Using Green Pedagogy Approach for Enhancing Inferential Reading Skills and Eco-literacy Oriented Incidental and Intentional EnglishVocabulary of Pre-service Teachers of Science

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Abstract

The preset study aimed at identifying the effect of a program that is based on Green Pedagogy approach for enhancing inferential reading skills and eco-literacy oriented incidental and intentional English vocabulary of pre-service teachers of science. Participants of the study were (60) pre-service science teachers at Hurghada Faculty of Education. Following the one-group quasi-experimental design, the program of the study was administered over the participants following a pre and post testing procedure. Instruments of the study included five instruments and materials of the study included: Inferential Reading Skills Questionnaire, Inferential Reading Skills Test, Eco-Literacy Oriented Vocabulary Questionnaire, Green Education-Based Program, and Eco-Literacy Oriented Vocabulary Test. The program included four units about science vocabulary and eco-oriented language as well as inferential reading skills. The results revealed that the program based on Green Pedagogy approach developed participants' reading inference skills and their knowledge of eco- and environment oriented language acquisition. Results also showed that there were significant mean differences between the participants' scores in both intentional and incidental vocabulary acquisition favoring the post testing. The study recommended using the Green Pedagogy approach in designing similar courses and modules in different EFL contexts. It also recommended integrating Content and Language Integrated CLIL courses at both pre and in-service contexts due to the merits of this approach in both language and content knowledge development. Suggestions for further research were also provided in in the light of the obtained results.

Key Words : Green Pedagogy- Inferential - Incidental- Intentional – Eco literacy

استخدام مدخل التدريس الأخضر لتحسين مهارات القراءة الاستنتاجية ومفردات التنور البيئي المقصودة والعرضية باللغة الإنجليزية لدي معلمي العلوم قبل الخدمة

المستخلص:

هدفت الدراسة إلي التعرف علي أثر برنامج قائم على مدخل التدريس الأخضر لتحسين مهارات الاستنتاجية ومفردات التنور البيئي المقصودة والعرضية باللغة الإنجليزية لدي معلمي العلوم قبل الخدمة. تكونت عينة الدراسة من (٦٠) معلم علوم قبل الخدمة بكلية التربية بالغردقة واتبع البحث التصميم شبه التجريبي ذي المجموعة الواحدة ، تم تطبيق برنامج الدراسة على المشاركين بعد إجراء الاختبارات القبلية ثم التطبيق البعدي للإختبارات بعد انتهاء البرنامج. تضمنت أدوات مواد البحث: استبيان مهارات القراءة الاستنتاجية ، واختبار مهارات القراءة الاستنتاجية ، واستبيان مفردات التنور البيئي ، والبرنامج القائم على مدخل التدريس الأخضر ، اختبار مفردات التنور البيئي. تضمن البرنامج أربع وحدات حول مفردات العلوم واللغة البيئية بالإضافة إلى مهارات القراءة الاستنتاجية. وأظهرت نتائج البحث أن البرنامج القائم على مدخل التدريس الأخضر قد نمي مهارات القراءة الاستدلالية لدى المشاركين وكذلك معرفتهم بمفردات التنور البيئي. كما أظهرت نتائج الدراسة وجود فروق ذات دلالة إحصائية بين درجات المشاركين في كل من اكتساب المفردات اللغوية البيئيةالمقصودة والعرضية لصالح الاختبار البعدي. وقد أوصت الدراسة باستخدام مدخل التدريس الأخضر في تصميم دورات ووحدات مماثلة لمدخل سياقات مختلفة للغة الإنجليزية كلغة أجنبية. كما أوصي بدمج دورات لمدخل اللغة والمحتوي المتكامل في سياقات ومستويات مختلفة للمعلمين قبل الخدمة وأثنائها نظرًا لمزايا هذا المدخل وأثره الذي ينمي كلا من جوانب ومهارات اللغة وأيضا المعرفة بالمحتوي، وقد تم عرض لبعض البحوث والدراسات المقترحة فيضوء نتائج الدراسة.

