy (Avcı & Durak, 2023; Gregory et al., 2013). Innovative thinking skills not only enable undergraduate students to generate new ideas and solve real-world problems but also integrates creativity, critical analysis, and collaborative problem-solving skills which are considered essential for qualified graduates to compete in a labor market. Innovative thinking skills refer to the capacity to generate new ideas that address specific needs and can be adapted to diverse contexts and working environments. Individuals with innovative thinking abilities are capable to resolve complex problems and adjusting their knowledge and perceptions by leveraging existing resources (Hart, 1996). It is a process of solving problems in novel and original way, which is not restricted by existing conventional thinking. According to Swallow (2012), innovative thinking skills comprise core competencies of questioning, observing, experimenting, networking, and associating. These skills enable undergraduate students to frame problems creatively, recognize patterns across disciplines, and develop original solutions. Therefore, Innovative thinking skills are essential skills that integrates creativity, analytical reasoning, and problem-solving. Undergraduate students with such abilities can generate, refine, analyze, and evaluate ideas to enhance existing concepts. From a social standpoint, they are also able to collaborate effectively with others, communicate and articulate new ideas clearly, consider diverse perspectives, understand real-world conditions, and produce applicable outcomes. As a critical competency, innovative thinking promotes creativity and problem-solving across various domains, including education, society, and the economy, contributing significantly to personal development and societal advancement. However, traditional educational management often emphasizes knowledge mastery while neglecting the assessment of undergraduate students' thinking abilities (Gao, 2023), which contributes to the under development of innovative thinking skills among Thai undergraduate students. According to Klinart (2019), many Thai undergraduate students have difficulty applying what they learn in class to real-world problems and lack the habits of questioning, experimenting, and networking that are key to innovation. As a result, it is urgent to adopt teaching methods that encourage undergraduate students to build these abilities so they can compete successfully in today's fast-changing job market.

Design Thinking is a human-centered approach that has been proven effective in promoting both deep learning and the development of creative thinking skills (Brown, 2009). Its procedure consists of five stages; empathize, define, ideate, prototype and test. This process of design thinking approach can be integrated in educational learning activities. This approach has been utilized as an effective learning tools to promote undergraduate students' understanding in multidisciplinary, fosters meaning learning with real-world experiences extensively (Carroll, et al., 2010). The design thinking process focuses on empathizing with users, clearly defining problems, generating creative ideas, prototyping, and testing solutions to refine them based on real-world needs. It also provides learners with opportunities to address real-world challenges and bridges the gap between theoretical knowledge and practical application.

Although Design Thinking has been widely recognized as an effective approach for fostering creativity and problem-solving skills, existing research has primarily focused on general education and business-related disciplines. Empirical studies examining the integration

of Design Thinking activities in English language learning contexts, particularly in English for Communication courses related to the service industry, remain limited. This gap is significant because English major undergraduate students must develop not only language proficiency but also innovative thinking skills to effectively communicate and respond to complex, real-world professional situations. Moreover, there is a lack of empirical evidence investigating the simultaneous impact of Design Thinking activities on both learning achievement and innovative thinking skills among English major students in higher education, especially within the Thai educational context. Addressing this gap, the present study integrates Design Thinking activities into an English for Communication in the Service Industry course and empirically examines their effects on students' learning achievement and innovative thinking skills. By doing so, this study contributes to the existing body of knowledge by extending the application of Design Thinking to English language education in a discipline-specific context and providing empirical evidence to support its effectiveness in promoting both cognitive and innovative skill development among undergraduate English major students.

Thus, this research aimed to compare undergraduate students' learning achievement and innovative thinking skills before and after learning through design thinking activities in the English for communication of service industry course and to study undergraduate students' self-evaluation on their innovative thinking skill after participating in design thinking activities. The findings of this study are expected to contribute to the development of an effective instructional approach that meets the needs of learners and prepare undergraduate students' readiness to be qualified graduates, aligned with demands of competitive labor market, enabling undergraduate students to develop themselves in education and career in the future.

Objectives

1. To compare undergraduate students' learning achievement before and after learning through design thinking activities.

2. To compare undergraduate students' innovative thinking skills before and after learning through design thinking activities.

3. To investigate undergraduate students' self-perceived innovative thinking skills after engaging in design thinking activities.

Research Hypotheses

H_{o1}: There is no statistically significant difference in undergraduate students' learning achievement before and after learning through design thinking activities.

H_{11}: Undergraduate students' learning achievement after learning through design thinking activities is significantly higher than before learning through design thinking activities.

