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The Effects of Fade-in and Fade-out Scaffolding on EFL Learners' Grammar Achievement and Foreign Language Anxiety in Project-Based Flipped Classrooms

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Abstract

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Static scaffolding often fosters learner over-reliance, prompting interest in fading techniques like fade-in (least-to-most) and fade-out (most-to-least) support. While scaffolding has been widely studied, limited research compares these two fading approaches within project-based flipped learning (PBFL), particularly in language education. This quantitative experimental study examined the effects of fade-in and fade-out scaffolding on English as a foreign language (EFL) learners' acquisition of passive voice structures and their foreign language anxiety (FLA). Over six weeks, ninety homogenized female learners in a project-based flipped learning (PBFL) course were randomly assigned to two experimental groups (fade-in or fade-out scaffolding) and a control group (no systematic scaffolding). A pretest and post-test measured grammar gains, and an FLA scale was administered post-course. ANCOVA results revealed four main findings. First, the fade-in group significantly outperformed the control group. Second, although the fade-out group showed higher gains than the control, this difference was not statistically significant. Third, no significant difference emerged between the two fading approaches. Finally, the type of scaffolding received did not significantly affect learners' FLA levels. These findings offer language teachers practical guidance for implementing fading scaffolding within PBFL environments.

Keywords: fade-in scaffolding, fade-out scaffolding, foreign language anxiety, English as a foreign language learning, project-based flipped learning.

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1. Introduction

The acceleration of modern life has led to increased adoption of innovative educational methods in language teaching, such as the flipped classroom approach. Flipped learning is an instructional model that reverses conventional learning activity sequences by shifting content delivery outside the classroom and bringing interactive activities into class time (Chen et al., 2025). This shift from teacher-centered lectures to student-centered pedagogy is driven by a growing emphasis on deep learning (Nouraei Yeganeh & Nemati, 2026), which values learners' active participation in knowledge construction (Archambault et al., 2022).

Flipped teaching can be integrated with project-based learning (PBL), an approach requiring active learner involvement and teacher support (Sudirjo, 2023). Project-based flipped learning (PBFL) enhances self-directed learning and develops key competencies such as creativity, teamwork, and problem-solving (Fitrah et al., 2025; Sanchez-Muñoz et al., 2022). However, the complex, multi-stage nature of projects in PBFL environments creates distinct cognitive and affective challenges for learners, making the strategic timing and adjustment of teacher support (i.e., scaffolding) particularly critical.

In PBL, students face gaps between their current and required abilities. Scaffolding, or support from peers or instructors, improves cognitive outcomes across learners of all ages (Belland et al., 2017) and is widely documented in foreign language contexts (Chih-Chung & Fu-Yun, 2025). Beyond cognitive benefits, scaffolding also plays a crucial role in shaping learners' affective experiences. In advanced EFL contexts, learners often experience elevated levels of foreign language anxiety (FLA), which appropriate support can help alleviate (Karima & Purnawan, 2025; Zhang et al., 2023).

Providing support, however, does not guarantee its effectiveness. The timing and quantity of support must also be considered. Persistent, unaltered support, static scaffolding, can create over-reliance, diminish performance (Zhang et al., 2025), counteract student autonomy (Mahan & Zarobe, 2024), and lead to disengagement (Sawyer, 2011). In response, fading scaffolding is recommended. Fade-in (least-to-most) scaffolding introduces supports incrementally as project complexity increases, while fade-out (most-to-least) scaffolding involves systematic support withdrawal as learner competency develops (Jennings & Muldner, 2020; Zheng et al., 2022). The instructional distinctiveness of these two patterns lies in their timing: fade-in delays support to promote initial productive struggle, whereas fade-out provides immediate guidance that is gradually removed.

Although previous research has examined scaffolding in grammar learning (e.g., Izanlu & Feyli, 2015; Moeen et al., 2019) and compared static

and fading scaffolding in online environments (Han et al., 2021), these studies have largely focused on isolated scaffold forms rather than systematic fading sequences. Moreover, investigations of fade-in and fade-out approaches have been conducted predominantly in non-language domains such as mathematics and programming (Chase & Abrahamson, 2015; Jennings & Muldner, 2020; Zheng et al., 2022), leaving their instructional value in EFL grammar learning largely unexplored. Critically, despite evidence that scaffolding can alleviate FLA (e.g., Zarei & Rezadoust, 2020; Ibrahim et al., 2023), prior research has not differentiated between types of fading scaffolding when examining anxiety outcomes. To the best of our knowledge, no empirical study has compared the effects of fade-in versus fade-out scaffolding on both grammatical development and FLA within PBFL contexts. Addressing this gap, the present study examines the effects of fade-in and fade-out scaffolding on EFL learners' grammar achievement and FLA within a PBFL context. Accordingly, the study seeks to answer the following research questions:

RQ1: Does the implementation of fade-in and fade-out scaffolding in PBFL significantly improve EFL learners' grammar proficiency on passive voice structures compared to instruction without systematic scaffolding?

RQ2: Is there a statistically significant difference in FLA levels among EFL learners in a PBFL setting exposed to fade-in scaffolding, fade-out scaffolding, or non-systematic scaffolding?

2. Literature Review

2.1 Theoretical Background and Definitions

2.1.1 Theoretical Framework: How Fading Scaffolding Affects Learning

Scaffolding is rooted in Vygotsky's sociocultural perspective, where temporary, adaptive assistance enables learners to progress through interaction with more capable others within their zone of proximal development (ZPD) (Yu & Hu, 2017). A defining characteristic of effective scaffolding is fading, the gradual adjustment of instructional support over time (Puntambekar & Hubscher, 2005).

