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Computerized Dynamic Assessment of Incidental Vocabulary Learning: A Case of Iranian ESP Learners

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ABSTRACT

Dynamic assessment (DA) has been widely researched in different linguistic areas, but there is paucity of research on its incorporation into English for Specific Purposes (ESP). Accordingly, this study investigates the effectiveness of DA on incidental words emerging in technical reading textbooks with a focus on electronic engineering students. The research method is a quasi-experimental research design focusing on an intact group of 25 Bachelor of Science students of electronics from the University of Zanjan, Iran. The instruments used are Preliminary English Test (PET), a vocabulary knowledge scale, and a mediation test (a 13-item multiple-choice test). The mediation test was delivered through the researcher-developed website, designed for this purpose. As a triangulation, participants' evaluation of computerized dynamic assessment (CDA), too, was elicited using a survey adopted from Nirmalakhandan (2007). The results of the qualitative and quantitative phases indicated that Electronic students' incidental vocabulary learning promoted dramatically using target CDA, employing structured prompts for the mediation process. The results of this study can inform both teachers and learners by providing a step-by-step procedure for both teaching and assessment of ESP learners' vocabulary.

KEYWORDS: Computerized dynamic assessment; Incidental vocabulary learning; English for specific purposes; Zone of proximal development; Mediation

1. Introduction

Assessment and why to be assessed is an important everlasting query of most teachers and learners, but the point to be made is that whatever the approach and ideology to learning and teaching are, assessment is an integral and inseparable part of the learning process (Poehner, 2008). Recent approaches and ideologies concerning language learning have led to the transformation of the concepts and bases of assessment, resulting in a shift in the relationship between assessment and teaching. Understanding the inadequacies in traditional assessment, scholars (e.g. Sternberg & Grigorenko, 2002) called for a more comprehensive approach so as to gauge multifarious aspects of learners' capabilities and help them enhance learning. The response to the call was that of integration of assessment and teaching with the goal of enhancing learning.

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Built on Vygotsky's sociocultural theory of mind, dynamic assessment (DA), as a uniform integration of teaching and assessment, aimed to address the deficiencies of traditional assessment. Since DA requires the examiner to take into account the examinees' zone of proximal development (ZPD), there are some impracticalities at work. This has made the use of DA for one-session mediation impossible. The idea of computerizing the implementation of DA procedures was a response to overcome the above-mentioned problem. Thus, computerized dynamic assessment (CDA) helped solve this problem by allowing the examiner to dynamically assess a greater number of learners and abilities in a single session (Poehner & Lantolf, 2013; Summers, 2008).

It is established that CDA puts emphasis on learning, and its product is successful learning (Lidz & Gindis, 2003), which is in line with the perspective dominant in English for Specific Purposes (ESP) (Hutchinson & Waters, 1987). By the same token, Hutchison and Waters (1987), for instance, put emphasis on ESP as an approach not a product, i.e. language learning is highlighted over language use. In fact, this is the reason why the present study attempted to introduce and probe the effectiveness of CDA in an ESP context.

Acquiring academic vocabulary is the main goal of ESP courses since university students are required to read English texts in their field of study so as to be able to obtain information regarding the latest technologies and advances, the prerequisite for which is having a good vocabulary knowledge (Nito, 2004). That is why teaching specialized vocabulary to ESP learners has been a concern throughout the history of ESP and language teaching (e.g. Dudley-Evans & St John, 1998; Sarani & Sahebi, 2012; Tangpijaikul, 2014).

The present study aims to answer the flowing questions:

1. Does CDA have an effect on incidental vocabulary learning by Iranian EFL learners in an ESP teaching/learning context?
2. What is the attitude of the participants to deployment of CDA in the ESP teaching/learning context?

2. Literature review

2.1. Dynamic assessment (DA)

DA challenged the view that assessment is seen as a distinct activity from teaching and argued that assessment and teaching are integrated rather than two distinct activities. In order to interpret learners' abilities and to lead them to higher levels of functioning, intervention is done during the assessment procedure and therefore, the two are integrated (Lidz & Gindis, 2003).