H_{o2}: There is no statistically significant difference in undergraduate students' innovative thinking skills before and after learning through design thinking activities.

H_{12}: Undergraduate students' innovative thinking skills after learning through design thinking activities are significantly higher than before learning through design thinking activities.

Conceptual Framework

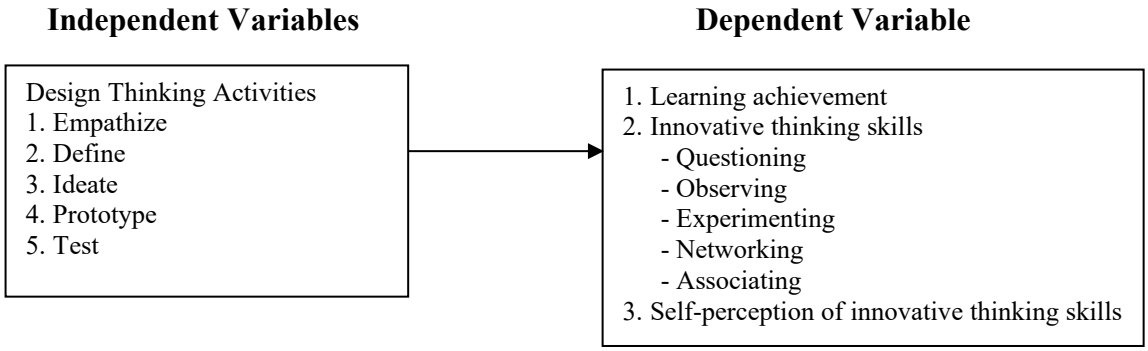


Figure 1 Conceptual Framework (Source: Researcher, 2025)

Methodology

Population and Samples

The population for this research consisted of 62 fourth-year English major undergraduate students at Chiang Mai Rajabhat University. The sample group, obtained through total population sampling, included 59 undergraduate students majoring in English (95.1% of the population) enrolled in the English for Communication in the Service Industry course during the 2024 academic year. Prior to data collection, the research procedures were reviewed and approved by the Institutional Review Board (IRB) of Chiang Mai Rajabhat University (Certificate No. IRBCMRU 2024/258.14.06). All participants were informed of the study's objectives, and written consent was obtained to ensure voluntary participation and the confidentiality of their responses.

Research Instruments

The research instruments in this study consisted of the following:

1. The design thinking activity plans were designed to cover the context of English for communication in the service industry, with an implementation period of 30 hours. The topics included 1) Understanding customer needs in the service business 2) Solving problems for passengers at the airport 3) Managing car rental services 4) Elevating customer experience at the hotel and 5) Designing travel packages. These activity plans served as the instructional intervention to enhance students' learning achievement and innovative thinking skills, and to provide experiences that enabled students to reflect on their innovative thinking skills.

2. The learning achievement test consisted of 20 multiple-choice items. It was developed to measure undergraduate students' learning achievement in the English for Communication in the Service Industry course. The test was utilized as both a pretest and a posttest to compare students' learning achievement before and after participating in the design thinking activities.

3. The innovative thinking skills test consisted of 20 multiple-choice items. It was constructed to assess undergraduate students' innovative thinking skills in applying English for communication in service industry contexts. The test was administered before and after the implementation of the design thinking activities to compare students' innovative thinking skills.

4. The self-perceived innovative thinking skills questionnaire was developed as a five-point Likert scale instrument to investigate undergraduate students' self-perceived innovative thinking skills after participating in the design thinking activities. The questionnaire covered

five key areas of innovation thinking skills: questioning, observing, experimenting, networking, and associating.

Research Instruments Development and Validation

1. The design thinking activity plans in the English for Communication in the Service Industry course were evaluated by three experts in curriculum development, language teaching and learning, and English language teaching. The Index of Item-Objective Congruence (IOC) was used to assess the alignment between the activity components and the learning objectives. The IOC values of the design thinking activity plans ranged from 0.67 to 1.00, indicating acceptable to excellent content validity. After expert validation, the activity plans were piloted with 12 undergraduate students representing different English proficiency levels based on the Common European Framework of Reference for Languages (CEFR), including levels A2, B1, and B2, as determined by the university's English proficiency placement records. The pilot test was conducted to evaluate the clarity, feasibility, and suitability of the activities for students with varying proficiency levels. Based on the pilot results, the activity plans were revised and refined before implementation with the sample group.

