



Research Article

# Exploring the influence of Flipped Classrooms Model on Cognitive and Affective Outcomes in Reading: the case of Iranian EFL Learners

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## Abstract

This study aimed to investigate the effect of flipped classroom instruction on the reading comprehension skills of Iranian EFL learners, with particular attention to Ambiguity Tolerance (AT) and Academic Satisfaction (AS). In the flipped classroom approach, content was delivered outside of class, allowing classroom time to be devoted to interactive and student-centered activities. The research employed a quasi-experimental design involving 60 intermediate EFL learners, who were randomly divided into an experimental group (flipped) and a control group (traditional). Pre- and post-tests were administered, using the Second Language Tolerance of Ambiguity Scale (SLTAS) and an Academic Satisfaction Questionnaire (ASQ), to assess changes in AT, reading performance, and AS. The findings indicated that the flipped teaching model significantly enhanced participants' AT, academic achievement, and AS compared to traditional instruction. Thematic analysis of semi-structured interviews also supported these results. The results highlighted that learners in the flipped group experienced greater autonomy, reduced anxiety, improved peer collaboration, and increased engagement with reading comprehension tasks. These findings suggested that the flipped teaching model offered a more effective and supportive environment for EFL learners. The study also has implications for teachers and curriculum designers and emphasized the potential of flipped instruction in promoting both cognitive and affective gains in language education.

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**Keywords:** Ambiguity Tolerance (AT); Academic Satisfaction (AS); Flipped Classroom; Reading Comprehension

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## 1. Introduction

Reading skill is considered as a process of getting and making meaning from a written text. Reading is the explanation of printed or written signs, which is filled with meaning. Readers have to construct a mental illustration of the written content. Just knowing individual vocabulary, phrases, and texts does not guarantee complete understanding. The reader must understand the

content to understand it fully. It is a complicated procedure through which the reader can identify written symbols and interpret the meaning according to those symbols.

Some variables influence reading comprehension ability, such as reading text complexity, reading anxiety, environmental influences, interest and motivation, word recognition or decoding speed, and health problems (Dennis, 2008).

Technology-enhanced instruction has improved the reading comprehension ability of EFL learners. It is also indicated that integrating technology into instruction led to notable improvements in reading comprehension and grammar skills among EFL learners (Isaac & Barjesteh, 2023; Yalaw & Filate, 2024). The flipped classroom approach has improved reading comprehension and boosted student involvement and motivation by empowering a more interactive and student-centered learning context (Speth, 2025).

### 1.1. Flipped Classroom

Using a flipped classroom approach, instructors provide learning materials and tasks for students to review beforehand, reserving face-to-face sessions for interactive activities even when online tools are not employed (Touchton, 2015). By delivering key content outside of class, technology enables deeper engagement with the material during in-person meetings. Touchton (2015) notes that this instructional strategy reallocates class time toward discussion and analysis, thereby enhancing student learning outcomes.

Flipped Classroom is far beyond a teaching method, which replaces F2F lecture-based instruction, offering students a chance to discuss, examine, and review materials with the instructor in the classroom. The flipped instruction can be considered as personalized learning, and the learners take responsibility of their own learning (Uzunboylu & Karagozlu, 2015).

Kim et al. (2014) have considered previous exposure to the content before receiving F2F instruction as a central part of the flipped Instruction. The flipped classroom method is related to the exposure of students to new content, through which they could examine and practice their skills; then, the learners practice their abilities and reiterate their knowledge during class time, to clarify content and receive feedback.

On the other hand, flipped teaching has been considered as an instructional procedure comprised of two key sections: direct or computer based, individual instruction out of the class context, and interactive or group activities in the class context. Besides, Maxson and Szaniszlo (2015) differentiated between the flipped classroom and flipped learning. Flipped learning is considered a move towards personalized learning using pre-exposure to new learning content, which could help students to have more engagement in the learning.

### 1.2. Academic Satisfaction

The satisfaction that students experience in their academic endeavors is a critical aspect in the overall assessment of educational programs' success, as well as a significant measure of the quality of the teaching

methods used by teachers (Fulfors, 2013). As Uka (2014) stated, Academic Satisfaction (AS) is considered as the degree to which the learners gain the favorite academic results and experiences related to their education. It pertains to how well students achieve their academic objectives and shows the knowledge they have acquired during their period of study (Uka, 2014). For educators, AS is about meeting students' needs and demands effectively. Student satisfaction is crucial as it has an impact on learners' motivation, which is essential for their success. Numerous factors affect learners' satisfaction, such as the quality of the educational programs, the efficacy of the teaching procedures, the instructional approach, and the focus on meeting the demands and needs of the learners, among others. EFL flipped methods have led to satisfactory academic achievements and satisfied learners. According to Riasati et al. (2024), the students who experienced blended learning outperform those who participate in traditional classes.

