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**A Design Thinking – Based Strategy for Enhancing
EFL Students' Writing Performance and their
Sustainability Awareness**

BY

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Abstract

A suggested design thinking-based strategy is proposed to develop the writing performance and sustainability awareness of EFL University students. This is a one group pre/post quasi-experimental study. Thirty 4th year students at Suez University majored in TEFL participated in the study. They were taught writing using a suggested strategy based on the design thinking approach. A pre and a post writing performance tests as well as a sustainability awareness scale were devised by the researcher to measure participants' writing performance and their sustainability awareness before and after the study. Dependent samples t-test yielded a significant difference in the participants' mean scores between the pre and the post tests of writing performance in favor of the post test. Additionally, a difference that is significant in the participants' mean scores of the pre and post sustainability awareness scale was found using paired samples t-test. It was concluded that the proposed strategy that is based on design thinking approach had significantly enhanced the participants' writing performance and raised their sustainability awareness.

Key Words: A Design thinking- based strategy, writing performance, sustainability awareness, EFL university students.

استراتيجية قائمة على التفكير التصميمي لتعزيز الأداء الكتابي والوعي بالاستدامة لدى طلاب اللغة الإنجليزية كلغة أجنبية

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تهدف الدراسة الحالية إلى معرفة أثر استراتيجية مقترحة قائمة على التفكير التصميمي في تنمية الأداء الكتابي والوعي بالاستدامة لدى طلاب اللغة الإنجليزية بالمرحلة الجامعية. أجريت الدراسة على مجموعة من طلاب الفرقة الرابعة بقسم اللغة الإنجليزية بكلية التربية بالسويس - جامعة السويس خلال العام الجامعي ٢٠١٩-٢٠١٨ (٣٠ طالبا). قبل بدء التجربة قامت الباحثة بتطبيق اختبار الأداء الكتابي القبلي ومقاييس الوعي بالاستدامة على الطلاب المشاركين. أثناء تطبيق الدراسة قامت الباحثة باستخدام استراتيجية مقترحة قائمة على التفكير التصميمي في تدريس الكتابة لمجموعة من طلاب الفرقة الرابعة بقسم اللغة الإنجليزية. بعد انتهاء التجربة تم تطبيق اختبار الأداء الكتابي البعدى وكذلك مقاييس الوعي بالاستدامة - من إعداد الباحثة - على جميع الطلاب.

ولقد توصلت الباحثة إلى النتائج التالية:

١. وجود فرق دال إحصائياً بين متوسطي درجات الطلاب المشاركين في القياسين القبلي والبعدي للأداء الكتابي.
٢. وجود فرق دالة إحصائياً بين متوسطي درجات الطلاب المشاركين في القياسين القبلي والبعدي لمقاييس الوعي بالاستدامة.

ولقد خلصت الباحثة من نتائج الدراسة الحالية إلى أن الاستراتيجية المقترحة القائمة على التفكير التصميمي ذات أثر دال إحصائياً على تنمية الأداء الكتابي لدى طلاب اللغة الإنجليزية بالمرحلة الجامعية وتنمية الوعي بالاستدامة لديهم.

الكلمات المفتاحية

استراتيجية قائمة على التفكير التصميمي ، الأداء الكتابي ، الوعي بالاستدامة، طلاب اللغة الإنجليزية كلغة أجنبية

I.

Introduction

Writing is one of the important means of communication in the 21st century. It is the process of collecting ideas and organizing them into clear sentences and coherent paragraphs (Rahmawati, 2018). For EFL students to be successful in school and beyond, they need to develop their writing performance. Writing skills are considered necessary tools for standardized tests because they are the medium through which most subjects are assessed.

Despite its importance, English writing is still one of the most challenging areas for teachers as well as students (Abdelhamid, 2010) because it is considered one of the most difficult skills to teach, as well as to learn (Rahmawati, 2018). Students face many challenges when trying to produce correct and appropriate written texts. Writing instruction has been neglected along different educational contexts and the Egyptian university context is no exception (Seiffedin and El-Sakka, 2017). In most classes writing is usually a solitary task, often given as homework and therefore unsupported. During teaching EFL seniors at Suez Faculty of Education, and through reviewing some of their written assignments, the researcher noticed their poor writing performance. To ensure her notices, the researcher administered a pilot writing performance test on a group of senior EFL students (out of the sample of the study) that ensured their struggling with EFL writing performance. The researcher's notices concerning EFL students' low level of writing performance found empirical support in the following previous studies on writing performance (e.g., Abdelhamid, 2010; El Henawy, Dadour, Salem & El-Bassuony, 2012; El Sakka, 2011; and Seiffedin & El-Sakka, 2017). One reason of such poor performance may be related to the strategies used in teaching writing. For example, in most writing classes, teachers just teach vocabulary and grammar, they do not guide students to write, they only give topics without helping their students develop ideas (Rahmadhani, 2014) and design paragraphs. So, poor writing performance cannot be simply treated by only teaching vocabulary and grammar lessons. Additionally, EFL students do not find any relevance of what they are writing to their everyday life.