Two primary fading patterns have been identified: fade-out and fade-in scaffolding (Jennings & Muldner, 2020). Fade-out scaffolding, the traditional approach, involves systematic support reduction as learners gain competence. This pattern is grounded in cognitive load theory, which emphasizes decreasing assistance to foster autonomy (Kalyuga & Renkl, 2010). However, premature support withdrawal can cause the vanishing scaffolding effect, where performance declines before skills are internalized (Pea, 2004). In contrast, fade-in scaffolding begins with minimal support and increases assistance in response to learners' difficulties. This pattern aligns with productive failure theory, which posits that initial struggle promotes

deeper learning and prepares learners to benefit more effectively from subsequent guidance (Kapur, 2016).

For the present study, these theoretical distinctions directly inform the instructional design. In the fade-in condition, learners initially grapple with project tasks using minimal grammar support, engaging in productive struggle before receiving targeted assistance. In the fade-out condition, learners receive immediate, explicit instruction that is gradually withdrawn, managing cognitive load through structured initial support.

2.1.2 Theoretical Framework: How Fading Scaffolding Reduces Anxiety

Sequenced scaffolding reduces FLA through interrelated cognitive, affective, and motivational mechanisms. From a cognitive perspective, Cognitive Load Theory (Sweller, 1988) explains how instructional support regulates learners' limited working-memory capacity during complex language tasks. Fade-in scaffolding initially distributes cognitive demands by externalizing task structure, preventing overload, while fade-out scaffolding gradually withdraws support as learners' schemas develop, aligning task difficulty with expanding capacity.

From an affective perspective, this calibrated support contributes to anxiety reduction by maintaining an optimal challenge level across project phases, consistent with Krashen's Affective Filter Hypothesis (1982). When tasks remain cognitively manageable, learners' affective filter remains low, facilitating input processing. From a motivational perspective, Bandura's Self-Efficacy Theory (1997) explains that fade-in scaffolding facilitates early mastery experiences, while fade-out scaffolding structures progressively challenging tasks that allow learners to attribute performance gains to their own developing competence. As self-efficacy increases, FLA correspondingly decreases (Huang & Liu, 2025).

For this study, these mechanisms predict that both fading patterns should reduce anxiety compared to non-systematic support, though potentially through different pathways: fade-in through managed productive struggle and subsequent mastery, and fade-out through structured cognitive load reduction.

2.2. Related studies

2.2.1 Scaffolding in Foreign Language Grammar Learning

Scaffolding has been widely investigated as an instructional strategy for supporting foreign language grammar learning. Early research demonstrated that systematically staged scaffolding facilitates learners' transition from supported to independent performance (Liang, 2007). Subsequent studies examined variations in scaffolding design. Izanlu and Feyli (2015) found that support tailored to learners' proficiency levels

produced significantly greater grammar gains than uniform scaffolding. Moeen et al. (2019) investigated implicit and explicit grammar scaffolding, reporting that both approaches improved accuracy and fluency, though with different patterns.

With technology-enhanced instruction, scaffolding has been explored in digital environments. Abdelaziz and Al Zehmi (2021) found that e-cognitive scaffolding improved grammar performance among underachieving EFL learners. Han et al. (2021) compared static and fading scaffolding in blended grammar instruction, reporting superior online performance for static scaffolding, though without examining affective outcomes. More recently, Chih-Chung and Fu-Yun (2025) compared multiple scaffold designs, finding that scaffold type differentially affected fluency and output quality.

Collectively, these studies establish the effectiveness of scaffolding for grammar learning. However, they leave critical questions about sequencing and timing unexplored: whether the order in which support is provided (increasing versus decreasing) affects learning outcomes, and whether these effects interact with task complexity in project-based environments. The present study directly addresses this gap by comparing fade-in and fade-out sequences within PBFL.

2.2.2 Fading Scaffolding: Fade-in and Fade-out Scaffolding

Empirical studies comparing fade-in and fade-out scaffolding have primarily been conducted outside of language learning. In mathematics education, Chase and Abrahamson (2015) found that fade-in scaffolding led to higher post-instruction performance among fourth- and ninth-grade students, suggesting that initial struggle followed by targeted support promotes deeper learning. Jennings and Muldner (2020) reported similar patterns in higher education, where fade-in scaffolding yielded greater learning gains and more autonomous problem-solving. In programming education, Zheng et al. (2022) showed that fade-in scaffolding enhanced collaborative knowledge building, performance, and metacognitive behaviors.

By contrast, Lange and Costley (2022) demonstrated that structured fade-out sequences, from explicit instruction to worked examples and independent practice, reduced cognitive load and improved performance in online learning. This suggests that fade-out can be effective when aligned with learners' cognitive readiness. Notably, these studies position fade-in and fade-out as competing approaches with different theoretical rationales, yet neither has been systematically examined in language learning contexts. Their findings cannot be directly extrapolated to EFL grammar learning, which involves distinct cognitive and affective demands. This study

addresses this gap by testing both approaches within the same language learning context.

2.2.3 Scaffolding Effect on Foreign Language Anxiety

Empirical evidence indicates that scaffolding reduces language anxiety. Scaffolded feedback has been shown to significantly reduce speaking anxiety while enhancing self-efficacy among EFL learners (Zarei & Rezadoust, 2020). Collaborative learning supported by instructional scaffolding has been found to lower reading anxiety and improve comprehension and motivation (Ibrahim et al., 2023). In technology-enhanced environments, virtual reality-based scaffolding reduced speaking anxiety, though learners experienced dual anxiety sources related to both language and technology (Khazaie & Derakhshan, 2023). A systematic review of 99 studies concluded that technology-mediated scaffolding can alleviate language anxiety by increasing psychological safety, though poorly designed support risks heightening anxiety through cognitive overload (Huang & Liu, 2025).

