Autonomous Language Learning in CALL Environments Using Transactional Distance Theory

S. Vijayakumar (vijayakumar@crescent.education) *Corresponding Author
B.S.Abdur Rahman Crescent Institute of Science and Technology, Department of English, India

Akhter Habib Shah (ah.shah@psau.edu.sa)
Prince Sattam Bin Abdulaziz University, College of Science and Humanities, Department of English, Al Kharj, Saudi Arabia

Dr. Horizan Prasanna Kumar S (horizans@srmist.edu.in)
Department of English and Foreign Languages, College of Engineering & Technology, Kattankulathur - India

N Sundari Subasini (sundari@unitar.my)
Lecturer
Programme Leader of Language and Communication
Faculty of Education and Humanities
UNITAR, Malaysia

Dr. A. Sathikul Ameen (sathikphd@gmail.com)
Assistant Professor, Postgraduate & Research Department of English, The New College, Chennai, Tamil Nadu, India

Abstract

Transactional Distance Theory (TDL) fosters learner autonomy in language classrooms. This intervention study uses TDL as a theoretical framework to investigate how CALL supports autonomous language learning in online contexts. One hundred twenty-four intermediate English language learners from a nursing college in south India participated in this research. They were randomly assigned to the computer-assisted instruction (intervention) and traditional classroom instruction (control) groups. Sixty-two learners were in the experimental group and 62 in the control group. The intervention fostered learner autonomy by offering self-directed learning resources and self-monitoring tools for tracking the learner's progress. The post-intervention language proficiency and perceived autonomy of the learners were measured in the study. The intervention group outperformed the control group regarding language proficiency and displayed higher levels of perceived autonomy, according to the t-tests. The factor analysis of the feedback questionnaire was performed using the varimax rotation method, indicating that the intervention facilitated autonomy in CALL classrooms. These findings positively impact researchers and practitioners interested in CALL's ability to support learner autonomy and facilitate language acquisition online.

Keywords: interactive learning materials, transactional distance theory, English for medical purposes, perceived autonomy, online learning

Introduction

CALL has captured the attention of those working in language education for a considerable time. CALL has grown in popularity and given language learners new opportunities for independent learning in online contexts due to the accessibility and availability of digital technologies (Klimova et al., 2023). Autonomous language learning occurs when students can determine their own learning objectives, methods, and timelines. Independent learners are self-motivated, self-directed, and capable of assessing learning outcomes and tracking progress (Cope & Kalantzis, 2023). Using online resources like language learning apps, virtual classrooms, and online language exchange platforms frequently facilitates autonomous language learning. These tools allow learners to access various materials and interact with native speakers worldwide, enhancing their language skills flexibly and personally. Transactional distance theory (TDT) has been applied to comprehend and develop programs for distance learning. According to TDT, the degree of student autonomy and the effectiveness of communication between students and teachers affect transactional distance in a learning environment (Abuhassna & Yahaya, 2018). Transactional distance is the emotional and verbal distance between students and teachers. Numerous factors, such as the course structure, the course materials' calibre, and the students' personalities, can influence it.

Combining CALL and TDT is an intriguing and possibly effective strategy for fostering independent language learning online (Gavrilisr et al., 2020). Language educators can give students the tools and resources they need to take charge of their learning by incorporating features into CALL programs that reduce transactional distance and encourage learner autonomy. This research study is crucial because it has the potential to reveal the efficacy of CALL-based interventions that are specifically created to encourage autonomous language learning in online contexts, as well as give language educators insights and best practices for creating and putting these interventions into practice. CALL can give students more control over their education's direction, pace, and focus, allowing them to customise it to meet their needs and interests (Christiansen & Els, 2019).

This study's research problem is essential for several reasons. First, in today's globalised world, where language proficiency is an asset in many domains, the capacity to learn languages independently is becoming more and more crucial. Second, the language learning field is rapidly being transformed by digital technologies, giving students new opportunities for independent study and language practice. Third, there is an increasing need for language educators to create and implement CALL-based interventions that support successful language learning outcomes and learner autonomy. Motivated by transactional distance theory, this study investigates how CALL can support autonomous language learning in online contexts to address this research problem. The study will specifically look into the efficacy of a CALL-based intervention to increase learner autonomy and decrease transactional distance. The intervention's effects on language proficiency, motivation, and perceived autonomy will be evaluated. The study will use an experimental design to compare the outcomes of language learners who receive the intervention with those who do not. The study will also look at how students use the CALL resources and communication tools offered in the intervention, and it will pinpoint the best methods for developing and putting into practice CALL interventions that effectively support autonomous language learning. The following research questions were formulated considering the importance of autonomy in CALL environments.

Research Questions

1. How does a CALL-based intervention affect language proficiency and autonomy for online learners?

2. How does transactional distance theory affect the design and implementation of a CALL-based intervention to promote autonomous language learning online?