Writing instruction at college should be tailored towards students' current and future needs (Deveci, 2018). Therefore, a teaching strategy

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that encourages innovation and entails much practice is required. In the present study, the researcher suggested a strategy based on the design thinking approach; innovative in finding the best ideas, and iterative in creating ultimate solutions to develop the writing performance of EFL students.

There is an insistent need for EFL seniors who are considered would-be teachers to raise their sustainability awareness through reshaping and re-constructing their lives' as well as schools' identity to support its sustainability for the future (Atmaca, Kiray & Pehlivan, 2019; Boon, 2011). Therefore, sustainability awareness has gained a great importance in educational settings, especially university setting (El Sakka, 2019). Sustainability education implies a transformation in educational thinking and practices through transformative learning that is holistic, systemic, and participative. So, university education should play an important role in raising sustainability awareness. Sustainability awareness that aims at creating students in accordance with the principles of the United Nation's Decade of Education for Sustainable Development (DESD) (Boon, 2011, and Summers, Kruger, Childs, & Mant, 2010). Also, sustainability awareness is concerned with developing responsible citizenship locally, nationally and internationally and providing continuing education to teacher trainers, pre-service and in-service teachers (UNESCO, 2002).

Therefore, to meet the 21st century's expectations, English educators need to spend more time in experimenting and collaborating in error-tolerant modes of engagement (Kwek, 2011). Thus, a teaching methodology that combines knowledge acquisition with its adequate application to educational practices is needed (Vilches, Lopez-Alcamia, & Mazuecos-Ciarra, 2019). In the current study the researcher presents a new strategy based on the design-thinking approach to achieve such a target. As the idea is a recent development in English language research, the concept of approaching pedagogy from a design perspective is less studied especially in EFL context. Here lays the importance of such a study.

II. Problem Statement

The study problem was the low level of EFL Seniors' writing performance at Faculty of Education, Suez University as well as their

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poor sustainability awareness. Therefore, this study aimed to develop their performance in writing and raise their sustainability awareness through a suggested strategy based on design-thinking approach or the 3 Es strategy, as the researcher called it.

The current research tried to find an answer to the following questions:

- 1) What is the impact of a suggested design thinking based strategy on the writing performance of EFL university students?
- 2) What is the impact of a proposed strategy based on the design thinking approach on the sustainability awareness of EFL university students?

III. Literature Review

Although the concept of design learning has existed for a long time, design based strategies as instructional practices for 21st century learning did not emerge until the last few decades (Rotherham & Willingham, 2009, Van Gompel, 2019). Design thinking is a practical human-centered approach, creative in finding the best ideas, and iterative in creating ultimate solutions (Brown, 2008: 92). Design thinking based learning is built upon the theory of constructivism (Van Gompel, 2019). Hence writing is a knowledge construction process, Noweski et al. (2012) and Scheer et al. (2012) suggested design thinking as an ideal strategy for writing instruction. Design thinking, as Scheer et al. (2012, p.11) claimed, “trains students in certain skills that are important requirements for a constructive learning: openness for new ideas, creative thinking, motivation for exploration and other metacognitive skills”, and that is exactly the skills needed for effective writers. When using design thinking strategy to write, learners experiment with words and sentences in order to communicate their ideas efficiently and effectively (Bello, 1997). Therefore, the researcher suggests that writing is best taught through a suggested strategy based on design thinking. Thus, the suggested strategy based on design thinking allows learners to experience an active process of constructing their own individual meanings as well as constructing a physical representation of that knowledge Oxman (1999) that is the written product.

Additionally, design thinking supports the abstractness and density of Dewey’s constructivism (Scheer et al., 2012). It can handle

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complex phenomena without abstracting too much by motivating learners to analyze and explore (Gompel, 2019), “but still being comprehensible for the student and applicable for the teacher” (Scheer et al., 2012:11) through participating in active problem solving (Goldman et al., 2014; Scheer et al., 2012).