2. The learning achievement test was developed to measure undergraduate students' learning achievement in the English for Communication in the Service Industry course before and after participation in the Design Thinking activities. The instrument was constructed in alignment with the course learning objectives and the research objectives. To establish content validity, the test was evaluated by three experts in English language teaching, curriculum design, and educational assessment. The evaluation focused on content relevance, clarity of language, and alignment between the test items and the intended learning outcomes. The Index of Item-Objective Congruence (IOC) values ranged from 0.67 to 1.00, indicating acceptable content validity. Subsequently, the instrument was pilot tested with 30 undergraduate students representing different English proficiency levels (A2, B1, and B2) according to the Common European Framework of Reference for Languages (CEFR). These students were comparable to the target population but were not included in the main study sample. The internal consistency reliability was calculated using the Kuder–Richardson Formula 20 (KR-20), yielding a coefficient of 0.74, which indicates acceptable reliability for research purposes (Nunnally & Bernstein, 1994). Based on the pilot results, the test was revised prior to its administration as a pretest and posttest in the main study.

3. The innovative thinking skills test was developed to assess undergraduate students' innovative thinking skills in applying English for communication in service industry contexts. The test was evaluated by three experts in English language teaching, curriculum design, and educational assessment to ensure content validity, appropriateness of language, and alignment with the research objective. The Index of Item-Objective Congruence (IOC) values ranged from 0.67 to 1.00, indicating acceptable content validity. The test was piloted with 30 undergraduate students representing CEFR proficiency levels A2, B1, and B2. Internal consistency reliability was determined using the Kuder–Richardson Formula 20 (KR-20), resulting in a coefficient of 0.79, which demonstrates acceptable reliability (Nunnally & Bernstein, 1994). Following the pilot analysis, necessary revisions were made to improve item clarity and overall test quality prior to implementation with the sample group.

4. A self-perceived innovative thinking skills questionnaire was validated by three experts. The content validity, appropriateness of language use, and the congruence between learning objectives and test items were evaluated. The Index of Item-Objective Congruence (IOC) was calculated to ensure alignment between the items and the objectives. The self-perception of Innovative thinking skills questionnaire was then piloted with 30 undergraduate students representing different English proficiency levels based on the Common European Framework of Reference for Languages (CEFR), including A2, B1, and B2 levels to assess

clarity and preliminary internal consistency. Cronbach's alpha coefficient was 0.91. Then the self-perceived innovative thinking skills questionnaire was revised before implementing with the sample group.

Data Collection

The data in this study were collected through the following steps. First, the researcher explained the objectives and content of the English for Communication in the Service Industry course, along with the procedures of the design thinking activities, to the participants. Next, the undergraduate students' prior knowledge in English for communication in the service industry and their innovative thinking skills were assessed using a learning achievement test developed for the course and an innovative thinking skills test before participating in the activities. The undergraduate students then took part in 30 hours of design thinking activities within the course, following the five stages of the design thinking approach: empathize, define, ideate, prototype, and test. After completing the activities, the undergraduate students' learning achievement and innovative thinking skills were reassessed using the same tests. Additionally, the undergraduate students evaluated their own innovative thinking skills through a self-assessment questionnaire after engaging in the design thinking activities. Finally, the collected data were analyzed using statistical methods.

Data Analysis

1. To compare undergraduate students' learning achievement before and after learning through design thinking activities, the scores obtained from the learning achievement test, administered as a pretest and posttest, were analyzed using descriptive and inferential statistics. The mean, standard deviation, and percentage were calculated to describe students' learning achievement. A dependent samples t-test was used to examine whether there was a statistically significant difference between the pretest and posttest scores. In addition, Cohen's d was calculated to determine the effect size and to measure the magnitude of the difference between pretest and posttest scores. The effect size was interpreted according to Cohen (1988) as follows: 0.20 = small effect, 0.50 = medium effect, and 0.80 or higher = large effect.

2. To compare undergraduate students' innovative thinking skills before and after learning through design thinking activities, the scores from the innovative thinking skills test, administered as a pretest and posttest, were analyzed using mean, standard deviation, and percentage. A dependent samples t-test was conducted to determine whether there was a statistically significant difference between students' pretest and posttest scores. Additionally, students' innovative thinking skills were classified into four-skill levels based on percentage scores, according to the criteria proposed by Harris (1969), as follows:

80–100% = Excellent
60–79% = Good
50–59% = Average
0–49% = Poor

Cohen's d was also calculated to examine the magnitude of the effect of design thinking activities on students' innovative thinking skills.