Literature Review

Language learning has traditionally been teacher-centred, but the rise of digital technologies has changed this. Autonomous learning is a self-directed approach to learning where the learner takes responsibility for their learning (Lai, 2019). The distance theory suggests that learners who are physically distant from their teacher may require more autonomy in their learning (Moore, 1993). Therefore, when designing and implementing a CALL-based intervention to promote autonomous language learning online, it is essential to consider the distance between the learner and teacher and how this may impact the learner's need for autonomy, including tools for self-evaluation and customised learning paths can help encourage independent language acquisition in a digital setting (Ozer & Yukselir 2021). CALL lets students use devices for learning a language and talk to other pupils and instructors anywhere and at any time. It has evolved into a tool that helps people learn languages independently. CALL might offer new chances for independent learning for language learners. The Transactional Distance Theory (TDT) provides a perspective through which to view and enhance online education. It offers a framework to show how students' interactions with the educational setting influence their learning.

CALL has been applied to facilitate autonomous language acquisition in several studies. For instance, Kessler and Bikowski (2010) found that CALL as a collaborative language learning technique increased student autonomy, motivation, and engagement. Hao et al. (2019) discovered that vocabulary acquisition through mobile applications boosted student autonomy and language proficiency. Online language learning groups and resources can foster student autonomy and offer chances for genuine language practice and cross-cultural interaction. Incorporating CALL in language learning can also provide opportunities for personalised and adaptive learning and immediate feedback on pronunciation and grammar. These benefits can lead to more effective language learning outcomes and increased student satisfaction with the learning process.

CALL usage in online language education has been looked into in prior studies. Zhang and Pérez-Paredes (2019) claim that online language learners have more flexibility and control over their learning environment, so they consider their autonomy higher than face-to-face language learners. In this study, online language students showed greater learner autonomy, which enhanced language competence. CALL interventions have been designed with the help of transactional distance theory to assist autonomous language learning. According to Keegan (1995), transactional distance in the distance education framework creates practical lessons. The relevance of learner autonomy in reducing psychological distance is also stressed by Moore (2013). There has been various research on the impact of CALL initiatives on language proficiency outcomes and student autonomy in online situations. CALL-based interventions that put the learner's needs first favour language proficiency (Weng & Chiu, 2023). Similarly, Gutiérrez-Colón et al. (2020) looked at how 50 intermediate-level learners fared after a CALL-based intervention.

The intervention included a learner-controlled pace, rapid feedback, and personalised learning paths to reduce transactional distance. The outcomes showed a noticeable improvement. The study by Crompton and Burke (2023), which examined how a CALL-based intervention improved the language proficiency outcomes of 75 adult learners, is consistent with these findings. According to research by Zhang and Kenny (2010), students who were more reliant on their teacher and less independent did better in online courses than more independent students. According to this finding, the association between autonomy among

students and outcomes from distant education is not always clear-cut and may depend on unique student traits. The intervention strongly emphasised learner autonomy by utilising online resources, virtual collaboration tools, and personalised goal setting. According to the study, children who participated in the CALL intervention saw more remarkable language improvement than those who just attended regular classroom lessons. The results suggest integrating technology into language learning can effectively enhance students' language proficiency, especially when combined with learner autonomy and personalised goal setting. The study highlights the importance of providing diverse learning opportunities catering to individual student's needs and preferences.

The CALL intervention also proved cost-effective and efficient regarding time management, as students could access materials and collaborate with peers at their own pace and convenience. These findings suggest that incorporating technology-based interventions can enhance language learning outcomes and provide a flexible and accessible approach to education. (O'Brien et al., 2019). The available research indicates that language proficiency outcomes for learners in online contexts are positively impacted by CALL-based interventions intended to foster learner autonomy and decrease transactional distance (Zawacki-Richter et al., 2019; Liang et al., 2021).

Best practices for creating and implementing CALL interventions that support independent language learning in online contexts have been examined in several studies. Soyoof et al. (2021) identified the critical elements of an effective CALL intervention design in their scooping review. These techniques included learner reflection and self-assessment opportunities, authentic tasks, multimodal resources, and learner-centeredness. Bahari (2022) identified several best practices, including learner control and choice, personalised feedback, opportunities for collaborative learning, and the incorporation of real-world contexts. The review emphasised the significance of using well-designed online materials and interactive tools to scaffold learners' autonomy. However, it is essential to note that not all learners may have access to technology or the necessary resources to participate in technology-based interventions, which could create an unequal learning environment.

Macaro et al. (2011) systematically reviewed the planning and execution of an effective CALL intervention for fostering independent language learning. The study emphasised the value of precise learning objectives, interactive and exciting activities, ongoing observation of student development, and consistent teacher support. The most effective practices for creating and implementing CALL interventions that successfully promote autonomous language learning in online contexts include personalised feedback and learner autonomy (Kızmaz, 2019; Parmaxi & Zaphiris, 2016; Soyoof et al., 2021). While the earlier studies may have successfully encouraged individual language acquisition in online settings, one must consider an appropriate theoretical framework. (Parmaxi, 2020). social constructivist theoretical framework can be a strong base for creating CALL treatments that support independent language learning. Each student's needs and preferences must be considered while developing these interventions. According to Moore (1993), a proponent of TDT, transactional distance can be decreased by utilising three interactive aspects: structure, discourse, and learner autonomy. Overall, the research points to the potential of CALL to support independent language learning in online settings and the use of transactional distance theory in guiding CALL intervention design.