IV. Rationale of the Study

The philosophy underlying design thinking based learning stems from the idea that ill-defined problems exist in every discipline, thus the process employed by designers—design thinking—can be applied to the educational setting (Carroll et al., 2010; Dorst, 2011; Gerber & Carroll, 2012). Design thinking based learning is a great tool for 21st century teaching, as it urges students to solve authentic problems through discovering and sorting information, collaborating and cooperating with others, and finally iterating their solutions based on real world, authentic experience and feedback. In the context of the study, a design thinking based strategy is supposed to create integrative learning experiences for EFL students in order to improve their writing performance and raise their awareness of sustainable development.

In the university setting, many educational programs, promote unsustainable practices and do not motivate students to become interested in sustainability. Moreover, students sometimes are not self-sufficient, and other times are destructive of themselves, society, and the environment. Therefore, there is a necessity for reorienting university education to include sustainable practices. In the present study, as soon as participants apply the proposed strategy based on design thinking, they are tackling authentic, real-world, universal challenges, relevant to their society, consequently, the purpose of their writing becomes obvious, and their sustainable development awareness raises.

In the design-based learning, writing is situated in a problem-solving form (Cassim, 2013), similar to problem-based learning, yet takes on a constructionist perspective (Kafai, 1996) by collaboratively designing a written product. Moreover, design thinking provides EFL writers with the tools to work with complex, authentic topics in which

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they become the creators and evaluators of the goodness of their written products (Glen et al., 2015:183).

The Design thinking based strategy prepare EFL university students for the 21st century teaching profession. Problem-solving, collaboration, self-efficacy are skills our students need if they are going to be successful in their future teaching profession, and these are the skills they develop in classrooms centered on design thinking (Cloberman, 2018). Design thinking makes the writing process lively, interactive, authentic and fun.

Design thinking, writing performance and sustainability awareness

Several composition theorists (e.g., Leverenz, 2014; Marback, 2009; Purdy, 2014) demonstrate a linkage between design thinking and the process of writing. As our world is comprised of individual systems, the process of essay writing can be considered as a system too. Thus, students can not accurately judge any part of the system without understanding its complexity and holistic view. A good essay can only arise from profoundly exploring the topic, experimenting the ideas as well as evolving the written product. Therefore, incorporating design thinking strategy into the writing process allows a thesis and a conclusion to grow organically from the evidence.

In the 21st century, writing can be considered as a social practice. It is not limited to an individual or a cognitive activity, yet it is developed in a social context within discourse communities. Watson (2017) argued that writing is a design process. He saw many similarities between design thinking and the writing process. Just as designers use empathy to understand who they are designing for, writers also use empathy to try to understand and connect with their audience. And just as designing involves ideation and prototyping, writing involves brainstorming and drafting. And as design thinking ends with a physical representation of the product, writing ends with a written product of the topic.

Recent Research

As a new discipline, there is a lack of research in design thinking as an instructional strategy in the field of TEFL. Few experimental studies evaluated the benefits and advantages of implementing design thinking in different disciplines (e.g., Carroll et al., 2010; Dukes & Koch, 2012; Lugmayr et al., 2013). Some of these advantages are: raising students' motivation to explore and solve problems, making students open to ideas and allowing them to be innovative and creative. To the best of the researcher's knowledge, no experimental study has examined the benefits of using design thinking in teaching EFL writing to students in the university context.

V. Hypotheses

The present study raises the following hypotheses:

1. A statistically significant difference would exist in the mean scores of the EFL students on the pre and the post test of writing performance.
2. A statistically significant difference would exist in the mean scores of the EFL students on the pre and post scale of sustainable development awareness.

VI. Method

1. Design

This quantitative study aims to explore the impact of a new proposed strategy based on design thinking approach on developing EFL students' writing performance and their sustainability awareness. This research employed a one group pretest-posttest quasi-experimental design because such a design is appropriate for studies where random assignment is not possible (McMillan & Schumacher, 2006).

2. Setting

The study was conducted in Suez University, Faculty of Education, during 2018-2019 academic year. The researcher proposed a teaching strategy based on design thinking approach to teach writing and raise sustainability awareness of EFL university students.