Through the EFL classroom, learners made more efforts to learn and attended the class more frequently than they had under the traditional F2F method. Most of the learners spoke highly of the flipped model since the lecturing videos provided could be paused, reviewed, and closed at the students' convenience. This undeniably facilitated the teaching and learning procedure and stimulated learners to engage in learning (Chen et al., 2014).

### 1.3. Ambiguity Tolerance

Ambiguity Tolerance (AT) is an essential learning skill that reflects how willing learners are to accept information or perspectives that challenge their current knowledge or beliefs. Because language acquisition inherently involves uncertainty and frequent ambiguity, students who struggle to cope with such ambiguity often experience stress, confusion, and discomfort when encountering linguistic difficulties. Consequently, AT is beneficial in facilitating or impeding the process of foreign language learning (Kamran, 2011).

In an L2 context, students might have difficulties interpreting due to the inadequacy of linguistic cues. AT is one of the main features of EFL learning that impede or smooth learning. A reasonable level of AT is conducive for EFL learners. AT is an essential and ultimate personality trait. Kamran and Maftoon (2012) have reported a significant relationship between AT and reading comprehension.

Students with diverse levels of AT differ in some of their skills. For example, learners with higher AT might take risks more easily; they are more independent (Arquero et al., 2015). A student with a better AT is more eager to be a multilingual speaker. They are more

willing to participate in EFL online class contexts (Tayebnik & Puteh, 2013). Learners with lower AT in language learning need more encouragement and assistance (Chu et al., 2015). AT is also highly significant in entrepreneurship, as it enables one to accept uncertainty and live with it. Risk-taking also means accepting risk in one's activities, and seeking achievement means the extent to which a person desires progress and success (Rezaie, 2018). However, research on the effectiveness of flipped classrooms for EFL learners remains limited. While some studies indicate that learners prefer flipped classrooms to traditional classes, there is insufficient empirical data on their effects on EFL learning outcomes, particularly in terms of AT and student satisfaction.

To address these gaps, the current research tried to estimate the effectiveness of the flipped instruction method in EFL reading courses in Iran, with the focus on its influence on student satisfaction and AT. It sought to inspect if flipped classroom is more effective than the traditional one in improving reading skills and how they affect students' attitudes toward language learning. This study used a flipped classroom model, incorporating instructional videos, to investigate how this pedagogical approach affects students' AT, AS, and learning outcomes in the setting of EFL reading comprehension skills. The goal was to enhance the reading comprehension skills of EFL learners by providing them with a more engaging and interactive educational experience. The research tried to assess the efficiency of this flipped classroom by assessing changes in EFL students' reading comprehension achievement following the intervention.

This study is directed by the following research questions:

- Does flipped learning have any effect on Iranian EFL learners' ambiguity tolerance concerning reading comprehension skills?
- Does flipped learning have any effect on Iranian EFL learners' academic satisfaction regarding reading comprehension?

## 2. Literature Review

### 2.1. Flipped Instruction

The flipped classroom concept, which reverses traditional teaching methods, has historical roots dating back to Socrates, who promoted active learning through pre-class readings followed by in-class discussions (Peterson, 2011). This approach has gained recognition for its effectiveness, as it allows for individualized learning, encourages interactions, and enhances transparency for parents and stakeholders (Moran & Young, 2014).

Initially, the flipped classroom model involved completing schoolwork at home and doing homework in class. Recent terminology includes inverted classroom and just-in-time teaching, reflecting a shift in educational practices (Bergmann & Sams, 2012).

This approach caters to modern "digital natives," who may not respond well to traditional lecture-based instruction due to their unique information processing styles (Roehl et al., 2013). By fostering collaboration and active participation, flipped learning can better engage contemporary students and sustain their motivation (Prensky, 2010).

### 2.2. Advantages and Challenges of Flipped Instruction

Advocates of flipped classrooms highlight their advantages, such as allowing students to engage with digital materials at their own pace before face-to-face sessions, which focus on interactive tasks like discussions and problem-solving (Bergmann & Sams, 2012). This method promotes active learning, enabling students to prepare according to their comprehension levels. Teachers benefit from enhanced student engagement outside of class, as they can shift content delivery online, allowing for more observation, feedback, and formative assessment (DeCapua & Marshall, 2010). This ongoing assessment helps identify learning needs and adapt instruction accordingly.

Xiu et al. (2014) note additional benefits, including increased engagement, personalized support, improved homework completion rates, and the opportunity for unprepared students to catch up by collaborating with peers. The flipped model also helps maintain class progress when instructors or students are absent (Berrett, 2012), allowing continued learning despite missed classes (Roehl et al., 2013).

Critics argue that the flipped classroom resembles traditional setups where students read at home; however, it uniquely ensures that educators are aware of the students' comprehension levels. While flipping a language classroom requires teachers to create video content, some may struggle with this transition due to the need for tech proficiency (Li, 2018). Challenges arise as many L2 learners can get distracted by digital devices, leading to inconsistent engagement with assigned videos (Ansari et al., 2017). Additionally, the reliance on technology poses issues for students without home access to computers or the Internet, as using public facilities can be limiting (McCoy, 2016).

