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Enhancing 6Cs Skills through a Transnational Design Thinking Online Program in Higher Education Program among Thai and Taiwanese EFL Learners

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Abstract

The objectives of this research were to 1) analyze and compare the levels of the 6Cs skills perceived by EFL students before and after participating in the transnational design thinking online program in higher education, and 2) to examine the concordance between

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facilitators' evaluation and students' self-assessment regarding 6Cs skills following participationin the program for 10 days. Using a quantitative approach, the data were collected from 28 Thai and Taiwanese EFL learners from two universities. The research instruments were pre- and post-self-assessments, and facilitators' evaluation. The statistical analysis revealed that students' self-assessment scores before and after the program differed significantly at the 0.05 level. The average scores after the program improved in the following areas: communication skills, critical thinking and problem-solving skills, creativity and innovation skills, and conceptual understanding, respectively. However, there was no significant difference in the average scores for collaboration and intercultural communication skills before and after the program. In addition, when comparing the facilitators' evaluation with the students' post-self-assessment, both showed consistent results. The highest ratings were found in collaboration and intercultural communication skills. Meanwhile, communication, critical thinking and problem-solving, as well as creativity and innovation were rated at a high level. However, the facilitators' evaluation of conceptual understanding differed from the students' post-self-assessment. In conclusion, integrating design thinking into EFL learning can enhance learners' communication, creativity, and collaboration skills, supporting language and skill development. Moreover, implementing ongoing DT cycles and reflection in language classrooms can help cultivate future competencies that support lifelong learning.

Keywords

6Cs skills, Design Thinking, EFL learners, Transnational Higher Education, Online Learning

Introduction

The United Nations' 17 Sustainable Development Goals (SDGs) call for global cooperation to reduce poverty, improve health and education, promote equity and economic growth, and protect the environment (United Nations, 2015). Higher education institutions play a vital role in achieving these goals by integrating them into their missions, research, and teaching, a practice known as Education for the SDGs (ESDGs), which prepares learners to support sustainable development (Sustainable Development Solutions Network, 2020). In particular, it focuses on a range of cross-cutting skills and core competencies essential for all learners to effectively engage with the SDGs. These include Design Thinking (DT), systems and critical thinking, empathy, integrated problem-solving skills, creativity, interdisciplinarity skills,

and entrepreneurial mindsets. It also covers curiosity, collaborative and communication skills, and cross-cultural competence (SDSN, 2020). In addition to this, it is important for universities and higher education institutes to build global partnerships with other universities to strengthen and expand their efforts for a sustainable development. Thus, many universities have merged internationalization with the SDGs by designing co-curricular programs, engaging in collaborative research, and organizing student exchange initiatives to foster interdisciplinary collaboration to sustainability development (Lim, 2024).

English plays a crucial role in the globalization of higher education, supporting the development of internationally minded graduates (Galloway et al., 2017). Based on Kachru's (1985) Three Circles of English, Thailand is categorized within the Expanding Circle, alongside Japan, China, Taiwan and Korea. In the Thai education system, English is taught as a Foreign Language (EFL) at all academic levels, including schools, colleges, and universities. Despite this, Thai EFL learners often face limited opportunities to practice English in everyday situations. To help bridge this gap, many educational institutions have introduced student mobility programs that aim to improve real-life English communication skills, while also nurturing critical global competencies and mindsets.

Transnational education programs are among the best internationalization practices to accelerate education for SDGs. In particular, several educational institutions in Singapore have introduced and conducted these programs with other partner institutions in Asia, emphasizing DT for sustainable innovation. In Thailand, Buphate et al. (2018) reported that such programs significantly enhanced students' English communication skills, understanding of social innovation, critical thinking, and cultural awareness. Similarly, Konchiab and Gunjina (2020) found that these programs also fostered Thai students' collaboration skills throughout the DT process. Notably, English communication skills were most likely improved during the Empathize and Ideate phases, while critical thinking and problem-solving skills were developed mostly during the Prototyping phase.

The effectiveness of DT in cultivating these essential skills has encouraged its integration into EFL learning contexts. For examples, Cleminson and Cowie (2021) applied DT in a Japanese EFL classroom, while Almache-Granda et al. (2024) incorporated it into English language instruction in Ecuador. Kang (2021) used DT to foster autonomous English learning among Korean students, and Buphate and Esteban (2022) implemented DT-based activities focused on the Ideate phase for Thai EFL learners. Despite contextual and methodological

differences, the studies consistently show that DT positively impacts EFL learning by improving language skills, enhancing communication confidence, fostering critical and creative thinking, as well as increasing motivation and positive attitudes.