3. Participants

Thirty fourth year English majors at Faculty of Education, Suez University formed the experimental group of the study. The participants were chosen from 4th EFL university students (sometimes called EFL seniors, pre-service teachers, would-be teachers or prospective teachers) because that population who chose teaching as a profession and have been trained in education faculties, should begin their profession as individuals with sustainable development awareness once they graduate (Demirbaş, 2015; Kahyaoğlu, 2011). They have reached a level in writing that help them explore the challenging issues of sustainability. Additionally, EFL university students need to be educators who have awareness of sustainable development to give their students the principles that make sustainable development a way of life. Participants' English proficiency level was almost the same depending on their results in an English placement test devised and administered by the researcher before starting the experiment. Their ages ranged between 20 to 22.

4. The Proposed Strategy (The 3 Es)

In the current study, the researcher proposed a suggested teaching/learning strategy based on the design thinking approach for teaching writing performance to EFL university students, and raising their sustainability awareness. The aim of such a strategy is to transfer the concept of design thinking into actionable steps fitting the writing process for both teachers and students. The proposed strategy is built upon the previous trials of some theoreticians and educators (e.g., Brown, 2009; Cloberman, 2018; Spencer and Juliani, 2016) to conceptualize design thinking approach to suit the educational settings. The proposed strategy consists of three main subsequent steps: Explore, Experiment, and Evolve. That is why the researcher called it the 3 Es strategy. The steps of the proposed strategy are as follows:

A. Explore: (a pre-writing step)

It is the first step in the 3Es strategy. The goal of such a step is to create awareness of the topic of writing. Therefore, it focuses on defining the topic, generating ideas, asking a lot of questions individually or collaboratively, reading a stack of relevant articles, books and gathering inspiration in order to understand the topic. In this step, the students look at the writing topic as a challenge. They may ask themselves: "we have a

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writing challenge. How can we approach it?”

In this step, the students are urged to write down anything they find interesting without fearing divergence (with the source written under each information, if found). The students here do not pay much attention to the writing mechanics. The aim here is to collect as much information and ideas about the topic as possible.

B. Experiment (A during writing step)

This step is the step of putting a design or a plan for the topic of writing. This step is a circular process of drafting and feedback. This phase focuses on making a draft of the writing topic, getting feedback and revising the draft accordingly. In this step, the student asks himself/herself “I have a lot of ideas. How do I build the essay?”. Thus, students have many many notes. In groups, they cut these notes into strips. These are the making of the mental puzzle they are about to solve (writing a topic). At this point, they should be able to make logical connections between their paper-strip-clusters. Once they identify their thesis, they can order their paragraphs accordingly. They can begin to arrange their notes according to convergent ideas (introduction – body-and conclusion). They highlight and test their ideas (what works/ not work, what suits into introduction, what suits into body, and what suits into conclusion), and write their first draft. Students revise their draft according to teacher’s and peers’ feedback, then making changes to their draft until it is ready to present.

C. Evolve (The written product):

In this step the students launch their written product to an audience (The whole class, the internet community). After the students finish their revised drafts, they publish them on the class weblog as well as the faculty weblog. Here, the hard part – the essay – is complete.

The writing material used in the following study consists of a number of descriptive as well as argumentative topics revolving around sustainable development issues. Therefore, in choosing the writing topics, the researcher was keen to choose the universal issues that are plaguing the universe and that need an innovative solution (an economic, environmental or social challenge) in order to achieve authenticity of the chosen writing topics. On the other hand, the researcher varied the

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writing topic in order to focus on the three dimensions of sustainability such as economic prosperity, environmental health, and social well-being. The chosen topics aim to introduce the participants to the concept of sustainability as well as building knowledge about each sustainability dimension.

5. Instruments

To achieve the research's aims, three instruments were devised: A writing performance pretest, a writing performance posttest and a sustainable development awareness scale.

The pre and the post tests of writing performance aim at measuring participants' performance in writing before and after the intervention. The pre and the post writing performance tests are equivalent forms. Each test consists of three topics (a descriptive, an argumentative and a persuasive topic; matching the writing genres covered during the study).

The participants are asked to write five paragraph essays about each one of them. The participants' writing performance has been assessed using three main dimensions of written language production: writing complexity, writing accuracy, and writing fluency (CAF). The participant's score in writing performance is the sum of their scores in the previous three dimensions. In order to ensure the consistency of the marking process, three raters (after being trained on the marking process) marked the pre-tests and the post tests of the participants and the mean of their scores was the final mark of the participant.

