Validating and Extending Ecological Affordance Theory: An Exploratory Mix-method Study Comparing Traditional and Flipped EFL Classrooms

Lili Qin
School of English Education, Guangdong University of Foreign Studies

Author Note
The author declares no conflicts of interest to disclose. Correspondence concerning this article should be addressed to Lili Qin, School of English Education, Guangdong University of Foreign Studies, Guangzhou, Guangdong 510420, China.
Email: Qinlili@gdufs.edu.cn

Abstract

Nowadays, the majority of second and foreign language (L2) classes around the world make use of technology-mediated instruction, with the flipped classroom (FC) being the most popular strategy. With the growth of flipped learning in L2 domains, several studies have examined the effectiveness of this instructional strategy in different contexts including English as a foreign language (EFL) classrooms. Nevertheless, most of the earlier inquiries have evaluated the effectiveness of flipped language classrooms in light of traditional, retrospective research approaches. Few studies have used emerging research approaches, including ecological affordance (EA), to assess the effectiveness of flipped language classes. To address this gap, this study examined the effectiveness of traditional and flipped language classes by investigating. In addition, we have to clarify that positive elements do not linearly lead to positive elements, i.e., negative interpretation of the UNIPUS platform may leads to positive actions, or vice versa. The transformation of different processes is more determined by individual differences, such as technology literacy, personal interest etc.(Lambton-Howard et al., 2021). Therefore, the interaction between the three original elements were extended to the nonlinear and complex interaction between five as indicated in Figure 2.
Chinese EFL learners' performance based on the three components of EA, namely *perception*, *interpretation*, and *action*. To do so, interviews, questionnaires, classroom observations, and narratives were employed in four different phases to collect the data. The study outcomes indicated that learners in flipped and traditional language classes did not differ significantly in terms of positive perception, interpretation, and actions. However, the flipped classroom group demonstrated a greater reduction in negative interpretations and actions. The results of this

Received 5 January 2026; revised 20 February 2026; accepted 5 March 2026; available online 25 March 2026; Version of Record 30 March 2026.

Citation: Qin, L. L. (2026). Validating and extending ecological affordance theory: An exploratory mix-method study comparing traditional and flipped EFL classrooms. *Journal of Language*, *2*(1), 1-37. https://doi.org/10.64699/26KJUJ3673

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DOI: 10.64699/26KJUJ3673

study may have some theoretical and practical implications for L2 researchers, language teachers, and educational administrators.
Keywords: Ecological affordance (EA), EFL classrooms, Flipped classroom (FC), Traditional classroom (TC), positive ecological affordance, negative ecological affordance

1. Introduction

With the rapid growth of technology, many higher education institutions worldwide are employing different blended or hybrid teaching methods, notably flipped classrooms (FC) (Chen Hsieh et al., 2017; Solmaz, 2021). Flipped classroom is a technology-enhanced instructional strategy in which "students watch lectures at home and teachers challenge them to solve problems and deepen their knowledge in class" (Hotle & Garrow, 2016, p. 1). The effectiveness of this instructional strategy, as Lee and Wallace (2018) mentioned, is generally determined by students' academic growth and development. The flipped classroom is not a cure for all educational problems. However, when planned and executed appropriately, it can offer several benefits over traditional classroom (TC) (Rotellar & Cain, 2016). The capability of reviewing the recorded sessions, the opportunity for interpersonal interactions, and the possibility of self-directed learning were reported as the outstanding benefits of flipped classrooms (Akçayır & Akçayır, 2018; Lee & Martin, 2020).

Given such benefits, several researchers have examined the effectiveness of this instructional strategy (Crabtree, Rasul & Arroyo, 2024; Istenič, 2024; Lan, 2024; Geiger, Bennison & Abidin, 2024). As the review of earlier studies revealed, most of previous studies have studied the effectiveness of flipped classrooms with respect to students' psycho-emotional characteristics, including academic motivation (Al-Hoorie et al., 2021), autonomy (Godwin-Jones, 2019), agency (Muir, 2017), anxiety (York et al., 2021), and self-efficacy (Enfield, 2013).

