

Research Article

Exploring the Design Thinking Orientation in English as a Foreign Language (EFL) for Learners: An Instrument Development Study

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ORCIDMujiono Mujiono: <https://orcid.org/0000-0003-3014-4673>**Abstract.**

Design thinking has transformed many areas but is still under-researched in English as a Foreign Language (EFL) education. The research aims to develop an instrument for assessing design thinking in the EFL context. The study engaged 107 undergraduate students aged between 18 and 25 years from English-centric programs, ensuring a diverse sample with a balanced gender representation. Participants were briefed about the study's objectives and voluntarily contributed during class hours. Confirmatory factor analysis (CFA) was utilized to assess the instrument's factorial, convergent, and discriminant validity and Cronbach's alpha-gauged internal consistency. Data analysis was executed using AMOS software, focusing on model fit, reliability, and validity. Findings reveal a structured guide to enhance students' understanding of design thinking, emphasizing empathy's central role in innovation. The study exhibits solid reliability and construct validity, with subtle deviations in model alignment. Limitations include sample size, geographical scope, and potential overlook of design thinking dimensions. Future research should explore cross-cultural validations and additional design thinking aspects to enrich understanding.

Keywords: design thinking, instrument development, evaluation

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1. Introduction

Design thinking (DT) has recently profoundly influenced various sectors. From its transformative role in the fashion industry emphasizing sustainable and zero-waste methodologies [1] to its burgeoning influence in civil engineering, accentuating distinct DT traits across varied academic disciplines [2], the universality of DT is undeniable. Grounded in human-centric problem-solving, iterative processes, and a harmonious blend of creativity and analytical prowess, DT offers a fresh paradigm for innovation and problem [3,4].

Concurrently, the global emphasis on English proficiency has surged, with English as a Foreign Language (EFL) education evolving as a pivotal facet of global communication.

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This surge aims to devise innovative methodologies that enhance language acquisition and learner engagement. With English established as the global lingua franca, it is an indispensable tool for international communication, trade, and cultural engagements.

Educators in the EFL domain have harnessed a broad spectrum of pedagogical strategies, ranging from time-tested grammar-translation methods to cutting-edge communicative approaches. The objective remains to ensure effective language acquisition and foster robust learner engagement [5,6]. Nevertheless, EFL learners often confront intricate challenges, from navigating linguistic nuances and grappling with cultural assimilations to surmounting affective barriers such as fluctuating motivation and occasional anxiety [7,8]

Amidst this evolving educational terrain, DT's potential, particularly its ability to nurture critical thinking, spur creativity, and offer holistic problem-solving, has gained traction. The ethos of DT, deeply rooted in human-centricity, resonates profoundly with the modern focus on student-centered pedagogy and experiential learning [9,10]. However, while DT has been assimilated into varied educational contexts, its implications and potential within the EFL milieu still need to be explored. This undercurrent underscores a prominent research gap: the compelling landscape of EFL learning, rife with its unique challenges and opportunities, has yet to be extensively studied through the DT prism.

The present study charts a novel trajectory in response to this research gap. Central to this exploration is crafting a pioneering instrument tailored to evaluate the orientation of EFL learners towards DT. This innovative endeavor transcends capturing mere perceptions. It aims to extract actionable insights that could catalyze a revolutionary integration of DT into EFL curricula, potentially magnifying the EFL learning experience profoundly [11,12].

As global pedagogical paradigms continuously recalibrate to address the multifaceted challenges and imperatives of the 21st century, the confluence of DT and EFL emerges as an intriguing academic horizon. With its unique lens and groundbreaking methodology, this study aspires to shed light upon this nexus, potentially offering transformative pedagogical strategies to reshape the contours of the global EFL pedagogic tapestry.

2. Literature Review

The Evolution of Design Thinking and Its Implications in Education Design Thinking (DT) has emerged from the backdrop of product design methodologies to a broad spectrum of applications, including sectors far removed from Design [1,3]. This innovative

problem-solving methodology places the human experience at the forefront, focusing on empathy and understanding the user's challenges before formulating solutions. DT's iterative process promotes adaptability and constant refinement, which have made it appealing to diverse fields. Notably, the world of education has felt the profound influence of DT. Modern pedagogies realize the value of moving from rigid, top-down instructional methods to more flexible, learner-centric approaches [11,12]. Within this framework, students aren't just passive listeners but active collaborators, enabling a more meaningful learning experience. DT is helping redefine the contours of the educational landscape, creating environments where creativity, collaboration, and problem-solving are championed.