### 2.3. Ambiguity Tolerance

AT refers to an individual's ability to manage unfamiliar or uncertain situations, particularly in how learners

process new information in ambiguous contexts. Those with low AT tend to hesitate, while those with high AT embrace ambiguity, significantly impacting success in learning a second or foreign language. Educators recognize AT's importance, as EFL learners often face unclear language and cultural situations, affecting their learning outcomes (Ehrman et al., 2003; Bagheri & Rassaei, 2021).

AT influences language performance and learners' perceptions of the learning process. Reading strategies play a crucial role in reading performance, with metacognitive strategies enabling learners to manage their learning better (Erten & Topkaya, 2009).

Oxford (1990) notes that language learners feel overwhelmed by the complexities of new languages, emphasizing the need for metacognitive strategies to improve focus. Keshavarz and Assar (2009) found a link between AT levels and reading strategy use, indicating that adaptable learners employed a wider range of strategies and performed better in reading comprehension. High AT learners utilized metacognitive strategies more effectively compared to those with low AT.

Chu et al. (2015) identified additional strategies, confirming that high AT learners frequently employed cognitive, metacognitive, compensation, and social strategies. However, their study noted limitations regarding the reliability of the modified AT assessment.

#### 2.4. Academic Satisfaction

AS is a multifaceted concept involving students' motivation, engagement, learning outcomes, and relationships with instructors. It reflects how well learners' needs are met, encompassing cognitive processes, emotions, and motivation. Mampane and Aluko (2018) emphasize that AS is shaped by individual characteristics, institutional resources, curriculum structure, and relationships with faculty and peers.

High AS is linked to effective learning and influences students' willingness to invest in their studies, while dissatisfaction may lead them to pursue more enjoyable activities (Kong & Yan, 2014).

For advanced learners, AS is crucial, prompting institutions to provide support that helps manage time, improve relationships, and handle stress. According to Zhang and Wang (2018), quality educational settings strive to meet the needs of both learners and instructors. AS enhances students' confidence and motivation, often resulting in higher grades and academic success. It is closely associated with better emotional and psychological health, leading to lower anxiety and higher self-esteem, ultimately contributing to improved educational outcomes (Franzen et al., 2021).

#### 2.5. Studies on the Effect of Flipped Education on Reading Skill

A study by Abeysekera and Dawson (2015) highlighted the effectiveness of the flipped classroom model, which integrates in-class and out-of-class tasks, in accommodating learners with varying proficiency levels and reducing cognitive load. In this model, students collaborate on pre-prepared materials to focus on key concepts and internalize knowledge through negotiation of meaning. Activities often include online resources like WebQuest for easy access to learning materials.

Hung (2015) explored flipped instruction in language classes using a WebQuest-based method. The findings showed that both structured (with WebQuest) and semi-structured (with TED-Ed) approaches outperformed traditional lessons in terms of academic achievement, learner attitudes, and engagement.

In an Iranian EFL context, Abaeian and Samadi (2016) found that flipped instruction significantly improved reading comprehension scores among 100 female learners, particularly benefiting intermediate students.

Irsheed (2022) studied 10th-grade female students using a quasi-experimental design and found that the flipped classroom method enhanced reading comprehension skills, with notable improvements in literal, inferential, critical, and creative skills. The results supported the adoption of this model in English language teaching for promoting student-centered, self-directed learning.

#### 2.6. Studies on the Effect of Flipped Education on Academic Satisfaction

Learners' AS in online education during the COVID-19 pandemic was generally moderate (Bawaneh, 2021). Young and Bruce (2020) found that students preferred traditional F2F instruction over all online formats. Gross et al. (2015) discovered that flipped instruction significantly increased student engagement and satisfaction due to its active learning strategies. Similarly, Hung (2015) noted that flipped lessons improved academic outcomes and fostered positive attitudes towards learning.

Despite the benefits observed in other subjects, the application of flipped instruction in English as an EFL context remains underexplored, with research often neglecting the unique challenges language learners face. The connection between flipped classroom models and EFL learners' academic satisfaction and achievement requires further investigation, as existing studies tend to examine these factors in isolation. Additionally, research on designing and implementing flipped classrooms tailored to EFL learners is still in early stages,

highlighting the need for more empirical support to enhance instructional strategies.

### 3. Method

#### 3.1. Research Design

This research used a quasi-experimental design model to examine the influence of flipped instruction on learners' AT and AS in relation to reading comprehension. The research included two groups of experiment and control. The experimental group received their teaching via the flipped teaching model, and the other group, the control group, received education through traditional methods. Under the flipped learning setting, students reviewed the content and materials such as video lectures and readings, prior to class, which enabled in-class time to focus on interactive and collaborative activities. Conversely, the control group received F2F instruction during class and completed practice assignments outside of school. To evaluate outcomes, pre-tests and post-tests were used to measure AT, while AS was assessed through a questionnaire administered after the intervention.