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Furthermore, some studies (e.g., Maheshwari & Seth, 2019; Wang et al., 2020) have examined the effectiveness of flipped classrooms through the lens of ecological affordance (EA), which emphasizes the teaching and learning process rather than the educational outcomes. Yet, few language studies have assessed the effectiveness of flipped language classes through the EA perspective. To bridge this gap, the current study intends to evaluate the quality and efficiency of flipped EFL classes using the EA approach through van Lier's framework of EA (perception-interpretation-action circle). As though he pointed out in his 2008 book that the ecological fluid interaction of the three elements in actualizing the affordances in L2 learning, which includes positive and negative affordances, van Lier did not elaborate the model by adding the two opposite sub-elements. Therefore, apart from evaluating and comparing the effectiveness of flipped and traditional EFL classrooms., this study also aims to extend the traditional three-element model proposed by van Lier, including its bidirectional relationships, differential roles of positive/negative affordances.

Considering that EA can be considered a viable instrument for assessing the effectiveness of flipped classrooms, it is worthwhile to compare how EFL learners actualize their EAs in flipped and traditional classrooms. This was achieved by recruiting two L2 classes in Northeast China, one in a flipped classroom model and another in a traditional classroom model. From a theoretical perspective, studies in technology-mediated language learning environments, such as flipped classrooms, have explored how EA is actually realized, either solely through perception (Song & Ma, 2021; McNeil, 2014; York et al., 2021) or with perception and action joint together (Young et al., 2002), which are very compatible with

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Gibsonian EA. As human beings perform tasks, they perceive the environment and act accordingly. van Lier (2004) in SLA, however, has decoded the overall process of EA actualization in its entirety by examining the interaction between three elements-*perception, interpretation, and action*. The current study also aims to translate van Lier's EA theory into practice to connect theory and practice, which will benefit both sides and render more implications.

2. Literature Review

2.1 Ecological Affordance (EA)

Gibson (1979) stated "ecological affordances are action possibilities offered by an environment or an object to an agent in the sociocultural environment, either for good or ill." (p.68). Later, Varela et al. (2017) added, "affordances consist in the opportunities for interaction that things in the environment possess relative to the sensorimotor capacities of the animal" (p. 203). Therefore, affordances are actional, object-oriented, and relative to both the environment and individual effectivity (Bahari & Li, 2024). Discourse refers not just to language but to systems of representation—including images, narratives, practices, and spatial arrangements—that produce meaning, construct identities, and shape social realities (Zhang, 2025). In the field of L2 education, van Lier (2004) described that "affordances arise out of participation and use, and learning opportunities occur as a consequence of involvement and use" (p.91). In his view, actualizing EA is a process involving perception, interpretation, and action, wherein learners perceive learning resources and interactive opportunities in the environment, interpret them, and then act to transform them into meaningful positive or negative affordances for language

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learning (Dey-Plissonneau, 2017; Zhang, Zou & Cheng, 2024; Istenič, 2024).

Therefore, what can be picked up or perceived (firstness before affordance emerges, or iconicity in Pierce's Semiotic Triangle) within the technology-mediated language teaching environment are the interactive opportunities (such as those created through human-computer interaction or enabler tasks, Danish & Hmelo-Silver, 2020). Pierce's Semiotic Triangle defines interpretation as a form of secondness or indexicality, which indicates what can be done with what you perceive at the firstness level. During this second level, we are trying to relate ourselves to the action possibilities or semiotic/meaning possibilities that we have perceived in the given cultural context, so we can determine what to do next based on these perceptions. As part of Pierce's Scheme, action is the thirdness or symbolic aspect that enables symbolic meaning to be created in the environment through action (van Lier, 2004). Affordances therefore appear as representations of the learning environment, whether they are positively or negatively related to language acquisition (p. 92). Meaning occurs when perception, interpretation, and action are synchronized through mutual reinforcement. Through tracking learners' actualization of EA, we hope to identify problems and their causes in language teaching/learning and develop effective solutions to improve language instruction quality.