However, while prior research has primarily focused on the 4Cs: Communication, collaboration, critical thinking and problem-solving, and creativity and innovation, less attention has been given to DT's potential in fostering cross-cultural communication and conceptual understanding. Recent work by Swallow and Tomalin (2024) suggests that DT can enhance intercultural competence through real-world simulations that build learners' confidence in managing diverse communication contexts. Similarly, principles from the Content and Language Integrated Learning (CLIL) approach indicate that DT can support deeper conceptual understanding by linking language use with meaningful content learning. Therefore, exploring DT's impact across the broader 6Cs framework is crucial to provide a more comprehensive understanding of its pedagogical roles in preparing learners for global and interdisciplinary communication in the 21st century.

In this research context, a public university in Thailand conducted a transnational online workshop with a private university in Taiwan in 2022 and again in 2023, known as the Design Thinking x Slow Movement workshops. English was used as the medium of instruction. The workshops focused on sharing knowledge and exchanging expertise in Design Thinking and the Slow Movement approaches, while also developing essential 21st-century skills among Thai and Taiwanese EFL students. In the first 2022 workshop, Yeh and Lin (2023) found that students rated their greatest improvements in English communication, followed by critical thinking, problem-solving, and creativity. However, like many previous studies that rely solely on self-assessment, the lack of comparison with facilitators' evaluations might limits the validity of the findings. Incorporating facilitator perspectives is necessary to provide a more comprehensive understanding of the results (Guaman-Quintanilla et al., 2023). This study aimed to further explore the impact of the 2022 Design Thinking x Slow Movement online workshop by examining both student and facilitator perspectives. The investigation focused on the development of the 6Cs skills, communication, collaboration, critical thinking and problem solving, creativity and innovation, cross-cultural communication, as well as participants' understanding of key concepts.

Objectives

1. To analyze and compare the levels of the 6Cs skills perceived by EFL students before and after participating in the transnational design thinking online workshop.

2. To examine the concordance between facilitators' evaluation and students' self-assessment regarding 6cs skills development following participation in the transnational design thinking online workshop.

Review of Literature

Design Thinking characteristics and process

Today's world is rapidly evolving, often in unpredictable ways, resulting in complex and multi-dimensional challenges known as "wicked problems." Design Thinking presents an innovative approach that cultivates a wide range of skills, expertise, and perspectives; required to address such problems. Firstly, grounded in a human-centered philosophy (Withell & Haigh, 2013), DT prioritizes empathy to gain in-depth understandings of users' contexts, challenges, and needs. Also, DT promotes collaboration among diverse, multidisciplinary teams to generate and refine user-centered solutions (Brown, 2008). The integration of varied expertise contributes to a cohesive outcome. Through co-creation, users are actively involved in Ideate and problem-solving, shifting the approach from designing for users to designing with them. In addition, DT is distinguished by its iterative, non-linear, and adaptive process of Empathize, Define, Ideate, Prototype, and Test (Dam & Siang, 2020) which is well-suited for solving complex, evolving problems and enhancing solution quality through continuous refinement.

Design Thinking and learning theories

Design Thinking (DT) reflects constructivist and experiential learning theories (Withell & Haigh, 2013). It aligns with constructivist principles by promoting a learner-centered approach in which students actively engage in identifying and addressing real-world problems (Koh et al., 2015). Knowledge is meaningfully constructed through hands-on activities, active participation, and reflective practices (Guaman-Quintanilla et al., 2023). Also, DT is aligned with experiential learning by emphasizing the development of understanding through direct experience, experimentation, reflection, and transformation. This process fosters the development of higher-order thinking skills (Withell & Haigh, 2013). In addition, DT aligns closely with lifelong learning theories. Through collaborative problem solving, open-minded ideation, and repeated refinement of solutions, DT encourages growth mindset and

metacognitive awareness, enabling learners to adapt, learn from failures, and continue developing their competencies across different contexts and stages of life (Seevaratnam et al., 2023).

Design Thinking in Education

Design Thinking has been widely recognized as a pedagogical approach to reforming educational paradigms and cultivating essential future-ready competencies. Although originally rooted in design and engineering education, DT has been effectively integrated across a wide range of academic disciplines over the past several decades (Kurokawa, 2013; Razzouk & Shute, 2012). For instance, Stoev et al. (2023) implemented a DT hackathon in Bulgaria to enhance career skills among Computer Science students, leading to improvements in creative thinking, organizational ability, empathy, and teamwork. In Belgium, Guaman-Quintanilla et al. (2023) introduced DT as a mandatory course for first-year students working in multidisciplinary teams, resulting in enhanced problem-solving and creativity skills. Likewise, Indrianto et al. (2024) incorporated DT into community-based tourism education in Indonesia. Their findings indicated that DT facilitated the development of critical thinking and problem-solving abilities, stimulated creative thinking, and promoted a collaborative learning environment.