While scaffolding is known to reduce FLA, existing research has primarily focused on static or single-support conditions. Critically, no studies have examined whether different patterns of fading scaffolding produce differential anxiety outcomes. This gap is theoretically significant: fade-in and fade-out may reduce anxiety through different mechanisms, fade-in through eventual mastery after productive struggle, fade-out through immediate cognitive load reduction, yet this has not been empirically tested. The present study addresses this by comparing both fading patterns' effects on FLA within the same instructional context.

2.3 The Present Study

While scaffolding is known to support both grammar learning and anxiety reduction, existing research has not systematically compared fade-in and fade-out scaffolding within project-based flipped learning for language learning. Studies in other domains suggest these patterns may have differential effects, but the unique combination of language learning and cognitive and affective demands requires direct empirical investigation. Furthermore, no research has examined whether these fading patterns differentially affect anxiety, despite theoretical grounds for predicting such differences. To address these gaps, this study examines the effects of fade-in and fade-out scaffolding on EFL learners' grammar proficiency in PBFL and their differential impact on foreign language anxiety. By comparing both fading patterns within a single experimental design, this study moves beyond demonstrating that scaffolding works to understanding how different

sequencing patterns influence both cognitive and affective outcomes in authentic language learning contexts.

3. Method

3.1. Design of the Study

This study employed a quasi-experimental pretest-posttest design to investigate the differential effects of fade-in and fade-out scaffolding within a project-based flipped learning (PBFL) model on the acquisition of English passive voice grammar. The design is considered quasi-experimental because, while the participants were randomly assigned to treatment conditions, the intervention was delivered within intact online classroom groups, reflecting authentic educational contexts rather than fully controlled laboratory conditions. The independent variable was the type of scaffolding (fade-in, fade-out, or no systematic scaffolding), and the dependent variables were grammatical accuracy (measured through tests) and foreign language anxiety (FLA) (measured through a questionnaire).

3.2. Participants

The participants were 90 female senior high school students, aged 13–17 years, from a private language institute in Tehran, District 2. The decision to include only female participants reflected the institute's single-gender class structure, which is common in educational settings in Iran. This sampling choice, while limiting generalizability, ensured consistent instructional dynamics within groups. The results and limitations sections explicitly address this gender-specific context.

To ensure homogeneity in proficiency, the Oxford Placement Test (OPT) was administered online through the institute's website with a standardized time limit. Of 138 initial volunteers, 97 scored within the intermediate range (51–59 out of 60). Meanwhile, the test indicated a high reliability index ($\alpha = .744$). From these, 90 participants were randomly selected and then randomly assigned to three online classes: Experimental Group 1 (EG1, fade-in scaffolding), Experimental Group 2 (EG2, fade-out scaffolding), and Control Group (CG, no systematic scaffolding), each comprising 30 students. Random assignment at the individual level, despite subsequent intact group instruction, strengthens internal validity by distributing individual differences evenly across conditions.

3.3. Materials and Instruments

3.3.1. Oxford Placement Test

The OPT served as the homogenization instrument. The online version, administered with a fixed time limit, was used to assess the participants' proficiency through two sections: "Use of English" (grammar, meaning, reading) and listening comprehension. The test demonstrated acceptable reliability ($\alpha = .786$) for the sample.

3.3.2. Pretest and Posttest on English Passive Voice Grammar

Two parallel 25-item tests (Test A and Test B) were used to assess knowledge of passive voice structures. Items included multiple-choice, error identification, and sentence transformation formats. Both tests were piloted with a comparable learner group using counterbalanced administration to minimize practice effects. Reliability analyses showed acceptable internal consistency (Cronbach's $\alpha = .70$ for pretest, $.77$ for post-test) and strong parallel-forms reliability ($r = .72$). Beyond expert judgment, construct validity was supported through alignment with the textbook's learning objectives and item analysis during piloting, which confirmed that items differentiated between proficiency levels as theoretically expected.

3.3.3 Foreign Language Anxiety Scale

Participants' FLA was measured using Tóth's (2008) 8-item Foreign Language Classroom Anxiety scale (Appendix 3). This unidimensional scale demonstrates high internal consistency (Cronbach's $\alpha = .92$) and has been validated for use with EFL learners. Compared to Horwitz et al.'s (1986) 33-item scale, Tóth's instrument reduces participant burden, particularly important for teenage learners. The scale captures general classroom-based language anxiety, aligning with the focus of this study. Items are rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), yielding total scores from 8 to 40 (higher scores = greater anxiety). The questionnaire was translated into Persian and back-translated for accuracy, then administered via Google Forms as both pretest and post-test to assess change over time.

3.3.4 Instructional Material and Time

The six-week intervention comprised three weekly 90-minute sessions (27 total hours). Instruction focused on Unit 5 of the intermediate-level English Result textbook (Paul, 2008), which targets passive voice constructions.

3.3.5 Instructional Context

A learning management system (LMS) served as the primary platform, providing centralized space for course materials, teacher-student interaction, assessments, and progress tracking.

3.4 Procedure

After participant selection and random assignment, all the learners provided written informed consent. All the participants were familiar with the LMS. A pretest was administered through the platform to establish baseline knowledge of passive voice and confirm no prior systematic instruction.

Project-based flipped instruction was implemented uniformly across all groups: learners studied teacher-provided materials asynchronously before class, while synchronous class time was devoted to practice, addressing difficulties, and collaborative project work. The project required small self-selected groups to produce a documentary-style video explaining a historical invention using passive voice. The only difference among groups was the presence and type of scaffolding.

At the end of the course, a post-test was administered via the LMS, and the learners completed the FLA questionnaire again. The pretest and post-test FLA administrations allowed the measurement of anxiety change over the intervention period.