الكلمات المفتاحية: التدريس الأخضر – الاستدلال – القراءة العرضية – القراءة المقصودة – التنور البيئي

Introduction

Education for Sustainable Development ESD is a core aim in the Egyptian higher education system including pre-service teacher education programs. This aim can be achieved through various integrative curriculum models and teaching approaches in its teacher education programs. One of the key programs at pre-service teaching level is science teacher education programs at Faculties of Education in Egypt. These programs aim to prepare future science teachers with required knowledge, skills and attitudes for their future profession through English as a medium of instruction. Thus, English is taught as a foreign language with the aim of integrating language to set scientific content.

According to Orehhova & Raoud (2022), teaching English as a Foreign Language in particular has moved to a new area of integrating different disciplines and content areas to language learning. For instance, Content and Language Integrated Learning (CLIL) approach is an example of how to integrate different science content to language education which was early introduced by David March in 1994. These approaches aim to integrate various pedagogies in the course of language learning (Haggag, 2017; Haggag, 2022).

The University College for Environmental and Agrarian Pedagogy (UCEAP) in Vienna first created the concept of Green Pedagogy approach. It is a learning activity set of plans based on Green Pedagogy as a learner-oriented (Ebhart, 2008). Green pedagogy is an integrative approach which primarily aims at enhancing students' eco-literacy. According to Aithal and Rao (2016), Green Education refers to the creation of environment oriented knowledge, skills and attitudes as well as values; it is an endeavor to connect the country's education to its economy and sustainability. Jorgenson (2011) views green pedagogy as signifying critical literacy approach and a

kind of "transformative teaching which engages the teachers to impart environmental education in the classrooms with the aim of guiding the students to engage themselves in nurturing and protecting the essential ingredients of the environment in their day to day life" (P.46). ALhussini (2020) indicated that the strategies followed in Green Education include: situated learning, virtual instruction, authentic tasks, competitive learning, and project based learning. Green pedagogy approach as an instructional and course design approach aims to enhance students' language competencies and literacies.

At the age of sustainability and "literacies", there is a need to reconsider curriculum design it is terms of its different literacy-oriented purposes. Literacy is a fairly new concept in TEFL literature; the concept was first introduced in 1992 by David Orr in his essay "Ecological Literacy" to refer to "the ability to understand the natural system that is related to our life. It is a way of thinking about the world in terms of interactions within natural systems including a consideration of the consequences of human actions" Jiwa and Esa (2013, p.1). It also refers to student's understanding not only of ecological concepts, but also of his or her place in the ecosystem (Meena and Alison, 2009). Similarly, Kwauk and Casey (2022, p.4) viewed eco-literacy as knowledge is not only about the environment and climate change, but also about the interconnected and interdependent socio-ecological systems through which humans are connected to each other and to the planet". It is knowledge about the language with its terms and expressions that are related to the environment.

Ecological literacy in TEFL has been a core research area in both EFL curriculum and different instruction approaches. For instance, in a study over EFL text books in Egypt, Hamed (2021) analyzed the environmental discourse in some EFL text books in the Egyptian schools and found out that

there are few topics related to ecology. The study assured that the aims of an EFL program need to be extended beyond the four language skills. Differently, in their study, Jiwa and Esa (2013) investigated the ecological literacy among secondary school students in Malaysia. The results of the interview session and the instrument of the research revealed that the literacy level of the secondary stage students is low. They do not relate what they study to their surrounding environment and that there is a need to raise secondary stage students' environmental awareness.

Ecological-oriented vocabulary literacy includes students' comprehension and eco-related vocabulary. In their study, Valentine, Rosmalina & Hayati (2015) explored student's inferential comprehension and reading comprehension over a sample of 126 university students. The study utilized two types of tests, namely inferential comprehension test and reading comprehension test. It was also found that there was a significant difference between male and female students; there was also a significant difference among the students in terms of inferential comprehension and reading comprehension. There was a significant correlation between participants' inferential comprehension and reading comprehension mastery.

Incidental vocabulary learning is the process of learning vocabulary without the intention of doing so; it is learning one thing while intending to learn other content (Richards & Schmidt, 2002). According to Sok and Han (2022), "Researchers in the field of SLA take different positions on the roles that incidental and intentional learning play in L2 vocabulary acquisition. The disagreements stem from different theoretical perspectives about the larger process of L2 acquisition as a whole". This distinction in both vocabulary learning "intentionally" and acquisition "incidentally" dates back to Krashens' Monitor Theory in 1987.