In the current study, writing complexity was measured through counting the number of dependent clauses to all clauses in the written product (DC/C) (Wiglesworth & Storch, 2009). Thus, higher complexity indicates higher performance levels. Writing accuracy is measured by counting the number of error-free T-units per T-unit (EFT/T) (Wolfe-Quintero, Inagaki and Kim, 1998:35). Accuracy errors were either syntax errors such as word order and missing elements or morphology errors such as use of articles and prepositions, verb tense, subject-verb agreement and errors in word forms or punctuation errors. In addition, following Caruso (2014), Tavakoli & Rezazadeh (2014) and Wiglesworth & Storch (2009), fluency was assessed by counting the

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number of words, T-units and clauses per text. The final mark of writing performance of each participant is the sum of the three dimensions of the written language production: writing complexity, writing accuracy, and writing fluency (CAF).

In order to measure the tests' reliability, the test re-test technique was used. The pre and the post tests were administered twice to a pilot group of prospective teachers (out of the sample of the study) within a two-week interval between the two administrations. The reliability coefficients of the pre and the post tests were 0.81 and 0.85 respectively, which is statistically acceptable for the purposes of the present study.

In order to measure participants' sustainability awareness before and after the experiment, a Sustainable Development Awareness Scale (SDAS) is developed by the researcher. Such a scale consists of three sub-dimensions that agree with the theoretical framework of sustainable development in the literature, namely economy, environment, and society. It consists of 30 items, 10 in each dimension. Items from 1 to 10 handle the social dimension of sustainable development including concepts of human rights, gender equity, peace and human security, cultural diversity and inter-cultural understanding, social services, health and education right, and social justice. As for the dimension on environment, it includes the items from 11 to 20 and it revolves around the concepts of natural resources conservation, sustainable urbanization, reduction of environmental pollution, the use of renewable energy sources instead of non-renewable energy sources, recycling of wastes, and global warming. Economic dimension on the other hand ranges from item 21 to item 30, including issues such as conservative use of resources, investments in vital sectors, elimination of income distribution inequality, reliable environments for investments, sustainable production and cost, income and expense balance, investments in high-income sectors, and research and development.

The scale is a five-point Likert scale rating from strongly disagree to strongly agree. The scale included both positive and negative statements. For the latter type, a reverse scoring is used in calculating students' levels. Scores on the SDAS range from 30 (the minimal score) to 150 (the maximal score). For scale's validity, a jury of TEFL specialists reviewed it and decided that it was suitable for measuring EFL

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prospective teachers' sustainability awareness. For the scale's reliability, the Cronbach's alpha reliability coefficient was calculated for the whole scale and the sub dimensions. For the whole scale, Cronbach's reliability coefficient yielded $\alpha = 0.89$. The Cronbach's reliability coefficients for the environmental, social and economical sub-dimensions were found to be $\alpha = 0.79$, $\alpha = 0.86$, $\alpha = 0.80$ respectively, that was seen to be sufficient for the scale's reliability.

6. The Intervention

The intervention was implemented in Faculty of Education, Suez University, Egypt during the 2018-2019 academic year. It lasted for a whole academic year starting from October, 2018 till the beginning of April, 2019, with a two-week interval during the mid-term vacation at the end of January and the beginning of February, 2019.

The experiment followed four main steps: pretesting, orientation, experimenting and post testing.

A. Pretesting

As a starting point, all the participants had taken the writing performance pretest and the scale of sustainable development awareness.

B. Orientation

Before initiating the instructional sessions and for two subsequent sessions, the participants were oriented on the proposed strategy based on design thinking approach (Explore, Experiment, Evolve) or (The 3Es Strategy, as called by the researcher). The Researcher explained the steps of the strategy and she modeled to the participants how they should implement the strategy's steps in writing their topics. Also, the participants were acknowledged that the writing topics that were to be handled during the experiment addressed one of the prevailing issues on the educational setting “sustainable development” in order to gain awareness concerning the principles of 2030 agenda.

C. Experimenting

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The experiment started in October 2018. During that period, the researcher and participants used to meet once a week for 90 min to apply the 3Es strategy in writing the assigned topics. Each writing topic was handled along two subsequent sessions. Before meeting at the session, the researcher assigned the new topic of writing on the class weblog. Once students had assigned the topic, they were asked to start the first phase of the proposed strategy that is: *Explore*. The participants explored their topics individually at home through brain storming, asking questions, surfing the net, listening to related films or news in order to build awareness of the assigned topic. They also could explore the topic collaboratively through class weblog. They were asked to take notes as much as possible about the topic they explored.