2.1. English as a Foreign Language (EFL) in the Modern World

In today's globalized era, English, as the dominant lingua franca, plays a crucial role in cross-cultural communication and international discourse. EFL instruction, thus, is more than just imparting linguistic knowledge; it's about bridging cultural, social, and contextual gaps [6,7]. However, while foundational, traditional EFL teaching methods often need to improve in equipping learners with skills beyond grammar and vocabulary. These methods sometimes need to address the broader, holistic language acquisition experience. Contemporary EFL pedagogies are shifting, emphasizing linguistic proficiency and the nuances of culture, context, and real-world communication. The goal is to produce well-rounded, globally-aware individuals who can navigate the complexities of international dialogues with ease and understanding.

2.2. Integrating Design Thinking in EFL: A New Frontier

The confluence of Design Thinking with EFL education represents an uncharted but promising intersection in pedagogical innovation. Given EFL's multifaceted challenges, ranging from linguistic intricacies to cultural understanding, DT's human-centric approach can offer ground-breaking solutions [10,13]. By understanding the learner's journey and addressing individual needs, DT can tailor EFL instruction to be more effective and impactful. The potential of such an integrated approach is not just about improved language proficiency but also about fostering a deep-rooted understanding of cultural contexts, promoting empathy, and encouraging global collaboration. The union of DT and EFL can pave the way for a holistic language learning experience, marrying linguistic skills with design-informed, innovative problem-solving methodologies.

2.3. Design Thinking Instrumentation in EFL Instruction

Instrumentation in Design Thinking (DT) offers systematic ways to integrate human-centric approaches into practical, measurable outcomes, particularly in education [2,5]; As EFL continues to evolve, there's a burgeoning need for tools and metrics that can adequately capture the depth and breadth of DT-enhanced EFL instruction. Traditional evaluative methods may need to sufficiently gauge the multifaceted competencies developed through this confluence [10]. Therefore, instruments grounded in DT principles focus on linguistic accuracy and the broader skills and competencies fostered by the DT approach. These can range from cultural empathy and contextual understanding to innovative problem-solving in language learning scenarios. Through such instruments, educators can gain actionable insights, feedback loops for refinement, and a clearer perspective on learners' progression and areas of improvement [12]. More so, these tools can bridge the gap between theoretical DT ideals and their tangible impact in EFL contexts. In essence, effective DT-based instruments in EFL can provide a harmonized methodology to assess, iterate, and enhance the learning process, ensuring learners derive maximum benefit from this innovative pedagogical approach

Integrating Design Thinking into EFL instruction underscores a paradigm shift in modern educational strategies. This fusion promises a more comprehensive and experiential learning trajectory for EFL learners, emphasizing linguistic competencies, cultural sensitivity, empathy, and problem-solving. As global challenges evolve and communication becomes even more integral to cross-border collaborations, this DT-infused EFL pedagogy can redefine how we approach language instruction, preparing learners for the nuanced demands of the 21st century [14].

3. Method

3.1. Participants

The research included 107 undergraduate students from programs focused on English Language Education and English Literature. The participants were carefully selected to ensure a diverse and representative sample. Their ages ranged from 18 to 25 years, with an average age of 22.5 ($M=22.5$; $SD=0.80$). This age range was chosen to encompass the typical age group of undergraduate students. Moreover, the participants were drawn from different academic semesters, reflecting a broad spectrum of educational backgrounds and experiences within their respective programs. Regarding gender

distribution, the group consisted of 30 male students and 77 female students, thereby maintaining gender balance and facilitating potential gender-related analysis of design thinking skills or preferences within the study—this systematic approach to participant selection aimed to enhance the overall robustness and comprehensiveness of the research.

3.2. Procedure

Initiating with a presentation of the study's aims, followed by its core content and guidelines for answering, students were apprised that their involvement was both significant and optional. For the underage participants, authorization was obtained from their guardians, either in writing or orally. A different researcher surveyed students in their routine class periods.

3.3. Factorial Validity

As assessed through Confirmatory Factor Analysis (CFA), factorial validity evaluates the extent to which an instrument accurately measures the intended construct and confirms the hypothesized factor structure based on prior research and literature. In this realm, CFA serves as a tool to validate these hypothesized factor structures. Unlike Exploratory Factor Analysis, which is exploratory, CFA operates on pre-existing hypotheses about the factor composition. An initial model is shaped by designating latent variables and their observed indicators, followed by an analysis to derive parameter estimates. Model fit is appraised using statistical measures such as Chi-Square, RMSEA, and CFI. If necessary, adjustments to the model are made to enhance its alignment with the collected data. The outcomes of CFA provide insights into the factorial validity of the employed instrument.