3.4.1 Intervention in the EG1 (Fade-in Scaffolding)

In the EG1, support was initially limited and gradually increased as project demands grew. During the Pre-Production phase (Weeks 1-2), the students received only basic project instructions and foundational resources, with no direct grammar guidance. For example, when the students selected an invention (e.g., the telephone) and drafted scripts, they faced grammatical challenges independently. The instructor provided only general feedback (e.g., "Consider how historical processes are described").

During Production (Weeks 3-4), as the students recorded voice-overs and encountered difficulties with formal language, targeted support was introduced, focused worksheets comparing active and passive sentences, mini-workshops on rewriting sentences, and structured peer-review using metacognitive checklists.

During Post-Production (Weeks 5-6), support intensified with direct teacher-led workshops, detailed corrective feedback on transcripts, and collaborative editing sessions focused on mastering passive voice in final outputs. A grammar checklist supported final revisions before submission.

3.4.2 Intervention in the EG2 (Fade-out Scaffolding)

In the EG2, support was initially high and systematically withdrawn. During Pre-Production (Weeks 1-2), the students received direct instruction on passive voice, sentence stems, templates, and extensive teacher modeling. For instance, the instructor provided templates like "The [invention] was invented by [inventor] in [year]" and co-wrote sample script openings with the class.

During Production (Weeks 3-4), support decreased: templates were removed, and feedback shifted from direct correction to guided prompting. Rather than correcting errors, the instructor directed the students to identify issues themselves (e.g., "Can you identify active voice sentences and consider if passive would be more appropriate?").

During Post-Production (Weeks 5-6), scaffolding was mostly removed. Reminders were broad (e.g., "Check your final narration for accuracy"), and direct grammar feedback was withheld unless requested, with support shifting to technical or creative aspects. The students were expected to independently apply previously learned strategies.

3.4.3 The CG (No Systematic Scaffolding)

The control group received no systematic scaffolding aligned with the grammar objective. Throughout all phases, the learners accessed general project guidelines and standard resources (e.g., grammar explanation files) but received no instruction, feedback, or tools specifically targeting passive voice. The instructor provided only general project facilitation, management advice, content clarification, and encouragement, while deliberately withholding passive-voice-specific support. This condition established a baseline reflecting only the initial flipped materials and students' existing knowledge, isolating the effect of strategic scaffolding in the experimental groups.

3.5. Data Analysis

Quantitative data from the pretest, post-test, and FLA questionnaires were analyzed using SPSS (version 21). Descriptive statistics summarized group performance. A one-way analysis of covariance (ANCOVA) was chosen because ANCOVA statistically controls for pretest differences, reduces error variance, and provides greater statistical power by adjusting post-test means for initial variability. This approach is particularly appropriate when pretest scores, though not significantly different across groups, may still influence post-test outcomes. Preliminary checks confirmed that ANCOVA assumptions, independence of observations, normality, homogeneity of variances, and homogeneity of regression slopes were met.

4. Results and Discussion

4.1. Results

Before any analysis, the reliability of the test scores and FLA scores of the participants was investigated by calculating Cronbach's alpha.

Table 2

Reliability of pretest, posttest, and Foreign Language Anxiety Scores

	Number of Items	Cronbach's alpha (α)
Pretest	25	.70
Post-test	25	.77
FLA scale	8	.75

As shown in Table 2, all Cronbach's alpha values exceeded .70, indicating acceptable internal consistency reliability for all measures. To provide an overview of the data, descriptive analysis is presented in Table 3.

Table 3
Descriptive Analysis by Groups

	Group	N	Mean	SD	Skewness
Pretest	EG1	30	13.21	1.03	-.651
	EG2	29	12.89	1.43	-.651
	CG	30	12.81	1.28	-.156
Post-test	EG1	30	23.33	2.50	1.561
	EG2	29	22.41	2.32	1.560
	CG	30	21.28	2.40	-.350
FLA Pretest	EG1	30	22.80	1.74	-.120
	EG2	29	23.28	1.41	1.410
	CG	30	23.41	2.12	1.090
FLA Post-test	EG1	30	22.73	1.74	-.020
	EG2	29	23.23	1.34	1.490
	CG	30	23.37	2.24	1.810

As shown in Table 3, the number of scores for the EG2 was one less than the number of participants in that class; this exclusion was due to the absence of a student during the post-test. Since the skewness values reported in Table 3 fall within the range of -2 to 2, and given the sample size ($N = 89$ for post-test analyses), parametric methods are robust to moderate violations of normality. The normality of the scores, when considered separately for each group as well as when the total number of participants is considered as one group, is supported. The normality of data is a fundamental prerequisite and a necessary condition for employing parametric statistical methods, such as ANCOVA, which are subsequently utilized in the analyses.

A one-way analysis of covariance (ANCOVA) was conducted to compare the effectiveness of the three scaffolding types (fade-in, fade-out, and no systematic scaffolding) on grammar post-test scores, while controlling for pre-test performance. Before the main analysis, the fundamental assumptions of ANCOVA, like independence of observations, normality of the data, homogeneity of variances, and homogeneity of regression slopes, need to be tested.

The design of this study (i.e., three separate classes including independent participants) meets the necessary conditions of independence of observations. The normality of data was confirmed according to Table 3. Moreover, the assumption of the linearity of the relationship between the dependent variable (posttest) and the covariate (pretest) was probed. To do so, the scatter plot of pretest and posttest was produced in SPSS, which

indicated no violation of the linear relationship. Tables 4 and 5 present Levene's test of equality of error variances and tests of between-subjects effects.