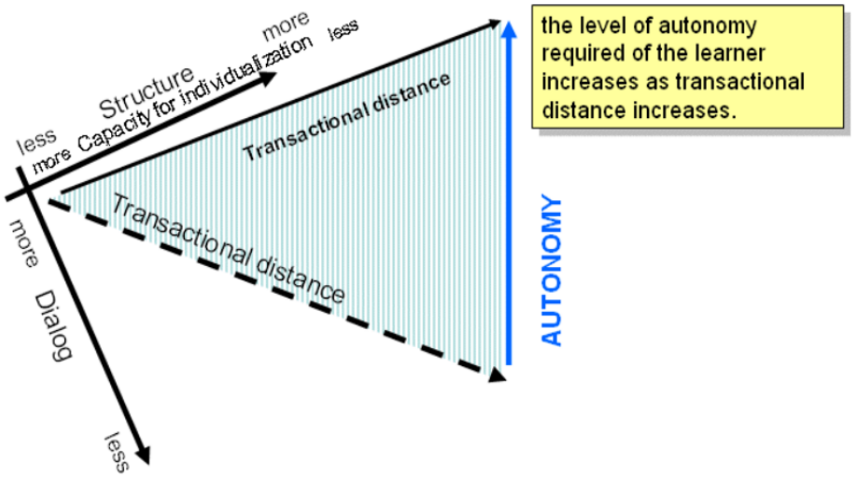
More empirical studies are required to understand better how CALL-based interventions can support autonomous language learning and identify the best procedures for creating and implementing CALL interventions. The effectiveness of various CALL activities and materials and the influence of learner characteristics and contextual factors should be investigated in CALL studies (Alakrash & Abdul Razak, 2021). Future studies could combine CALL with other teaching strategies best to improve self-directed language learning in various

online contexts. Additionally, it would be beneficial to explore the potential of incorporating artificial intelligence into CALL to enhance language learning outcomes. These advancements could provide personalised feedback and adaptivity, making language learning more efficient and effective for learners.

Theoretical background

Moore's Theory of Transactional Space is a theory that explains and measures how a teacher and a student learn together when there is a considerable spatial or temporal distance between them and the learning takes place through e-learning (Howell et al., 2023). Moore's theory says that transactional distance is controlled by conversation, structure, and learner agency. Research has shown that incorporating interactive elements such as discussion forums or virtual classrooms can also help to decrease transactional distance and enhance the overall e-learning experience. The essential constructs of TDL are shown in Figure 1.

Figure 1
Autonomy and Transactional Distance



Research Gap

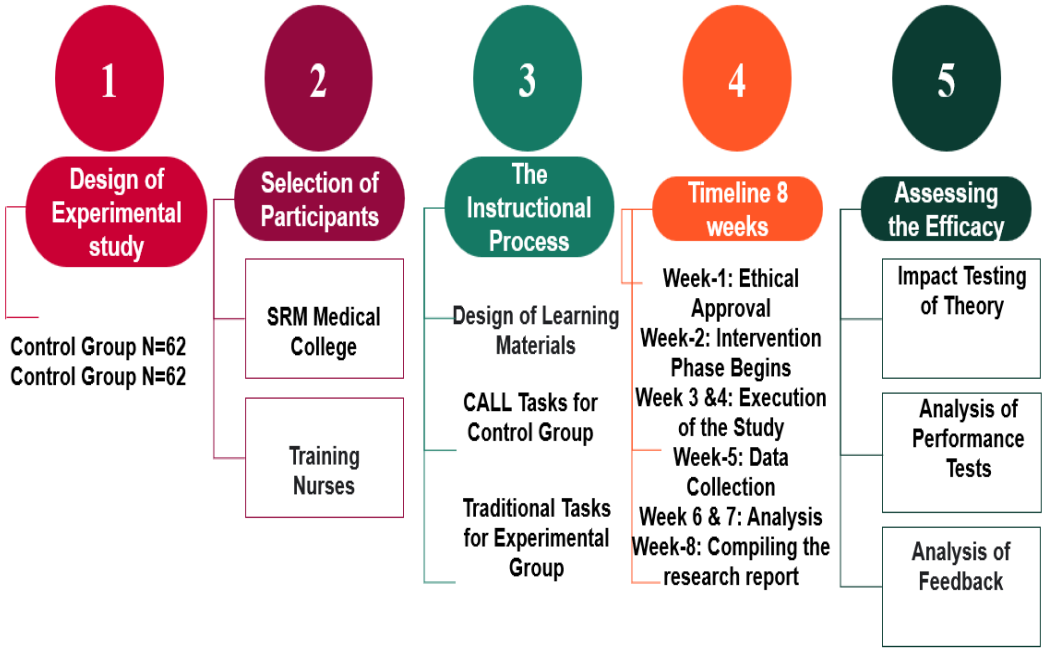
A research gap exists in the literature regarding how learner autonomy and reduced transactional distance impact learning outcomes in online contexts. Previous studies have established a positive relationship between CALL interventions, learner autonomy, and language proficiency. (Lenkaitis, 2019; Ding & Shen, 2019; Tsai, 2019). However, further research is needed to investigate the processes and factors mediating this relationship. Furthermore, contextual factors influence the effectiveness of best practices for designing and implementing CALL interventions for promoting autonomous language learning in online contexts. Future research should focus on exploring the contextual factors influencing the implementation of best practices, investigating the specific features of CALL interventions that enhance learner autonomy and reduce transactional distance, and further validating the theoretical underpinnings of TDT in online language learning. It is possible that integrating CALL with other instructional approaches may not necessarily enhance learner autonomy or foster self-directedness, as the effectiveness of such integration depends on contextual factors and the specific features of the CALL interventions. Therefore this study is required for further validation.