3.4. Convergent validity

Confirmatory Factor Analysis (CFA) effectively validates the convergent validity of a construct. The empirical data becomes more reliable by determining if indicators accurately reflect specific constructs. Factor loadings of indicators are optimized when they reach or exceed the commendable threshold of 0.7. Including two pivotal metrics, Average Variance Extracted (AVE) and Composite Reliability (CR), enrich the analysis. When the AVE surpasses 0.5 and the CR exceeds 0.7, it showcases the robustness and

internal consistency of the model, respectively. Achieving these benchmarks enhances confidence in the model's alignment with its theoretical principles

3.5. Discriminant validity

Discriminant validity, assessed through Confirmatory Factor Analysis (CFA), ensures that interconnected constructs retain their unique theoretical identities. One primary measure, the Fornell-Larcker criterion, sets a clear standard: the square root of a construct's Average Variance Extracted (AVE) must overshadow its principal correlation with other constructs in the analysis. Beyond this, a systematic comparison of models—one where constructs are freely correlated and another where they're constrained—serves as a supplementary validity check. Achieving this level of discriminant validity solidifies the distinction between constructs, confirming that each resonates exclusively with its specified theoretical domain

3.6. Internal consistency

Cronbach's alpha (α) is a crucial measure to determine the internal coherence of scales or questionnaires. This metric aids in understanding the interconnectedness of items present in a measuring instrument, evaluating their combined efficacy in capturing a specific construct. A value of α above 0.7 typically signifies notable reliability. However, values near one can hint at repetitiveness within the items. Ultimately, Cronbach's alpha plays a vital role for scholars in verifying the solidity and consistency of their measurements.

3.7. Data analysis

In conducting a Confirmatory Factor Analysis (CFA) utilizing the AMOS software, the preliminary action necessitates formulating a systematic model that articulates principal variables in conjunction with their ancillary indicators. After data integration within the software, an analytical procedure is initiated to scrutinize the nexus between the indicators and their respective variables through factor loadings. Furthermore, indices such as CFI, TLI, and RMSEA elucidate the stipulated model's unity with the empirical data at hand. The ensuing evaluative phase is comprehensive, emphasizing Composite Reliability and AVE for reliability assessment and accentuating convergent and discriminant validity facets for validity determination. Should any incongruities be identified, the

model warrants meticulous refinement followed by a successive analysis to ascertain the optimal alignment

4. Result and Discussion

4.1. Design Thinking Scale

TABLE 1: Design Thinking for Academic Writing.

| No | Dimension | Indicators |
|----|--------------------|---|
| 1 | Empathy | Understand user needs and challenges. Understand reader needs, writing goals, and research questions. |
| 2 | Problem Definition | Determine and understand the problem to be solved. Formulate a research question or thesis. |
| 3 | Ideation | Generate as many ideas as possible to solve the problem. Develop arguments, hypotheses, or ideas for essays or research papers. |
| 4 | Prototype | Create a physical or digital model of the solution. Create a framework or preliminary draft of a term paper. |
| 5 | Testing | Gather feedback on prototypes and make improvements based on that feedback. Revise based on feedback from teachers or peers. |
| 6 | Implementation | Put into practice what you've learned in real projects. Write and complete a research paper. |
| 7 | Reflection | Review and evaluate the learning process and its results. Reflect on the writing process and evaluate the final quality of writing. |

Based on the research findings, a guide has been developed to enhance students' grasp of design thinking. This guide begins with "empathy," exploring students' ability to connect with various user needs. It progresses to "problem definition," emphasizing the clear identification of challenges. In the "ideation" phase, the emphasis lies on innovative thought processes, transitioning to the "prototyping" stage where ideas evolve into tangible models. The suitability of these prototypes for real-world applications is subsequently assessed. During the "implementation" phase, the efficacy of students' application of theoretical knowledge is gauged, concluding with a "reflection" on their methodologies and outcomes. For a comprehensive understanding of the design thinking mindset and its specific indicators, see Table 1.

