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Research Article

Effects of Computerized Dynamic Assessment and Computerized Formative Assessment on Iranian EFL Learners' Vocabulary Learning and Academic Buoyancy

Hassan Alizadehmahmoudalilo
Department of English, Ta.C., Islamic Azad University, Tabriz, Iran
hassan.alizadehmahmoudalilo@iau.ac.ir

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Abstract

Given that technology-enhanced assessment has transformed language education by providing adaptive and interactive evaluation methods, the current research aimed to examine the comparative effects of Computerized Dynamic Assessment (CDA) and Computerized Formative Assessment (CFA) on vocabulary learning and academic buoyancy among Iranian EFL learners. Employing a quasi-experimental, non-equivalent groups pre-test-post-test-control group design, the study involved 60 intermediate male EFL learners aged 15–24 recruited from two language institutes in Tabriz, Iran. The participants were assigned to CDA, CFA, and control groups. The participants were assigned to CDA, CFA, and control groups. The Oxford Placement Test examined the participants' proficiency levels, while the Vocabulary Knowledge Scale and Academic Buoyancy Scale assessed their vocabulary learning and buoyancy, respectively. The CDA group engaged in dynamic, adaptive scaffolding through Adobe Captivate software, while the CFA group used Google Forms and Quizlet for formative feedback. The control group received traditional instruction. The results from ANOVA indicated that CDA and CFA significantly enhanced the experimental groups' academic buoyancy, with no significant difference between them. However, CDA demonstrated superior vocabulary learning compared to CFA. These findings highlight CDA's effectiveness in fostering vocabulary learning through tailored mediation and CFA's role in promoting self-regulation and academic buoyancy. The study underscores the importance of integrating adaptive assessment models in EFL instruction to optimize cognitive and affective learning outcomes.

Keywords: academic buoyancy, computerized dynamic assessment, computerized formative assessment, EFL learners, vocabulary learning

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Introduction

Assessment permits checking what students already know and modifications in the instructions on how students are taught, which links what students currently know to what they want to know (Sherkuziyeva et al., 2023). Assessment is an important tool for keeping an eye on students because it helps teachers choose the best ways to teach them (Estrada-Araoz et al., 2023). Within the context of EFL, vocabulary learning improves the communication of learners (Ebadi & Yari, 2017). However, Iranian EFL learners still face challenges in learning and using new vocabulary. This is mostly because of the differences between Persian and English, their limited exposure to real English input, and the fact that teachers still rely on conventional techniques, which have been studied in the past (Estaji & Mirzaii, 2018; Estaji & Saeedian, 2020). As a result, we need to implement new types of assessments that allow us to evaluate language abilities.

Academic buoyancy is the ability of students to deal with everyday academic problems like short-term challenges, stress, and small failures (Martin & Marsh, 2008, p. 4). This kind of approach is crucial for learning a language because EFL students often have trouble with new words, complicated grammar, and speaking (Heydarnejad et al., 2022). Academic buoyancy depends on the ability to keep going, since learning new words takes time and practice. Academic buoyancy assists students in considering problems to be solvable so that they continue to put a lot of effort and think of new tricks for solving the problems when things become difficult (Li et al., 2024). For instance, students who are more excited about learning will find it easier to try out new words, ask for help after making a mistake, and not lose their confidence when they talk. All the above psychological characteristics of emotional regulation, growth mindset, and self-efficacy are associated with academic buoyancy relevant to language learning. Such aspects enable the learners to make the best out of feedback and the option of using the various learning cycles (Jahedizadeh et al., 2019). One of the strategies that teachers can apply to keep the students positive is to make them regard the problems they come across every day as learning opportunities (Nurjamin et al., 2023). This kind of behavior helps students develop long-term psychological and linguistic buoyancy. Academic buoyancy is an essential emotional resource that assists students in sustaining themselves through difficulties in learning vocabulary. The reason for this is that learning new words usually involves repeated exposure, practicing how to remember them, and fixing mistakes.

Dynamic Assessment (DA), which is based on Vygotsky's Sociocultural Theory (SCT), is one post-psychometric theory that shows how

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assessment and instruction are connected. It has been postulated by Sternberg and Grigorenko (2001) that the premise of DA has essentially been a development of that of Vygotsky's (1978) Zone of Proximal Development (ZPD) that transcends the skills that an individual may currently possess to what has yet to be acquired in the future. Kozulin and Garb (2002) make it clear that DA is much more interested in seeing how a learner's performance changes before and after mediation than in using static measures of ability. Lantolf and Poehner (2011) mention that there are two main ways to do DA: the interactionist approach, which uses dialogically negotiated mediation and shifts between implicit and explicit cues (Poehner and Lantolf, 2013), and the interventionist approach, which uses a planned, scripted series of prompts of hierarchically organized and moving implicit to explicit forms of assistance (Ritonga et al., 2022).

Formative Assessment (FA), which is also called assessment for learning, helps students learn by giving them feedback and evaluations all the time (Black & Wiliam, 2009). It can be used during a course when you can get answers to the question of how well the teaching is working to figure out what works and what does not, and make decisions about what to do next in the teaching process (Rea-Dickins & Gardner, 2000). FA is formative when the teachers change how they teach based on what their students need (Black & Jones, 2013). The main goal is to improve learning by giving teachers and students constant feedback that lets them change how they teach and what they teach (Dixson & Worrell, 2016). FA assists the teachers, students, schools, and parents by removing the speculation of what to work on, allowing educators the opportunity to realize what has been learnt and what still requires improvement, and directing interventions (Black & Wiliam, 2010). The fact that FA is process-oriented leads automatically to self-regulation and resilience being regarded as strengths, helping students to achieve at school.