2.2 Flipped Classroom (FC)

Vitta and Al-Hoorie (2020, p. 3) defined a flipped classroom as "…involves presentation of new content to learners to be independently studied before class, and then class time is devoted to reinforcing and engaging with the 'flipped' content" (Kraml, 2024; Mehring, 2018; Mirzaei, Shafiee & Rahimi, 2024; Authors; Verdonck et al., 2024; Zhang, Zou & Cheng,

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2024). In a flipped classroom, the in-person time aims to help students solve problems and engage students in collaborative and hands-on activities (Bergmann & Sams, 2014; Mehring, 2018). The online time, an extension of in-class learning, uses digital resources to support students' learning of linguistic and intercultural knowledge (Carhill-Poza, 2019; Chen Hsieh et al., 2017; Feyzi Behnagh et al., 2020). In traditional classrooms, teachers instill knowledge in students, who learn passively. Instead, within the pedagogical framework of the flipped classroom, teachers assist and guide learners through their learning process and thus allow greater learner autonomy (Evseeva & Solozhenko, 2015; Galindo-Domínguez & Bezanilla, 2025).

2.3 Previous Studies on Flipped Classrooms

There have been two conclusions derived from the actualization of EA in flipped classroom language teaching. One argument holds that flipped classrooms facilitated language learning, while the other asserts that flipped classrooms were not significantly different from traditional classrooms. As a result of an individual's actualized EA in the flipped classroom, language learning is directly impacted (Balzotti & Mccool, 2016). With more access to teaching and learning resources provided by information technology, students can also realize positive affordances, improving their ability to learn independently (Khodabandeh, 2022; Loewen et al., 2019; Muir, 2017) and enhancing their achievement (Murillo-Zamoranoa et al., 2019). According to Murillo-Zamoranoa et al. (2019), EA actualization was high among EFL learners in higher education in flipped classrooms. The correlation between positive EA actualization and language proficiency also indicated that the greater the actualization of

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positive EA, the better the students' language proficiency (Nsyengula et al., 2024). Besides, negative EA impeded flipped classroom's learning. The study, however, did not recruit a control group in traditional classroom to serve as a reference for comparison but rather investigated flipped classroom's strengths and weaknesses in a flipped classroom only. A few studies concluded that the actualization of EA between the two models did not differ significantly (Sahin et al., 2015). There are contextual factors (e.g., teaching content) or limitations of enablers (e.g., teachers, students) that may affect these results. For example, when students are IT-literate (Kern, 2014) and motivated, they can flip independently in traditional classroom, as well. Conversely, those who are less motivated may become accustomed to traditional classroom learning and resist using new technologies when they encounter difficulties in flipped classroom (Sahin et al., 2015), thus affecting their language learning negatively. In addition, due to spatial distance, emotional detachment from the classroom environment, and limited interactions between learners, they may become more prone to burnout when they spend more time online. Thus, there are controversy over flipped classroom's effectiveness, and comparative studies between flipped classroom and traditional classroom are rare (Chen et al., 2021).

Even less research has examined the effectiveness by describing the actualization process of EA. Although there existed some studies, the majority of empirical studies using EA in a technology-mediated environment for L2 learning are qualitative or detailed descriptions of discourse analysis (Martin-Beltran, 2009; Zheng et al., 2017) or log analysis (Song & Ma, 2021, Sydorenko et al., 2019). Therefore, a quantitative investigation is essential to

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understanding the dynamic and complex changes in EA actualization caused by the interaction between three elements (perception, interpretation, and action). Consequently, we took an exploratory sequential mixed-methods approach to address the following research questions:

(1) What is the outcome and process of EA actualization by EFL learners in flipped classrooms & traditional classrooms? Are there differences between flipped classrooms & traditional classrooms?

(2) What are the differences in language proficiency change between flipped classrooms and traditional classrooms? And does language proficiency change correlate with EA actualization outcome?

(3) What are the correlations between the three elements (perception, interpretation, and action) of EA actualization, including positive and negative ones?

3. Methodology

This study utilized an exploratory sequential mixed-methods design. Four steps are involved: (1) collecting qualitative interview data encompassing three dimensions (perception, interpretation, and action); (2) developing a questionnaire based on previous interview findings through factor analysis of SPSS 27.0; (3) administering the questionnaire with flipped classroom and traditional classroom and tracking EA actualization; (4) triangulation of data with qualitative methods including classroom observations, narratives, and interviews (see Table 1).