3. To investigate undergraduate students' self-perceived innovative thinking skills after participating in the design thinking activities, the data obtained from the self-assessment questionnaire were analyzed using mean and standard deviation. The interpretation of students' self-perceived innovative thinking skills was based on the following five-point Likert scale criteria:

4.51–5.00 = Highest level
3.51–4.50 = High level
2.51–3.50 = Moderate level
1.51–2.50 = Low level
1.00–1.50 = Lowest level

Results

1. The results in Table 1 show that the undergraduate students' mean score on the learning achievement test before participating in the Design Thinking-based activities was 11.05 (SD = 1.45) out of a total score of 20. After the intervention, the mean score increased to 16.20 (SD = 2.27). A dependent-samples t-test indicated that the post-test scores were significantly higher than the pre-test scores, $t(58) = 19.72$, $p < .001$. In addition, the effect size calculated using Cohen's d was 2.57, which is considered a very large effect according to Jacob Cohen (1988). This finding suggests that participation in the Design Thinking-based activities was associated with a substantial improvement in undergraduate students' learning achievement in the English for Communication in the Service Industry course.

Table 1 Comparative analysis of students' learning achievement scores before and after learning through Design Thinking activities

Learning achievement test	N	Total scores	$\overline{X}$	S.D.	t	P	Cohen's d
Pre-test	59	20	11.05	1.45	19.72*	0.001	
Post-test	59	20	16.20	2.27			2.57

*p < 0.05

2. The undergraduate students' pre-test scores of innovative thinking skills in the English for Communication in the Service Industry course had a mean of 9.41 and a standard deviation of 1.75. While the post-test scores had a mean of 13.85 and a standard deviation of 1.96. This indicates that the undergraduate students' innovative thinking abilities after participating in design thinking activities was significantly higher than before, at the .05 level of statistical significance. The effect size for this improvement was very large (Cohen's d = 2.14), suggesting that the Design Thinking activities were highly effective in developing undergraduate students' innovative thinking skills, as presented in table 2.

Table 2 Comparative analysis of undergraduate students' innovative thinking skills scores before and after learning through design thinking activities

Innovative thinking test	N	Total scores	$\overline{X}$	S.D.	t	P	Cohen's d
Pre-test	59	20	9.41	1.75	16.41*	0.001	
Post-test	59	20	13.85	1.96			2.14

*p < 0.05

3. According to the data in table 3, it compares undergraduate students' sub-elements of innovative thinking skills before and after learning through design thinking activities. Before learning through design thinking activities, undergraduate students' observing skills was at an average level. Meanwhile, the questioning, experimenting, networking and associating were at a poor level. After the intervention, every element of undergraduate students' innovative thinking skills improved to a good level. For questioning skill, the mean score improved from 1.98 (SD = 0.66, 49.50%) to 2.56 (SD = 0.62, 64.00%), resulting in a difference of +0.58. Similarly, observing skill mean scores increased from 2.17 (SD = 0.62, 54.25%) to 2.58 (SD = 0.65, 64.50%), with a difference of +0.41. The skill of experimenting rose from 1.92 (SD = 0.53, 48.00%) to 2.53 (SD = 0.60, 63.25%), with a difference of +0.61. Notably, the highest gained scores were observed in associating and networking skills. Therefore, these outcomes support the effectiveness of the design thinking activities in fostering innovative thinking skills among undergraduate students.

Table 3 A comparative analysis of undergraduate students' innovative thinking skills presented in sub-skills before and after learning through design thinking activities

Innovative thinking skills	Scores 20	Pre-test				Post-test				Difference (Post – Pre)
		$\overline{X}$	S.D.	%	level	$\overline{X}$	S.D.	%	Level	
Questioning	4	1.98	0.66	49.50	Poor	2.56	0.62	64.00	Good	+0.58
Observing	4	2.17	0.62	54.25	Average	2.58	0.65	64.50	Good	+0.41
Experimenting	4	1.92	0.53	48.00	Poor	2.53	0.60	63.25	Good	+0.61
Networking	4	1.81	0.51	45.25	Poor	3.02	0.78	75.50	Good	+1.21
Associating	4	1.53	0.54	38.25	Poor	3.17	0.70	79.25	Good	+1.64

4. The undergraduate students' overall self-perceived innovative thinking skills after participating in design thinking activities was at a high level, with a mean score of 3.88 and a standard deviation of 0.72. When ranking the innovative thinking skills by their mean scores, the highest was networking skills, rated at a high level with a mean score of 4.27 and a standard deviation of 0.11. This was followed by associating skills (mean = 3.94, SD = 0.89), questioning skills (mean = 3.82, SD = 0.49), experimenting skills (mean = 3.72, SD = 0.06), and finally, observing skills (mean = 3.68, SD = 0.30), respectively. When considering individual items, the three highest mean scores were: (1) the ability to listen to others' opinions (mean = 4.59), (2) the ability to develop new concepts or knowledge by making connections (mean = 4.54), and (3) the ability to interact effectively with stakeholders (mean = 4.53), as shown in table 4.