As DT continues to expand across educational contexts, its application in digital and hybrid formats has also gained increasing attention. highlights both its potential and its challenges in fostering collaborative, creative learning experiences. Vallis and Redmond (2021) showed that even within time and technical constraints, an online DT workshop for first-year business students in Australia effectively cultivated DT skills, process awareness, and mindset transformation. Similarly, Moffett et al. (2024), through a qualitative analysis of students' reflective journals, found that online DT workshops promote teamwork, leadership development, and collaborative engagement. Nonetheless, they also acknowledged challenges such as limited interpersonal connection, fear to speak up, and cultural barriers, all of which can affect student participation and group dynamics in virtual settings. To address these limitations, Minet et al. (2024) proposed a hybrid DT model, based on interviews with 41 DT experts. Their findings suggested that face-to-face settings better support divergent thinking and interaction in Empathize, Ideation, and Prototype phases. In contrast, virtual platforms are more effective for tasks requiring convergent thinking and analysis, particularly in the Define and Prototype phases. Together, these studies indicate that while DT can be

flexibly adapted to various formats, careful consideration of delivery mode is essential to optimize learning outcomes across diverse groups of students.

Design Thinking in Language Education

Design Thinking has been increasingly implemented across various academic disciplines, demonstrating positive effects on learners' communication skills and other essential competencies. However, its direct application in language education remains limited. Existing studies highlight promising but varied outcomes. Cleminson and Cowie (2021) found that DT enhanced collaboration, creativity, and communicative confidence among Japanese EFL learners, while Almache-Granda et al. (2024) reported improvements in vocabulary, writing, and speaking confidence in Ecuador. Kang's (2021) study in Korea showed that DT supported autonomous learning and motivation, despite minimal measurable gains in speaking proficiency. In Thailand, DT-based activities in the Ideate phase improved learners' speaking skills, critical thinking, and attitudes toward language learning (Buphate & Esteban, 2022). These findings suggest that DT can serve not only as a language learning tool but also as a means to enhance a broad range of future-ready competencies in EFL learners. Nonetheless, research remains sparse, particularly in online and transnational contexts where differences in proficiency, cultural diversity, and reduced face-to-face interaction may affect the effectiveness of DT practices.

Design Thinking and the 6Cs Skills

The 6Cs skills, including communication, critical thinking and problem solving, creativity and innovation, collaboration, cross-cultural communication, and conceptual understanding, are essential competencies for success in modern education and work environments. The first four, known as learning and innovation skills (P21, 2019), are closely aligned with the DT process (Jones, 2024). Communication involves expressing ideas clearly and actively listening to others. In DT, communication is a key of team discussions, feedback exchanges, and presentations. Critical thinking and problem solving, including data analysis, idea selection, and informed decisions making, are fostered through problem identification and iterative test. Creativity and innovation cover generating ideas and taking risks to propose solutions. These skills are central to the ideation and prototyping phases of DT. Collaboration involves working respectfully and productively in teams, a core feature of DT, where interdisciplinary cooperation and shared responsibility drive solution development. In addition, cross-cultural communication is increasingly vital in globalized and transnational learning contexts. Design

Thinking projects often require learners from diverse backgrounds to co-construct meaning and navigate intercultural dynamics, fostering empathy and global competence. As Swallow and Tomalin (2024) noted, the DT framework allows learners to develop linguistic and intercultural skills through real-world simulations, boosting their confidence and motivation in challenging intercultural communication contexts. Lastly, conceptual understanding involves grasping underlying principles and transferring knowledge across contexts. Design Thinking supports this through experiential learning, connecting abstract ideas with real-world applications. Together, the 6Cs skills position DT as a powerful framework for cultivating well-rounded, future-ready learners.

Research Methodology

This research adopted a quantitative methodology, aiming to evaluate the 6Cs skill levels of Thai and Taiwanese students by using facilitators' evaluation and students' pre and post self-assessment questionnaires for measuring development of 6Cs skills. Figure 1 presents the conceptual framework of the study, including students' pre-self-assessment prior to participating in the Design Thinking x Slow Movement program. Following the 10-day program, students' post-self-assessment and facilitators' evaluation were examined to assess the development of the 6Cs skills, essential for lifelong learning.