According to Day & Park, 2005, inferential comprehension is a process that involves the understanding of the content which goes beyond literal meaning. Students may face difficulties when answering these questions because their answers are not explicitly defined. On the other hand, teachers do not include sufficient strategies in their instruction to teach help students answer these questions. Hulstijn (2003, 357) expressed the view that the use of the terms incidental and intentional "to describe two types of learning is widespread in L2 vocabulary research". This pragmatic comprehension is crucial to language learner development.

Thus, this study aims to identify the effect of a program based on green pedagogy approach for enhancing inferential reading skills and eco-literacy oriented incidental and intentional vocabulary acquisition of pre-service science teachers.

Problem of the Study and its context

Problem of the study can be identified through its context and statement as follows:

1. Context of the Study

Problem of the study evolved from the researchers' experience in teaching English for Science Purposes course to science department customized program at Hurghada Faculty of Education. This problem was obvious in students' scores in the pilot study. The two tests of reading skills and science vocabulary were used in a pilot study which included (35) pre-service teachers of science. Analyzing the results of their reading answers revealed the challenges that they face. These difficulties include their interpretation for the main ideas and supporting details of the passage. The difficulties also included vocabulary use during presentations and their knowledge of environment related vocabulary in their English language courses. In sum, these difficulties included both reading skills and vocabulary

development. Moreover, reviewing literature (e.g. Ebadi, 2021; Ahmed, 2012; Eldekhely, et. al., 2019; Faragallah, 2016) showed the need for developing pre-service teachers (including science teachers) in different language skills such as English inferential reading and intentional and incidental vocabulary learning.

2. Statement of the problem.

Based on the above literature, piloting, and the researchers' teaching experience to the participants, problem of the study can be stated in the following:

Many pre-service science teachers face difficulties in learning inferential or pragmatic reading and incidental reading skills; they also face difficulties in learning and using English vocabulary related to ecology and environment.

Questions of the research

1. What is the form of the program based on green pedagogy approach that enhances pre-service science teachers' English language learning?

2. What is the effect of this program on participants' inferential reading skills?

3. What is the effect of this program on participants' intentional and incidental vocabulary development?

Objectives of the study

The study aims to the following:

1. Identifying the inferential reading skills that are needed for pre-service teachers of science.

2. Identifying eco-oriented English intentional and incidental vocabulary and idioms that are needed for pre-service teachers of science.

3. Designing a program based on green pedagogy approach for pre-service teachers of science.

4. Enhancing pre-service science teachers' inferential reading skills and their intentional and incidental English vocabulary using the program based on Green Pedagogy approach.

Significance of the Study

The results of the present study maybe significant to the following:

1. It integrates green pedagogy approach in developing both reading skills and eco-oriented vocabulary and thus, combining content knowledge and language learning.

2. The compiled program of the study which integrates between language learning and content achievement may develop both their content knowledge and reading skills.

3. The study compiled an integrated a program for developing both readings kills and content vocabulary.

4. Results of the study compares between two types of vocabulary (inferential and incidental) which may add to the literature of Foreign Language Learning FLL.

5. Results of the study may be useful for both pre-service English and Science teachers.

Hypotheses of the research

1. There would be significant mean differences between the scores of the participants in the pre and post testing of their inferential reading skills favoring the post testing.

2. There would be significant mean differences between the mean scores of the participants in the pre and post testing of their intentional English vocabulary development favoring the post testing.

3. There would be significant mean differences between the scores of the participants in the pre and post testing of their incidental English vocabulary favoring the post testing.

4. There would be significant mean differences between the scores of the participants in the pre and post testing of their overall score in both intentional and incidental English vocabulary favoring the post testing.

Design

This study follows the one-group quasi-experimental design with its pre and post testing procedure. It was delimited to the following variables:

1. Specialization: Science section students.

2. Fourth year pre-service science department students (Customized program, N. 60).

3. Hurghada Faculty of Education, South Valley University.

4. Variables: the independent variable is Green Pedagogy approach while the dependent variables are inferential reading skills, incidental and intentional vocabulary.