DA is theoretically based on two psychologists' work: it is based on Vygotsky's socio-cultural theory and ZPD and Feuerstein's structural cognitive modifiability theory and mediated learning experience (MLE). Based on Vygotsky's (1978) definition, ZPD is the distance between a child's actual developmental level, independent problem solving and the higher level of potential development, problem solving under adult guidance or in collaboration with more capable peers. ZPD is of great practical significance for education because of identifying how instruction can optimally develop learning by aligning mediation to abilities that are emerging, not those that are emerged (Xi & Lantolf, 2021). Therefore, ZPD is considered as the activity in which instruction leads to development. Moreover, Tzuriel (2001) defines MLE as an interactional process in which parents manipulate adult-child interactions in order to trigger child development.

DA is usually contrasted with static assessment (SA), which is not sensitive to ZPD. SA refers to the conventional forms of assessment in which assessment is performed without any intervention by the assessor, who just records learners' scores (Tzuriel, 2001); thus, DA, as an intervention-oriented approach, came as a result of dissatisfaction with SA as such (Lidz & Gindis, 2003).

There are two approaches toward DA, resulting from the two different interpretations of ZPD (Vafaee, 2011). The first interpretation is quantitative, leading to interventionist DA and the second one is a qualitative interpretation of ZPD, resulting in interactionist DA (Lantolf & Poehner, 2004; Lantolf & Thorne, 2006). Since mediation is the crux of DA, the difference between the two approaches is in terms of the mediation offered during assessment. Sternberg and Grigorenko (2002) differentiated between two formats of the interventionist DA, namely, the "sandwich" and the "cake" formats.

The sandwich format is evocative of traditional test formats and is conducted in the form of pretest-intervention-posttest either individually or in group size. According to Budoff (1968), test results are reported in the form of pre-training scores and post-training scores.

In the cake format, a standardized menu of hints, ranging from implicit to explicit, as for most interventionist approaches, is provided for the examinee during the administration of the assessment itself (Lantolf & Poehner, 2008; Poehner & Lantolf, 2021). Like the layers of a cake, the test items and hints are layered and a menu of hints is available for each question or problem before moving on to the next item on the test.

With the recent advances in technology, computer-based tests are being widely common and used. DA researchers have not lagged behind and are investigating ways to conduct mediation processes via the computer. CDA is quite new and few studies have been reported to use CDA to date. According to Poehner (2008), "CDA has several distinct advantages, including the following: it can be simultaneously administered to large numbers of learners; individuals may be reassessed as frequently as needed; and reports of learners' performances are automatically generated" (p. 177).

In recent years, DA has attracted the attention of many scholars around the world, and Iranian scholars are not exceptions. For example, MovahedFar et al. (2022) carried out a study to investigate the effect of CDA on Iranian EFL learners' performance in writing and their attitude towards CDA. They found that teaching and assessing writing skills through a computer can improve students' performance.

Estaji and Ameri (2020) examined the effect of interventionist approach to DA on Iranian English as a Foreign Language (EFL) learners' grammar achievement at two proficiency levels of pre-intermediate and high-intermediate. They found that the interaction effect of type of assessment and proficiency level was significant, which meant that the effect of DA on grammar achievement was higher for pre-intermediate learners than it was for high-intermediate learners.

Zangoei et al. (2019) consolidated assessment and instruction of L2 pragmatics comprehension through interventionist CDA. Like the present study, this paper provides three actual, mediated, and learning potential scores (LPS). The results of this study showed that the test could improve test takers' pragmatic comprehension competence.

Ebadi and Saedian (2015) investigated the impacts of CDA on promoting at-risk advanced Iranian EFL students' reading skills. Their results showed that this type of assessment may be most useful for individuals requiring a lot of attention, that is, at-risk or retarded learners.

Hessamy and Ghaderi (2014) attempted to investigate the role of DA in vocabulary learning of 50 intermediate Iranian EFL learners. They followed the sandwich format and found that incorporation of DA to standard testing had a positive effect on test performance and vocabulary learning by EFL learners.