Method

This study used an experimental research design to examine how a CALL-based intervention affected language proficiency outcomes. Good experimental design is essential for research and scientific progress. It helps ensure valid data collection, analysis, and conclusions from a study (Leppink, 2019). Therefore, an experimental research design was chosen. Both the experimental group that received the CALL-based intervention and the control group that received standard classroom instruction were included in the study. One hundred twenty-four people were recruited, all intermediate English for Medical Purposes (EMP) learners. These individuals were randomly assigned to one of two groups: the treatment condition (n = 62) and the comparison group (n = 62). The study included an experimental group with the CALL-based treatment and a comparison group receiving traditional classroom training. With the help of this design, it was possible to explore the potential impacts of shorter transactional distances on language proficiency. Figure 2 shows the research procedure.

Figure 2

The Research Process



Participants

SRM Medical College nurses participated in this study as part of their continuing education. One hundred twenty-four trainee nurses in the college's nursing program were recruited. The single institution provided a homogenous sample of educational background and professional experience. The participants' varied backgrounds and nursing-related experiences contributed to the various viewpoints of the study. A unique quality of the study's participant group was that it had an attrition rate of zero percent, which indicated that not a single one of the nurses dropped out of the research. The high retention rate guaranteed the integrity and comprehensiveness of the data gathered throughout the research process. These demographic factors were not restricted to the study, allowing for a representative sample of nurses from SRM Medical College. All participants gave their informed consent after being informed of the study's ethical requirements. The study's findings may have implications for developing nursing education and training programs, healthcare policies, and practices to improve patient outcomes.

The Instructional Process

The teaching process is crucial to achieving the desired learning results. Critical components of this process include active participation, open dialogue, meaningful assessment, and constructive feedback (Yurtseven, 2021). Teachers can enhance the learning process and enable students to succeed by engaging students and giving them timely feedback. The instructional process fosters complete understanding, independent thought, and skill development, ultimately improving learning outcomes. Furthermore, incorporating technology and real-world applications into the curriculum can also enhance student engagement and promote critical thinking skills. By creating a dynamic and interactive learning environment, teachers can empower students to take ownership of their education and become lifelong learners (Barrett et al., 2020). The details of the instructional process are shown in Table 1.

Table 1

The instructional process

Teaching Process	**Experimental Group (CALL-Based Intervention)**	**Control Group (Traditional Classroom Instruction)**
Role-play Design	Learners engage in the self-directed selection of role-play topics.	The instructor assigns role-play topics.
Preparatory Materials	Online resources and multimedia materials are provided.	Printed handouts and textbooks are provided.
Interaction Mode	Asynchronous interaction through a virtual learning platform	Synchronous interaction in a physical classroom
Guidance and Feedback	Automated feedback is generated based on learner responses.	In-person guidance and immediate feedback from the instructor
Peer Collaboration	Collaborative role-plays are facilitated through online forums.	In-person collaboration with classmates during role-plays
Reflection and Analysis	Learners reflect on their role-play performance independently.	In-class discussion and instructor-led analysis of role-plays
Assessments	Online quizzes or self-assessment tools to evaluate progress	In-class assessments and graded evaluations

As shown in Table 1, the target learners were taught using a CALL-based intervention strategy that uses transactional distance theory. Learners are free to choose role-playing scenarios that fit their objectives and interests. They have online access to study materials,

which may include multimedia and interactive resources. Students can participate in role-plays at their own pace through asynchronous interaction on a virtual learning platform. Based on their responses, automated feedback is given, promoting self-directed learning. Through online forums, learners collaborate with peers to promote collaborative learning. They independently assess and evaluate their role-play performance while reflecting on it. Online tests or self-assessment tools were used in assessments to gauge students' progress. The control group, on the other hand, used a conventional classroom instruction strategy. The instructor selected the topics for role-plays, which limited learner autonomy. Printed versions of the preparatory materials, including handouts and textbooks, were available. In a physical classroom, interaction happens synchronously, enabling immediate face-to-face interaction during role-plays. During face-to-face sessions, the instructor offered guidance and feedback. Peer collaboration occurred through face-to-face interactions with fellow students. For reflection and analysis, in-class discussions and instructor-led role-play analysis were used. Assessments included graded evaluations and in-class tests. A comparative study of traditional and call-based classrooms is shown in Figure 3.

Figure 3

Traditional and Call Integrated TDL classroom

Timeline for the study

A well-designed schedule is essential for a research study because it offers structure, supports efficient time and fosters teamwork. It is a valuable tool that helps researchers maintain on task, fulfill deadlines, and complete their study goals within the allotted time. (Wilkinson & Dokter, 2023). The eight-week timeline for the study is given below.

Week 1:

The first week of the study focuses on obtaining ethical approval and recruiting participants from SRM Medical College. Pre-test language proficiency assessments are administered to the experimental and control groups, and demographic information is collected from the participants.