#### 3.2. Participants

The study involved 83 intermediate EFL students (ages 15-30) from Farjad Institutes in Shiraz, Iran. All the participants were female. A sample of 60 students was randomly selected and divided into two groups of 30, including the flipped learning group (experimental group) and the traditional instruction group (control group). Randomization ensured comparability across key demographic variables such as age.

#### 3.3. Instruments

##### 3.3.1. Cambridge Preliminary English Test (PET)

At the outset of the research, participants' overall English language proficiency was assessed using the Cambridge Preliminary English Test (PET), currently referred to as B1 Preliminary. This standardized assessment, corresponding to the B1 level of the "Common European Framework of Reference for Languages" (CEFR), examines learners' intermediate abilities across four skills: listening (25 items), reading (35 items), writing (7 items), and speaking (a four-part interview).

The participants needed to obtain a minimum score of 140, thereby guaranteeing a uniform proficiency level. Such a requirement is consistent with the linguistic competence typically reported for Iranian EFL learners (Rahimi, 2009).

##### 3.3.2. Ambiguity Tolerance Scale (ATS)

The researchers utilized Ely's (1995) "Second Language Tolerance of Ambiguity Scale" (SLTAS) to assess learners' ability to cope with uncertainty during second language acquisition. Designed particularly for EFL environments, this tool consists of 12 items assessed on a five-point Likert scale from "strongly disagree" to "strongly agree." It assesses learners' ability to cope with uncertainty in different aspects of language learning, including unclear instructions, ambiguous sentence structures, and unfamiliar lexical items. Previous research has reported strong internal reliability for the SLTAS, with a Cronbach's alpha of 0.84 (Kazamina, 1999), and the scale has been extensively validated as an effective measure of ambiguity tolerance among language learners.

##### 3.3.3. Academic Achievement Test

Academic achievement in reading skills was assessed using the IELTS Academic Reading Test. This globally recognized test measures the proficiency of non-native speakers in understanding complex academic texts. It consists of three sections, each featuring progressively difficult passages from authentic sources like academic journals, books, and newspapers, totaling 2,150-2,750 words. The test evaluates skills such as understanding main ideas, details, inferences, and the writer's tone. It includes 40 questions and is scored on a 9-band scale, with higher scores indicating stronger proficiency in academic reading. IELTS is widely accepted for its rigorous development and reliable scoring, making it an ideal tool to assess students' reading comprehension abilities in EFL contexts. The test's relevance to academic reading ensures its alignment with real-world demands in higher education.

##### 3.3.4. Academic Satisfaction Questionnaire

Learners' views regarding the flipped classroom method were evaluated through a 16-item survey originally designed by Alsowat (2016). Responses were assessed on a five-point Likert scale, extending from "strongly disagree" to "strongly agree," which helped the researchers to capture different degrees of satisfaction. This measurement framework facilitated a nuanced examination of learners' subjective experiences. Experts in language education evaluated the questionnaire to ensure its content validity and educational assessment, leading to slight revisions for clarity and cultural relevance. Its reliability was established by Alsowat (2016) to be 0.81, and the current study reaffirmed this with a reliability coefficient of 0.79. The questionnaire was conducted post-intervention to the experimental

group, ensuring that students' feedback reflected their complete experience with the flipped classroom approach. This timing minimized potential biases, providing an accurate measure of student satisfaction.

### 3.4. Materials

The reading component of Touchstone, Book 3 (McCarthy, McCarten, & Sandiford, 2012) was used as the primary instructional material in this study. This widely recognized textbook is designed for intermediate learners and integrates all four language skills. The reading sections focus on enhancing comprehension, critical thinking, and engagement with diverse texts, drawn from real-life contexts to ensure relevance and engagement. Each unit begins with a reading passage, followed by integrated listening, speaking, and writing tasks that reinforce learning and encourage the application of skills across different contexts. A unique feature, the "Wrap-Up" page, helps consolidate learning by reviewing vocabulary, grammar, and functional language. This section also promotes self-reflection, allowing students to assess their progress. It was selected based on its balanced approach, clear objectives, and real-world content, making it an ideal tool for exploring the effect of the flipped classroom model on the academic performance and learning satisfaction of EFL learners.