Table 4 Analysis of the mean and standard deviation of undergraduate students' self-perceived innovative thinking skills after learning through design thinking activities

No.	Innovative thinking self-assessment topics	$\overline{X}$	S.D.	Opinion level	Ranking
Questioning skill					
1	I can ask questions that align directly with the objectives of the teaching and learning activities.	3.80	0.64	High	3
2	I can ask questions that relate to problem-solving approaches.	3.78	0.70	High	4
3	I can ask questions that stimulate participatory thinking.	3.81	0.75	High	2
4	I can ask questions that lead to problem-solving or the creation of new ideas in a clear and focused manner.	3.90	0.71	High	1
	Overall score of questioning skill	**3.82**	**0.49**	**High**	
Observing skill					
5	The data from my observation is accurate and complete.	3.59	0.68	High	4
6	I can define details of customer problems in the target group within the service industry.	3.63	0.74	High	3
7	I can take notes and summarize data from observation clearly and completely.	3.80	0.74	High	1
8	I can use details obtained from observations in the design and development of innovations	3.69	0.77	High	2
	Overall score of observing skill	**3.68**	**0.30**	**High**	

Table 4 Analysis of the mean and standard deviation of undergraduate students' self-perceived innovative thinking skills after learning through design thinking activities (Continued)

No.	Innovative thinking self-assessment topics	$\bar{X}$	S.D.	Opinion level	Ranking
Experimenting skill					
9	I can formulate hypotheses.	3.85	0.74	High	1
10	I can create innovative prototypes.	3.56	0.70	High	4
11	I can conduct experiments to solve problems or create new things accurately and systematically.	3.73	0.83	High	3
12	I can evaluate the results of experiments.	3.75	0.80	High	2
	Overall score of experimenting skill	**3.72**	**0.06**	**High**	
Networking skill					
13	I share knowledge and experiences with others regarding problem-solving.	4.07	0.74	High	3
14	I interact with relevant stakeholders in the service industry.	4.53	0.54	Highest	2
15	I create new products or service process with clear and concise communication.	3.88	0.77	High	4
16	I am willing to listen to others' opinions.	4.59	0.62	Highest	1
	Overall score of networking skill	**4.27**	**0.11**	**High**	
Associating skill					
17	I can connect concepts, principles, and processes to solve problems or create new things.	3.92	0.79	High	2
18	I can integrate knowledge from different disciplines.	3.61	0.77	High	4
19	I can connect ideas from innovative prototypes.	3.68	0.75	High	3
20	I can generate new ideas or knowledge in an integrated way.	4.54	0.60	Highest	1
	Overall score of Associating skill	**3.94**	**0.89**	**High**	
	Overall	**3.88**	**0.72**	**High**	

Discussions

According to the research findings, the results can be discussed as follows:

1. The undergraduate students' learning achievement was significantly improved after learning through design thinking activities in the English for Communication in the Service Industry course. This improvement may be due to the design thinking activities follow a learner-centered approach which encourages undergraduate students to actively participate in classroom. It emphasizes questioning and information gathering to construct knowledge independently. In the empathize stage, undergraduate students were required to observe and research information according to the given situations provided in each activity. They gathered relevant information about target customers in the real service industry, such as interviewing tourists or airline passengers, to understand the genuine needs related to products and services. Furthermore, the design thinking activities allowed undergraduate students to think analytically and systematically, using reliable sources of information to identify problems. They exchanged knowledge with peers in small groups to create prototypes of products and services. Knowledge and ideas were then summarized collaboratively with classmates. Meanwhile, the teacher