Instruments and Materials

The study utilized the following instruments and materials which were designed by the researcher and were validated in terms of content validity and reliability:

1. English Inferential Reading Skills questionnaire.

2. Eco-literacy oriented intentional and incidental vocabulary acquisition questionnaire.

3. Inferential reading comprehension skills test (which was used in the pilot study, pre and posttests). The test was validated by jury validation and its reliability was calculated (test-retest procedure).

4. Green Pedagogy-based Program which included five units about inferential reading skills and eco-oriented vocabulary.

5. Eco-literacy Oriented intentional and incidental vocabulary test which was used in the pilot study, pre and post-testing procedures. The test includes two parts: the first is intentional vocabulary while the second is about incidental vocabulary development.

Theoretical Framework

This review aims to integrate between pertinent literature and theoretical findings that are related to three main variables; the first is green pedagogy approach, the second is inferential reading and the third is English vocabulary development related to ecological literacy.

1. Green Pedagogy Approach

Green Pedagogy is an approach in TEFL literature which according to Hussain (2018) mainly aims to propose environment knowledge and skills in the classroom to make the learners work on the motto, "We are going to make the world a better place". This eco-related research area was guided by different studies (e.g. Gordon, 2010; Nkwetisama, 2011; Riegerova, 2011; Setyoati & Widiati, 2014). For instance, Setyoati and Widiati (2014) conducted a study that aimed at integrating environmental education into EFL classroom. The study concluded that the concept of greenery has a value in inspiring the pupils to be motivated to protect the ecosystem that they live in. Similarly, Riegerova (2011) proposed practical ways of integrating environmental education in the English language classroom. The study aimed to encourage the learners to read texts regarding the environment; write about it and learn the vocabulary on it. The study proposed many other explicitly aspects that can be practiced in the setting of the classrooms and the practices of both the teachers and students.

In TEFL literature, Green Pedagogy GP approach shaped the basis of a new type of *Green English*. For instance, Timothy & Obiekezie (2019) expressed the view that "Green English, therefore, refers to learning and

teaching practices in the English class that integrate environmental themes, issues and solutions. Green English is a sustainable, environmentally friendly approach to learning, teaching, and evaluation in the English class" (P.23). They further explained that this approach can be the vehicle for inculcating sustainable values and concepts and attitudes in the students in an effective communication setting. It is an ecological approach to language teaching for a real life communication. Similarly, According to Souza (2015) an ecological approach offers a sensitive perspective of language that considers students' social interaction and real life communication opportunities.

The ecological approach follows a different flipped learning perspective, which is, moving from the social umbrella to the inner psychological mindset. In this view, Van Lier (2004, p.174) stated that ""mind and consciousness develop as a result of social activity in the world, and learning consists of achieving more complex, more effective ('better' would of course be rather loaded terminology) activity in the world". This approach disagrees with the notion of learning emergence to the head, rather, it relates to the interaction with the environment. It views language as an instrument for world projection.

Green pedagogy moved to a whole schooling philosophy that aimed to enhance student's eco and language literacies during the learning process. Green schooling was early defined by Gordon (2010, p.1) stating that "green schools are the results of the planning, designing, and construction process, with a focus on creating an environment that is optimal for learning". Ecological literacy literature has been shaped by key researches (e.g. Orr, 1992; Jordan et al., 2009; and Knapp & D'Avanzo, 2010; & Berkowitz et al., 2017). For instance, Nkwetisama (2011) attempted to enact eco-applied linguistic approach in the EFL classrooms in Cameroon and asserted that

even EFL practitioners can contribute to sustainable and environmental development through practicing green pedagogy in the classrooms.