Table 4

Levene's Test of Equality of Error Variances

F	df1	df2	Sig.
.491	2	86	.614

Table 5

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	69.330 ^a	3	23.110	4.992	.003
Intercept	310.137	1	310.137	66.998	.000
Group	57.379	2	28.690	6.198	.003
Pretest	6.075	1	6.075	1.312	.255
Error	393.468	85	4.629		
Total	44891.250	89			
Corrected Total	462.798	88			

As Table 4 indicates, the assumption of homogeneity of variances was confirmed, (Levene's $F(2, 86) = 0.491, p = .614$). Subsequently, in Table 5, a one-way ANCOVA was conducted with Group as the independent variable, post-test scores as the dependent variable, and pretest scores as the covariate. The pretest covariate was not a significant predictor, $F(1, 85) = 1.312, p = .255$. However, a significant main effect for Group was found, $F(2, 85) = 6.198, p = .003$, partial $\eta^2 = .127$. This represents a medium-to-large effect size according to conventional guidelines (Cohen, 1988). This result confirms that the scaffolding condition had a significant impact on grammar proficiency. Follow-up pairwise comparisons with Bonferroni adjustment were conducted to identify specific group differences in Tables 6 and 7.

Table 6

Pairwise Comparisons

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig. ^a	95% Confidence Interval for Difference ^a	
					Lower Bound	Upper Bound
EG1	EG2	.848	.564	.408	-.528	2.225
EG2	CG	CG	1.117	.560	-.251	2.486
CG	EG1	EG1	-1.966*	.560	-3.334	-.597

In summary, according to Table 5, the ANCOVA results indicated a significant main effect of group on grammar post-test scores. Pairwise comparisons, as presented in Table 6, showed that EG1 had significantly higher adjusted mean scores than CG. No significant difference was found between EG2 and CG, nor between EG1 and EG2.

In response to the second research question, an ANCOVA procedure was used. The results of preliminary analyses and the main test of between subjects effects are presented below.

Table 7
Levene's Test of Equality of Error Variances

F	df1	df2	Sig.
.292	2	86	.747

Table 8
Tests of Between-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	270.367 ^a	3	90.122	413.866	.000
Intercept	.155	1	.155	.713	.401
Group	.030	2	.015	.068	.934
PreFLAscores	263.634	1	263.634	1210.680	.000
Error	18.509	85	.218		
Total	47831.000	89			
Corrected Total	288.876	88			

The independent design of the groups guarantees the independence of observed FLA scores among the groups. The normality of the FLA scores was already indicated in Table 3. Moreover, the assumption of the linearity of the relationship between the dependent variable (FLA posttest) and the covariate (FLA pretest) was probed. To do so, the scatter plot of pretest and posttest was produced in SPSS, which indicated no violation of the linear relationship. According to Table 7, $F(2, 86) = 0.292$, $p = .747$, homogeneity of variances is also met. So, with the presence of all preliminary conditions, we can proceed with ANCOVA in Table 8. The results revealed no significant main effect of group on the adjusted post-test means, $F(2, 85) = 0.07$, $p = .934$, partial $\eta^2 = .002$. The near-zero effect size indicates that the scaffolding condition accounted for virtually no variance in FLA post-test scores beyond that explained by pretest anxiety. So, the scaffolding pattern as the independent variable did not significantly affect the perceived FLA in EFL learners in post-test FLA. These results are discussed and justified in the discussion section.

4.2. Discussion

This study investigated the effects of fade-in and fade-out scaffolding on EFL learners' grammar acquisition and foreign language anxiety within online project-based flipped learning (PBFL). Three main findings emerged from the grammar analysis: (a) fade-in scaffolding produced significantly higher post-test scores than no systematic scaffolding; (b) fade-out scaffolding did not produce a statistically significant advantage over the control condition; and (c) no significant difference was found between the two fading approaches. Additionally, no significant differences in FLA were observed across conditions. This section interprets these findings in relation to theoretical frameworks and prior empirical research.

4.2.1. Grammar Outcomes: Fade-in Scaffolding

The significant advantage of fade-in scaffolding over the control condition aligns with productive failure theory (Kapur, 2016). In the fade-in condition, learners initially engaged with the documentary project using minimal grammar support, encountering challenges in using passive voice structures independently. This phase of productive struggle may have activated learners' existing knowledge, highlighted specific gaps in their understanding, and prepared them to benefit more substantially from subsequent targeted instruction. When support was gradually introduced, through focused worksheets, mini-workshops, and structured peer feedback, it addressed precisely the difficulties learners had already experienced, potentially leading to deeper integration of the target structures.

This interpretation is consistent with research by Chase and Abrahamson (2015) and Jennings and Muldner (2020), who found that fade-in scaffolding promoted deeper learning in mathematics and problem-solving contexts. The present study extends these findings to language learning, suggesting that the cognitive benefits of productive struggle may generalize across domains when task complexity is sufficiently high.

Alternative explanations for this finding should be considered. The timing of the fade-in condition coincided with learners' peak project demands, which may have increased their receptivity to grammar instruction. Additionally, the metacognitive checklists and peer feedback sessions in this condition may have fostered collaborative learning processes that enhanced outcomes independently of the fading pattern. Future research could disentangle these mechanisms by systematically varying the presence of specific scaffold types.

4.2.2. Grammar Outcomes: Fade-out Scaffolding

The non-significant difference between fade-out scaffolding and the control condition requires careful interpretation. Although the fade-out group

showed numerically higher adjusted mean scores than the control (22.43 vs. 21.32), this difference did not reach statistical significance. This pattern partially aligns with cognitive load theory (Kalyuga & Renkl, 2010; Sweller et al., 2019), which predicts that structured initial support should reduce extraneous cognitive load and facilitate learning. However, the non-significant outcome suggests that the fade-out sequence may not have been optimally calibrated for this context.