Though various assessment methods have been announced to help improve the process of vocabulary learning, not much has been done when it comes to comparing analyses of CDA and CFA in the Iranian EFL setup. Research indicates that CDA and CFA strategies have the potential to positively influence the motivation and self-regulation aspects among learners, which are major constituent elements of academic buoyancy. As an example, CDA is identified to positively impact the motivation and self-concept of learners (Estrada-Araoz et al., 2023), whereas CFA is reported to decrease the levels of test anxiety and enhance self-regulation abilities (Ismail et al., 2022). CFA also streamlines these activities by giving immediate

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feedback, monitoring the performance of the learners, and adjusting assessment activities to personal needs (Ismail et al., 2022). It has also been demonstrated that CFA could improve vocabulary learning by promoting repeated encounters and proactive work with lexical units (Estaji & Mirzaii, 2018). Through this process, stronger lexical storage and recall are allowed to develop because the words are used by the learner in multiple situations and their meanings are reaffirmed to him/her via the repetitive feedback and self-checking systems. Accordingly, the two-fold interest of the present study in vocabulary learning and academic buoyancy is well-placed and well-timed: both are dependent on assessment type, and both are critical to long-term success in language.

It was demonstrated in previous studies (e.g., Ebadi & Saeedian, 2015; Ebadi et al., 2023; Estaji & Saeedian, 2020) that the CDA and CFA, founded on SCT, can be applied to develop individual student learning paths through both personalized feedback and adaptive mediation. However, despite the research in specific skills such as listening (Izadi et al., 2023), writing (Davoudi & Ataie-Tabar, 2015), and reading comprehension (Ebadi et al., 2023), a comparative discussion of effectively teaching vocabulary and academic buoyancy using these approaches has not been in-depth. According to Poehner et al. (2017), CDA offers three vital benefits compared to traditional DA: it allows large groups of learners to be assessed simultaneously, learners can be reassessed as often as necessary, and computers automatically report learners' performance. Such characteristics are most applicable to the present study, since they are directly associated with the research questions concerning the differences or similarities between CDA and CFA in their capacity to support vocabulary learning and academic buoyancy. CDA has the potential to increase the retention of vocabulary and even hold its own over either traditional or non-dynamic FA by intuitive mediation that is scalable and adjustable. Furthermore, it is crucial to know whether the automated scaffolding in CDA can lead to academic buoyancy in learners to determine its overall implications for the psychology of language learning.

CDA has also been particularly useful in establishing a ZPD, in which students will have individual help in improving their command of a language (Hanifi et al., 2016; Ebadi & Yari, 2017). The literature suggests that DA has a profound beneficial influence on vocabulary learning, and it can be explained by the timing (scaffolded feedback in real-time) that contributes to the enhanced level of cognitive processing and metalinguistic awareness (Rajaeizadeh et al., 2015). CDA also enhances such advantages by employing

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technology to provide personalized feedback, automate guidance, and create individualized learning opportunities. The above findings have been substantiated by the present study, which shows that the combination of ZPD-based scaffolding in CDA helps learners retain their vocabulary much higher than CFA. This implies that the dynamic nature of the mediation adjustment by the respondent in the CDA approach promotes deep processing of lexicons, resulting in an improved, more permanent acquisition of language. The studies have shown that CDA does enhance language development, especially the ability to remember and understand languages and which may merge with the findings of this current research. Nevertheless, little has been done on its effect on academic buoyancy, particularly among Iranian EFL learners; hence, the necessity to reinforce the importance of further research on how CDA can be helpful in propagating buoyancy and self-regulated language learning among language learners.

However, less focus has been given to the relative efficiency of these types of assessment in facilitating vocabulary learning and scholarly buoyancy amongst Iranian EFL learners. Since vocabulary knowledge is a fundamental component of language proficiency, and academic buoyancy is becoming a critical aspect of language learning, this research gap needs to be filled. Nevertheless, the existing studies devoted to the interaction of two constructs, vocabulary and buoyancy, in diverse assessment conditions are scant, and the present research considers them. To illustrate, the integration of DA was found in the works by Ebadi and Yari (2017), Haghani Zadeh (2018), Hanifi et al. (2016), Rajaeizadeh et al. (2015), and Saeidi and Hosseinpour (2013), as the study of research reporting that the specific delivery of feedback is effective in vocabulary learning in the ZPD of the learners. Likewise, FA approaches such as the reciprocal questioning (Ahmadi et al., 2021), concept mapping, and quizzes (Estaji & Mirzaii, 2018) can also improve the overall vocabulary learning, comprehension of reading texts, and overall enhancement of academic achievements. The finding was further corroborated by other studies that indicate overall positive impacts of FAs on language proficiency, psychological, and academic elements (Ross, 2005; Ismail et al., 2022; Gallardo, 2020).

Failure to use effective assessment strategies may cause poor vocabulary learning, and eventual poor linguistic competence and disorders in communication among the Iranian EFL learners. Ebadi and Yari (2017), Hanifi et al. (2016), and Yarahmadzehi and Goodarzi (2020) discovered that the lack of employing useful and active assessment strategies led to the fact that the retention of vocabulary was worse, and the vocabulary was developed

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more slowly as the learners lacked the support they needed in their ZPD. Haghani Zadeh (2018) and Rajaeizadeh et al. (2015) reported that students who followed a non-interactive assessment that was also delivered as a static assessment performed poorly on vocabulary learning and scored significantly lower than other low-level groups than dynamic, mediated feedback groups. Other than merely learning new vocabulary, Li et al. (2024) assert that poor academic buoyancy, caused by inefficient assessment styles, affects the motivation levels of the learners, self-efficacy, and the overall academic performance, thereby leading to an increase in the dropout rate and a lack of interest to learn the EFL. The results show that tense and psychological buoyancy are serious problems that need instant solutions based on new and adaptive models of assess modalities that resort to technology, such as CDA and CFA, which will help provide real-time adaptive solutions to minimize the problems and ensure that in the long-run, linguistic and psychological buoyancy of EFL learners can be achieved successfully.