Saeidi and Hosseinpour (2013) meticulously investigated the effect of DA on Iranian EFL learners' vocabulary learning. The results suggested that the rate of vocabulary learning can be enhanced using DA. This study is somehow similar to the present study, but there are two main points to be made here. First, their study dealt with DA, while the present study has employed CDA. Second, they conducted their study on general vocabulary learning, but this study was done on ESP vocabulary.

As the literature suggests, in the last two decades, the number of studies conducted on DA has increased significantly, each exploring different aspects of language learning within different frameworks (Qingha & Di, 2015), but to the best of the researchers' knowledge, there is paucity of research on the role of DA in vocabulary learning, in general, and CDA, in particular. Although there are some studies attempting to do so, all of them are in the context of general vocabulary and none has incorporated DA into the context of ESP and, specifically, vocabularies emerging in an ESP context.

2.2. Incidental vocabulary

Incidental vocabulary learning has been defined by various researchers from different aspects. For instance, Bogdanov (2013) defines incidental vocabulary learning as the learning of words that are the product of interactive activities, such as reading, listening, and communicating. It should be noted that the definition provided by Hill and Laufer (2003) has been adopted for this study, in which learning vocabulary is the by-product of another activity.

An important point about incidental L2 vocabulary acquisition lies in the fact that the teacher does not direct the learner's attention to the target words. For example, in Laufer (2006), "participants were not told that the purpose of the experiment was vocabulary learning and that they would be tested on vocabulary" (p. 156). But in the end, it is the learner not the teacher who decides whether to attend to the input or not. The empirical studies on incidental vocabulary are presented below.

Tang and Treffers-Daller (2016) studied Chinese EFL students' incidental vocabulary through involvement load hypothesis (ILH). They provided evidence that incidental vocabulary uptake is limited and tried to improve it. In this regard, they employed ILH and found it to be effective in incidental vocabulary learning.

Wang (2013) aimed to investigate whether Taiwanese lower-level EFL learners could increase their word knowledge through extensive reading. The tool for assessing vocabulary knowledge in this study was the table proposed by Paribakht and Wesche (1999). He found that learners achieved significant vocabulary gains after this program, suggesting that extensive reading affects lower-level learners' incidental vocabulary learning.

To the best of researchers' knowledge, there was no study investigating incidental vocabulary learning within the framework of DA. It is noteworthy that the concept of incidental learning has been particularly important in the context of

research on vocabulary acquisition, which is the core of ESP (Nito, 2004) and therefore, both notions will be discussed jointly incorporating DA as well.

2.3. ESP revisited

ESP has increasingly grown since its emergence, believed to be in the early 1960s (Swale, 1988). Because of the advances in technology and many other factors such as globalization, overseas scholarship for higher education, economic and political ties among nations, tourism, and international academic gatherings, ESP has become the focus of attention all over the world.

In 1997, the first conference on ESP was held in Japan. In this conference, all participants were asked to give a definition of ESP. Some of them defined ESP as teaching of any English material for any specified purpose. Others defined it more precisely as teaching English in academic lessons or for professional and vocational purposes (Anthony, 1998). Dudley-Evans and St. John (1998), however, offered a characteristic definition of ESP, focusing on absolute and variable characteristics as follows. Regarding the absolute features, an ESP course subscribes to the following essential principles:

1. ESP is defined to meet specific needs of the learners

2. ESP makes use of underlying methodology and activities of the discipline it serves

3. ESP is centered on the language appropriate to these activities in terms of grammar, lexis, register, study skills, discourse and genre.

And the following constitute some of the variable features of an ESP course:

1. ESP may be related to or designed for specific disciplines
2. ESP may use, in specific teaching situations, a different methodology from that of General English
3. ESP is likely to be designed for adult learners, either at a tertiary level institution or in a professional work situation. It could, however, be for learners at secondary school level
4. ESP is generally designed for intermediate or advanced students
5. Most ESP courses assume some basic knowledge of the language systems (p. 4).

Studies conducted on ESP have focused on one dimension of ESP, either the learning process or teachers' and students' attitudes toward ESP. These studies also showed that ESP teachers' lack of sufficient knowledge and training in this area has affected the whole process and has caused it to be in a poor condition. Again as for the incidental vocabulary learning, the researchers could find no international or national studies focusing on the role of DA in incidental vocabulary learning in an ESP course setting. Accordingly, the present study was launched to fill this gap in the related literature.