In class, the participants implemented the second phase of the suggested strategy that is *Experiment*. Participants were divided into groups of six in order to discuss their ideas, the information they wrote in their notes. They identified the main themes that have emerged, started collaboratively composing the first draft of the topic that consisted of introduction (about the topic), body (information about the topic and its challenges), and finally conclusion (it included innovative ideas to solve the challenges). Then, they started reviewing their draft in terms of five main features content, fluency, accuracy, vocabulary and syntax using the rubrics submitted by the researcher for each feature. The researcher played the role of a facilitator. She introduced advice and correction. The researcher gave students feedback about where they were lacking and where they needed to go; it should also be student-centered, longitudinal, with real time feedback. The participants may have creative but impossible ideas. Here, the teacher should provide them with real world experience to help ensure that they have a good start. The researcher helped each group of students understand the feedback they got, and worked with them to understand the best way to implement solutions. This session ended with an acceptable draft.

The next session is allocated to the third phase of the proposed strategy that is *Evolve*. Each group of participants started writing their own essay about the topic in order to introduce it in front of the whole class, as well as other classes that were invited to share the session. During the *evolve phase* the researcher was keen to invite other participants from other classes to share the students their final product.

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Each group should present the written final topic. The most accepted and innovative written topics were published on the class weblog.

D. Posttesting

After finishing all the instructional sessions, the participants took the writing performance post test as well as the sustainable development awareness scale. The difference between the participants' pre and post tests' mean scores was calculated using paired samples t-test.

VII. Results of the Study

To perform all the statistical analyses of this study, SPSS 20 was used.

1. Results for Writing Performance

The dependent samples t-test was used to investigate the first hypothesis that stated " A statistically significant difference ($\alpha \leq 0.05$) would exist in the mean scores of EFL seniors on the pre and the post test of writing performance ". The results were depicted in the following tables:

**Table 1.
Descriptive statistics of the writing Performance pre and post tests**

Writing Performance	Test	N	Mean	SD
	Pre	30	69.433	16.816
	Post	30	102.833	9.720

The descriptive statistics in table one shows that the mean score of the participants' writing performance post test ($M=102.833$) was higher than that of the pre test ($M=69.433$). To test the significance of such difference, the paired samples t-test was used as shown in table 2.

**Table 2.
Dependent Samples t-test for the Difference in the Mean Scores of the pre
and post tests of Writing Performance**

Writing	Standard	Sig.
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Performance	Mean	Deviation	t	df	
Pre/post	33.4000	16.835	10.867	29	0.000

As indicated in Table 2, the dependent samples t-test revealed a significant difference in the participants' mean scores between the pre test and posttest of writing performance ($t = 10.867$, $p < 0.05$), in favor of the posttest. Therefore, it was concluded that the proposed strategy (the 3Es) that is based on design thinking approach developed the writing performance of EFL students.

2. Results for Sustainability Awareness

To investigate the second hypothesis of the study stating that " A statistically significant difference ($\alpha \leq 0.05$) would exist in the mean scores of the EFL students on the pre and post administration of the sustainability awareness scale" the paired samples t-test was used as shown in the following tables:

**Table 3:
Sustainability Awareness Descriptive Statistics**

Sustainability awareness	Test	N	Mean	SD
	Pre	30	75.033	19.535
	Post	30	117.666	22.410

As depicted in table 3, the mean scores of the post administration of the sustainability awareness scale ($M = 117.666$) is higher than that of the pre administration of the same scale ($M = 75.033$). Thus, there is a difference in the means scores of the participants between the first and the second administration of the scale. To determine the significance of such a difference, the dependent samples t-test was used as shown in the following table.

**Table 4.
Dependent Samples t-test for the Difference in the Mean Scores of the Pre
and Post Test of Sustainability Awareness**

Sustainability awareness	Mean	Standard Deviation	t-value	df	Sig.
Pre/post	42.633	25.387	9.198	29	0.000

As indicated in Table 4, the paired-samples t-test revealed a significant difference in the experimental group mean scores on the pre and post administration of sustainability awareness scale ($t = 9.198$,

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p<0.05), in favor of the post administration. Therefore, it was concluded that the new strategy based on design thinking learning (the 3Es) raised the participants' sustainability awareness.