Consequently, this study was conducted to explore how CDA and CFA influence academic buoyancy and vocabulary learning since these two elements in success are considered to be interrelated for learners of EFL. This discovery is especially strong regarding the Iranian EFL language learners, whereby, despite some studies conducted to cover this group, no single study has been conducted to determine the impacts of both of these computerized evaluation tools on vocabulary learning, as well as the level of academic buoyancy. The discussion on the merits of using modern, technology-integrated methods of assessment in the development of not only language proficiencies but also the attitudes that would contribute to long-term academic achievement would be helped by filling this gap. To guide the investigation, this study formulates the following research questions:

1. Is there any statistically significant difference between the vocabulary learning of EFL learners engaged in CDA and CFA?
2. Is there any statistically significant difference between the academic buoyancy of EFL learners engaged in CDA and CFA?

Method

Participants

The participants were selected from a population of 350 from two different institutes in Tabriz, namely Pardisan and Goldis. The final sample was 60 lower-intermediate EFL learners, male only, with the age range of 15 to 24, who were native speakers of Azari and spoke Persian as a second language, and were recruited in the institutes teaching identical curricula. In an attempt

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to make the comparison between the two institutions valid, both institutions followed and pursued similar syllabi in instruction, hired similar instructors who were trained to the same academic rigor, and taught in similarly equipped classrooms. The standardization that occurred between the two contexts involved the weekly number of contact hours, assessment procedures, and instructional materials, and this made all the contexts methodologically consistent and reduced institutional variability. This technique ensured that study subjects had similar academic backgrounds. The participants were selected through a convenience sampling method because of practical limits like accessibility and the willingness to participate. This approach guaranteed that the participants chosen would be representative of the typical population of lower-intermediate EFL students at institutes, as they were exposed to similar educational backgrounds, standard of language proficiency, and stages of learning. According to the placement criteria of the institutes, they were lower-intermediate students. Nonetheless, to guarantee the integrity and uniformity of the participants, a proficiency test was administered before the commencement of the primary research. Based on the proficiency test, the candidates who scored between 30 and 39 were included in the study and rated as proficient. The participants were then non-randomly assigned to three groups that included two experimental groups (CDA and CFA) and a control group. The final sample was composed of 20 participants of the Pardisan Institute CDA experimental group and 40 participants of the Goldis Institute: 20 of the CFA experimental group and 20 of the control group. Originally, after conducting the proficiency test, there were 24 homogeneous students in the Pardisan Institute class, but to equalize their numbers with those of the Goldis Institute, four participants were excluded from the main study. These four people were not put into the treatment stage but received routine training by the institute and were not subject to any experimental manipulations or tests. In order to remove the confounding variables of teachers, all groups were instructed by the same teacher. The participants had studied Evolve 1-3. They further taught using the Evolve 4 textbook during the study to maintain consistency in the teaching content and exposure across all of the groups.

Instruments

To gather the data needed for the study, the researcher applied the following instruments at various stages of the study.

Oxford Placement Test

The Oxford Placement Test (OPT), developed by Dave (2004), was systematically applied to assess and verify if the proficiency levels of the

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English language differed in any significant ways between the experimental and control groups investigated. This is a well-known and standard examination test that properly and effectively ascertains the knowledge of language at various levels of the Common European Framework of Reference for languages (CEFR). As an evaluation instrument, the OPT is considered one of the main characteristics since it serves as the homogenizing tool, which measures a variety of linguistic skills such as grammar, vocabulary, and reading comprehension. The test is a well-structured formal evaluation diluted to six levels of proficiency on the CEFR scale and assigns test scores to well-defined value boundaries for each of the discrete levels: Basic (A1: 0–17), Elementary (A2: 18–29), lower intermediate (B1: 30–39), upper intermediate (B2: 40–47), advanced (C1: 48–54) and very advanced (C2: 54–60). To ensure that all participants fell strictly within the lower-intermediate (B1) band and not the adjacent upper-intermediate (B2), only those whose scores ranged from 30 to 39 were included in the study. This range of scores was a strict cut-off point; any learner who scored 40 or more or below 30 was left out of the sample. This process ensured that the participants had the same and acceptable standardized level of proficiency that matched the CEFR B1 standard. Those OPT results obtained at the beginning of the research were crucial in the sense that they gave researchers the opportunity to place participants whose results would be placed at the lower intermediate level on the scale intentionally to ensure that the language proficiency level was identical in the groups. Moreover, the psychometric characteristics of the OPT have been tested in previous studies that report high reliability and construct validity of the tool in the EFL environments. Normally, the internal consistency of the grammar part of the OPT and the listening part of the test is more than 0.85 Cronbach's alpha (Geranpayeh, 2003). The results of the current study showed that the Cronbach alpha of the OPT on a pilot sample (n = 20) was 0.87, which indicates high internal reliability of this group of Iranian EFL students. In addition, the test was CEFR-based, making the process of decisions made on the placement content valid.

Vocabulary Knowledge Scale

The Vocabulary Knowledge Scale (VKS) developed by Wesche and Paribakht (1996) was employed to measure the students' vocabulary knowledge before the intervention, as the pre-VKS, and after the intervention, as the post-VKS. This instrument, originally developed as a comprehensive word knowledge test, requires language learners to demonstrate their familiarity and usage of target words using a five-point scale that ranges from complete unfamiliarity ("I don't remember having seen this word before") to