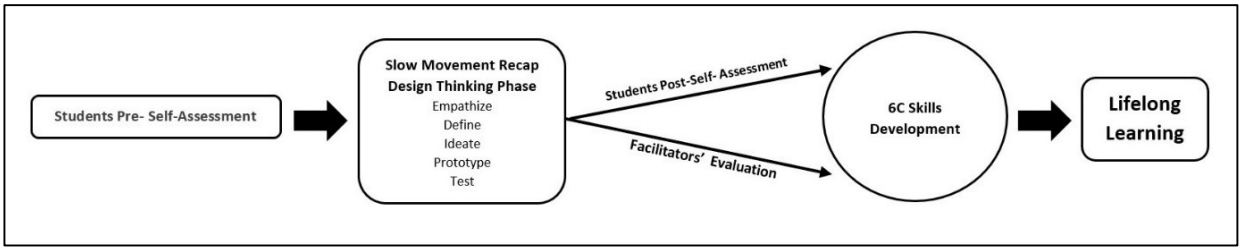

Figure 1: *Conceptual Framework*

Participants

Participants were purposively selected based on their involvement in the 2023 DTxSlow Movement Workshop. Purposive sampling was employed to ensure the inclusion of individuals whose backgrounds and experiences were directly relevant to the study, thereby enhancing data validity and supporting credible conclusions (Memon et al., 2025). Two groups participated: students and facilitators.

The student group consisted of 28 Thai and Taiwanese undergraduates from diverse majors and academic levels. The Thai students (n = 14) majored in International Business

Management, Business English, English for International Communication, Tourism, Interior Architecture, and Business Information Systems. The Taiwanese students (n = 14) majored in International Business, Life and Death Studies, Ethnomusicology, Computer Science and Information Engineering, Visual Arts and Design, Finance, Natural Biotechnology, and Information Management. Their English proficiency ranged from A2 to C1 on the CEFR scale, assessed using the EF SET online test (EF SET, n.d.). All students completed a self-assessment questionnaire before and after the workshop.

The facilitator group included 10 members. Five were certified DT facilitators from Thailand with expertise in Engineering, Business Management, Law, and Language and Communication. The remaining five were lecturers from Taiwan with backgrounds in Natural Biotechnology, Tourism Management, and Sociology. All facilitators had experience with the Slow Movement and had previously served as principal investigators in University Social Responsibility (USR) projects. They guided students through the DT process and SLMM concepts, ensured alignment within teams, and provided continuous feedback. Facilitators were organized into five groups, each supporting student projects that engaged local communities. Three projects in Mae Wang, Chiang Mai focused on waste management, local product marketing, and elderly well-being, while two projects in Dalin, Chiayi addressed slow food and tree frog conservation. Facilitators completed the evaluation at the end of the workshop.

Research Instruments

The instruments used for this research included: (1) pre- and post- workshop self-assessment completed by students to measure the development of the 6Cs skills, and (2) a facilitators' evaluation questionnaire designed to evaluate students' 6Cs skills performance after the workshop. They were adopted and adapted from Konchiab and Gunjina (2020) and Yeh and Lin (2023). Each item asks for five levels of agreement: the most likely agree (5), more likely agree (4), likely agree (3), less likely agree (2), and the least likely agree (1). Content validity was ensured through the Index of Item-Objective Congruence (IOC), reviewed by three experts in teaching and DT. The questionnaires were piloted with five teachers and 10 students to assess its clarity and the respondents' comprehension. They demonstrated high reliability, with a Cronbach's alpha coefficient of 0.964 and 0.970, respectively.

The first attribute was communication skills (C1) consisting of 10 items: English conversation confidence (C1a), willingness to take speaking risks (C1b), use of gestures in

communication (C1c), English writing practice (C1d), message translation ability (C1e), English reading and searching skills (C1f), English Q&A skills (C1g), English listening comprehension (C1h), project presentation in English (C1i), communication negotiation skills (C1j). Secondly, critical thinking and problem-solving skills (C2) involve five items: Idea support reasoning (C2a), systematic thinking (C2b), problem-solving suggestions (C2c), solving unexpected problems (C2d), informed decision-making (C2e). Thirdly, creativity and innovation skills (C3) comprise of five items: Team brainstorming (C3a), idea creation and sharing (C3b), out-of-the-box thinking (C3c), idea development (C3d), openness to new ideas (C3e). Next, collaboration skills (C4) are made up of five items: Teamwork skills (C4a), respect for others' ideas (C4b), shared responsibilities (C4c), team leadership (C4d), team member reliability (C4e). Fifthly, cross-cultural communication skills (C5) include five items: Openness to new cultures (C5a), cultural sharing (C5b), culture comparison (C5c), cross-cultural interaction (C5d), building mutual understanding (C5e). Lastly, conceptual understanding (C6) entails of six items: Slow movement understanding (C6a), slow movement exemplification (C6b), applying slow movement (C6c), DT understanding (C6d), DT process (C6e), and applying DT (C6f).