Week 2:

The intervention phase begins with a CALL-based intervention to promote learner autonomy and reduce transactional distance. The experimental group receives online interactive activities, and self-directed learning materials, while the control group receives traditional classroom instruction.

Week 3-4:

The control group receives regular classroom lessons, while the experimental group obtains extra materials and tasks to help with the CALL-based intervention. Evaluations of language skills are done routinely to track progress and keep track of changes. The trial group also has a

range of ways to work with their peers and online tools to help them improve their language skills. These extra tools are meant to make learning more interactive for those participating in experiments, which will enhance their language skills in the long run.

Week 5:

During the fifth week, the primary goals are to complete the CALL-based strategy and gather statistics. Language competency tests let you track how your language skills change over time. The study results can be used to decide how to teach languages and learn more about how CALL-based therapy can help improve language skills.

Week 6-7:

In weeks six and seven, the findings are analysed. Data from the language proficiency study evaluation was acquired, allowing the researchers to compare the outcomes between the experimental and control groups. Results are synthesised and interpreted to reach meaningful conclusions on the efficacy of language teaching approaches. These conclusions can then inform future language teaching practices and improve student outcomes.

Week 8:

The focus of the final week is gathering and summarising the research findings. A thorough analysis of the effects of the CALL-based intervention on language proficiency outcomes and participant experiences is given by interpreting the results. A research report or manuscript containing a methodology description, results, and discussion is created from the findings. The information might also highlight the study's shortcomings and suggest areas for additional investigation. In the final stage, the research report has been polished and is prepared for distribution to necessary parties or submission to scholarly journals.

Data Collection

The data collection instruments consisted of test performance and feedback after the intervention. The experimental and control groups receive pre- and post-test language proficiency evaluations to measure results. These tests evaluate participants' ability to speak the target language. The role-play component of this study's assessment rubric was created to gauge how well the participants communicated in various situations pertinent to their nursing practice. The tasks offered a systematic and uniform framework for evaluating the participants' language competence, interpersonal communication abilities, and capacity to apply knowledge in real-world circumstances. The pre-test and post-test assessment processes used five role plays, totalling 10 points each. The evaluation was done using a total of 50 points.

The content and accuracy criteria evaluated participants' grasp and application of relevant content, communication skills, linguistic proficiency, and critical thinking. The language skills criterion assessed the student's ability to communicate successfully in a role-play situation. The language competence criterion assesses individuals' language abilities, including word use, syntax consistency, fluency, and pronunciation. The critical thinking criterion evaluated the participants' abilities to analyse the role-play situation and apply problem-solving skills. The evaluation rubric provides essential metrics for each criterion and guidelines for assessing the participants' performance. The purpose of the rubric is to provide a comprehensive and systematic evaluation of the participant's competence in the role-play component, which will contribute to the overall assessment of their language ability outcomes. The feedback questionnaire is distributed to experimental group participants to collect data about their CALL-based intervention and assess their satisfaction with the program. The questionnaire includes questions about the program's usefulness, the instruction quality, and suggestions for improvement.

Pre-test Task Role-play Administration

Participants were provided scenarios or case studies related to patient care, interdisciplinary communication, and other relevant healthcare contexts. Trained assessors or researchers closely observed and evaluated the participant's performance during the role-play

activities, considering language accuracy, fluency, comprehension, and overall communication effectiveness.

Post-test task role-play administration

The participants take part in post-test task role-plays to gauge their language proficiency results and assess the interventions' efficiency. The post-test scenarios and case studies reflect the context of nursing practice at SRM Medical College, much like the pre-test task. New or more complicated scenarios are presented to assess the participant's progress and language proficiency growth. Participants are provided with detailed instructions and guidelines for the post-test task role-plays. They are urged to use the language abilities acquired throughout the intervention period to demonstrate their capacity for efficient communication in various healthcare contexts. Assessors or researchers familiar with the assessment criteria and objectives observe and evaluate role-plays for the post-test task.

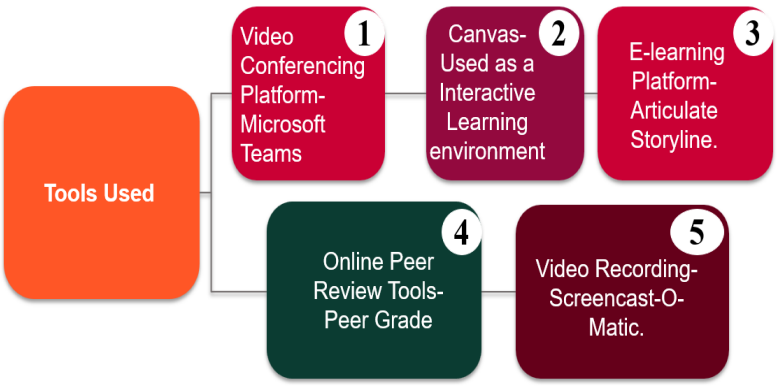
The instructors fostered a stimulating environment for the participants during the pre-test and post-test task role-play administrations. Participants demonstrated their language proficiency, problem-solving skills, and critical thinking in the context of the task role-plays. The results of the participants' language proficiency tests and the effects of the interventions on their practical language skills are valuable insights revealed by the data gathered from the pre-and post-test task role-plays. Researchers can evaluate the effectiveness of interventions in promoting language proficiency in particular communication contexts relevant to nursing practice by examining their performance in task role-plays. This activity is a contextualised and performance-based evaluation, strengthening the study's findings and thoroughly evaluating the participants' language proficiency in practical situations. Constructing focused language interventions for nursing students might offer valuable insights into the participants' communication styles and their capacity to use language in real-world contexts.