The call of integrating Green Pedagogy in ELT was guided by the climate emergency (see Burton, 2019; Gordon, 2010; & Lier 2004). The main study follows the green pedagogy model in ELT by Nur et. al. (2022) which calls for environmentally based language teaching practices. The following figure (1) shows the interrelated aspects of the model.
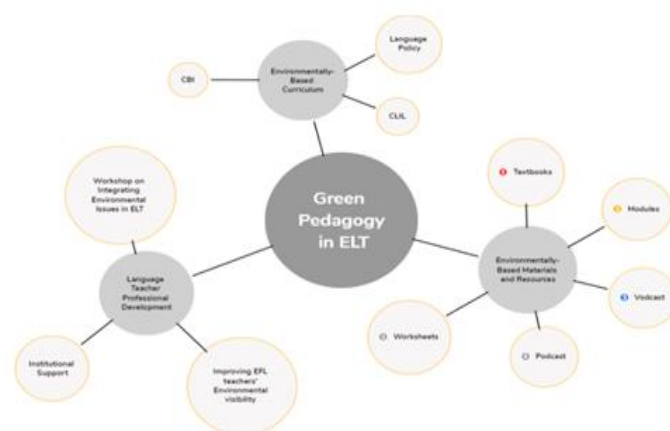

Figure1.

Green Pedagogy in ELT

The figure shows three main areas of integrating green pedagogy in English Language Teaching field. The first is the curriculum; through various course design approaches such as CLIL and CBI that aim to develop environment related language outcomes. The second is the environmentally based resources and materials, while the third is the Professional Development PD field. The main study provides a framework for the second is *resources* as it aims to provide a resource program for integrating green pedagogy for reading and vocabulary development.

There are various advantages for implementing Green pedagogy approach in EFL contexts next to the challenges. For instance, Wogowitsch & Foz (2021) stated that the advantage of Green Pedagogy is that "it provides a template for learning activity planning, with the six dots at the base of the spiral representing a recommended lesson planning structure and sequence. The plan can be stretched over a series of connected lessons that could represent a case study, a project, a research activity, a lab activity, work placement or a field activity" (P.4). The key challenge to apply the approach is the difficulty to provide authentic materials that integrate between language skills and content knowledge, which is one of the aims of this research.

2. Inferential Reading comprehension

Inference was early categorized by Chikalanga (1992) into three main types: lexical inference, logical inference and pragmatic inference. Roth & Green (2013) explored the different inference skills for reading in a study that investigated the effectiveness of reading intervention program. The study aimed for developing students' inference skills through the intervention program. Results showed the effectiveness of this program based on both literal and inferential question types to develop the various types of inference skills of the participants.

Inference skills at a university level were discussed in a study by Azman (2021) which investigated instructors and students' use of literal, recognition and inferential reading strategies. This study aimed at identifying and comparing reading strategies used by both instructors and students in dealing with literal comprehension, reorganization, and inferential comprehension questions. Participants were 27 university students and the study utilized an English Language Proficiency Program. The analysis of the data revealed that both instructors and students practice various reading strategies when dealing

with comprehension questions, and some strategies used by the instructors are never used by students.

Similarly, Ebadi (2021) explored EL leaners' inferential comprehension skills through a flipped classroom. The study utilized the mixed-methods approach in finding the effects of the Web-Quest based classroom on the EFL learner's reading comprehension skills. The study was run over a group of IELTS participants. Two main results were reported from the study: the first is the positive attitudes of the participants towards the new methods in teaching; the second is the effectiveness of the flipped classroom method in teaching reading comprehension.

Summing up, inferential reading skills are pragmatic in their genre; there have been various researches that aimed to integrate different approaches to develop inference of both EFL teachers and the students as well. The aim of this study is different as it aims to develop reading inference of pre-service science teachers; it also aims to develop both content knowledge and reading inference of the participants.

3. English Vocabulary Acquisition (intentional vs. incidental)

There are various studies and researches that examined intentional and incidental vocabulary learning and acquisition (e.g. Al-Qarni, 2009; El Nekhely, et. al., 2019; Bogaards, 2001; Nation, 2001; Qian, 2002, and Webb, 2007). According to Ahmad (2012), vocabulary learning is "an indispensable process for ESL learners to acquire proficiency and competence in the target language. He further claims that word-power facilitates fluent speaking and effective writing. It substantiates both: learners' acquisition of knowledge and production of knowledge" (p.71). According to Bowers (2003), there is a need to foster students' values for the environment by incorporating outdoor experiences in science and language education. This is a key step in experiencing, learning and caring balance. Unfortunately, for many students,

learning experiences do not involve these types of opportunities even students' ecological knowledge is not seen as important for the student.