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the ability to use the word in a sentence accurately and appropriately. The VKS assesses two main constructs: vocabulary size, which is measured through four items that capture the continuum from total unfamiliarity to correct meaning identification, and vocabulary depth, which is evaluated by asking students to produce a grammatically and semantically correct sentence using the word. This scale was chosen for its ability to provide verifiable evidence of both receptive and productive knowledge, making it an ideal tool for research focused on word identification and utilization in EFL contexts. To ensure cultural and linguistic relevance, the VKS instructions were translated into Persian and administered on a separate sheet, and its validity has been supported by previous research. In the pre-VKS, to verify that the students were unfamiliar with the vocabulary they were expected to learn during their EFL classes in the treatment period, an 80-item vocabulary scale was administered before the experiment. After analyzing the questionnaire responses, 50 items that the students did not recognize were selected as the target words for treatment, while the 40 items that were familiar to the students were removed from further consideration. For the post-VKS, these 50 unfamiliar words were employed to assess any vocabulary gains resulting from the treatment. In the current study, scoring was conducted independently by two raters to ensure inter-rater reliability, with responses scored as follows: a score of 0 for complete unfamiliarity, 1 for basic recognition without understanding, 2 for correctly providing a synonym or translation, and either 3 or 4 for using the word in context, with a three assigned for contextually correct but ungrammatical usage and a 4 for fully correct usage, resulting in a per-word score that ranges from 0 to 4. Both raters engaged in a discussion to resolve any discrepancies in scoring to maintain consistency. This approach ensured that differences in interpretation were addressed collaboratively, leading to a more reliable and standardized assessment process.

Academic Buoyancy Scale

The Academic Buoyancy Scale (ABS) was developed by Jahedizadeh et al. (2019) to assess academic buoyancy in EFL students in higher education. Although originally designed for higher education contexts, the ABS was deemed appropriate for this study for several reasons. First, the core constructs of the current research are highly relevant to EFL learners in language institutes, who regularly face linguistic and academic challenges. Second, the participants in this study (aged 15–24) are developmentally comparable to university-aged students. Third, to ensure contextual appropriateness, minor linguistic and cultural adaptations were made, and expert reviewers validated content clarity. Finally, the strong internal

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reliability observed within this study further supports its applicability beyond tertiary settings. This questionnaire consists of 27 items, measuring four key constructs: sustainability, regularity adaptation, positive personal eligibility, and positive acceptance of academic life. Each item is rated on a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The ABS was selected for this study due to its comprehensive nature, addressing various aspects of academic buoyancy relevant to EFL learners, and its successful application in previous studies. Unlike earlier scales, which contained fewer items and focused on specific subjects like mathematics, the ABS was designed specifically for EFL learners and incorporates context-specific dimensions. The validity of the questionnaire was confirmed through confirmatory factor analysis by Jahedizadeh et al., which demonstrated acceptable model fit indices. The questionnaire was translated into Persian to make it accessible for participants, and its accuracy and clarity were confirmed by two expert judges. The four dimensions of the ABS are as follows: (1) Sustainability (7 items), which assesses students' ability to overcome academic challenges; (2) Regularity Adaptation (4 items), measuring goal-setting and discipline; (3) Positive Personal Eligibility (8 items), evaluating self-efficacy and independence; and (4) Positive Acceptance of Academic Life (8 items), which reflects attitudes toward learning and academic engagement. The overall possible score on the measure ranged from 27 to 135. Higher scores on the ABS indicate greater academic buoyancy, signifying a stronger ability to handle academic setbacks and maintain motivation. Like VKS, this scale was used before and after the intervention to check the impact of the treatment on the learners' academic buoyancy. In this study, the overall Cronbach's alpha coefficient was calculated at 0.82, further demonstrating the internal consistency of the ABS.

Procedure

This study utilized a pre-test and post-test quasi-experimental design to explore the impact of CDA and CFA on vocabulary learning and academic buoyancy among Iranian EFL learners. The procedure was grounded in rigorous, reliable, ethical principles; systematic steps were implemented chronologically from November 2024 to January 2025 at Pardisan and Goldis Language Institutes, Tabriz, Iran. The study was approved by the Ethical Committee of Pardisan and Goldis Language Institutes, and they acted as the gatekeepers to ensure that ethical research matters were addressed before the study. The recruitment was conducted during regular class sessions. The researcher described the purpose, procedures, and voluntary nature of the study and assured the participants of anonymity and confidentiality as well as

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the right to withdraw from the study without consequence. The informed written consent was obtained from all subjects using printed forms that were signed, returned, and kept in a locked filing cabinet accessible to the researcher.

Prior to the main data collection, a pilot study was done to improve the clarity and reliability of the research instruments used. 20 learners who matched the proficiency level of the main sample completed both the VKS and the ABS. This pilot study was conducted to detect the ambiguities in the questionnaire items, assess the time needed to complete the scale items, and validate the Persian version of both tools. The pilot study showed both instruments to have high reliability for internal consistency, with Cronbach's alpha coefficients of 0.79 for the VKS and 0.86 for the ABS, supporting their use in the main study.

To establish baseline equivalence, two assessments were given. To ensure homogeneity amongst the participants, the OPT was first conducted in a 60-minute session where all participants took part. The answer sheets were collected manually and scored by the researcher using the official scoring key. Only the participants with 30–39 scores (lower-intermediate, B1) were considered to maintain consistency. Out of an original pool of 350 male students, only 60 were kept, with some ruled out because their scores were outside this range. The results were entered manually into a spreadsheet, with a colleague double-checking the scores for accuracy. The participants were divided into three groups: CDA (n=20, Pardisan), CFA (n=20, Goldis), and Control (n=20, Goldis). This non-random assignment ensured inter-institutional uniformity. To control for teacher-related variation, all groups were taught by the same instructor, who was fluent in Azari and English.

Prior to the treatment, baseline data on vocabulary learning and academic buoyancy were collected. First, the VKS, as a pre-test, was administered in an 80-minute session. The scores were recorded manually on a scoring sheet. This test was conducted to ensure the learners' unfamiliarity with target words. The words that the learners were familiar with were discarded from the treatment. Then, ABS was administered in a 30-minute session to measure the participants' initial level of academic buoyancy. It was distributed in print and recorded in the spreadsheet.