Data Collection

After receiving ethical approval (RMUTL-IRB 127/2023), all participants provided informed consent confirming their understanding of the research's objectives, procedures, and their rights and roles. Data were collected between November and December 2023 during a transnational online DT workshop. Table 1 outlines the 10-day weekend-based program, supplemented by two weekday site visits and user interviews. Teaching materials included instructional videos, an e-handbook, and task sheets. Google Meet served as the primary platform for synchronous communication, using breakout rooms for group discussions, role assignment, and solution development. Its live discussion and instant feedback kept participants engaged. Miro supported collaborative tasks such as POEMS analysis, interview planning, insight generation, data clustering, persona creation, and ideation through sticky notes and visual mapping. Canva was employed for final presentations.

Table 1 10-Day Transnational Design Thinking Online Program Activities

Stages	Learning outcomes	DT x SLM Activities
Day1: Introduction	● Understand the program's goals and scopes. ● Understand the principles of the Slow Movement.	● Orientation ● Summary of the local community's context ● Lectures: Modern Society and Slow Movement, Slow Travel in Taiwan, Food Diversity in Taiwan and Thailand, Slow Food Movement in Taiwan
Day 2: Empathize	● Understand DT process ● Apply empathy tools to gather user insights.	● DT process Recap ● Observation framework ● Interview techniques
Day 3-4: Empathize	● Collaborate in real-world settings to explore local community contexts in Taiwan and Thailand.	● Activities in the local sites (2 sites in Taiwan, 3 sites in Thailand) ● Conducting interview with locals. ● Online group discussion
Day 5: Define	● Define users' problems and needs based on data analysis.	● Data Clustering ● Insight mining ● User Persona design
Day 6: Ideate	● Generate and select innovative ideas to address community challenges based on SDGs.	● SLM to SDGs positioning ● Brainstorming ideas and selecting the best Ideas ● Creating the raw concept
Day 7: Prototype	● Design prototypes from concepts through visual or physical representation.	● Interpreting selected ideas into tangible models ● Draft initial prototypes
Day 8: Test	● Communicate their design journey and receive constructive feedback from users.	● Get user feedback (Co-creation)
Day 9: Test	● Analyze and integrate user feedback to iteratively improve their prototypes.	● Refine prototypes based on user feedback
Day 10: Presentation	● Demonstrate understanding of DT process and SLM concept.	● Present projects and get feedback from facilitators

Table 1 10-Day Transnational Design Thinking Online Program Activities (Continue)

Stages	Learning outcomes	DT x SLM Activities
	• Reflect on learning process and outcomes.	

The program began on Day 1 with an introduction to the DT framework, the local community context, and the Slow Movement. The Empathize stage (Days 2–4) involved learning and applying observation and interview techniques during fieldwork in Taiwan and Thailand, followed by reflective online discussions. On Day 5, during the Define stage, students synthesized field data, clustered insights, formulated needs statements, and developed user personas. Day 6 focused on the Ideate stage, where students brainstormed, selected, and refined ideas into preliminary concepts, which were then developed into prototypes on Day 7. The Test stage (Days 8–9) involved user engagement and co-creation to collect feedback and iterate on the prototypes. The workshop concluded on Day 10 with final project presentations and facilitator feedback to support deeper learning and reflection.

Data Analysis

1. The facilitators' evaluation and students' self-assessment data were analyzed using mean and standard deviation. The skill levels were categorized as follows:

Table 2 Ranges and Description of Levels for Skill Development

Ranges	Levels of students' skills evaluated by facilitators	Levels of students' skills
4.21–5.00	Very high	Very high
3.41–4.20	Above Average	Above Average
2.61–3.40	Average	Average
1.81–2.60	Below Average	Below Average
1.00–1.80	Very Low	Very Low

2. Additionally, a paired samples t-test was conducted to compare the levels of 6Cs skills before and after the program, identifying significant differences in skill development.

Research Results

1. Research results from students' pre- and post- self-assessment comparison

The results, as shown in Table 3, indicate statistically significant improvements ($p < 0.05$) in four out of the six skills: Communication skills (C1), critical thinking and problem-solving (C2), creativity and innovation (C3), and conceptual understanding (C6). Particularly, there was a notable increase in means scores of communication skills from 3.51 to 4.16. Similarly, critical thinking and problem-solving skills improved from 3.47 to 4.02, and creativity and innovation from 3.83 to 4.21; both with significant t-values.

In contrast, there was no statistically significant difference ($p > 0.05$) between collaboration skills (C4) and cross-cultural communication skills (C5). The former slightly improved from 4.14 to 4.29, and the later increased from 4.44 to 4.51. This means that while most skills improved from the activity, both collaboration and cross-cultural communication might need additional initiative and pedagogical tools to improve the progress.