3. Methodology

3.1. Participants

The participants of the present study included an intact group of 25 undergraduate electronic engineering students pursuing their studies during the academic year of 2020 – 2021. They all had passed their ESP course. They were both male and female students and all were native speakers of Persian. However, it should be noted that gender wasn't considered as a moderating variable in this study. Their age range was between 19 and 24 years old and they were all informed of the voluntary nature of the study. They were assured that the personal information they provide at the starting page of the website would remain confidential; they were then provided with sufficient information about the procedure and purpose of the study.

3.2. Research tools

The instruments and materials used in this study include The English Preliminary Test, a researcher-developed vocabulary knowledge scale (VKS) based on the model of Paribakht and Wesche (1999), a researcher-developed multiple-choice type test of vocabulary. These instruments are elaborated below.

3.2.1. The proficiency test

The PET was used to ensure the homogeneity of the proficiency level of students. This test is composed of two parts: Reading and Writing. The reading part includes five sections with 35 multiple-choice items providing simple written information. The writing section, on the other hand, consists of three parts with 8 items for which students are asked to do sentence completion task, provide specific information, and write a letter with the word limit of 100 words.

3.2.2. Vocabulary knowledge scale

The textbook used in this university for the ESP course was written by Haghani (2013) and published by SAMT organization. The book is composed of twenty short passages on different issues in electronics, followed by some exercises. It is worth mentioning that the first draft of the vocabularies chosen to be included in the VKS contained some compound nouns, but they were excluded for the purpose of the homogeneity of elicitation test. Accordingly, another list without any compound structure was prepared. Finally, thirty out of the forty-three incidental vocabularies were included in the final VKS.

The VKS was based on Paribakht and Wesche's (1999) model and was run to ensure that they were unfamiliar to the participants. Based on this scale, the participants were required to indicate whether they had seen or known each of the thirty target words. The vocabularies, which students didn't know or couldn't recall the meaning, were selected to be included in the mediation-based incidental vocabulary test (MBIVT). Accordingly, thirteen out of the thirty vocabularies were kept for assessment purposes and the others were excluded. Paribakht and Wesche's (1999) model solves the validity concerns since the items to be assessed were based on a needs-analysis basis. Therefore, there was no need to conduct a pilot study for validation indexes.

3.2.3. MBIVT

The development of CDA was inspired by the concept of graduated prompt approach proposed in the research of Brown and Ferrara (1985) and Campione and Brown (1990). In this approach, mediation is provided during a single test administration in the form of prompts arranged from the most implicit to the most explicit. In this form, prompts are offered for each item whenever the learners need. One of the advantages of this approach is that it provides information on the number of prompts required by each learner (Poehner et al., 2015).

The design of the CDA test was based on the cake format of interventionist approach, i.e. test-within-test design. Accordingly, a standardized menu of hints is prepared in this approach and is provided for each item. If the examinee gives a wrong answer in this process, the first mediation prompt appears and the item is re-attempted; otherwise, he or she will be directed to the next item.

The MBIVT was administered to a pilot group of 25 students from the University of Zanjan, who were at the same proficiency level as the participants of the study. Accordingly, some modifications were made to the test items based on the results of the test piloting and comments of the participants. The KR-21 method, as an estimation of reliability, was used to examine the internal consistency of the test. To this end, the calculator at www.cedu.niu.edu/~walker/calculators/kr.asp was used (Poehner et al., 2015).

3.3. Student Survey

The qualitative phase of this study, addressed by the second research question, dealt with the participants' evaluation of this CDA-based approach to incidental learning of the target vocabulary items within the ESP course setting. To this end, the survey used in Nirmalakhandan (2007) weighing students' evaluation of CDA was adopted in the present study. This survey consisted of eight items that were rated based on the five-point Likert scale (1 = strongly disagree, 5 = strongly agree). It is of great importance to note that the reliability of this survey was calculated to be .073, which is acceptable. The figure was not included in the original paper and after mailing the author, he assured the reliability of the student survey.