### 3.5. Data Collection Procedure

At the start of the research, a pre-test was utilized to assess participants' baseline reading comprehension and ambiguity tolerance. The pre-test included a reading comprehension test, designed to evaluate the students' ability to understand and analyze academic texts. Additionally, participants completed the SLTAS. The pre-test results were utilized to assess the participants' initial proficiency and ensure a comparable baseline for both groups. The intervention phase lasted for 12 weeks and included 20 instructional sessions. During this period, participants of the experimental group experienced flipped teaching. The students in this group were provided with e-learning materials, including pedagogical videos, voice-annotated power points, and links to external websites, all distributed through Telegram and WhatsApp prior to class. This allowed them to review the materials at home, preparing them for interactive and collaborative activities in class. In-class sessions focused on applying the knowledge gained through pre-class materials, including discussions, activities, and questions and answers designed to deepen their understanding of the reading passages, while the participants of the control group had traditional f2f instruction. After reading, the students answered

comprehension questions to test their understanding of the text. The traditional method involved direct in-class instruction without the use of online resources, focusing on teacher-led activities and individual practice. Following the intervention process, a post-test was used to inspect possible improvements in reading comprehension. This assessment followed a design with the same structure as the pre-test, allowing for a straightforward comparison of participants' development. Both groups (experimental and control) completed the identical reading comprehension test to determine their performance outcomes after the instructional phase. Moreover, participants were required to answer once more the AS questionnaire and the SLTAS to assess their perceptions of the learning experience and any shifts in AT. The data gathered from the post-test were subsequently examined to assess the relative effectiveness of the flipped classroom model in contrast to conventional teaching methods. For the interview data gathering, 10 students were selected randomly. Each interview, lasting approximately 30 to 40 minutes, followed a semi-structured format with guiding yet adaptable questions. The discussions covered participants' general views on the flipped classroom approach, their perceived progress in reading abilities, levels of satisfaction with learning activities inside the class and outside of the classroom, emotional reactions, and suggestions for further improvement.

### 3.6. Data Analysis Procedure

The study employed both descriptive and inferential statistical procedures. Descriptive statistics were used to summarize and present the general characteristics of the gathered data. Furthermore, inferential analyses were conducted to inspect the effect of the flipped learning method on students' academic outcomes. An independent samples t-test was performed to determine whether there were significant differences in post-test reading comprehension scores between the experimental and control groups. To evaluate changes in AT, scores from the SLTAS were analyzed using analysis of covariance (ANCOVA). In this analysis, the post-test AT scores served as the dependent variable, group membership (experimental vs. control) was treated as the independent variable, and the pre-test AT scores were included as a covariate. This procedure was employed to control any initial differences between the groups and to more accurately determine the effect of the flipped learning method on students' AT after adjusting for baseline levels. To assess variations in AS, the questionnaire results were analyzed. An independent samples t-test was conducted to examine differences in the post-test AS scores between two groups, allowing for the detection of statistically significant differences

between them. Reflective Thematic Analysis (RTA) was utilized to examine the interview-derived quantitative data. This method allows researchers to interpret participants' accounts of their experiences and to explore their viewpoints, highlighting both commonalities and distinctions while revealing unexpected insights (Braun & Clarke, 2021). An inductive strategy guided the analysis so that the themes emerged directly from the data and remained closely connected to it (Braun & Clarke, 2021). Theme construction was informed by the researcher's own expertise, background, and assumptions. The six-phase process offered by Braun and Clarke (2021) was carefully followed, beginning with systematic coding. To enhance the accuracy of coding and the robustness of interpretation and theorization, a TEFL specialist collaborated with the primary researcher. Representative excerpts from participants were included to substantiate the identified themes and strengthen the study's trustworthiness, with verbatim quotations ensuring verifiability (Silverman, 2015). Moreover, Shenton's (2004) recommendations were observed to support the credibility and confirmability of the findings and to ensure that they authentically reflected the participants lived experiences.

## 4. Results

### 4.1. Descriptive Results

Number of 60 EFL students participated in the research. Before the intervention of the initial levels of AT, academic achievement in reading skills of the students of both comprising groups were assessed. The summary statistics for these pre-intervention scores are shown in Table 1 below. Table 1 illustrates the average scores for AT, academic achievement, and AS among participants in both the control and experimental groups. For AT, the control group's pre-test mean was 2.47 (SD = 0.93), while its post-test mean reached 3.4 (SD = 3.45). In the experimental group, the pre-test mean was 2.76 (SD = 2.7) and the post-test mean increased to 4.15 (SD =

0.76). Regarding academic achievement, assessed through reading skills, the control group obtained a mean of 4.37 (SD = 1.03) in the pre-test and 4.9 (SD = 0.92) in the post-test. The experimental group achieved a mean score of 4.48 (SD = 1) before the intervention and 5.67 (SD = 1.17) afterward. For AS, the control group's mean score was 2.9 (SD = 0.81), whereas the experimental group recorded a higher mean of 4.28 (SD = 0.67).