Table 1. Procedure

Phase	Data collection instrument	Participants (N)	Goals	Period	Time overlaps

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Phase One	Interview	5	Abstracting statements to develop a Likert-type questionnaire	Pilot study	Previous term
Phase Two	Questionnaire survey	1292	Developing a reliable and valid questionnaire with factor analysis	Pilot study	
Phase Three	Questionnaire survey Language test	70; 35 in FC and 35 in TC	1)Understanding the EA actualizing outcome and describe the differences between two classrooms; 2)Understanding the learners' language proficiency change and compare the two classes; 3)Understanding the correlation between EA actualization and language proficiency	Week 2-pre-tests Week 16-post tests	Current term
Phase Four	Classroom observation, interviews, narratives	6; 3 from each class	Triangulation to questionnaire survey and to describe the process of EA actualization	from Week 2 to Week 16	

Note: FC=flipped classroom; TC=traditional classroom

3.1 Phase One: Collecting Interview Data

3.1.1 Participants

The purpose of this study was to examine the process of actualizing EA in College English classes from the perspective of Chinese-as-first-language EFL learners. The study involved five randomly selected EFL sophomore students (4 females, 1 male; average age 19.2) who took *College English* course at a Northeast Chinese university.

3.1.2 Data Collection and Analysis

A semi-structured interview was administered to understand how students perceive,

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interpret, and act when learning English (Schaeffer & Dykema, 2011). In accordance with the interviewees' permission, interviews were recorded and transcribed for later analysis. In addition, a thematic analysis was conducted to identify the major affordances actualized by students (Braun & Clarke, 2006). To promote the credibility of the findings, the thematic analysis was performed jointly by two researchers, who have conducted several empirical studies on blended/hybrid learning methods. After the thematic analysis, member-checking strategy was implemented to improve the trustworthiness of the analysis (Lincoln & Guba, 1985). The interview transcripts and analysis outcomes were then sent to an external researcher to check out the thematic analysis process. This helps researchers increase the confirmability of their study (Nassaji, 2020).

3.2 Phase Two: Developing the Questionnaire

Following Creswell and Plano Clark's (2018) examination of variables from the qualitative data and after extracting the relevant themes arising from the above interview texts, the researchers developed a 7-point Likert-type scale (Cicchetti et al., 1985) to enhance differentiation, ranging from 1 (strongly disagree) to 7 (strongly agree). 67 items were modified and redrafted by two scholars with doctoral degrees and administered to 1,292 EFL students at the university.

3.3 Phase Three: Quantitatively Describing EA Actualizing Process and Outcome with Questionnaire Survey and Language Test

This step involved collecting data over a period of 17 weeks.

3.3.1 Participants

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A total of 70 learners were recruited from two randomly selected EFL classes (each with 35 students) in the same university, with an average age of 18.8 years (7 males and 63 females). There were two classes implemented with flipped classrooms and traditional classrooms, respectively. Shirley (anonymous), with a doctoral degree and 22 years of English teaching experience, taught both classes.

3.3.2 Classroom Background

Table 2 summarizes the teaching procedure in two contexts:

Table 2. FC and TC Teaching Procedure

Classroom	Online teaching	Offline teaching	Teaching content	Classroom organization
FC	1)Online: two hours per week compulsory on Unipus platform*, 2)other learning time is voluntary; 3) learners must complete compulsory learning content online before face-to-face class.	Offline/Face-to-face in classrooms: two hours per session, once per week	1)Same teaching content online & offline; 2)Same textbooks used	Learner-focused: 1)learning of teaching content is mostly through online platform resources. 2) Most in-class time is devoted to group, solo or pair presentations on teaching content that are prepared before class or impromptu
TC	Online: Unipus accessible, but not compulsory	Offline/Face-to-face in classrooms: two hours per session, twice per week		1) teacher-focused, learning of teaching content is mostly through offline teaching. 2) Some in-class time is devoted to group, solo or pair presentations on teaching content that are prepared before class or

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	impromptu

**Unipus is the E-learning platform with e-resources of the textbook.*

In Table 2, it is observed that Unipus is an E-Platform accessible to both classes, however the difference lies in the flipped classroom's requirement to complete online tasks via Unipus, whereas the traditional classroom's requirement is optional. To encourage students to participate, the teacher organizes the same tasks in offline face-to-face classrooms. However, it can be seen that learners in the flipped classroom are more encouraged to learn with the online Unipus, whereas learners in the traditional classroom are learning in a more teacher-focused approach. Therefore, even though the teacher organizes the same tasks for them to participate in communicative interactions, the flipped classroom group spares more time in interacting with peers.