Table 3 The Results from Students' Pre- and Post- Self-Assessments

6Cs Skills	Self-Assessment	Means	S.D.	t	P-value
C1: Communication skills	Pre	3.51	0.662	-4.30	<0.05
	Post	4.16	0.491		
C2: Critical thinking and problem-solving skills	Pre	3.47	0.667	-3.31	<0.05
	Post	4.02	0.605		
C3: Creativity and innovation skills	Pre	3.83	0.643	-2.78	<0.05
	Post	4.21	0.625		
C4: Collaboration skills	Pre	4.14	0.746	-.96	>0.05
	Post	4.29	0.548		
C5: Cross-cultural communication skills	Pre	4.44	0.580	-.47	>0.05
	Post	4.51	0.585		
C6: Conceptual understanding	Pre	3.82	0.539	-3.02	<0.05
	Post	4.27	0.578		

Table 4 indicates a statistically significant increase in students' perceived 6Cs skill levels after the workshop. The negative t-value reflects the direction of change (Post > Pre), and the p-value < 0.05 confirms that this improvement is significant at the 95% confidence level.

Table 4 Paired Samples Comparison of 6Cs Skills Before and After a Workshop

6Cs Skills	Self-Assessment	Means	S.D.	t	P-value
Paired t-test	Pre	3.87	0.535	-3.004	<0.05
	Post	4.24	0.497		

Furthermore, changes in each attribute group (C1 to C6) are illustrated in Figure 1. All attributes under communication skills (C1) are highly improved, particularly English writing practice (C1d), project presentation in English (C1i), and willingness to take speaking risks (C1b). Similarly, the most highly developed critical thinking and problem-solving skills (C2) included informed decision-making (C2e) and solving unexpected problems (C2d). In terms of creativity and innovation skills (C3), idea creation and sharing (C3b), and openness to new ideas (C3e) stood out with stronger improvements, indicating enhanced confidence in creative skills. Regarding conceptual understanding, students showed clear improvements, especially in understanding Slow Movement (C6a) and Design Thinking (C6d). On the other hand, collaboration skills (C4), particularly in aspects like team member reliability (C4e) and shared responsibilities (C4c) showed only slight changes in average scores, which were not statistically significant. A similar pattern was observed in cross-cultural communication skills (C5), specifically in cross-cultural interaction (C5d) and cultural sharing (C5b). It indicates that DT-based learning effectively builds cognitive and creative abilities, but its influence on collaboration and cross-cultural communication is more limited and may require more sustained or explicitly structured instructional support.