### 4.2. Academic Achievement

An independent t-test was conducted to examine the effect of flipped instruction on reading achievement by comparing the post-test results of the experimental and control groups. Levene's test assessing the equality of variances approached significance ( $F = 3.24, p = 0.076$ ), implying possible variance discrepancies across the two groups. Subsequent independent t-test analysis revealed a statistically significant difference in post-test performance between the experimental and control groups ( $t(78) = -3.0, p = 0.004$ ). The mean difference was calculated at 0.712 with a standard error of 0.237, and the 95% confidence interval ranged from -1.185 to -0.239. Collectively, these findings demonstrate that students in the experimental group, who received instruction via the flipped classroom approach, achieved higher post-test scores than those in control group.

### 4.3. Ambiguity Tolerance

An analysis of covariance (ANCOVA) was conducted to assess the effect of flipped classroom instruction on learners' AT, controlling for initial group differences. In this analysis, post-test AT scores were the dependent variable, grouping (experimental versus control) was the independent variable, and pre-test AT scores served as the covariate. Before performing ANCOVA, the assumptions of normality, homogeneity of variances, linearity between the covariate and dependent variable, and homogeneity of regression slopes were tested and confirmed.

Table 1. Descriptive Statistics

Measure	group	test	Mean	Std. Deviation	Std. Error Mean
Ambiguity Tolerance	Control	Pre-test	2.47	0.93	0.14
		Post-test	3.45	0.74	0.11
	experimental	Pre-test	2.76	1.2	0.19
		Post-test	4.15	0.76	0.12
Academic Achievement	Control	Pre-test	4.37	1.03	0.16
		Post-test	4.96	0.92	0.14
	experimental	Pre-test	4.48	1.0	0.15
		Post-test	5.67	1.17	0.18
Academic Satisfaction	Control	Post-test	2.9	0.81	0.12
	experimental	Post-test	4.28	0.67	0.10

**Table 2.** Independent t-test results for post-test scores in reading

Levene's Test for Equality of Variances		t-test for Equality of Means						
F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
3.240	0.076	-3.0	78	0.004	0.712	0.237	-1.185	-0.239
-	-	3.0	73.952	0.004	0.7125	0.237	-1.185	-0.239

**Table 3.** ANCOVA for Post-test Ambiguity Tolerance Scores Controlling for Pre-test Scores

Levene's Test for Equality of Variances		t-test for Equality of Means						
F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
0.041	0.840	-4.12	78	0.000	0.70	0.16984	-1.038	-0.361
-	-	-4.12	77.94	0.000	0.70	0.16984	-1.038	-0.361

**Table 4.** Independent t-test on post-test means scores of academic satisfactions

Levene's Test for Equality of Variances		t-test for Equality of Means						
F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
3.240	0.076	3.0	78	0.004	0.7125	0.237	-1.185	-0.239
-	-	3.0	73.95	0.004	0.7125	0.237	-1.185	-0.239

**Table 5.** Themes, subthemes, and example codes

Theme	Subthemes	Frequency in Interviews (n=10)	Example
Learner Autonomy and Empowerment	Self-paced learning, Responsibility for preparation, Strategic planning	10	Watching the videos at my own speed allowed me to understand everything without the pressure of keeping up with the teacher. (Participant 7)
Increased Classroom Engagement	Motivation boost, Active participation, Confidence to share ideas	8	Knowing the topic before class made me want to participate more. It felt good to share my ideas instead of just listening. (Participant 3)
Reduced Academic Anxiety	Lower fear of mistakes, Classroom comfort, Self-confidence	5	Because I had already prepared by watching videos, I was not afraid of being called to answer a question. (Participant 9)
Strengthened Peer Collaboration	Group work, Peer explanation, Academic solidarity	6	If I missed something from the videos, my groupmates explained it better to me. Working in groups made reading easier and less boring. (Participant 2)
Perceived Learning Gains	Better comprehension, Improved critical reading, Increased enjoyment	7	After flipped classes, I could guess the difficult vocabulary meaning better and understand complex texts more easily. (Participant 6)

The ANCOVA results demonstrated a statistically significant effect of instructional group on post-test

ambiguity tolerance, after controlling for pre-test scores,  $F(1, 57) = 23.28, p < 0.001$ . The covariate, pre-test

ambiguity tolerance scores, was also significant,  $F(1, 57) = 15.36$ ,  $p < 0.001$ , indicating that initial AT levels contributed to post-intervention outcomes. Adjusted mean scores indicated that the experimental group exhibited greater AT than the control group, after accounting for baseline differences. These results indicate that the flipped classroom model produced a significant positive effect on students' AT beyond pre-existing group differences. The previously reported independent samples t-test results for reading achievement and academic satisfaction remained consistent. The experimental group significantly outperformed the control group in post-test reading achievement and reported higher academic satisfaction, indicating that flipped instruction contributed positively to both cognitive and affective outcomes.