3.3.3 Data Collection and Analysis

A questionnaire and language test paper (OPT=Oxford Placement Test) were distributed to the two classes in week 2 and week 16 as pre-tests and post-tests (see Table 1). Both data were analyzed using SPSS 27.0.

3.4 Phase Four: Triangulation with Qualitative Data

3.4.1 Participants

A purposive sampling was used in this step to better understand the process of actualizing EA and the factors influencing it (Creswell and Plano Clark, 2018). Six focal students were recruited (3 from each class). The following table (Table 3) provides their demographics.

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Table 3. Demography for Focal Students

Class	Pseudonyms	Gender	Age	Team roles	Major language
FC	Begonia	Female	19	Group leader	Japanese
	Daffodil	Female	20	Group leader	Japanese
	Rose	Female	18	Group member	Italian
TC	Aloe	Female	19	Group leader	Japanese
	Green	Female	19	Group leader	German
	Hanging Orchid	Female	18	Group member	Spanish

3.4.2 Data Collection and Analysis

The qualitative triangulation of data in this step includes classroom observations, narratives, and interviews over 17 weeks (overlapping period as Phase Three, see Table 1).

3.4.2.1 Classroom Observation

In offline face-to-face classrooms, non-participant observations were conducted to observe students' actions as they actualized affordances. We videotaped six lessons during the term (1,080 minutes) to observe the actions of six focal students. The video clips were coded with NVivo 12 plus (please note that interpretations and perceptions cannot be observed through video). The coding samples can be found in Table 4.

Table 4. Coding of In-class Observation Video

Nodes	**Exemplar Meaning Units**
Positive actions	Raising hands; Standing up to answer questions; Shouting out answers though sitting etc.
Negative actions	Distracted by mobile phone texts; Looking sway instead of the blackboard or the teacher while the teacher is lecturing

3.4.2.2 Narrative

The narrative method was used to investigate students' perception, interpretation and

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actions to actualize EA. Following each observation week, the six focal students emailed the researcher a text narrative of their learning experience in approximately 500 words (Chinese). We collected 18,982 Chinese characters of narrative data.

3.4.2.3 Interview

In week 17, six focal students were interviewed for 232 minutes (about 30 minutes per person) to gain a deeper understanding of their perceptions, interpretations, and actions, as well as the factors that influenced their performance. By coding, annotating, and tallying all interviews and narratives using NVivo 12 plus, a professor and a doctoral student pursuing achieved an internal coding consistency of 85%. The coding system for narratives and interview transcripts is displayed in Table 5. Two proficient bilingual translators verified the translations.

Table 5. Coding System for Narratives and Interviews

Level 1 Node	Level 2 Node	Level 3 Node	Number of Nodes	Exemplar Meaning Units
Perception	In class	positive/negative	60/0	The teacher explains the content of the teaching PowerPoint (positive)
	Out of class	Positive/negative	36/0	I don't know what Unipus can do; I haven't checked out yet (negative)
Interpretation	In class	positive/negative	60/2	I pretty much enjoy the teacher's interpretation of the language points. I think they are quite necessary. (positive)
	Out of class	Positive/negative	35/3	Some of the groups' teamwork presentation is less meaningful. (negative)
Action	In class	positive/negative	396/20	I participated in interactive

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			tasks in class, as I have learned those content online, so I know what I say. (positive)
	Out of class	Positive/negative	530/8 I did not open up the textbook after class. (negative)

4. Results

Our first step was to abstract a viable questionnaire through a pilot study. Based on the results of the questionnaire survey, we were able to provide a quantitative overview of the outcomes of EA actualization. As part of our effort to **answer Research Question 1**, we also used data from classroom observations, narratives, and interviews to provide a qualitative description of the process of actualizing EA. For the purpose of verifying the effectiveness of flipped classrooms, we then compared the language proficiency changes between the two classes and correlated them with the three elements in EA actualization to **answer Research Question 2**. In addition, the data for the three dimensions of the questionnaire perception, interpretation, and action in positive and negative modalities-are correlated to address **Research Question 3**, which offers further implications for the theory of EA.