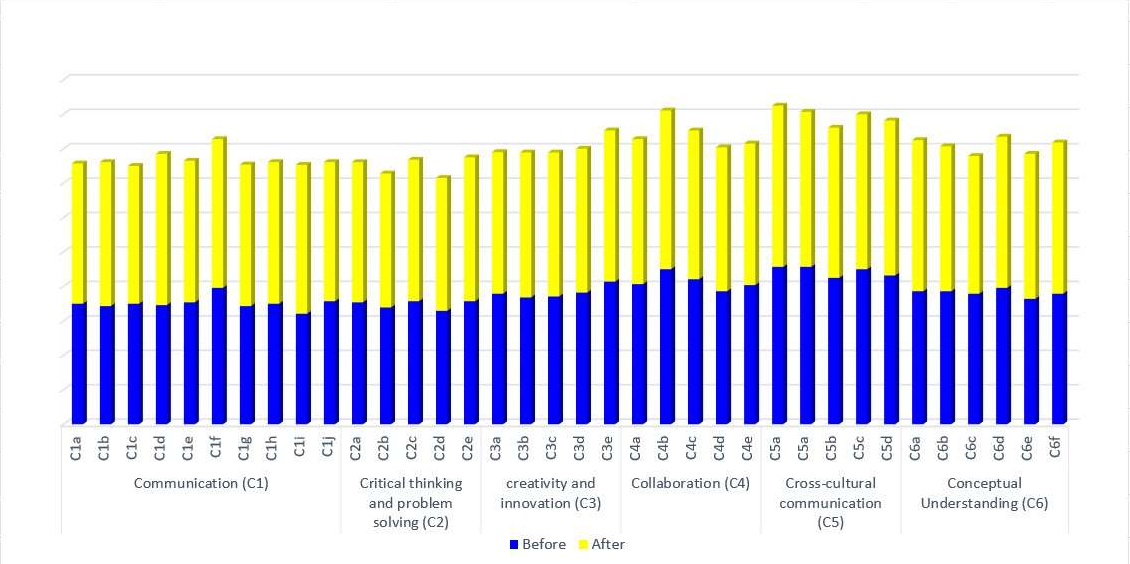

Figure 1: Comparison of Students' Pre- and Post- Self-Assessments of 6Cs Skills

2. Research results from facilitators' evaluation questionnaire for assessing students' 6Cs skills after workshop

The findings show facilitators rated all six skills at above average and very high levels, with mean scores ranging from 3.95 to 4.36. Among these, cross-cultural communication skills (C5) received the highest average score (M = 4.36, S.D. = 0.505). This was followed by collaboration skills (C4) with a mean of 4.30, also rated very high. Creativity and innovation skills (C3) (M = 4.19), critical thinking and problem-solving (C2) (M = 4.00), and communication skills (C1) (M = 3.99) were all classified as an above average, ranked third, fourth, and fifth, respectively. Concept understanding (C6) had the lowest mean score (M = 3.95), but was still considered above average, ranking sixth.

Table 5 The Mean and Standard Deviation of Facilitators' Post-Workshop Assessment on Students' 6Cs Skills.

6Cs Skills	Facilitators' Assessment			Students' Post- Self-Assessment		
	Means	S.D.	Levels of students' skills	Means	S.D.	Levels of students' skills
C1: Communication skills	3.99	0.579	Above Average	4.16	0.491	Above Average
C2: Critical Thinking and Problem-Solving skills	4.00	0.525	Above Average	4.02	0.605	Above Average
C3: Creativity and Innovation skills	4.19	0.496	Above Average	4.21	0.625	Very high
C4: Collaboration skills	4.30	0.661	Very high	4.29	0.548	Very high
C5: Cross-cultural Communication skills	4.36	0.505	Very high	4.51	0.585	Very high
C6: Conceptual Understanding	3.95	0.519	Above Average	4.27 m	0.578	Very high

According to Table 5, both facilitators and students agreed that collaboration skills and cross-cultural communication skills were ranked at a very high level. Collaboration skills (C4) were rated at a very high level, particularly in teamwork (C4a), respect for others' ideas (C4b), and shared responsibilities (C4c). Similarly, there was strong agreement regarding the high levels of all attributes in cross-cultural communication skills (C5), including openness to new cultures (C5a), cultural sharing (C5b), and cross-cultural interaction (C5d). In addition, both groups assessed communication skills and critical thinking and problem-solving skills as above

average. These skills included English conversation confidence (C1a), the use of gestures in communication (C1c), and communication negotiation skills (C1j) as well as problem-solving suggestions (C2c), solving unexpected problems (C2d), and informed decision-making (C2e).

A slight difference was observed in the rating of creativity and innovation skills (C3), with facilitators rating them at above average (M = 4.19), while students perceived these skills at a very high level (M = 4.21), particularly in idea creation and sharing (C3b). However, a more noticeable difference emerged in the rating conceptual understanding (C6). Students rated such skill at a very high level, including slow movement understanding (C6a), slow movement examples (C6b), and applying slow movement (C6c). The comparatively lower ratings for conceptual understanding (C6), particularly from facilitators, point to challenges in achieving deep conceptual transfer in an online format, especially when students engage with unfamiliar concepts such as the Slow Movement.

Discussion

1. The first objective was to compare the levels of the 6Cs skills perceived by EFL students before and after participating in the transnational design thinking online workshop in 2023. According to students' self-assessment, there was a significant improvement in the 6Cs skill levels. Communication, in particular, were the most highly increased skills, mainly those of writing, oral presentation, and the willingness to take risks in speaking. Since the workshop was a transnational program, English served as the primary medium of instruction, and students were required to document interview data, develop Persona profiles, propose solution ideas, and prepare materials for presentations. Each group presented their Persona during the Empathize phase, their design concept during the Ideate phase, the revised prototype, and the overall DT process to the class. In addition, students were encouraged to share and exchange ideas within their teams, fostering a willingness to take communicative risks. This aligns with many previous studies (e.g., Almache-Granda et al., 2023; Cleminson & Cowie, 2021) who argue that DT activities enhance English language skills. Similar to communication skills, students also reported significant improvement in their critical thinking and problem-solving abilities. According to Buphate and Esteban (2022), DT activities, including ideation discussions, brainstorming, and idea selection using 2×2 matrices and weighing scale rubrics, can effectively promote critical thinking. Furthermore, Guaman-Quintanilla et al. (2023)

notes that observation and interviews to gain empathy and define problems contribute to the development of problem-solving skills.