3.4. Procedure

3.4.1. Test construction procedure

The first step in preparing the intended test was the selection of passages. First, the professors of electrical engineering department, who had the experience of teaching this course book, were consulted to see which parts of the book were covered during the term. Accordingly, eight passages were randomly selected from this book. Having selected the passages, it was the time to set out to prepare items and their response options based on the passages.

The response options for each item were sentences extracted either from the exercises of the aforementioned book or from the final exams prepared for the electrical students of Payame Noor University. It is noteworthy that five response options

were prepared per item; four response options as the conventional multiple-choice format and one as a distractor in order to provide examinees more freedom and to allow them to make multiple re-attempts (Poehner & Lantolf, 2013).

The next step, after preparing passages, items and response options, was to prepare four hints per item. If the number of response options and hints was equal for each item, the participants would find the answer in the second attempt. In other words, if the test was in a conventional four-option multiple-choice format, one response option would be deleted offering a hint and, thus, the participants would have two alternatives in the second hint. To avoid this problem, the number of the response options was five and the number of the given hints was four per item. The first and the last hints remained fixed for each item, arranged from the most explicit to the most implicit. The format of the first and the second prompts per item was as follows:

Hint 1: That is not the right answer.

Hint 4: The correct answer was.

When the test finished, it was the time to make it a CDA test. Therefore, it was prepared in the form of an online test.

3.4.2. Website preparation

The test starts with the first passage. After reading the passage, the first item appears on the next page. If the examinee answers incorrectly, the first prompt, i.e. the most implicit one, is offered and the examinee is given the chance to re-attempt the item. If the second response of the examinee is again incorrect, the second prompt, i.e. more explicit one, is provided. The procedure continues until either the examinee gives the correct answer and is moved to the next item or until the last hint and the right answer, i.e. the most explicit one, is offered.

During the pre-test stage, five professors of the electrical engineering department were asked to comment on the test for the purpose of ensuring the content validity of the MBIVT. This phase was considered as the "expert judgment" for the current test. As a result, the experts confirmed the content validity of the test and then, a pilot group of 25 students, with the same proficiency level as the participants, were asked to take the test. Taking into account the feedback of professors and the pilot group, the researchers modified some problematic response options and prompts.

As was mentioned earlier, the KR-21 method was used as an indicator of reliability estimation. The reliability of dynamic and non-dynamic tests was calculated based on the scores of the pilot group, which turned out to be 0.79 and 0.92, respectively. The reliability of the reading and writing section of the PET is 0.88, the listening section is 0.77, and the speaking section is 0.84. The overall reliability of the test is 0.92. Reliability and validity of dynamic and traditional tests have been calculated in the pre-test stage. The results can be seen in Table 1.

Table 1. Validity and reliability of the MBIVT

	Traditional	Dynamic
Reliability	0.921	0.796
Validity		0.938

After the completion of the test procedure, the participants' evaluation of DA procedures was qualitatively reported. To this end, the student survey mentioned earlier was sent to the participants' email and they were asked to rate the degree to which they agreed or disagreed with the statements. Along with this survey, students were given the freedom to comment on the CDA and its procedure in order to have a more comprehensive image of their evaluation of CDA.

3.4.3. Scoring procedure

Unfortunately, automatic score file creation was impossible due to the problems and difficulties in designing the website. Consequently, the authors themselves calculated three actual, mediated, and learner potential scores. As it was suggested in the literature (e.g. Poehner et al., 2015), the actual or non-dynamic score is the score to be calculated exactly the same as traditional assessments, i.e. the first response without any mediation. Accordingly, the score is either 0 or 4 in a way that 0 is for incorrect responses and 4 is calculated for correct responses. The mediated or dynamic score ranges from 0 to 4 based on the number of prompts offered to the examinee so that by offering a prompt, one point is reduced. Finally, LPS was calculated based on the formula proposed by Kozulin and Garb (2002) to distinguish the independent and mediated performance of examinees, which captures learners' ZPD.