Several factors may explain this result. First, Pea's (2004) concept of the vanishing scaffolding effect suggests that support may have been withdrawn too early or too rapidly for some learners, particularly those who had not yet consolidated their understanding of passive voice structures. Second, Puntambekar and Hubscher (2005) argue that in complex, authentic tasks, pure fade-out sequences may be insufficient unless fading is contingent on ongoing performance assessment rather than a fixed schedule. In the present study, support reduction followed a predetermined timeline rather than responding to individual learners' demonstrated readiness, which may have disadvantaged some participants.

Third, the nature of project-based learning may interact with fade-out scaffolding in ways that differ from simpler task contexts. In the studies by Lange and Costley (2022), where fade-out sequences proved effective, the tasks were more structured and less collaborative than the documentary project used here. The social and creative dimensions of project work may require different support patterns than discrete skill acquisition tasks. Finally, the possibility of insufficient statistical power cannot be dismissed. The observed mean difference (1.12 points) might represent a meaningful effect that this sample size was unable to detect as significant.

4.2.3. Grammar Outcomes: Equivalence of Fading Approaches

The absence of a significant difference between fade-in and fade-out conditions merits consideration. Both experimental groups demonstrated higher adjusted means than the control group, yet they did not differ significantly from each other. This pattern suggests that in complex, project-based language learning contexts, the presence of systematic, adaptive scaffolding may be more critical than its specific temporal direction.

This interpretation aligns with Vygotsky's (1978) concept of the zone of proximal development (ZPD). Both fading patterns, despite their different sequences, provided learners with support calibrated to their emerging capabilities. In the fade-in condition, support increased as task demands grew; in the fade-out condition, support decreased as competence developed. Both approaches may have successfully kept learners within their ZPD, even though they achieved this through different mechanisms. The data cannot directly demonstrate ZPD alignment, as this would require

moment-to-moment assessment of learner performance. However, this theoretical interpretation offers a plausible explanation for the observed equivalence.

This finding diverges from studies in mathematics (Chase & Abrahamson, 2015) and programming (Zheng et al., 2022), where fade-in scaffolding produced superior outcomes. Language learning in project-based contexts may differ fundamentally from skill acquisition in well-defined domains. Grammar knowledge in communicative tasks involves both declarative and procedural dimensions, and the collaborative nature of project work may provide additional scaffolding through peer interaction that moderates the effects of teacher-provided support sequences.

4.2.4. Foreign Language Anxiety Outcomes

The absence of significant differences in FLA across conditions, with a near-zero effect size (partial $\eta^2 = .002$), indicates that scaffolding type did not influence anxiety beyond the substantial effect of pretest anxiety. This finding requires explanation, particularly given theoretical predictions that scaffolding should reduce anxiety through cognitive, affective, and motivational pathways.

One possibility is that the PBFL context itself provided sufficient anxiety-buffering effects across all conditions, creating a floor effect that diminished the measurable impact of in-project fading patterns. The flipped model, in which learners engaged with instructional materials asynchronously before synchronous sessions, may have pre-emptively reduced the novelty and pressure of collaborative tasks. Krashen's (1982) Affective Filter Hypothesis suggests that when learners feel prepared and supported, their anxiety decreases, facilitating input processing. In this study, even the control group benefited from the flipped structure and successful project completion, which may have provided potent mastery experiences that enhanced self-efficacy (Bandura, 1997).

From a cognitive load perspective (Sweller et al., 2019), the online PBFL environment may have managed extraneous load effectively for all groups through clear digital interfaces and structured task instructions. If total cognitive load was already well-regulated across conditions, the additional load management provided by systematic fading patterns may have been redundant. This interpretation suggests that the anxiety-reducing effects of scaffolding may be most detectable in less-structured learning environments where baseline cognitive load is higher.

An alternative explanation concerns measurement. The FLA scale captured general classroom anxiety rather than task-specific anxiety. It is possible that fading patterns influenced learners' moment-to-moment anxiety during project phases, but these fluctuations were not captured by

the end-of-course measurement. Future research might employ repeated measures or experience sampling methods to detect more fine-grained affective responses.

4.2.5. Summary and Integration

Taken together, these findings suggest that fade-in scaffolding offers advantages over unsystematic instruction for grammar learning in PBFL contexts, while fade-out scaffolding, as implemented here, does not produce statistically reliable benefits. The equivalence of the two fading approaches raises questions about whether their differential effects, observed in other domains, generalize to language learning. The absence of anxiety differences highlights the need for research designs sensitive to contextual factors that may moderate the affective impact of scaffolding.

5. Conclusion and Implications

This study investigated the effects of fade-in and fade-out scaffolding on EFL learners' grammar achievement and foreign language anxiety within online project-based flipped learning (PBFL). The findings contribute to the emerging literature on fading scaffolding sequences in three ways. First, they demonstrate that fade-in scaffolding, characterized by initial minimal support followed by increasing assistance, can significantly enhance grammar learning compared to unsystematic instruction in project-based contexts. Second, they reveal that fade-out scaffolding, as implemented here with a fixed withdrawal schedule, did not produce statistically reliable benefits, suggesting that the effectiveness of this approach may depend on contextual factors such as task complexity and fading contingency. Third, they show that the two fading patterns did not differentially affect foreign language anxiety, indicating that the anxiety-reducing potential of scaffolding may be mediated by the broader instructional context.