Although no significant improvement was found in collaboration and cross-cultural communication skills, students and facilitators consistently rated both at very high levels. The consistently high ratings in cross-cultural communication may reflect the students' pre-existing motivation and positive attitudes toward international interaction, which are known to enhance perceived communicative competence in EFL contexts (Dörnyei & Csizér, 2002). Likewise, the strong collaboration ratings may be influenced by the collectivist cultural orientations of Taiwanese and Thai students, who typically value group harmony, cooperative work, and interdependence (Oyserman et al., 2020). However, the online workshop format likely limited opportunities for deeper interaction and team-based engagement. As noted by Moffett et al. (2024), virtual DT environments can hinder personal connection and reduce learners' confidence in speaking up, which may constrain genuine collaborative processes despite participants' culturally grounded predispositions toward teamwork.

2. The second objective was to examine the concordance between facilitators' evaluation and students' self-assessment regarding the 6Cs skills after participating in the transnational design thinking online workshop. The findings indicated common perceptions regarding communication, as well as critical thinking and problem-solving skills, which were rated as slightly above average. Both groups noted moderate proficiency in sub-skills such as conversational confidence, use of gestures, and negotiation, suggesting uneven performance likely linked to the students' varied English proficiency levels (A2–C1). As Sándorová et al. (2020) noted, students with lower English proficiency often perceive communicative tasks in DT as demanding and time-intensive, affecting their self-confidence and participation. These findings highlight the importance of implementing English preparatory courses and tailored learning resources to accommodate linguistic diversity. Also, both facilitators and students rated critical thinking and problem-solving skills as above average, indicating room for deeper cognitive engagement. Instructional design should therefore integrate strategies such as divergent and convergent thinking, synthetic and abductive reasoning, reflection, and visualization (Withell & Haigh, 2013), which are foundational not only for DT but also for lifelong learning. Strengthening these skills supports the development of adaptive, self-directed learners capable of navigating complex and uncertain professional environments, an essential component of lifelong learning and social innovation.

Despite areas of agreement, facilitators' post-workshop evaluations tended to be slightly lower than students' self-ratings. In particular, students showed limited understanding of the Slow Movement concept, likely due to unfamiliarity with the topic. Although DT promotes experiential knowledge construction (Guaman-Quintanilla et al., 2023), the fully online format may have constrained real-world engagement with local communities and concrete Slow Movement practices. Cultural factors also play a role: in collectivist contexts, students may overestimate performance to maintain group harmony or present themselves positively, contributing to inflated self-assessments. A hybrid workshop model may therefore offer a more effective balance, enabling deeper conceptual understanding alongside richer interpersonal interaction. As Minet et al. (2024) suggest, hybrid DT formats can better support both divergent and convergent thinking, facilitate sustained collaboration, and foster the co-construction of practical knowledge, conditions essential for cultivating the 6Cs, social innovation competence, and long-term lifelong learning orientations.

Conclusion and Implication

This study presents a critical and innovative approach to EFL learning through the integration of DT. The findings indicate that DT can support the development of the 6Cs skills among EFL learners, particularly in communication, critical thinking and problem-solving, creativity and innovation, and conceptual understanding. The transnational nature of the workshop also highlighted the shared collectivist values of Thai and Taiwanese students, fostering collaboration and cross-cultural awareness that enriched their learning experience. Throughout the DT process, students were able to use and develop English language skills in meaningful, real-world contexts while engaging in interdisciplinary and cross-cultural collaboration. These interactions allowed students to co-construct knowledge and creatively address complex challenges, positioning DT as a valuable framework for promoting authentic and purposeful language use.

Importantly, the outcomes of this study also align with the aims of SDGs and ESDGs. By cultivating competencies such as empathy, collaboration, critical and systems thinking, and intercultural communication, the DTxSlow Movement workshop contributed to the broader set of skills identified by the SDSN (2020) as essential for advancing sustainable development. Moreover, the cross-border partnership between Thai and Taiwanese universities reflects SDG 17's emphasis on strengthening global collaboration in higher education. As such, DT-based

transnational programs represent a promising pedagogical model for preparing learners to engage with sustainability challenges through creativity, social innovation, and globally minded communication.

Limitations and Recommendation

This study has a few limitations. Firstly, the very high pre-assessment scores for collaboration and cross-cultural communication suggest a ceiling effect that may have restricted the detection of post-workshop improvement. Future research should employ more sensitive measurement tools or pre-screening procedures to better capture small gains in high-proficiency skills. Second, the reliance on quantitative data limits understanding of how specific skills developed through the DT process. Incorporating qualitative methods such as reflections, interviews, or analysis of project artifacts would offer deeper insight into the mechanisms of skill growth, including how testing activities support critical thinking or how group presentations enhance communicative confidence. To strengthen the application of DT in EFL education, ongoing DT cycles, English preparation support, and structured reflection are recommended. Future studies should also explore additional competencies, such as digital literacy, intercultural awareness, and growth mindset, to better understand DT's role in fostering transferable skills for lifelong learning.

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