A similar study by Ahmad (2012) compared between the different advantages of integrating both intentional and incidental vocabularies. He stated that "Incidental Vocabulary promotes deeper mental processing and better retention. The learners get themselves fully involved in the process of deciphering the meaning through the clues available in the text" (P.72). Further, it motivates learners for extensive reading and enhances learners' abilities to guess new words from contextual clues. It also promotes deeper mental processing and better retention. On the other hand, intentional vocabulary learning is based on synonyms, antonyms, word substitution and other techniques that cram meaning through rote learning.

Sinyashina (2020) further distinguished between intentional and incidental vocabulary learning referring to Krashen's distinction stating that when learners do not know they are acquiring the language because they consciously focus on the *message* not the *form* of the language. On the other hand intentional learning requires a deliberate attempt to use *rehearsal techniques*. Sinyashina further assured that " New vocabulary can be learned intentionally, while consciously intending to do so, and incidentally when the learning itself is not in the focus of an activity. Many scholars highlight the importance of intentional learning and teaching when target language (TL) learners want to achieve high results in new lexis acquisition" (p.93). Summing up, there is a correlation between inference and incidental vocabulary learning.

Thus, inferential intended vocabulary learning and incidental vocabulary acquisition have been early discussed by Krashen's Hypothesis which emerged to be integrated with new EFL approaches such as the main Green Pedagogy Approach. In such approach pre-service teachers need to

develop their discipline-oriented vocabulary to pursue their future profession as well as their language skills development. The following section discusses the obtained results from the instruments about the two variables of the research.

Results

Using SPSS statistical analysis, the obtained quantitative results verified the following hypotheses of the study:

H.1. There would be significant mean differences between the scores of the participants in the pre and post testing of their inferential reading skills favoring the post testing.

To test this hypothesis, the following statistical results show the difference in means between the participants in the pre and post testing of their inferential reading.

Table 1.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre_reading	21.87	60	2.266	.293
	Post_reading	23.77	60	2.424	.313

The above table (1) shows that the mean of the participants in reading was (21.82) in the pre testing compared to the post testing (23.77). This shows that there was an increase in participants' means in inferential reading. The following table (2) compares between the means of the participants and shows the degree of significance between the pre and post testing procedures.

Table 2.

Paired Samples Test

Variable		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Reading - Reading	-1.900-	2.297	.297	-2.493-	-1.307-	-6.406-	59	.000

Table (2) shows that there are statistically significant mean differences between the participants in the pre and post testing of their inferential reading skills (.000) favoring the post testing procedure. This shows that the performance of the participants was better in the post testing due to the effect of the program over the participants.

H.2. There would be significant mean differences between the mean scores of the participants in the pre and post testing of the participants' intentional English vocabulary development favoring the post testing.

To verify the above hypothesis, the following the table shows the differences in means in the pre testing of intentional vocabulary (39.43) compared to the post testing (43.50). This shows that the mean of the participants is higher after the application of the program compared to the pre-testing before applying the program.

Table 3.

Paired Samples Statistics

Variable		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Inten_Vocab	39.43	60	4.252	.549
	Inten_Vocab	43.50	60	2.182	.282

The following table (4) compares between the means of the participants and shows the significance value (.000) due to these differences. This difference is clearly significant between the two testing procedures and this shows the impact of the program on intentional vocabulary of the participants.

Table 4.

Paired Samples Test

Variable		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Inten_Vocab - Inten_Vocab	-4.067-	4.242	.548	-5.163-	-2.971-	-7.426-	59	.000

The following statistical treatment was run to verify the hypothesis related to incidental vocabulary acquisition of the participants.

H.3. There would be significant mean differences between the scores of the participants in the pre and post testing of their incidental English vocabulary favoring the post testing.

Comparing the results obtained from the pre and post testing procedure of participants' incidental English vocabulary development shows the following differences. The following table (5) compares between the means of the participants in the pre and post testing procedure.