5.1. Theoretical Contributions

This study extends previous research on fading scaffolding in three significant ways. First, it moves beyond the predominant focus on STEM domains (Chase & Abrahamson, 2015; Jennings & Muldner, 2020; Zheng et al., 2022) to examine fading sequences in language learning, demonstrating that productive failure theory (Kapur, 2016) can inform instructional design in communicative, project-based contexts. Second, it provides empirical evidence that the superiority of fade-in over fade-out scaffolding observed in well-defined skill domains may not generalize directly to language learning, where the equivalence of the two approaches suggests that task and disciplinary characteristics moderate fading effects. Third, it contributes to the scaffolding and anxiety literature by showing that in supportive learning

environments such as PBFL, the differential affective impact of scaffolding patterns may be attenuated, highlighting the importance of considering contextual moderators in future research.

5.2. Practical Implications

The findings offer several concrete recommendations for educators, instructional designers, and language program administrators. For classroom practitioners, the results suggest that fade-in scaffolding is a viable and effective strategy for supporting grammar learning in project-based EFL contexts. Teachers implementing similar projects might consider beginning with minimal grammatical guidance, allowing students to encounter authentic language challenges during initial project phases, and then introducing targeted support, such as focused worksheets, mini-lessons, and structured peer feedback, as project demands increase. This approach appears to leverage productive struggle to prepare learners for subsequent instruction.

For instructional designers, the non-significant findings for fade-out scaffolding warrant attention. Simply providing high initial support and withdrawing it on a fixed schedule may not optimize learning in complex, collaborative tasks. Designers should consider making fading contingent on ongoing assessment of learner readiness rather than adhering to predetermined timelines. Additionally, in project-based contexts, fading might usefully shift focus over time, from grammatical support during early phases to metacognitive or collaborative support later, rather than withdrawing support entirely.

For language program administrators, these findings support investment in professional development that helps teachers implement systematic scaffolding sequences. The equivalence of the two fading approaches on grammar outcomes, combined with their similar affective profiles, suggests that multiple scaffolding pathways can be effective. Programs might therefore encourage teachers to experiment with different fading patterns while emphasizing the importance of aligning support with project phases and learner needs.

5.3. Limitations and Future Research Directions

Several limitations should be acknowledged. First, the sample was confined to intermediate-level female learners in a single private language institute in Tehran, limiting generalizability to other populations and educational contexts. Second, the intervention was delivered by a single instructor; although this ensured consistency across conditions, it raises the possibility of instructor effects that cannot be disentangled from scaffolding effects. Third, the fixed-schedule fading in both experimental conditions may not reflect more adaptive, performance-contingent scaffolding that occurs in

naturalistic teaching. Fourth, the FLA measure captured general classroom anxiety at two time points rather than task-specific anxiety fluctuations during project phases, potentially missing more fine-grained affective responses. Fifth, the absence of delayed post-testing leaves unanswered questions about the durability of observed grammar gains.

Future research should address these limitations through several theory-driven directions. First, studies could investigate whether adaptive fading, in which support adjustments are contingent on real-time assessment of learner performance, produces different outcomes than the fixed-schedule fading employed here. Such research would test whether the equivalence of fade-in and fade-out in this study reflects the specific implementation rather than the approaches themselves. Second, researchers might examine whether fading patterns interact with task type, comparing project-based learning with more structured grammar tasks to determine whether task complexity moderates fading effects. Third, longitudinal designs with repeated measures of both grammar and anxiety could reveal whether the effects observed here are sustained or change over time. Fourth, studies incorporating multiple instructors and diverse learner populations would strengthen the generalizability of the findings.

5.4. Concluding Statement

This study shows that systematic scaffolding sequences matter for grammar learning in project-based EFL contexts, with fade-in scaffolding offering a particularly promising approach. At the same time, it reveals that the differential effects of fading patterns observed in other domains do not simply transplant to language learning, where task complexity, collaboration, and the broader instructional context may moderate outcomes. By bringing together research on scaffolding sequences, project-based learning, and foreign language anxiety, this study advances understanding of how and when to adjust instructional support in technology-mediated language education. The findings underscore that effective scaffolding is not merely about providing support, but about timing and sequencing support in ways that align with learners' evolving needs and the demands of authentic communicative tasks.

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Appendices

Appendix I

Test A: English Passive Voice Assessment

Time: 30 minutes | Total Marks: 25

Part I: Multiple Choice (5 Questions, 1 mark each = 5 marks)

Choose the best option to complete the sentence.

- The new art museum ___ by thousands of visitors since it opened.
a) is visited b) has been visited c) was visited d) will be visited
(Correct: b)
- The meeting room ___ for the weekly staff briefing right now.
a) is preparing b) is prepared c) is being prepared d) has been prepared
(Correct: c)
- Before email, important messages ___ by courier.
a) are often sent b) were often sent c) will be sent d) have been sent
(Correct: b)
- The instructions for this machine must ___ carefully.
a) follow b) be followed c) are followed d) followed
(Correct: b)
- The winner of the competition ___ next Monday.
a) will announce b) is announcing c) will be announced d) announces
(Correct: c)

Part II: Error Identification (5 Questions, 1 mark each = 5 marks)

Identify the one underlined word or phrase that is incorrect.

6. The report was wrote by the new intern and is being reviewed by the manager now.

A B C D

(Incorrect: B - should be "was written")

- This ancient temple was build over 500 years ago but has been beautifully preserved.
A B C D
(Incorrect: B - should be "was built")
- The project deadline has not he met because of unforeseen complications.
A B C D
(Incorrect: C - should be "not been met")
- Your application is process currently and a decision will be sent to you by email.
A B C D
(Incorrect: B - should be "is being processed")
- All necessary precautions are took to ensure the experiment is conducted safely.
A B C D
(Incorrect: B - should be "are taken")

Part III: Sentence Transformation (15 Questions, 1 mark each = 15 marks)

Rewrite the given active voice sentence in the passive voice. Do not change the tense.