facilitated undergraduate students by giving advice and feedback on their learning performances. This learning process of design thinking activities enables undergraduate students to improve their learning outcomes effectively according to their own potential. The design thinking activities are relevant to problem-based learning approach which emphasizes collaborative learning, finding solutions in real-world context and constructing new knowledge through self-direct learning. Moreover, the design thinking activities enabled undergraduate students to engage in learning within real-life contexts that closely related to their own experiences in the service industry. Through participation in design thinking activities, undergraduate students constructed their own knowledge and skills by observing, collaborating in group activities, thoughtfully analyzing service industry-related data, and applying the acquired knowledge to classroom tasks. This engagement with real-world experiences, reflection on undergraduate students' own experiences and conceptual development contributed to a deeper understanding, enhanced undergraduate students' critical thinking skills, and improved the ability to transfer knowledge to new situations. The process in the design thinking activities aligns with Kolb's (2014) experiential learning theory, which suggested that learners engage in concrete experiences, reflect on experiences, abstract conceptual knowledge, and actively experiment with the newly acquired knowledge in different contexts. This research result is consistent with the findings of Jones & Peck (2023), who found that design thinking can be effectively applied in higher education instruction, enhancing undergraduate students' academic achievement and their ability to solve problems creatively and effectively. This research result also aligns with the finding of Yu et al. (2024), who examined design thinking's effects on student learning and found that design thinking can significantly enhance various learning outcomes such as creativity, engagement, motivation, problem-solving skills, self-efficacy, and academic achievement which are essential for successful learning.

Nevertheless, the participants in this study were English-major students with proficiency levels ranging from A2 to B2 according to the CEFR framework. As language-specialized students, they may possess relatively strong motivation toward English learning and professional communication compared to students from other academic disciplines. This motivational orientation may have interacted positively with the design thinking activities, thereby enhancing engagement and contributing to the significant improvement observed in posttest scores. Consequently, the positive outcomes reported in this study may partially reflect the participants' disciplinary background and may not be fully generalizable to non-English-major populations. Furthermore, the successful implementation of design thinking requires learners to engage in brainstorming, collaborative inquiry, problem analysis, and oral presentation—processes that presuppose adequate linguistic competence. Learners at lower proficiency levels, particularly students at the A1 CEFR level, may experience cognitive overload when required to manage simultaneous language production and higher-order thinking tasks. Therefore, effectiveness of design thinking in English for Specific Purposes contexts may be influenced by students' language proficiency, suggesting the need for proficiency-sensitive scaffolding when applying this approach in lower-level settings.

2. The undergraduate students' innovative thinking skills scores after learning through design thinking activities in the English for Communication in the Service Industry course were significantly higher than the pre-test scores. When considering each of the five subskills of the undergraduate students' innovative thinking; questioning, observing, experimenting, networking, and associating, it showed positive gains from pre-test to post-test, indicating the effectiveness of the design thinking activities. Among the five skills assessed, associating and networking gained the most points. Firstly, the undergraduate students' questioning skill improved from an average to a good level. This aligns with Dyer et al. (2011) assertion that questioning is foundational to disruptive innovation, as it challenges existing assumptions and

sparks new ideas. Encouraging undergraduate students to formulate their own questions likely contributed to questioning skill development. The observing skill also increased from an average to a good level. Observation is critical in identifying unmet needs and opportunities (Brown, 2009). The undergraduate students' attention to detail may have been enhanced by hands-on activities and field-based tasks used in design thinking activities, as suggested by Liedtka (2015), who emphasized observation as a core practice in design thinking. The undergraduate students' experimenting skill showed a notable rise from poor to good level. Experimentation fosters creative confidence, allowing learners to test and refine ideas through trial and error (Kelley & Kelley, 2013). This result is consistent with findings by Seelig (2012), who highlighted that practical experiments help unlock innovative potential in educational contexts. A significant increase was observed in the networking skill, which improved from poor to good level. This could be attributed to the activities in the Ideate stage that encourage undergraduate students to brainstorm and exchange ideas in small groups actively. These sessions encouraged knowledge sharing and integration of diverse perspectives in a positive learning environment. It promotes undergraduate students' idea networking skill which contributes to the development of problem-solving abilities and enhances creativity by encouraging openness to diverse perspectives. According to Sawhney et al. (2006), networking expands exposure to diverse perspectives, which is essential for innovation. Moreover, the collaborative group projects in design thinking activities provide more opportunities for interaction and knowledge exchange. In terms of idea associating skill, the greatest improvement showed in undergraduate students' associating skill, which rose from poor to good level. This may be because the design thinking process allowed undergraduate students to connect information and ideas from various sources and different contexts to generate new ideas. According to Dyer et al. (2011), associational thinking is the ability to connect seemingly unrelated concepts, and was identified as the most powerful skill among innovators. Associational thinking enables undergraduate students to see relationships between different data points, which can lead to the development of effective innovations. This remarkable gain suggests that the integrated tasks and cross-disciplinary in design thinking activities encouraged undergraduate students to form new idea connections, leading to the ability of innovative thinking. This research result confirms the findings of Gao & Jeong (2024) who study the impacts of design thinking on the creativity of college students majoring in art and design and found that design thinking stimulates innovative thinking, encourages students to think outside the box and develop new ideas. It improves undergraduate students' practical operation ability when they are required to create projects. These findings also align with the study of Ravankar et al. (2018), who identified associational thinking as a fundamental component of innovation, as it allows individuals to integrate knowledge from various disciplines. Similarly, Christensen et al. (2013) emphasized that exposure to ideas from various fields enhances cognitive flexibility and fosters creative problem-solving skills.