4.2. Reliability and Validity

Table 2 provides information on the reliability and validity of several dimensions associated with the "Design Thinking" variable. Each dimension, such as Empathy, Problem Definition, and so on, consists of two measured items (Figure 1). For the "Empathy" dimension, the first item (Emp1) has a factor loading of 0.901, while the second item

(Emp2) registers a loading of 0.824. The reliability of this dimension, as measured by Cronbach’s Alpha, is 0.849, indicating good reliability. The AVE value for this dimension stands at 0.745, and its CR is 0.854. To provide another example, the “Problem Definition” dimension showcases item DM1 with a loading of 0.886 and DM2 at 0.799. This dimension boasts a Cronbach’s Alpha of 0.829, an AVE of 0.712, and a CR of 0.831. Other dimensions, such as Ideation, Prototyping, Implementation, and Reflection, also possess pertinent item loadings, Cronbach’s Alpha values, AVEs, and CRs, all of which underscore these items’ construct validity and reliability. Overall, Table 2 offers insights into how each dimension and its contained items are valid and reliable within the Design Thinking context. High loadings, Cronbach’s Alpha values above 0.7, and AVEs and CRs nearing or exceeding 0.7 collectively signal the commendable quality of the measurements.

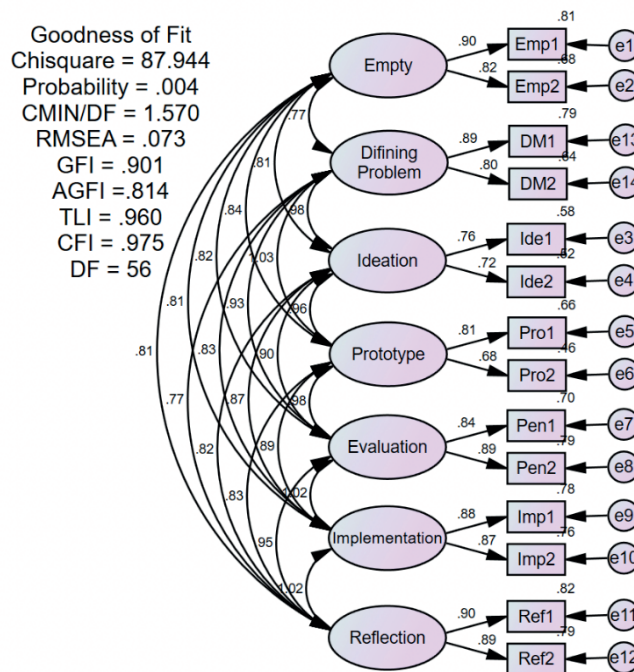


Figure 1: Construct of the Design Thinking Mindset Scale for Academic Writing.

Table 3 presents several fit indices for a theoretical model in a study. The table shows that the model has a degree of freedom (df) of 56 and a chi-square value of 87.944, with a probability or p-value of 0.004. A probability value less than 0.05 suggests that the model may not fit the data. The ratio of chi-square to the degree of freedom (Cmin/df) is 1.570, which is generally considered to indicate a good fit since it is below 2. RMSEA, a measure of root mean square error of approximation, stands at 0.073, indicating a good fit as it is below the general threshold of 0.08. The Goodness of Fit Index (GFI) is 0.901, slightly above the considered suitable threshold of 0.90. Meanwhile, the Adjusted

Goodness of Fit Index (AGFI) is 0.814, slightly below the threshold of 0.90. However, two relative fit measures, the Tucker-Lewis Index (TLI) and Comparative Fit Index (CFI), exhibit excellent results with values of 0.960 and 0.975, respectively, well above the 0.95 thresholds. While some areas might require attention, the fit indices suggest that the theoretical model aligns well with the analyzed data.

TABLE 2: Reliability and Validity.

| Variables | Dimension | Items | Loadings | Cronbach's Alpha | AVE | CR | |
|-----------------|--------------------|-------|----------|------------------|-------|-------|-------|
| Design Thinking | Empathy | Emp1 | 0.901 | 0.849 | 0.745 | 0.854 | |
| | | Emp2 | 0.824 | | | | |
| | Problem Definition | Dm1 | 0.886 | | 0.829 | 0.712 | 0.831 |
| | | Dm2 | 0.799 | | | | |
| | Ideation | Ide1 | 0.761 | | 0.705 | 0.548 | 0.708 |
| | | Ide2 | 0.719 | | | | |
| | Prototype | Pro1 | 0.810 | | 0.706 | 0.557 | 0.713 |
| | | Pro2 | 0.676 | | | | |
| | Implementation | Imp1 | 0.885 | | 0.871 | 0.771 | 0.871 |
| | | Imp2 | 0.871 | | | | |
| Reflection | Ref1 | 0.904 | 0.891 | 0.805 | 0.892 | | |
| | Ref2 | 0.890 | | | | | |