Over eight weeks, each group received distinct instructional approaches tailored to their assigned assessment method. The CDA group engaged with customized Adobe Captivate software designed to deliver dynamic scaffolding during vocabulary tasks. During weekly 50-minute sessions, the students interacted with Evolve 4 reading activities containing

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target words, triggering four levels of computerized mediation upon errors: implicit prompts (e.g., contextual highlighting), contextual clues (synonyms/definitions), explicit explanations (grammatical rules), and direct answers. The software logged responses and mediation usage while the instructor monitored progress without direct intervention. In contrast, the CFA group utilized Google Forms and Quizlet for formative tasks, including weekly quizzes with automated feedback (e.g., error corrections, model sentences) and peer assessment activities where the students exchanged sentences for rubric-based evaluations. Additionally, the learners maintained self-reflection journals and received individualized teacher feedback (e.g., recasts, elicitation) during discussions. Meanwhile, the control group followed conventional instruction: the target vocabulary was taught through textbook drills, rote memorization, and teacher-led translations, with corrections limited to end-of-unit tests and no formative or computerized support. All groups adhered to the same Evolve 4 curriculum and session duration, with the instructor, who was also the researcher, possessing formal teaching credentials as an appointed teacher under the Ministry of Education in Iran. As an experienced instructor of online, assessment-integrated EFL courses, he was well qualified to ensure uniform instruction across groups. His background enabled him to apply consistent pedagogical strategies and manage the CDA and CFA procedures impartially, ensuring methodological consistency while isolating the effects of CDA and CFA interventions.

Identical to the pre-tests, the post-intervention data were collected after conducting the treatment, and inter-rater reliability was calculated, with discrepancies resolved through discussion to ensure consistency in the post-VKS. All data were stored and anonymized using the participant codes (e.g., CDA-01). The same classroom conditions (e.g., lighting, seating) and timing (morning sessions) were maintained across institutes to minimize external variables. The data analysis was conducted in SPSS 27, with the pre- and post-test scores compared using Analysis of Variance (ANOVA), ensuring statistical rigor.

Research Design

This quasi-experimental research, which had a pre-test-post-test-control group design, required the existence of three groups: two experimental groups and a control group. The experimental groups were given treatment using innovative methodologies of computerized assessment, and the control group was instructed conventionally. Thus, the dependent variables in the scope of this study are vocabulary learning and academic buoyancy, while CDA and CFA serve as the independent variables.

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Data Analysis

The collected data were entered into SPSS 27 for further statistical analysis. At the onset, the OPT scores checked the initial homogeneity between the two groups. Then, Cronbach's alpha was used to check the internal consistency of the scales. Descriptive statistics, including mean and standard deviation (SD) and standard errors (SEs), were presented for both VKS and ABS scales. The Pearson correlation coefficient was used to evaluate inter-rater reliability between the two raters. The researcher used Levene's Test of Equality of Error Variances to check the normal distribution of data. In the case of normal data, ANOVA was used to explore the effect of the independent variables on the dependent variables.

Results

In order to answer the posed research questions, some calculations, statistical analyses, and results were produced, which will be explained in detail in this section.

Results for the First Research Question

An ANOVA was performed to determine whether CDA and CFA statistically impact Iranian EFL learners' vocabulary learning. The details about descriptive statistics of the groups regarding the post-VKS are illustrated in Table 1.

Table 1
Descriptive Statistics of Post-VKS

					95% Confidence Interval for Mean			
	N	Mean	SD	SE	Lower Bound	Upper Bound	Min	Max
CDA group	20	148.35	2.183	.488	147.32	149.37	145.00	153.00
CFA group	20	126.65	1.843	.412	125.78	127.51	123.00	130.00
Control group	20	95.65	2.719	.608	94.37	96.92	90.00	101.00
Total	60	123.55	21.923	2.830	117.88	129.21	90.00	153.00

As Table 1 demonstrates, the mean score of the post-VKS for the CDA group is 148.35 (*SD*= 2.183, *SE*= .488), for the CFA it is 126.65 (*SD*= 1.843, *SE*= .412), and for the control group 95.65 (*SD*= 2.719, *SE*= .608). Concerning the vocabulary development, which was measured through the VKS, the total sample (*N*= 60) for the post-VKS scores showed a mean of 123.55 (*SD*= 21.923, *SE*= 2.830), reflecting significant variability across

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groups. The 95% CI for the total mean is [117.88, 129.21], and the scores ranged from 90 to 153.

Additionally, the Pearson correlation coefficient was used to evaluate inter-rater reliability and compare the consistency between both raters. Table 2 outlines these analyses.

Table 2
Inter-Rater Correlation for the Post-VKS Scores

		Rater 1	Rater 2
Post-VKS of Control Group (Rater 1)	Pearson Correlation	1	.945**
	Sig.(2-tailed)		.000
	N	20	20
Post-VKS of Experimental Groups (Rater 2)	Pearson Correlation	.945**	1
	Sig.(2-tailed)	.000	
	N	40	40

**. Correlation/is/significant at the 0.01 level (2-tailed).

As Table 2 displays, for the post-VKS scores of the control group, the inter-rater correlation was almost perfect for the control group, $r = .945$, $p < .001$, i.e., excellent scoring consistency. In the same way, the post-VKS scores of the experimental group exhibited identical reliability ($r = .945$, $p < .001$), indicating that raters consistently applied the scoring criteria between the groups after intervention. Considering this high level of inter-rater agreement, one can conclude that both raters provided an equal level of accuracy and objectivity in assessing the participants' performance in the post-VKS. Moreover, LTEEV was administered to determine whether the dependent variables' error variance was equal across the groups. Table 3 demonstrates these results.

Table 3
Levene's Test of Equality of Error Variances for the Post-VKS

Tests	Levene Statistic	df1	df2	Sig.
Post-VKS	1.131	2	57	.330

According to Table 3, the results showed that for the argumentative writing post-test, the test statistic was $F(2, 57) = 1.131$, with a significance value of .330, which is marginally above the .05 threshold, indicating that the null hypothesis of equal error variance across all the groups cannot be rejected, thus confirming homogeneity of variance. This suggests that the assumption of equal error variance across groups is also reasonably met. These findings support the use of ANOVA for analyzing both dependent

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variables, as the assumption of homogeneity of variance is generally upheld. Table 4 presents the ANOVA results for the post-VKS scores across the three groups: CDA, CFA, and Control.