4. Results

4.1. Results for the first question

As a prerequisite to the parametric analysis, the normality of data distribution was checked through the Kolmogorov-Smirnov test because of the potential effect that outliers and extremes could have on the results of the study. The results confirmed that the normality assumption was met ($p > 0.05$). Also, paired-sample t-test was meant to answer the first question of the study to see whether there was a significant difference between the actual and mediated scores of the participants. The results of this test revealed a statistically significant difference between the mean actual score ($M = 28.96$, $SD = 10.47$) and mean mediated score [($M = 40.36$, $SD = 6.794$), $t(24) = -11.125$, $p = .000$]. Therefore, the null hypothesis that "CDA has no effect on incidental vocabulary learning by Iranian EFL learners in an ESP teaching/learning context" is rejected and CDA is proved to be effective in improving incidental vocabulary learning of ESP learners. The results appear in Table 2 below.

Table 2. Distribution of CF by type

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	T	Df	Sig. (2-tailed)
Pair 1	Actual score - Mediated score	-11.400	5.123	1.025	-13.515	-9.285	-11.125	24	0.000

In addition, the effect size turned out to be quite large (Eta squared = .83). Thus, 83 percent of the shared variance could be explained by the CDA approach. The results of the preceding statistical analyses suggested that mediation helped all examinees without regard to their independent performance.

The scoring profile of four learners was selected to clarify the promotional role of mediational steps and learners' potential for learning. First, two learners with the same actual score, relatively low scores, were selected to show different learning potentials and then, two relatively high scores were selected for further comparison. The scores are presented in Table 3 for further comparison. The classification of LPS according to Kuzolin and Garb (2002) is such that an LPS of greater than or equal to 1 is considered high, an LPS between 0.71 - 0.8 is considered mid, and an LPS of lower than 0.71 is considered low. Therefore, LPS can give an in-depth understanding of learning ability.

Table 3. Actual, Mediated, Gain and Learning Potential Scores for a Number of Learners

	Actual score	Mediated score	Gain score	LPS
Learner 1	16	24	8	0.61
Learner 2	16	36	20	1.07
Learner 3	44	49	5	1.03
Learner 4	36	45	9	1.03

The first obvious point that can be seen in Table 3 above is that all learners benefited from mediational prompts. Accordingly, the first two learners had the same actual scores, showing that they were at the same level of independent performance, with different mediated scores and LPSs. This suggests that learners can benefit differently from the mediation procedure and they have different learning abilities. In other words, learner 1 has an actual level of 16, which is the same as learner 2. Going through the mediational steps, learner 1 was promoted by 8 scores and got a mediated score of 24, which was

much less than that of learner 2, who was promoted by 20 scores and got 36. Regarding their LPSs, learner 1, with a score of 0.61, was in a lower range and learner 2, with a score of 1.07, was in a higher range of LPS, suggesting their different ZPDs or learning capabilities. In other words, despite the same actual scores, they needed different instructional support.

The next point to be made in this regard is the case of learners 3 and 4. These two learners got different actual and mediated scores, but had the same LPSs. This indicates that unlike their different actual and mediated scores, the two learners' potential for learning or further progress was the same. Their high LPSs suggest that learners who have high independent performance can also benefit more than those who perform poorly.

4.2. Results for the second research question

The second research question was meant to investigate the participants' evaluation of the CDA program. To this end, the survey questionnaire adopted from Nirmalakhandan (2007) was adopted and mailed to the participants. They were also asked to comment on the CDA program. The quantified results of the survey were analyzed through frequency analysis. As mentioned earlier, anchor 1 in this survey indicated strongly disagree and anchor 5 indicated strongly agree. The results of frequency analysis are presented in Table 4 below.

Table 4. The Emerging Percentages for the Survey Items

Items	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Item 1	0 (0%)	2 (8%)	3 (12%)	10 (40%)	10 (40%)
Item 2	0 (0%)	1 (4%)	4 (16%)	12 (48%)	8 (32%)
Item 3	0 (0%)	1 (4%)	4 (16%)	11 (44%)	9 (36%)
Item 4	5 (20%)	7 (28%)	7 (28%)	6 (24%)	0 (0%)
Item 5	8 (32%)	8 (32%)	2 (8%)	7 (28%)	0 (0%)
Item 6	0 (0%)	0 (0%)	5 (20%)	15 (60%)	5 (20%)
Item 7	0 (0%)	5 (20%)	3 (12%)	12 (48%)	5 (20%)
Item 8	0 (0%)	0 (0%)	8 (32%)	7 (28%)	10 (40%)