TABLE 3: Goodness of Fit Skala Pemahaman Design Thinking Menulis Akademik.

| Research Model | df | Chi-square | Probability | Cmin/df | RMSEA | GFI | AGFI | TLI | CFI |
|----------------|----|------------|-------------|---------|-------|------|------|------|------|
| | 56 | 87.944 | .004 | 1.570 | .073 | .901 | .814 | .960 | .975 |

4.3. Discussion

The Design Thinking Mindset Scale provides a strategic framework, delving into the multi-layered dimensions of design thinking, particularly in student-centric contexts. At its inception, empathy serves as the compass. As [5] has remarked, empathy extends beyond merely resonating with user needs; it embodies the spirit of design thinking. When students immerse in the end-users milieu, they understand and absorb nuances that drive authentic solutions. [1] mirror this sentiment, emphasizing the integration of empathy in fashion design thinking, where user-centricity drives aesthetic and functional outcomes. Interestingly, [3] merges this user-focused approach with the agile innovation

model. The synergy of these models underscores that, while integral, empathy gains potency when coupled with agile, responsive strategies.

As the journey progresses to “Ideation”, intricate layers unravel. [15] narrative pivots towards the harmony of innovative thinking with pragmatism. The dichotomy here is apparent: while ideation unleashes creativity, its efficacy is in its grounding. [16] in their exploration of military design thinking, reiterate this. The realm of defense, with its stringent demands, necessitates ideas that are both transformative and actionable.

Transitioning to prototyping unveils the bridge between abstract and concrete. Eklund et al. (2022) elucidate this phase with a distinct term: “sensemaking.” A prototype is not a mere representation but a tangible narrative, narrating the Design story. [17] in their analysis of healthcare design thinking, spotlight this transition. In healthcare, where stakes are high, prototyping isn’t just design; it’s a potential lifeline.

The culmination in reflection is introspective yet expansive. While [11] emphasizes internal growth through critique and learning, [4] project reflection is an external tool, gauging the Design’s resonance in real-world scenarios. This dual perspective is echoed by [8], emphasizing the pedagogical implications, where reflection fosters personal growth and curriculum enhancement.

Synthesizing the Design Thinking Mindset Scale with the broader research landscape uncovers intricate interplays. For instance, the scale’s user-centric foundation resonates with [1]’s insights into fashion design, illuminating how user needs to sculpt design outcomes, from clothing to curriculums. Yet, [3]’s perspective introduces agility into this matrix, suggesting that design thinking is not just about the user but also about the pace and adaptability of the design process.

Moreover, as the scale encapsulates, design thinking isn’t a siloed paradigm. As evidenced by [13], its tendrils extend into diverse domains, from entrepreneurial ventures to academic pursuits. This interdisciplinary nature makes Design thinking both a challenge and an opportunity. As [18] elucidates, while engineering students might grapple with the fluidity of design thinking, it’s this very adaptability that fosters innovation, evident in diverse sectors, from civil engineering [2] to business [12].

While robust, the Design Thinking Mindset Scale is just the tip of the iceberg. Its true depth emerges when juxtaposed against a tapestry of research, where it weaves a narrative of innovation, empathy, adaptability, and continuous evolution, characteristics that are seminal to driving solutions in our ever-evolving world.

5. Conclusion

The research presents a structured guide to enhance students' comprehension of design thinking, from the initial empathy stage to the concluding reflection. This integrative approach underscores the pivotal role of empathy in grasping user needs, which subsequently informs the process of problem definition and the generation of innovative solutions. The rigorous evaluation of each dimension signifies reliability and construct validity, solidifying the trustworthiness of the study's approach. The theoretical model aligns substantially with the analyzed data, though some indications suggest potential misfits.

Identifiable limitations to this study include the sample size, geographical confines, and potential oversight of other relevant design thinking dimensions that might influence the study's generalizability. Moreover, the Design's intricate nature could render it less applicable in more straightforward educational scenarios.

In light of these findings and constraints, future research recommendations encompass conducting cross-cultural validations to ascertain the guide's relevancy across diverse educational and cultural landscapes. Additionally, subsequent studies might contemplate including supplementary design thinking dimensions and potentially leverage mixed methodologies to garner a more encompassing perspective.

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