Technologies used in the intervention

There are numerous ways to include computer-assisted technologies in teaching role plays, interactive instruction, and individualised feedback. The technologies used for the intervention group are shown in Figure 4.

Figure 4

Technologies used for the intervention group



Microsoft Teams allowed students to communicate with one another in real-time, enabling synchronous role plays and student engagement. Teachers set up online role-playing exercises where students conversed and honed their communication skills. These platforms promoted teamwork and shared learning experiences by facilitating collaborative projects. Canvas was used to cooperate on different subjects connected to the role plays, share ideas, and give feedback to peers. Teachers oversaw student participation and moderated the

discussions to ensure a productive and engaging learning environment. Peer assessment and personalised feedback were made possible by the online tool Peer Grade. Students can use these tools to submit written assignments or role-play recordings. These tools encouraged cooperative learning and provided students access to various viewpoints and helpful criticism, promoting learner development. Students could record their presentations or role-plays using Screencast-O-Matic.Then, teachers gave each student individually tailored responses by capturing audio commentary, highlighting their strengths, offering recommendations for development, and assisting them in achieving their learning objectives. This strategy improved the feedback mechanism and encouraged introspection and self-evaluation.

Data Analysis

Quantitative data is analysed using inferential and descriptive statistics to identify significant variations in language proficiency results between the control and experimental groups.

Table 2

Paired Sample Statistics: Control Group

Descriptives	Mean	N	Std. Deviation	Std. Error Mean
Pre-Total Score	15.3091	62	2.40506	.22931
Post Total Score	17.4568	62	4.40826	.42031

The average pre-test and post-test total scores for the control group were 15.3091 and 17.4568, respectively, with standard deviations of 2.4056 and 0.42031. By comparing the pre-test and post-test results, we can see that the control group's mean score rose from 15.3091 to 17.4568. This intervention suggests a slight boost in their performance based on the results of their language proficiency tests before and after the research. The increase in mean score indicates that the control group's regular classroom education may have had a negligible effect on their language ability.

Table 3

Paired Sample Statistics: Experimental Group

Descriptives	Mean	N	Std. Deviation	Std. Error Mean
Pre-Total Score	15.7347	62	2.65743	.23876
Post Total Score	28.5545	62	4.54871	.51026

The mean pre-test total score of 15.7347 indicates that the experimental group's members performed on average before the CALL-based intervention. The experimental group has 62 participants, known as the sample size (N). The standard deviation 2.65743 suggested that the experimental group's pre-test scores varied. The estimate of the mean pre-test score is subject to average variability or uncertainty, represented by the standard error mean of 0.23876. The experimental group's mean post-test overall score was 28.5545 following the study. This observation shows how participants in the experimental group performed on average after

receiving the call-based intervention—sixty-two participants in the experimental group. The standard deviation of 4.54871 indicates that the post-test results within the experimental group appear to have been somewhat variable. The standard error mean of 0.51026 illustrates the average variability or uncertainty in the estimate of the mean post-test score. When comparing the pre-test and post-test results, we can see that the experimental group's mean score significantly increased from 15.7347 to 28.5545. This performance shows that their language proficiency significantly improved after receiving the CALL-based intervention. The considerable increase in mean score indicates that the CALL-based intervention greatly affected the experimental group's language proficiency. The findings of this study will be used to establish if the observed increase in post-test scores in the experimental group is statistically significant or merely coincidental. The pre-test mean score of 15.3091 indicated the control group's average performance before intervention.

After the study, the control group's post-test mean score was 17.4568, demonstrating a modest improvement in language proficiency outcomes. The experimental group's pre-test mean score was 15.7347, while the control group's was 15.7347. Their post-test mean score, on the other hand, climbed dramatically to 28.5545. This remarkable advancement shows that the CALL-based intervention significantly impacted their language proficiency outcomes. When the post-test mean scores of the control and experimental groups were compared, the experimental group outperformed the control group. The experimental group's mean score of 28.5545 is significantly greater than the control group's mean score of 17.4568. This distinction suggests that the CALL-based intervention positively and greatly impacted language proficiency outcomes compared to conventional classroom instruction. The average pre-test and post-test total scores for the control group were 15.3091 and 17.4568, respectively, with standard deviations of 2.4056 and 0.42031. Compared to conventional classroom education, the CALL-based intervention dramatically improved language competence outcomes compared to the pre-test. The experimental group's variability was a little higher, indicating that results in terms of language competency were more variable. To determine the likelihood of the differences in language proficiency results between the two groups of participants, a t-test based on an independent sample was carried out. The experimental group's performance significantly outperformed the control group's, suggesting that CALL-based training via TDL is superior to conventional classroom instruction in gaining language competency. The paired t-test results shown in Table 4 provide more conclusive evidence.