To ensure that result, the paired samples t-test was used to test the difference between the pre and the post administration for each dimension of the three dimensions of the sustainability awareness scale.

**Table 5.
Environmental Sustainability Awareness Descriptive Statistics**

	Test	N	Mean	SD
Environmental Sustainability Awareness	Pre	30	19.133	6.642
	Post	30	37.400	7.346

In table 5, the mean scores of the post administration of the environmental sustainability awareness dimension ($M= 37.400$) was higher than the pre administration of the environmental sustainability awareness dimension ($M=19.133$). To test the statistical significance of that difference, paired samples t-test was used.

**Table 6.
Paired Samples t-test for the Difference in the Mean Scores of the pre and post administrations of environmental sustainability awareness scale**

Environmental Sustainability Awareness	Mean	Standard Deviation	t-value	df	Sig.
Pre/post	18.26667	4.91958	-20.337	29	0.000

In table 6, the paired samples t-test yielded a statistically significant difference in the experimental group mean scores on the pre and post administrations of environmental sustainability awareness scale ($t = -20.337$, $p<0.05$), in favor of the post administration. Therefore, it was concluded that the new strategy based on design thinking learning (the 3Es) raised the participants' environmental sustainability awareness.

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Table 7.
Social sustainability awareness descriptive statistics

Social Sustainability Awareness	Test	N	Mean	SD
	Pre	30	27.266	10.859
	Post	30	38.400	9.946

As indicated in table 7, there exists a slight difference between the mean score of the post administration of the social sustainability awareness dimension ($M= 38.400$) and the mean score of the pre administration of the social sustainability awareness dimension ($M=27.266$). To test the statistical significance of that difference, paired samples t-test was used as shown in table 8.

Table 8.
Paired Samples t-test for the Difference in the Mean Scores of the pre and post administrations of Social Sustainability Awareness

Social Sustainability Awareness	Mean Mean	Standard Deviation	t-value	df	Sig.
Pre/post	-11.13333	13.39772	-4.552	29	0.000

In table 8, the paired samples t-test yielded a statistically significant difference in the experimental group mean scores on the pre and post administration of social sustainability awareness scale ($t = -4.552$, $p<0.05$), in favor of the post administration. Therefore, it was concluded that the new strategy based on design thinking learning (the 3Es) raised the participants' social sustainability awareness.

Table 9.
Economic Sustainability Awareness Descriptive Statistics

Economic Sustainability Awareness	Test	N	Mean	SD
	Pre	30	26.266	10.058
	Post	30	38.800	10.600

In table 9, the mean scores of the post administration of the economic sustainability awareness dimension ($M= 38.800$) was higher than the pre administration of the economic sustainability awareness dimension ($M=26.266$). To test the statistical significance of that difference, paired samples t-test was used.

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Table 10.
Paired Samples t-test for the Difference in the Mean Scores of the
administrations of the pretest and post test of economic sustainability
awareness

Economic Sustainability Awareness	Mean	Standard Deviation	t-value	df	Sig.
Pre/post	12.533	12.408	-5.532	29	0.000

In table 10, the paired samples t-test yielded a statistically significant difference in the experimental group mean scores on the pre and post administration of economic sustainability awareness scale ($t = -5.532$, $p < 0.05$), in favor of the post administration. Therefore, it was concluded that the new strategy based on design thinking learning (the 3Es) raised the participants' economic sustainability awareness.

From the previously shown tables, it is concluded that the new strategy based on design thinking (The 3 Es) was significant in raising the awareness of the three dimensions of sustainability as well as the sustainability awareness as a whole.

VIII. Discussion of the Results

As for the writing performance, using dependent samples t- test indicated a statistically significant difference between the mean scores of the pre and post tests of writing performance ($t = 10.867$; $p < 0.05$). Based on this statistical result, the first hypothesis of the study was accepted and the researcher concluded that the proposed design-thinking based strategy (the 3 Es) improved EFL seniors' writing performance. An explanation of that result can be attributed to the collaborative and co-contributive nature of the design thinking approach on which the proposed strategy was based. In writing practice, the proposed strategy based on design thinking acted as a structured framework for identifying challenges, collecting information, generating innovative ideas, refining ideas, and testing the written product at the end. Thus, the design thinking based strategy served equally well as a roadmap for writing the topics. Again, writing is not an individual act. Collaborative and interactive nature of the design thinking strategy during the writing process might have facilitated students' development in writing

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performance (Wu, 2015). Therefore, using collaborative writing helped create an interactive learning environment where learners interact with each other, and engage in more conversation which is internalized as thoughts facilitating participants to write (Wu, 2015). Put it another way, during the three phases of the suggested strategy the researcher noticed that there were increased interaction and negotiation among the participants while writing their topics, as a result, participants improved their understanding of the topics, and exchange new ideas and perspectives that enhanced their writing performance (Talib & Cheung, 2017).