Table 4
ANOVA Results: Effects of CDA and CFA Usage on Post-VKS Scores

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	28061.200	2	14030.600	2705.037	.000
Within Groups	295.650	57	5.187		
Total	28356.850	59			

As Table 4 illuminates, the results indicate a statistically significant difference among the groups ($F = 2705.037$, $p < .001$), confirming that computerized assessment methods had a substantial effect on vocabulary learning. Table 5 outlines the results of the Tukey HSD post hoc test, which compares the mean differences between groups.

Table 5
Tukey HSD Pairwise Comparisons for Post-VKS Scores

					95% Confidence Interval	
(I) group	(J) group	MD (I-J)	SE	Sig.	Lower Bound	Upper Bound
CDA group	CFA group	21.70000*	.72020	.000	19.9669	23.4331
	Control group	52.70000*	.72020	.000	50.9669	54.4331
CFA group	CDA group	-21.70000*	.72020	.000	-23.4331	-19.9669
	Control group	31.00000*	.72020	.000	29.2669	32.7331
Control group	CDA group	-52.70000*	.72020	.000	-54.4331	-50.9669
	CFA group	-31.00000*	.72020	.000	-32.7331	-29.2669

*. The mean difference is significant at the 0.05 level.

Table 5 shows that the CDA group significantly outperformed the CFA group (*MD*= 21.70, $p < .001$). Furthermore, the CDA group also exhibited a significantly higher vocabulary knowledge score than the control group (*MD*= 52.70, $p < .001$). Moreover, the CFA group performed

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significantly better than the Control group (*MD*= 31.00, p < .001). These results suggest that while both CDA and CFA positively influenced vocabulary learning, CDA was the more effective method.

Results for the Second Research Question

Regarding the second research question, an ANOVA was first performed to determine pre-existing differences in academic buoyancy pretest scores among the three groups. This initial analysis ensured the comparability of the groups prior to the intervention. The details about descriptive statistics of groups regarding the pre-ABS are illustrated in Table 6.

Table 6

Descriptive Statistics of Pre-ABS Scores

					95% Confidence Interval for Mean			
	N	Mean	SD	SE	Lower Bound	Upper Bound	Min	Max
CDA group	20	58.45	2.502	.559	57.27	59.62	54.00	63.00
CFA group	20	56.65	2.796	.625	55.34	57.95	51.00	61.00
Control group	20	58.15	2.183	.488	57.12	59.17	54.00	62.00
Total	60	57.75	2.588	.334	57.08	58.41	51.00	63.00

According to Table 6, the pre-ABS scores indicated slight baseline differences across the groups, with the CDA group having a mean of 58.45 (*SD* = 2.502, *SE* = .559), the CFA group a mean of 56.65 (*SD* = 2.796, *SE* = .625), and the control group a mean of 58.15 (*SD* = 2.183, *SE* = .488), the CFA group showing the lowest mean and highest variability. Furthermore, Levene's Test of Equality of Error Variances was administered to determine whether the dependent variables' error variance was equal across the groups. Table 7 demonstrates these results.

Table 7

Levene's Test of Equality of Error Variances in Pre-ABS Scores

Levene Statistic	df1	df2	Sig.
.768	2	57	.469

As Table 7 demonstrates, the test for homogeneity of variance yielded F(2, 57) = .768, p = .469, exceeding the .05 threshold. This indicates that the assumption of equal error variance across groups is met, supporting the

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suitability of ANOVA for analyzing the dependent variables. Table 8 presents the ANOVA results for the pre-ABS scores across the three groups: CDA, CFA, and control.

Table 8

Results of ANOVA Analysis for Pre-ABS Scores of Three Groups

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	37.200	2	18.600	2.961	.060
Within Groups	358.050	57	6.282		
Total	395.250	59			

As shown in Table 8, the ANOVA yielded an F-value of 2.961 with a significance level (p = .060), which exceeds the conventional threshold of .05. This result suggests that any observed differences in mean scores between groups are not statistically meaningful. Further pairwise comparisons using the Tukey HSD post hoc test, as shown in Table 9, support this conclusion.

Table 9

Tukey HSD Pairwise Comparisons for Pre-ABS Scores

					95% Confidence Interval	
(I) group	(J) group	MD (I-J)	SE	Sig.	Lower Bound	Upper Bound
CDA	CFA group	1.800	.792	.068	-.1072	3.7072
group	Control group	.300	.792	.924	-1.6072	2.2072
CFA group	CDA group	-1.800	.792	.068	-3.7072	.1072
	Control group	-1.500	.792	.150	-3.4072	.4072
Control	CDA group	-.300	.792	.924	-2.2072	1.6072
group	CFA group	1.500	.792	.150	-.4072	3.4072

As Table 9 represents, none of the group comparisons yielded statistically significant differences. The comparison between the CDA and CFA groups showed a mean difference of 1.800 with a p-value of .068, which, although relatively close to the .05 level, still does not meet the criteria for statistical significance. The other comparisons, CDA vs. Control (*MD* = 0.300, p = .924) and CFA vs. control (*MD* = -1.500, p = .150), also failed to show significant differences, with confidence intervals that include zero in all

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cases. Overall, both the ANOVA and Tukey HSD results indicate that there were no significant differences in pre-ABS scores among the CDA, CFA, and control groups. These findings confirm that the groups were statistically equivalent at baseline concerning their pre-ABS scores.

Moreover, to address the second research question, an ANOVA was performed on the post-ABS scores to determine whether CDA and CFA statistically impact learners' academic buoyancy. Table 10 delineates the descriptive statistics for the post-ABS test scores across CDA, CFA, and control groups, summarizing the central tendency for post-intervention phases.