Table 5.

Paired Samples Statistics

Variable		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Inci_Vocab	40.72	60	2.981	.385
	Inci_Vocab	43.23	60	2.166	.280

Table (5) shows that the mean value of the participants in the pre testing was (40.72) compared to the post testing value (43.23). This indicates that there is an increase in participants' incidental vocabulary; the following table shows the significance of this difference.

Table 6.

Paired Samples Test

Variable		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Inci_Vocab - Inci_Vocab	-2.517-	3.111	.402	-3.320-	-1.713-	-6.266-	59	.000

The above table (8) shows that there was significant difference between the means of the participants in the pre and post testing (sig .000) favoring the post testing. This difference also confirms the effectiveness of the Green Pedagogy-based program in developing the participants' incidental ecology-oriented vocabulary.

H.4. There would be significant mean differences between the scores of the participants in the pre and post testing of their overall score in both intentional and incidental English vocabulary favoring the post testing.

The above hypothesis discusses the overall scores of both incidental and intended vocabulary of the participants. The following table shows the means of the participants in the pre and post testing of their overall vocabulary scores.

Table 7.

Paired Samples Statistics

Variable		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre_Total_Vocab	80.15	60	5.822	.752
	Post_Total_Vocab	86.82	60	3.757	.485

The table shows that the mean score of the pre testing before the application of the program was (90.15) compared to their mean score in the post testing (86.82). This shows that there was a development in participants' overall scores in the vocabulary after the application of the program. The following table shows the significance of this difference.

Table 8. Paired Samples Test

Variable	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Pre_Total_Vocab Post_Total_Vocab	-6.667-	5.839	.754	-8.175-	-5.158-	-8.844-	59	.000

Table (8) shows that there was a significant value of (.000) that indicates mean differences between the participants in the pre and post testing of vocabulary overall score favoring the post testing. This difference accepts the alternative hypothesis and rejects the null hypothesis. The following section discusses these results within literature and related studies that dealt with the variables of the research.

Discussion

The present study utilized a program based on Green Pedagogy approach for enhancing inferential reading skills and eco-literacy oriented incidental and intentional vocabulary acquisition of pre-service science teachers. The obtained results showed that there were significant mean difference between the participants in the pre and post testing of both reading and vocabulary favoring the post testing. The following discussion relates these results to literature and related studies.

The scarcity in literature in eco- oriented pedagogy literature highlighted the value of eco pedagogy and approaches in language and content education. In this view, a study by Zahoor & Janjua (2020) aimed to investigate textbooks' eco-related topics in EFL context showed the limited number of these materials. The study investigated the discourse representations of nature at ELT textbooks in relation to the linguistic features of discourse and students' participation. Student participation was also examined in similar studies such as (Jacobs & Goatly, 2000; & Stibbe, 2004).

In the Egyptian educational system context, results of this study agree with another study by Faragallah (2016) which assessed environmental education in the Egyptian formal education by investigating the extent of the students' knowledge and awareness of environmental issues as well as the effectiveness of the environmental policies in enhancing this environmental

awareness. Study interviews which were conducted with a sample of public-school students indicated a poor level of environmental knowledge by the majority of the participants as well as a disregard of environmental education in public policies.

Similarly, the positive impacts of the independent variable of the study confirm the call for environmental context in EFL course books and English language teaching (Hamed, 2021). This curricula-based call may increase the integration between content knowledge and language learning. It may also encompass the ethical dimensions of both human and nonhuman entities in the environment apart from language acquisition. This also agrees with the results obtained from a study by Hussain (2018) which aimed to explore the possibility of enacting green pedagogy concentrating atmospheric development in the EFL classrooms. Similarly, this study agreed with the previous study in achieving two targets simultaneously; the first is being improved in English language skills and the other is being consolidated environmental awareness.