#### 4.4. Academic Satisfaction

An independent t-test was employed to determine whether the flipped instruction had a significant effect on EFL learners' AS by comparing the satisfaction scores of the experimental and control groups. As indicated in Table 4, the outcomes of Levene's test for equality of variances confirmed that the homogeneity of variance assumption was satisfied ( $F = 3.24$ ,  $p = 0.076$ ). The independent samples t-test revealed a statistically significant difference in satisfaction scores between the experimental and control groups ( $t(78) = 3.0$ ,  $p = 0.004$ ). The observed mean difference was 0.71, with a standard error of 0.237 and a 95% confidence interval ranging from -1.18 to -0.23. These findings imply that students participating in the flipped classroom approach experienced notably higher academic satisfaction than those receiving conventional instruction. Therefore, the flipped teaching strategy seems effective in enhancing both learning performance and students' satisfaction with their learning experience.

#### 4.5. Qualitative results

The qualitative information obtained through semi-structured interview was examined using an inductive thematic analysis. The initial codes were generated manually and later organized into overarching themes. A summary of the findings is presented on the table below. Table 5 presents the main themes, related subthemes, and illustrative codes derived from the qualitative data collected through semi-structured interviews. The analysis identified five central themes that capture essential dimensions of the flipped classroom experience and its impact on students' learning processes. The first theme, Learner Autonomy and Empowerment, highlights the students' increased sense of control over their learning. This theme includes

subthemes such as self-paced learning, responsibility for preparation, and strategic planning, all of which emphasize the importance of students' responsibility of their own study process. The frequency of this theme was observed in all 10 interviews, suggesting its central role in the flipped classroom model. An example quote supporting this theme is: "Watching the videos at my own speed allowed me to understand everything without the pressure of keeping up with the teacher" (Participant 7). The second theme, Increased Classroom Engagement, reveals a notable change in students' behavior within the classroom context. The flipped classroom encouraged more active participation, a boost in motivation, and greater confidence in sharing ideas. Eight out of the 10 students expressed that they were more engaged in classroom discussions after having prepared for class. One participant stated: "Knowing the topic before class made me want to participate more. It felt good to share my ideas instead of just listening" (Participant 9). The third theme, Reduced Academic Anxiety, explores how flipped learning alleviated the students' fear of mistakes and increased their comfort level in the classroom. Students reported feeling more relaxed and self-confident, particularly due to their preparedness through the pre-class materials. As one participant explained, "Because I had already prepared by watching videos, I was not afraid of being called to answer a question" (Participant 2). This theme was highlighted by five participants. The Strengthened Peer Collaboration theme focuses on the social aspect of learning in a flipped classroom. Students reported that working with peers and helping each other enhanced their learning experience. Group work, peer explanations, and academic solidarity were common subthemes in this category, with six participants mentioning the benefits of collaborating with others. For example, one participant noted: "If I missed something from the videos, my groupmates explained it better to me. Working in groups made reading easier and less boring" (Participant 3). Finally, the Perceived Learning Gains theme reflects the students' recognition of improvements in their reading comprehension skills. Many participants observed that the flipped classroom model assists them to have a better understanding of difficult texts, develop critical reading skills, and enjoy the reading process more. One participant stated: "After flipped classes, I was able to guess the meaning of difficult words better and understand complex texts more easily" (Participant 6). This theme was mentioned by seven participants.

## 5. Discussion

This study examined the effectiveness of flipped classroom instruction on AT, AS, and reading

achievement among Iranian EFL learners. The first research question was “Does flipped learning have any effect on Iranian EFL learners’ ambiguity tolerance concerning reading comprehension skills?” it investigates whether flipped classroom instruction affects Iranian EFL learners’ AT in reading comprehension skills. AT refers to individuals’ ability to perceive and accept ambiguous situations without undue anxiety or discomfort. The results of this research reveal a noteworthy positive influence of flipped learning on AT among Iranian EFL learners.

The observed positive effect can be attributed to several factors inherent in flipped classroom instruction. First, the pre-class preparation required in flipped learning encourages students to confront and engage with ambiguous concepts independently (Strayer, 2012). Flipped instruction fosters a mindset where ambiguity is considered as a natural element in learning rather than a barrier to comprehension. Additionally, in-class activities in flipped learning contexts often emphasize collaborative learning and discussion (Tucker, 2012), providing opportunities for learners to negotiate meaning and explore different interpretations of ambiguous content, thus enhancing their tolerance for ambiguity.

The result of the current research lends support to Strayer’s (2012) findings. Strayer (2012) explored the influence of flipped learning on student engagement and found that students in flipped classrooms demonstrated greater independence in managing complex and uncertain concepts. This independence correlates with increased AT, as students become more adept at navigating challenging material outside of traditional lecture settings.

The second research question asked: “Does flipped learning have any effect on Iranian EFL learners’ academic satisfaction regarding reading comprehension?” which examines whether flipped classroom instruction impacts the EFL learners’ AS in reading comprehension ability. Academic satisfaction pertains to students’ overall contentment with their learning experiences. The obtained results revealed a significant improvement in AS among participants exposed to flipped learning model in comparison to those in traditional classrooms. This finding is consistent with research from diverse educational settings, including the study by Strayer (2012) which highlights increased student engagement and satisfaction with flipped approaches. However, contrasting cultural contexts, such as those in western countries where individualism is more pronounced, may influence how AS is perceived and evaluated compared to the collectivist values typically observed in Iran.