3. The undergraduate students' self-perceived innovative thinking skills overall were at a high level. Among the dimensions, undergraduate students rated their networking skill at the highest mean score. The undergraduate students were willing to listen to others' opinions and interacted with relevant stakeholders in the service industry at the highest level. This aligns with Chesbrough's (2003) argument that open innovation is driven by strong collaborations and alliances outside the organization. This research result suggests that undergraduate students value collaboration and open dialogue, which are crucial in the service industry where customer-centered innovations often emerge from stakeholder interactions (Tidd & Bessant, 2018). Furthermore, the associating skill was ranked second, with the highest score on the item of being able to generate new ideas and knowledge in an integrated way. This research finding supports the idea that innovative thinkers are skilled at linking unrelated concepts to generate new solutions (Dyer et al., 2011). The strong performance in associating skill indicates that

undergraduate students are capable of synthesizing knowledge across disciplines, a competence increasingly necessary in the era of cross-sectoral innovation (Crossan & Apaydin, 2010). Additionally, undergraduate students rated their questioning skill at a high level. This may be attributed to the characteristics of the design thinking process, which begins with the empathy stage, requiring undergraduate students to engage in extensive questioning to understand users' needs and problems. As effective questioning enables undergraduate students to gather essential information and develop innovative solutions (Brown, 2009; Cross, 2023). This finding is consistent with the study of Alaimi et al. (2020), who found that learners who engage in systematic questioning during the define stage of design thinking activities tend to demonstrate greater creativity and critical thinking abilities. Meanwhile, undergraduate students' experimenting skill was rated at a high level. The undergraduate students found themselves to be able to formulate hypotheses, innovate prototypes, test their developed products or service process to solve problems according to the given situations in service industry to meet the target customers' needs systematically. The repeated experimentation in design thinking activities encourages undergraduate students to learn from failures and improve their concepts. This process fosters flexibility, adaptability, and an attitude that embraces failure as part of learning—an essential aspect of innovation development (Holmes et al., 2015). The undergraduate students who engage in an experimental design process are better equipped to develop their problem-solving and innovation capabilities (Brown, 2020). The undergraduate students evaluated their observing skill at a high level. They could observe data accurately and thoroughly, also identify problems and needs of target customers in service industry context in details. They could apply the details obtained to design and develop innovative products or service models that meet the needs of target customers. As during the empathize stage of design thinking activities, undergraduate students were required to observe and analyze customer behaviors to gain insight information in order to understand real needs of the target customers. This process of design thinking develops undergraduate students' observing skill, encourage them to understand problems in various perspectives which is an essential foundation for innovative ideas development. According to Martin (2009), elaborate observation fosters critical awareness and creative thinking. Observing real-life situations enables undergraduate students to uncover problems that might not be identified through only theoretical study.

Conclusion and suggestions

This study investigated the effects of design thinking activities on undergraduate students' learning achievement and innovative thinking skills in the English for Communication in the Service Industry course. The findings revealed that undergraduate students' learning achievement significantly improved after participating in the design thinking activities. This indicates that design thinking activities can effectively enhance students' understanding and application of English in service industry contexts. In addition, undergraduate students' innovative thinking skills significantly improved after the implementation of design thinking activities. The findings suggest that design thinking provides meaningful learning experiences that promote students' ability to analyze problems, generate ideas, and develop appropriate solutions in real-world communication situations.

Furthermore, undergraduate students reported a high level of self-perceived innovative thinking skills after participating in the design thinking activities. This reflects that the learning activities supported students' confidence in their ability to apply innovative thinking processes, including questioning, observing, experimenting, networking, and associating. Overall, the findings confirm that integrating design thinking into English language instruction can

effectively promote both learning achievement and innovative thinking skills among undergraduate students in the service industry context.