As to the vocabulary-oriented literature, a comparative study by Ahmad (2012) compared between intentional and incidental vocabulary learning over participants from a Saudi university. Results showed that incidental type performed significantly better than intentional type. Similarly, Sinyashina (2020) compared s the effectiveness of two combinations of new vocabulary learning techniques: 'incidental + intentional' and 'intentional + incidental'. For the incidental part, the participants viewed 3 hours of captioned authentic videos, whereas for the intentional one they were asked to do a set of tasks with the target vocabulary at home. The overall scores revealed better performance of the 'incidental + intentional' condition in the three tests. Comparing the results of the main study with the previous results shows that intentional vocabulary was more developed by the participants than

incidental vocabulary. This can be due to the type of the direct vocabulary knowledge assessment followed by the study rather than indirect decontextualized incidental vocabulary.

These results also agree with a study by Sanos & Yung (2020, 1) which stressed that "the current rate of unprecedented global environmental degradation demonstrates that there is an urgent need to integrate Environmental Education in educational institutions around the world". The results also agree with what Santos & Yung explained as merits of green pedagogy. These merits include increased language learning motivation from peer collaboration and scaffolding, opportunities for greater self-reflection, and development of higher-order cognitive skills. Results support his claims about the currently plethora of methods that educators can use to integrate Environmentally-Responsive EFL Pedagogy into the EFL classroom.

For a qualitative input, participants were asked to submit journals about their experiences in the course. One of the participants "Zeyad Tamir" reported that he could focus on *"what I am doing more than what I learn "*. This agrees what Lier (2010) expressed regarding the ecological approach as it aims to look at the learning process, the actions and activities of teachers and learners, the multilayered nature of interaction and language use, in all their complexity and as a network of interdependencies among all the elements in the setting" (p.3). Based on the above results, the study adds to the scarce research in green pedagogy as an approach to be integrated in EFL context. The obtained quantitative and qualitative results show the positive impact of the approach in both reading skills and vocabulary learning. Thus, the obtained results agree with literature in the positive impact of *Green Pedagogy* approach in foreign language learning. It differs in participants' figure, types of reading skills discussed and in the comparison between the two types of vocabulary gained by the participants.

Implications of the Study

Implications of the study stem from the challenges faced during its running. The first challenge is the lack of integration between content and language learning. Many university-level English for science courses do not integrate pedagogies such as CLIL or green pedagogy as effective approaches in teaching English courses. Therefore, one of the implications of the study is compiling green pedagogy-based program for both content knowledge and language learning development at the university level, which is useful for course designers and teachers. Another challenge was in the instruction procedures that the students were acquainted with, which is mainly rote-lecturing. The program of this study presents interactive activities and discussion activities that can be used in workshops or interactive lecture settings. These implications can be useful for course designers, teachers, students, and ELT theory and practice.

Recommendations and suggestions for further research

In the light of the obtained quantitative and qualitative results, the study recommends using Green Pedagogy approach for compiling other language courses which aim to develop other areas such as vocabulary and reading skills. Students can make of these materials based on this approach for both language development and content achievement. Teachers as well can design their course materials, activities, tasks, and assignments using this approach. The main study also recommends integrating similar approaches to green pedagogy such as CLIL, CBI, and ESP. Green pedagogy approach adds to both theory and practice of ELT course design. Thus, this study recommends integrating this approach in Egyptian Course design practices in general and in pre-service education programs in particular. The study recommends its program as a means to combine both incidental and intentional vocabulary. It also suggests running further researches and studies that explore different

aspects of incidental and intentional vocabulary, assignments, and performance based assessments. It also recommends longitudinal studies that examine the effects of long-term vocabulary interventions that discuss how the incremental process of vocabulary learning / acquisition is affected by incidental and intentional vocabulary.

Conclusion

Eco- related pedagogy can positively affect pre-service science teacher's reading skills and vocabulary learning as well. Green Pedagogy as a course design approach can positively provide pre-service science teachers with a deep knowledge of both language areas and eco-oriented content. The impacts of this approach can be beneficial to students, pre-service teachers, in-service teachers, course designers and class practice. The study highlighted vocabulary development as an intentional process that adds to the incidental acquisition of words in developing a foreign language competence. It also highlighted inferential reading as an ability to recognize hidden concepts and unstated relationships between ideas and lines in a text. Both quantitative and qualitative results obtained from the instruments of the study showed that green pedagogy approach is also effective in foreign language development in general and in reading and vocabulary learning in particular.

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