11. Someone cleans the office every evening.

(Answer: The office is cleaned every evening.)

12. They are constructing a new bridge across the river.
(Answer: *A new bridge is being constructed across the river.*)
13. The company delivered the package yesterday.
(Answer: *The package was delivered yesterday.*)
14. They had completed the renovations before we arrived.
(Answer: *The renovations had been completed before we arrived.*)
15. The government will announce the new policy tomorrow.
(Answer: *The new policy will be announced tomorrow.*)
16. You must return the library books by Friday.
(Answer: *The library books must be returned by Friday.*)
17. Someone might have left the door unlocked.
(Answer: *The door might have been left unlocked.*)
18. The chef is preparing a special meal for the guests.
(Answer: *A special meal is being prepared for the guests.*)
19. People speak Spanish in many countries.
(Answer: *Spanish is spoken in many countries.*)
20. They gave her an award for her bravery.
(Answer: *She was given an award for her bravery. OR An award was given to her for her bravery.*)
21. The heavy rain has delayed the flight.
(Answer: *The flight has been delayed by the heavy rain.*)
22. You should handle this fragile item with care.
(Answer: *This fragile item should be handled with care.*)
23. They are going to install the new software next week.
(Answer: *The new software is going to be installed next week.*)
24. Someone was watching our house last night.
(Answer: *Our house was being watched last night.*)
25. The teacher has corrected all the essays.
(Answer: *All the essays have been corrected.*)

Appendix 2

Test B: English Passive Voice Assessment

Time: 30 minutes | Total Marks: 25

Part I: Multiple Choice (5 Questions, 1 mark each = 5 marks)

Choose the best option to complete the sentence.

1. The newly renovated library ___ by many students since it reopened.
a) is used b) has been used c) was used d) will be used
(Correct: b)
2. The auditorium ___ for the annual conference at this moment.
a) is setting up b) is set up c) is being set up d) has been set up
(Correct: c)
3. Before smartphones, urgent news ___ by telegraph.
a) is often sent b) was often sent c) will be sent d) have been sent
(Correct: b)
4. The safety guidelines for this lab must ___ strictly.
a) obey b) be obeyed c) are obeyed d) obeyed
(Correct: b)
5. The results of the election ___ later this evening.
a) will declare b) are declaring c) will be declared d) declares
(Correct: c)

Part II: Error Identification (5 Questions, 1 mark each = 5 marks)

Identify the one underlined word or phrase that is incorrect.

6. The proposal was wrote by the junior analyst and is now being considered by the board.
A B C D
(Incorrect: B - should be "was written")
7. This historic castle was build more than 800 years ago but has been meticulously maintained.
A B C D
(Incorrect: B - should be "was built")
8. The sales target has not be achieved due to market fluctuations.
A B C D
(Incorrect: C - should be "not been achieved")
9. Your complaint is review by our team and a response will be issued shortly.
A B C D
(Incorrect: B - should be "is being reviewed")
10. All required measures are took to guarantee the procedure is followed correctly.
A B C D
(Incorrect: B - should be "are taken")

Part III: Sentence Transformation (15 Questions, 1 mark each = 15 marks)

Rewrite the given active voice sentence in the passive voice. Do not change the tense.

11. A janitor cleans the classrooms every night.
(Answer: The classrooms are cleaned every night.)
12. Workers are repairing the main road this week.
(Answer: The main road is being repaired this week.)
13. The courier delivered the parcel last Tuesday.
(Answer: The parcel was delivered last Tuesday.)

14. They had finished the preparations before the guests came.
(Answer: *The preparations had been finished before the guests came.*)
15. The committee will reveal the decision next week.
(Answer: *The decision will be revealed next week.*)
16. Students must submit their assignments by Monday.
(Answer: *The assignments must be submitted by Monday.*)
17. Someone may have forgotten the window open.
(Answer: *The window may have been left open.*)
18. The team is drafting an important report for the director.
(Answer: *An important report is being drafted for the director.*)
19. People use this app in numerous countries.
(Answer: *This app is used in numerous countries.*)
20. They offered him the job after the final interview.
(Answer: *He was offered the job after the final interview. OR The job was offered to him after the final interview.*)
21. A technical error has canceled the online meeting.
(Answer: *The online meeting has been canceled by a technical error.*)
22. You must store these chemicals in a cool place.
(Answer: *These chemicals must be stored in a cool place.*)
23. They are going to publish the findings in a journal.
(Answer: *The findings are going to be published in a journal.*)
24. Someone was monitoring the network constantly.
(Answer: *The network was being monitored constantly.*)
25. The editor has checked all the manuscripts.
(Answer: *All the manuscripts have been checked.*)

Appendix 3

The 8-Item Foreign Language Classroom Anxiety Scale (FLCAS-SF)

Instruction to Participants: Please indicate to what extent you agree or disagree with each statement as it relates to your experience in your foreign language class (e.g., English class). Use the following scale:

1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree

Item No.	Statement
1	I never feel quite sure of myself when I am speaking in my foreign language class.
2	I don't worry about making mistakes in language class. (R)
3	I tremble when I know that I'm going to be called on in language class.
4	It frightens me when I don't understand what the teacher is saying in the foreign language.
5	It wouldn't bother me at all to take more foreign language classes. (R)
6	During language class, I find myself thinking about things that have nothing to do with the course.
7	I keep thinking that the other students are better at languages than I am.
8	I am usually at ease during tests in my language class. (R)

Note: Items marked with **(R)** are **reverse-scored** (1=5, 2=4, 3=3, 4=2, 5=1) before calculating the total score.

Scoring: After reverse-coding the relevant items, sum the scores for all eight items. **Total scores range from 8 to 40.** A higher total score indicates a higher level of foreign language classroom anxiety.