Based on the findings, design thinking can be effectively integrated into English language teaching to enhance both learning achievement and innovative thinking skills. Instructors are encouraged to provide opportunities for students to express their ideas, participate in collaborative problem-solving, and engage in real-world service scenarios, as these are essential components of the design thinking process. Additionally, the use of visual thinking tools, such as mind maps, journey maps, and concept diagrams, is recommended to help students organize their ideas, simplify complex information, and recognize relationships between concepts. Furthermore, grouping students with different proficiency levels is suggested, as mixed-ability grouping can promote peer learning, collaboration, and mutual support during the design thinking process.

Future research is recommended to integrate design thinking with other instructional approaches, such as problem-based learning or case-based learning, to examine their combined effects on students' learning achievement and higher-order thinking skills. Further studies should also investigate the impact of design thinking activities on other essential skills, including creativity, problem-solving, communication, and teamwork skills. In addition, future research should employ more rigorous research designs, such as quasi-experimental or experimental designs with control groups, to strengthen causal conclusions. Expanding the sample size and including participants from multiple institutions is also recommended to enhance the generalizability of the findings across different educational contexts.

Limitations of the Study

This study employed a one-group pretest–posttest design without a control group, which limits the ability to attribute the observed improvements solely to the design thinking activities. External factors, such as prior knowledge and learning experiences, may have influenced the results. Therefore, future research should adopt more robust research designs to improve internal validity.

Additionally, the study relied primarily on test scores and self-assessment questionnaires to measure students' learning achievement and innovative thinking skills. Future studies are encouraged to incorporate performance-based assessments, such as project evaluations, presentations, or authentic tasks, to provide more comprehensive evidence of students' abilities. Finally, the sample consisted of undergraduate students from a single university, which may limit the generalizability of the findings. Future research should include larger and more diverse samples from multiple institutions to enhance external validity.

New knowledge and the effects on society and communities

This research contributes new knowledge to the field of English language education by empirically investigating the structured integration of Design Thinking within an English for Specific Purposes English for specific purposes course focused on the service industry. Although prior studies have examined design thinking in general education contexts, limited research has explored its systematic application in English major programs aimed at simultaneously developing communicative competence and innovative thinking skills in authentic service-industry settings. By addressing this gap, the study advances existing knowledge through the development and validation of a Design Thinking-based instructional model tailored specifically to an English for Communication in the Service Industry course.

The findings provide empirical evidence that structured design thinking activities are associated with substantial improvements in students' learning achievement and innovative

thinking skills. Beyond demonstrating instructional effectiveness, the study extends theoretical understanding by showing how the five stages of the design thinking process can be pedagogically aligned with English for specific purposes learning objectives and core innovation skill dimensions. In doing so, it positions design thinking as an integrative framework through which language education and innovation pedagogy can converge. Rather than treating communicative competence and creativity as parallel goals, the instructional model demonstrates how empathy-driven inquiry, stakeholder engagement, collaborative problem definition, ideation, and prototype presentation can function simultaneously as language-learning processes and innovation practices. Within this framework, English serves not merely as a medium of classroom interaction but as a cognitive and professional tool for analyzing user needs, negotiating meaning, generating solutions, and presenting service innovations. This reconceptualization shifts English for specific purposes instruction from discrete language-skill training toward innovation-oriented communicative practice situated in authentic professional contexts.

The study further suggests that the effectiveness of design thinking in English for specific purposes settings may be context-dependent, influenced by learners' disciplinary background and linguistic proficiency. This introduces a nuanced theoretical perspective, indicating that the impact of innovation-based pedagogies in language education may be shaped by learner readiness and professional alignment. Thus, design thinking does not simply enhance language learning outcomes but redefines the functional relationship between communication and innovation within discipline-specific education.

For society and communities, the research highlights the potential of integrating design thinking into English for specific purposes instruction to cultivate graduates who are not only linguistically competent but also capable of generating context-sensitive service innovations. In service-oriented economies, effective communication and user-centered problem-solving are essential for enhancing customer satisfaction, service quality, and competitive capacity. By equipping undergraduate students with empathy-driven inquiry skills and collaborative innovation practices, the instructional model prepares future professionals to identify community needs, design responsive service solutions, and contribute to sustainable improvements in local and national service sectors. At a broader level, fostering innovative thinking within language education supports workforce development and sustainable growth in knowledge-based service industries.

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