A more explanation might be attributed to the different types of feedback (teacher – individual – peers) the participants received on their drafts during the second phase of the 3Es startegy; Experiment. Using feedback loops help participants to iterate and make continued improvements to their drafts. That explanation finds empirical support in Seiffedin and El-Sakka (2017)'s study that indicated combining different types of feedback develop EFL students' writing accuracy.

An additional explanation might be the increased level of engagement resulting from applying the 3Es in writing the assigned topics. The best way to teach students to write is by engaging them to write. During the design thinking based strategy, participants engage in writing individually (during the third phase of the strategy called *Evolve*) as well as collaboratively (during the second phase of the strategy called *Experiment*).

The long duration of the experiment might be another reason of that result. The experiment lasted for a whole academic year that gave the participants the opportunity to develop writing performance through the long run writing practice. Using authentic writing topics was also among the acceptable explanations of the findings. When the students found relevance between the writing topics and their society, that encouraged them to feel ownership of their writing and therefore developed their writing performance. A final explanation might be attributed to design thinking-friendly learning environments which are compatible with the social constructivist approaches to teaching and learning. The non-threatening atmosphere the participants enjoyed while writing improved their writing performance (Tran & Duong, 2018). In such environments,

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students have the opportunity to present their own ideas as well as reflect on their teachers' and peers' ideas, help them to change or reinforce conceptions, acquire new skills, and reinforce already existing ones freely.

As for sustainability awareness, using paired samples t- test yielded a statistically significant difference between the mean scores of the pre and post administration ($t = 9.198$; $p < 0.05$). Based on this result, the second hypothesis of the study was accepted and the researcher concluded that the proposed design-thinking based strategy (the 3Es) boosted EFL seniors' sustainability awareness. An explanation for that result might be attributed to the three steps of the proposed design thinking based strategy (the 3Es). Writing is a concrete activity that helped raise awareness and emphasize learning. Writing about sustainability topics through exploring, experimenting and evolving phases raised the awareness of such topics. This view of writing as a process of design has postulated that students' engagement in small group discussions increased their motivation and built a deeper understanding of content matter, thereby advocating self-regulation skills (van Merriënboer & de Bruin, 2014). The long duration of the experiment might be another reason for that result. Handling sustainable development topics for a whole academic year should have raised the awareness of such topics.

IX. Conclusion and Educational Implications

Within the delimitations of the study as well as the results reached, the researcher concluded that the proposed design thinking-based strategy (the 3Es) significantly developed the writing performance of EFL students and raised their sustainability awareness. Consequently, the results of this study adds a new dimension to the growing body of research regarding design thinking based learning. It adds to the literature on applying design thinking approach in university context by providing an example of the implementation of a proposed design thinking based strategy (the 3 Es) for educators to reference as a resource. It can be helpful for educational developers and policy makers to reorient existing educational programs to develop writing performance and to raise sustainability awareness. It encourages teachers to apply

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design thinking approach as a pedagogical strategy to increase sustainability awareness. It encourages teachers to apply design thinking as a pedagogical strategy to teach writing. It provides learners with an innovative strategy to increase their engagement and interest in writing, and raise their sustainability awareness

The researcher recommends that Design thinking approach should be applied in teaching English writing as writing can be considered as a design process. Also, Sustainability awareness instruction should be made part of the courses at university level, students should not be departed from the problems of their society as well as the whole universe. Additionally, university staff should encourage their students to collaborate, think, create as well as iterate their failure.

X. Suggestions for further research

1. Further research about the impact of design thinking based learning on the teaching performance of in-service teachers becomes apparent.
2. The impact of design thinking approach in fulfilling the vision of English language learning in 2030 agenda should be overstudied.
3. The impact of design thinking strategies on the reading comprehension of secondary EFL students should be researched.
4. A study on the effect of design thinking strategies on the speaking proficiency of EFL university students should be investigated.

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