Table 10

Descriptive Statistics of Post-ABS Scores

					95% Confidence Interval for Mean			
	N	Mean	SD	SE	Lower Bound	Upper Bound	Min	Max
CDA group	20	95.40	3.067	.685	93.96	96.83	91.00	101.00
CFA group	20	95.50	2.910	.650	94.13	96.86	90.00	100.00
Control group	20	58.45	2.981	.666	57.05	59.84	53.00	63.00
Total	60	83.11	17.832	2.302	78.51	87.72	53.00	101.00

According to Table 10, the post-ABS scores revealed higher means for the experimental groups, with the CDA group at 95.40 (*SD* = 3.067, *SE* = .685), the CFA group at 95.50 (*SD* = 2.910, *SE* = .650), and the control group at 58.45 (*SD* = 2.981, *SE* = .666), indicating minimal difference between the CDA and CFA groups but a substantial gap compared to the control group. These descriptive statistics suggest that both computerized formative and dynamic assessments played a crucial role in enhancing students' academic buoyancy.

Table 11 displays the results of Levene's test, which assessed the homogeneity of variances in the post-ABS scores.

Table 11

Levene's Test of Equality of Error Variances in Post-ABS Scores

Levene Statistic	df1	df2	Sig.
.151	2	57	.861

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As Table 11 represents, the test yielded a non-significant result (p = .861), indicating that the variance in post-ABS scores was approximately equal across groups, justifying the application of ANOVA. Table 12 outlines the ANOVA results.

Table 12

ANOVA Results: Effects of CDA and CFA Usage on Post-ABS Scores

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	18253.433	2	9126.717	1022.551	.000
Within Groups	508.750	57	8.925		
Total	18762.183	59			

The ANOVA results in Table 12 yielded a statistically significant result, $F(2, 57) = 1022.551$, $p < .001$, indicating that the type of assessment had a substantial effect on learners' post-intervention academic buoyancy. The between-group sum of squares (18253.433) was considerably larger than the within-group sum of squares (508.750), highlighting the strong influence of assessment type on the dependent variable. These findings confirm that participation in either CDA or CFA significantly improved students' academic buoyancy compared to the control group. Table 13 presents the results of pairwise comparisons using the Tukey HSD test to determine which specific groups differed significantly in terms of academic buoyancy.

Table 13

Tukey HSD Pairwise Comparisons of CDA and CFA on Post-ABS Scores

					95% Confidence Interval	
(I) group	(J) group	MD(I-J)	SE	Sig.	Lower Bound	Upper Bound
CDA group	CFA group	-.10000	.944	.994	-2.373	2.173
	Control group	36.95000*	.944	.000	34.676	39.223
CFA group	CDA group	.10000	.944	.994	-2.173	2.373
	Control group	37.05000*	.944	.000	34.776	39.323
Control group	CDA group	-36.95000*	.944	.000	-39.223	-34.676
	CFA group	-37.05000*	.944	.000	-39.323	-34.776

*. The mean difference is significant at the 0.05 level.

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As Table 13 demonstrates, the comparison between the CDA and CFA groups yielded no statistically significant difference (*MD* = -0.10, p = .994), suggesting that both methods were equally effective in enhancing academic buoyancy. However, both experimental groups significantly outperformed the control group: the CDA group (*MD* = 36.95, p < .001) and the CFA group (*MD* = 37.05, p < .001). These results demonstrate that while both CDA and CFA methods are effective in promoting academic buoyancy, neither is superior to the other in this regard, but both are significantly more effective than traditional instruction.

Discussion

The findings of this study present compelling evidence for the effectiveness of CDA and CFA in enhancing vocabulary learning and academic buoyancy among Iranian EFL learners. The results indicate that while both computerized assessment methods significantly contributed to the learners' vocabulary learning and academic buoyancy, CDA demonstrated a superior impact on vocabulary learning, whereas CFA and CDA proved equally effective in promoting academic buoyancy. These outcomes align with and extend existing literature on technology-mediated assessment and learner psychology in EFL contexts.

The statistical analysis revealed that the participants in the CDA group significantly outperformed those in the CFA and control groups in vocabulary learning. This finding corroborates earlier studies emphasizing CDA's efficacy in scaffolding lexical development through adaptive feedback within learners' ZPD (Ebadi et al., 2023; Estrada-Araoz et al., 2023). This study extends the work of Ebadi and Yari (2017) and Hanifi et al. (2016), who emphasized the effectiveness of DA in scaffolding vocabulary development within Vygotsky's (1978) ZPD framework. The present findings reinforce their conclusions by demonstrating that CDA's adaptive scaffolding enables learners to move beyond their current proficiency levels through targeted mediation. This supports Pileh Roud and Hidri (2021), who argued that computerized interventionist DA allows learners to receive real-time, personalized feedback, thereby fostering deeper cognitive engagement. Furthermore, Ghahderijani et al. (2021) observed similar advantages in speaking proficiency, suggesting that CDA's structured yet flexible feedback mechanisms transcend skill-specific applications to enhance overall linguistic competence. In contrast, while CFA also promoted vocabulary learning, its effect was not as pronounced as that of CDA. This aligns with Estaji and Mirzaii's (2018) research, which found that FA primarily enhances recognition and retrieval through repetitive exposure rather than interactive,

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mediated learning. However, CFA's contribution to academic buoyancy corresponds with the findings of Ismail et al. (2022), who demonstrated that FAs reduce test anxiety and improve self-regulation skills by providing structured and ongoing feedback. Gallardo (2020) further argues that CFA's focus on self-regulation may not sufficiently address the cognitive demands of vocabulary internalization, which requires contextualized and mediated practice, a gap CDA fills effectively. However, the CFA's role in promoting learner autonomy and reducing test anxiety (Yarahmadzehi & Goodarzi, 2020) remains critical, particularly in contexts where resources for individualized CDA implementation are limited.