Accordingly, from the eight items constituting the student survey, items 4 and 5 were somehow against the use of CDA. The frequency of responses for items other than these two items shows that respondents mostly favored the CDA and its use. That is to say, 40% strongly agreed and 40% agreed with the first item. Regarding item 2, 32% strongly agreed and 48% agreed. With respect to item 3, 36% strongly agreed and 44% agreed. For item 6, 20% strongly agreed and 60% agreed. Regarding items 7 and 8, 20% and 40% strongly agreed and 48% and 28% agreed, respectively.

With respect to the two items that were against CDA, 20%, 28%, and 28% strongly disagreed, disagreed, and were neutral, respectively. For the second item, 32% strongly disagreed, 32% disagreed, and 8% were neutral. The results suggest that most of the participants strongly agreed or agreed with the items favoring CDA and most of them strongly disagreed or agreed with the items against CDA. Also, most of the participants commented positively on the CDA program and only a few of them mentioned some negative points in this regard. Taken together, students' evaluation of CDA was positive.

5. Discussion

The present study aimed to investigate whether CDA was effective in assisting learners' incidental vocabulary learning in the context of ESP. Regarding the first research question, the results of the paired-sample t-test helped reject the null hypothesis

that CDA has no effect on incidental vocabulary learning of Iranian EFL learners in an ESP teaching/learning context. In other words, the CDA program proved to be significantly effective in improving the participants' incidental vocabulary learning within the ESP course context. This finding is in line with the findings of Saeidi and Hosseinpour (2013) who showed that learners' vocabulary learning rate can be enhanced through DA. Overall, the results of the present study are in line with the main body of the literature (e.g. MovahedFar et al., 2022; Estaji and Ameri, 2020; Poehner & Lantolf, 2021; Khomijani et al., 2019; Zangoei et al., 2019; Ajideh & Nourdad, 2013; Hessamy & Ghaderi, 2014; Mardani & Tavakoli, 2011; Orikasa, 2010; Pishghadam et al., 2011; Poehner et al., 2015), demonstrating the positive role of DA and CDA in improving L2 learning skills and sub-skills.

The results also indicate that the LPS can be used to predict learners' abilities and the amount of help received. Literature suggests that DA and CDA are powerful learning tools to enhance learning, and LPS can be used to distinguish learners who have similar actual scores and gain useful information about learners' ability to learn.

The second research question aimed to investigate the participants' evaluation of the CDA program. The results of the survey along with the comments of the participants on the CDA program and its use showed that their evaluation was in favor of the program and its use as an assessment tool, integrating instruction and assessment. This finding of the study was in line with the findings of Nirmalakhandan (2007) and Hidri (2014), who investigated the benefits of the use of CDA in improving students' achievement and learning.

6. Conclusion

To sum it up, DA, being underpinned by Vygotsky's sociocultural theory, is not an assessment tool per se, rather it focuses on promoting learning through determining learning potentials. L2 CDA is an inchoate concept and does not have a long history. The present study endeavored to apply interventionist CDA on ESP incidental vocabulary learning, which is scarce in the literature. Accordingly, both qualitative and quantitative procedures were applied through a mixed method triangulation research design to find possible answers to the research questions.

The findings of this study suggested that CDA is effective in improving incidental vocabulary learning among students of electrical engineering and also it can encourage lackadaisical students to engage more in the learning process. Furthermore, CDA can help overcome some difficulties of DA so that it is less time- and labor-consuming and can be applied in group size.

In addition, a majority of ESP students are not satisfied with their courses and their outcomes and believe that these courses do not meet their academic and occupational needs and, thus, ask for an urgent shift and transformation in ESP teaching and testing (e.g. Alibakhshi et al., 2011; Moslemi et al., 2011). Therefore, the use of CDA for vocabulary learning, as the core of ESP, can serve as a possible solution to the current problems faced by the students. CDA is specifically efficient because of its view of instruction and assessment as a uniform activity, which can respond to ESP students' needs in both teaching and assessment areas.

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