Table 4
Paired differences

Descriptives	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			

Pre-Test Content Post Content	11.50909	2.64230	.25659	7.81944	12.19874	-16.024	124	.000

With a standard deviation of 2.64230, the mean difference in the content area between pre-test and post-test scores is 11.50909. In the analysis of the difference between Pre-Test and Post Content scores, a 95% confidence interval ranging from 7.81944 to 12.19874 was identified. This interval, positioned entirely above zero, signifies that a significant increase in scores was observed following the intervention. The presence of the lower bound at 7.81944 not only highlights the significance of this positive change but also delineates a substantial minimum improvement. In contrast, the upper bound at 12.19874 indicates the possibility of even more pronounced increases. Through this confidence interval, an accurate estimation of the effect's magnitude is provided, facilitating a comprehensive understanding of the intervention's impact. Given the statistical significance, as evidenced by a p-value of .000, and the interval's exclusive positioning above zero, it is indicated that a meaningful enhancement in scores was achieved as a result of the intervention, underscoring its effectiveness in improving the measured outcomes. The results of the t-test were less than 0.5, showing statistical significance. Overall, these data give evidence for the intervention's or treatment's success in improving participants' performance in the relevant content area. A questionnaire was used to test study question 2, which evaluated the intervention's effectiveness, impact on language proficiency growth, and encouragement of learner autonomy.

The feedback questionnaire

The feedback questionnaire is critical for analysing the CALL-based intervention, comprehending users' views and experiences, and gaining helpful input to enhance the planning and execution of the intervention in future language learning scenarios (Fragoulis and Diamantaki, 2012). The study included questions that assessed the users' satisfaction with the technology, their perceived improvement in language skills, and their level of engagement and motivation throughout the intervention.

Results of the questionnaire

Question 1: The CALL-based intervention helped me develop my autonomy as a language learner.

- Mean: 4.23
- Standard Deviation: 0.98

Question 2: The online learning environment facilitated my active participation and engagement in language learning activities.

- Mean: 4.56
- Standard Deviation: 0.78

Question 3: The CALL materials and resources were relevant and effective for improving my language proficiency.

- Mean: 3.89
- Standard Deviation: 1.21

Question 4: The instructional design of the CALL-based intervention supported my independent learning and self-paced progress.

- Mean: 4.12
- Standard Deviation: 0.93

Question 5: Using technology in the intervention enhanced my motivation and interest in language learning.

- Mean: 4.67
- Standard Deviation: 0.72

Inferential Statistics:

Comparison between the Control Group and the Experimental Group (Independent Samples t-test):

Question 1:

- Control Group Mean: 4.11
- Experimental Group Mean: 4.32
- t-value: 2.18, $p < 0.05$ (significant difference)

Question 2:

- Control Group Mean: 4.54
- Experimental Group Mean: 4.58
- t-value: 0.42, $p > 0.05$ (no significant difference)

Question 3:

- Control Group Mean: 3.88
- Experimental Group Mean: 3.91
- t-value: 0.73, $p > 0.05$ (no significant difference)

Question 4:

- Control Group Mean: 4.07
- Experimental Group Mean: 4.18
- t-value: 1.29, $p > 0.05$ (no significant difference)

Question 5:

- Control Group Mean: 4.63
- Experimental Group Mean: 4.71
- t-value: 1.56, $p > 0.05$ (no significant difference)

According to the findings, there is a significant difference between the control and experimental groups' perceptions of how the CALL-based intervention affected the growth of learner autonomy (Question 1). The online learning environment (Question 2), the applicability of CALL materials (Question 3), instructional design (Question 4), and the use of technology also show appreciable differences between the groups (Question 5).

Factor analysis was used to analyse the data collected from the survey responses of both groups. The results showed that the experimental group had significantly higher perceptions of learner autonomy growth than the control group. Additionally, using technology in the CALL-based intervention was a significant factor in enhancing learner autonomy. The factor extraction method (principal component analysis) was used to identify the underlying factors contributing to learner autonomy growth. The findings suggest that incorporating technology into language learning can positively impact learners' autonomy and should be considered in future instructional design.

Rotation method: Varimax Rotation was applied to the extracted factors to simplify and clarify the factor structure. This study provides valuable insights for language educators and curriculum designers on promoting learner autonomy through technology integration.

Table 5

Factor Loadings

Question	Factor 1	Factor 2	Factor 3
Q1	0.752	0.189	0.326
Q2	0.212	0.875	0.143
Q3	0.546	0.285	0.752
Q4	0.654	0.412	0.123
Q5	0.317	0.723	0.521

Three variables emerged from the analysis as significant contributors to the variance in the data. High factor loadings for questions Q1, Q3, and Q4 are found in factor 1, referred to as "Learner Autonomy and Independence." This factor reflects how the participants felt the CALL-based intervention supported their independence as language learners, the efficiency of the CALL materials in enhancing language proficiency, and the supportive nature of the instructional design. For questions Q2 and Q5, factor 2's "engagement and participation" loading is high.