The observed differences in vocabulary learning outcomes between CDA and CFA can be attributed to their distinct theoretical foundations. CDA is deeply rooted in Vygotsky's Sociocultural Theory, which emphasizes dialogic mediation and social interaction as crucial elements for cognitive development (Poehner & Lantolf, 2013). This study supports Poehner et al. (2017), who posited that DA's interventionist approach enhances learning by identifying and responding to students' emergent needs within their ZPD. On the other hand, CFA's success in promoting academic buoyancy aligns with Black and Wiliam's (2006) FA model, which highlights continuous feedback loops and self-regulation. This suggests that CFA may not directly scaffold vocabulary learning in the way CDA does but instead helps learners develop buoyancy and self-efficacy, key components of academic buoyancy (Martin & Marsh, 2008). Similarly, a recent study by Ritonga et al. (2022) further validates this distinction, demonstrating that DA's interventionist approach yields greater gains in complex language skills compared to non-dynamic methods. In the same vein, research by Haghani Zadeh (2018), Hanifi et al. (2016), Rajaeizadeh et al. (2015), and Saeidi and Hosseinpour (2013) highlighted that DA, by providing tailored feedback within the learners' ZPD, is effective in promoting vocabulary knowledge. The current study corroborates these findings, as the CDA group significantly outperformed both the CFA and control groups in vocabulary learning. The individualized, adaptive mediation inherent in CDA aligns with the principles of DA outlined in these prior studies, reinforcing the idea that customized scaffolding enhances learners' ability to internalize vocabulary more effectively. However, the present study expands on these previous works by comparing CDA with CFA, revealing that FA, while beneficial, does not provide the same level of targeted, dynamic support for vocabulary learning.

Notably, both CDA and CFA significantly enhanced academic buoyancy compared to the control group, with no significant difference

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between the two methods. This suggests that both assessment approaches foster learners' capacity to navigate academic challenges, albeit through different mechanisms. CDA likely bolstered academic buoyancy by enhancing self-efficacy through scaffolded success experiences, as Estrada-Araoz et al. (2023) found that adaptive feedback reinforces learners' belief in their ability to overcome difficulties. Similarly, CFA's continuous feedback loops and peer interactions may have reduced anxiety and fostered a growth mindset, aligning with Ismail et al.'s (2022) findings on the FA's role in promoting self-regulation. Heydarnejad et al. (2022) posit that academic buoyancy thrives in environments where learners perceive challenges as manageable, a condition both CDA and CFA cultivate through structured support. Nurjamin et al. (2023) further emphasize that assessment practices emphasizing reflection and goal-setting, key components of CFA, enhance buoyancy by empowering learners to take ownership of their progress. These results collectively emphasize the complementary functions of CDA and CFA in promoting psychological buoyancy, despite the fact that their pedagogical emphases differ.

The results of this study have important implications for teachers and policymakers who want to improve their assessment methods, especially for EFL teachers. It is important to use CDA in digital learning environments since it has been shown to help people learn new words. EFL programs should use adaptive learning technologies like Adobe Captivate to give each student their own support. This agrees with what Shamshiri et al. (2023) said about how important it is to use technology to make assessments more individualized and helpful for language acquisition. Similarly, using CFA to foster academic buoyancy is vital, given its success in improving academic buoyancy. CFA should be integrated into classrooms to assist students in developing self-regulation skills and reducing test anxiety, supporting the findings of Yarahmadzehi and Goodarzi (2020), who promoted mobile-based FAs to enhance learner confidence and motivation. Additionally, adopting a blended assessment model that combines CDA's adaptive scaffolding with CFA's formative feedback cycles could optimize both linguistic and psychological outcomes (Ghahderijani et al., 2024). For instance, integrating CDA's hierarchical prompts into CFA platforms such as Quizlet could provide a balanced approach to vocabulary learning and learner autonomy. Therefore, a comprehensive assessment strategy that unites CDA and CFA principles has the potential to improve both language acquisition and students' academic buoyancy.

This study, while beneficial, has certain limitations that should be acknowledged. The research utilized convenience sampling, which, while practical, restricts the external validity of the findings to broader groups. Future research should include randomized sampling techniques to enhance sample representativeness and improve the reliability of conclusions. Second, the exclusive focus on male Iranian EFL learners further limits generalizability. Future studies should incorporate female participants and learners from diverse educational backgrounds to assess potential gender-based and contextual differences in CDA and CFA effectiveness. Third, this study examined short-term vocabulary learning and academic buoyancy changes, but a longitudinal analysis is necessary to determine the long-term impact of CDA and CFA on vocabulary learning and academic buoyancy. Lastly, cultural and linguistic factors, such as Persian-English linguistic distance, may play a role in assessment effectiveness. Future research should explore how cultural differences shape learners' responses to computerized assessments, providing deeper insights into their adaptability in different EFL contexts.

In conclusion, this research enhances our understanding of the dual function of computerized testing in enhancing language proficiency and academic buoyancy. Given that CDA proves to be a superior method for vocabulary learning, the resemblance between CFA and CDA in fostering buoyancy underscores the significance of diverse assessment methods. By integrating these findings into the broader context of education, including AI-assisted learning, educators will be able to build curricula that harmonize technological enthusiasm with pedagogical efficacy, ultimately yielding proficient and capable EFL learners.

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Biodata

Hassan Alizadehmahmoudalilo earned his B.A. in Food Industrial Engineering from Shiraz University in 2015, followed by an M.A. in TEFL from the Islamic Azad University of Tabriz, and is currently pursuing his Ph.D. in TEFL at the same university. As an adjunct

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professor, he is presently engaged in teaching TEFL courses at Tabriz Azad University, while also serving as an appointed teacher in the Ministry of Education. His scholarly contributions include the publication of over 10 articles in various international and national journals, reflecting his research interests that encompass a wide range of topics, particularly alternative assessment and language teaching methodologies integrating AI and innovative technologies.