The findings align with prior research conducted in various educational contexts. For example, Strayer

(2012) conducted a study comparing student engagement and satisfaction in traditional versus flipped classrooms. Like the current study, Strayer (2012) stated that learners in flipped classrooms reported higher engagement and AS due to increased interaction and active learning opportunities. Furthermore, Bergmann and Sams (2012) explored the implementation of flipped learning models in different educational settings. Their findings also supported the notion that flipped approaches contribute to enhanced student satisfaction by allowing for personalized learning experiences and more effective use of classroom time.

Despite the consistency in findings across several studies, variations can be observed due to contextual and cultural differences that impact the perception and evaluation of AS.

Studies conducted in western countries, such as those by Bergmann and Sams (2012), often highlight individualistic values where student satisfaction is often linked to autonomy and personal achievement. In contrast, in collectivist cultures like Iran, AS may also be influenced by factors such as peer relationships, teacher-student interactions, and group harmony. On the other hand, the criteria used to evaluate AS may differ across studies. While some focus on qualitative aspects such as student engagement and enjoyment of learning (Strayer, 2012), others may include quantitative measures such as performance outcomes and retention rates.

## 6. Conclusion

The research findings underscore the transformative effect of flipped instruction on AT, AS, and academic achievement in reading comprehension skills among Iranian EFL learners. The positive outcomes observed validate the effectiveness of flipped learning as an innovative pedagogical approach and highlight its relevance with regard to improving pedagogical methods in language teaching and acquisition. By encouraging active engagement, self-directed learning, and critical thinking, the flipped teaching approach helps the learners to overcome some limitations and drawbacks of traditional instruction and helps the students to meet the requirements of the modern educational landscape. These results provide compelling evidence for educators and policymakers to consider integrating flipped classroom models into their teaching practices. The enhanced AT, increased AS and improved academic achievement observed in this study demonstrate that flipped learning plays a crucial role in the development of more effective and engaging language education programs.

Several pedagogical features of the flipped classroom model contribute to the observed

enhancement in ambiguity tolerance. Pre-class engagement with instructional materials allows learners to process unfamiliar or complex linguistic input at their own pace, reducing time constraints and permitting repeated exposure to ambiguous content. This method encourages learners to view uncertainty as an integral and manageable aspect of the learning process rather than as a source of anxiety. Furthermore, collaborative in-class activities promote negotiation of meaning, peer explanation, and guided feedback, collectively supporting learners in addressing ambiguity in second language contexts.

The results of the study assert that educators should design pre-class activities that require students to engage with ambiguous and complex materials. These activities could include open-ended questions, real-world problem scenarios, and critical thinking tasks that compel students to navigate uncertainty and develop their understanding before coming to class.

The results have some implications for curriculum designers. They should develop flexible learning paths that allow students to progress at their own speed. This flexibility can help accommodate different learning speeds and preferences, leading to greater student satisfaction. Additionally, they should incorporate student feedback. Regularly incorporating student feedback into curriculum design can ensure that the learning materials and activities remain relevant, engaging, and responsive to students' needs. This iterative process can help maintain high levels of student satisfaction over time.

Teachers should adapt a student-centered approach for their teaching practices. This involves understanding students' individual needs, interests, and learning preferences, and tailoring in-class activities to address these factors. As a result, learners are more motivated to perceive their learning experiences as meaningful and feel a greater sense of satisfaction.

The current research suffered from some limitations, that is, the research included a limited sample size because of limitations related to course enrollment, which limits the generalizability of the results. Moreover, the research was done within a specific cultural and demographic context, in a language institute, where participants shared similar cultural, social, and academic backgrounds. Furthermore, the flipped learning intervention in this study was limited to 22 sessions, which contributed to deeper comprehension of the immediate effects of this teaching method on AT, academic achievement, and satisfaction. However, the study did not account for the long-term sustainability of these effects. A longitudinal study design would be beneficial for assessing the durability of the observed outcomes over an extended period, providing a more comprehensive insight of the long-term benefits or

potential drawbacks of flipped learning model in EFL reading instruction.

The current study used specific instruments to measure AT and AS. Future research could develop new measurement tools or utilize qualitative approaches. Creation and validation of new instruments could capture more accurately the nuances of AT and AS in the context of flipped learning. Also, through the interview process a deeper understanding of learners' experiences and viewpoints on flipped learning could be gained.

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### Authors Contribution

All the authors have participated sufficiently in the intellectual content, conception and design of this work or the analysis and interpretation of the data (when applicable), as well as the writing of the manuscript.

### Availability of data and materials

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

### Conflict of interests

The author states that there is no conflict of interest.

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