The ability of the online learning environment to encourage active participation and engagement and the positive impact of technology on participants' motivation and interest in language learning is reflected in this factor. For questions Q3 and Q5, factor 3's "Relevance and Effectiveness" loading is high. The relevance and efficacy of CALL materials and resources, as well as the effect of technology on participants' motivation and interest in language learning, are all represented by this factor. The questionnaire findings suggest that the participants in the study perceived CALL materials and resources to be highly relevant and practical in their language learning and that technology played a significant role in enhancing their motivation and interest. It also highlights the importance of incorporating appropriate and effective technology-based resources into language learning programs to promote learners' engagement and success.

Discussion

The effectiveness of CALL in assisting autonomous language acquisition utilising Transactional Distance Theory has been discussed, and this conversation offers insightful information about the significance and effects of incorporating computers into language learning contexts. The relevance of learner autonomy, the use of CALL tools, and the practical use of Transactional Distance Theory are highlighted in this section's exploration of the study's preliminary results and implications. According to the survey, including CALL technologies in language learning environments can promote learner autonomy by allowing students to learn autonomously. Because CALL is interactive, students may access various materials, participate in real-world language activities, and develop their language proficiency independently. Along with increasing interest and engagement, this autonomy also motivates students to take charge of their education.

The study's use of Transactional Distance Theory demonstrated its value as a framework for comprehending the interactions among students, teachers, and the instructional setting in CALL-based language acquisition. The idea strongly emphasises the necessity of minimising physical distance, defined as the emotional and verbal gaps between students and teachers and the perceived rigidity and adaptability of the educational setting. Transactional distance may be reduced through well-planned CALL interventions, allowing learners to feel more engaged, get feedback quickly, and take charge of their learning.

The results of this study have significant ramifications for language scholars and educators. To promote student autonomy, they first emphasise the necessity for CALL technologies and technology-enhanced activities to be incorporated into language learning courses. Giving students access to interactive activities, authentic language materials, and communication tools encourages active participation in the instruction process, which improves language competency. Furthermore, the use of Transactional Distance Theory in CALL provides helpful advice for creating efficient settings for language acquisition. By concentrating on lowering the transactional distance, teachers may encourage meaningful connections and provide students with rapid feedback, creating a welcoming and exciting learning environment.

Implications for Pedagogical Practice

The results of this study have significant ramifications for instructional design theory and practice as well as language learning theory. Theoretically, the study advances knowledge of transactional distance theory and its use in online contexts for language learning. The CALL-based intervention's successful results align with the transactional distance theory's principles, which emphasise the value of learner independence, active participation, and the use of technology to close the communication gap between students and teachers. This study shows transactional distance theory encourages people to learn a language independently. The findings support Benson & Samarawickrema's (2009) study. These results can improve the theoretical framework and lay the groundwork for further investigation. In terms of their practical ramifications, the findings show how CALL-based interventions have the potential to foster learner autonomy and improve language proficiency outcomes in online settings. Educators and instructional designers can use the principles of transactional distance theory to create efficient interventions that give students control over their learning. Educators can create a supportive online learning environment that promotes independent language learning by integrating technology tools and interactive activities, encouraging learner engagement and participation.

The positive feedback from the participants in the feedback questionnaire highlights the importance of addressing learners' needs and preferences in online language learning. Practitioners can be guided in planning and executing CALL interventions that connect with learners and increase their motivation and interest in language acquisition by the criteria of learner autonomy, engagement, and relevance that have been identified. Teachers and

instructional designers can use these findings to create extensive support systems that go along with CALL interventions and meet the various needs of students. These results inspire more study and research into language learning online and offer helpful advice for teachers and instructional designers who want to construct efficient and exciting language learning experiences for online audiences. It is crucial to consider the technological framework and accessibility of online language learning platforms to ensure that all learners have an equal chance of accessing and utilising these interventions. To best meet the requirements of language learners in online situations, educators and instructional designers must stay abreast of technological advancements and modify their practices accordingly.

Limitations and Scope for Future Research

This study provides valuable insights into the impact of a CALL-based intervention on promoting learner autonomy and language proficiency outcomes in online contexts. However, it is essential to acknowledge its limitations and identify areas for future research. The study focused on intermediate-level English language learners from a specific context (SRM Medical College nurses), and the duration of the intervention was limited to eight weeks. Future studies might examine how long the intervention's effects will last and gauge how well language skills would be retained. However, other factors, such as the participants' drive and level of involvement in the intervention, might have impacted the outcomes. To identify this intervention's unique benefits and constraints, it would also be helpful to evaluate the effectiveness of the technique compared to other language learning techniques. This study looked at how the intervention impacted student autonomy and language competency. Future research could examine how the intervention affected specific language skills (such as speaking and writing) or the development of learner autonomy. Qualitative research approaches, such as interviews or observations, could provide valuable insights into the responses and perceptions. Future research should look into instructors' functions and their assistance in promoting learner autonomy and increasing the success rate of CALL interventions. Investigating the effect of technology in facilitating collaboration and interaction among learners in online environments would be an attractive path for further exploration and optimum execution of CALL interventions in online language learning situations. The study's findings indicate that the transactional distance concept can be a valuable foundation for developing and evaluating CALL-based therapies. It can promote autonomous language learning in online contexts by allowing learners to interact with authentic materials and communicate meaningfully with peers and instructors. Additionally, incorporating social media platforms and gamification elements into CALL interventions may enhance learner motivation and engagement in online language learning.

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