4.1 Questionnaire's Reliability and Validity

There were 1,180 valid questionnaires collected (91.33% valid returns, 997 females, 183 males, average age 18.4). The validity and reliability of all items were demonstrated by *KMO =.942* and *Cronbach's alpha =.955*. 13 factors were included with the cumulative variance of 66.377%. However, some items did not conform to expectations, and were considered for deletion, amendment or further confirmation during the formal investigation.

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Finally, 10 factors were extracted after the dimensionality reduction, resulting in 51 indicators with a cumulative variance of *65.016%*. We then administered this questionnaire in the following procedure.

4.2 Outcome of EA Actualization in Terms of Three Elements

4.2.1 Perceptions

Using both paired and independent sample tests for each perception (see Table 6), we examined the differences in learner perceptions between the two classes (Q1). Neither pre- nor post-tests showed significant differences (*p>.05*), indicating that students in the two classes perceived similar learning resources and opportunities.

Table 6. Comparisons Within and Between Groups on Perception

Class	pre (n=35) *M*	post (n=35) *M*	Paired Sample *t*-tests *t*	*p*	*d*	tests	Independent sample *t*-test *t*	*p*	*d*
FC	5.169	5.206	-0.168	0.868	-0.028	pre	-0.295	0.769	0.071
TC	5.230	5.123	0.598	0.554	0.101	post	0.493	0.624	0.118

4.2.2 Interpretation

A paired and independent sample *t*-test analysis of the questionnaire data showed no significant group differences in the interpretations of positive affordances within or between groups (*p>.05*). The mean value of positive interpretations on the post-test was higher in FC (*M=5.231*) than in TC (*M=5.061*) (see Table 7). Additionally, negative interpretations decreased significantly among students in FC (*p=.0008<.05; d=.473*).

Table 7. Positive and Negative Interpretation Within and Between Groups

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Class		pre (n=35) *M*	post (n=35) *M*	Paired Sample *t*-test *t*	*p*	*d*	tests		Independent Sample *t*-test *t*	*p*	*d*
F	PI	5.237	5.231	0.031	0.975	0.006	pre	PI	0.052	0.958	0.120
C	NI	4.629	4.000	2.796	0.008	0.473		NI	0.360	0.720	0.086
T	PI	5.226	5.061	0.954	0.347	0.162	post	PI	1.165	0.249	0.278
C	NI	4.548	4.371	0.797	0.431	0.135		NI	-1.614	0.111	0.386

4.2.3 Action

Positive actions did not increase significantly within groups (*p>.05*, see Table 8). But there was a significant group difference between FC (*M=3.595*) and TC (*M=3.994*) in the post-test in negative actions of FC students (*p=.009<.05; d=.641*). Given that FC acted more positively with what they perceived than TC, it appears that FC is slightly better at actualizing EA than TC.

Table 8. Positive/Negative Actions Comparison Within and Between Group

Class		pre M	post M	paired sample t-test t	p	d	tests		independent sample t-test t	p	d
FC	PA	5.173	5.164	.050	.960	.009	pre	PA	.030	.976	.007
	NA	4.410	3.595	3.362	.002	.568		NA	.415	.679	.099
TC	PA	5.167	4.946	1.372	.179	.232	post	PA	1.412	.163	.338
	NA	4.309	3.994	.142	.888	.024		NA	-2.680	.009	.641

Note: PA=positive actions; NA=negative actions

4.3 The Process and Manifested Characteristics of Positive/Negative EA Actualization

4.3.1 Perception

The qualitative analysis of the classroom observation, interview and narrative data echoed how learners actualize positive or negative EA (Question 1). In the first instance, six of the focus students perceived similar EA overall, but differed in the depth at which they

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perceived online affordances, which has an impact on the learning results. For instance, despite the fact that students in TC could also perceive the accessibility of the E-platform at any time independently, they perceived very few resources and did not mention the Unipus introduced by the teacher at the beginning of the semester in the interview, nor were they able to comprehend the platform functions and contents in depth, as Hanging Orchid indicated in Excerpt 1. Contrary to the students in TC, the students in FC not only possessed a greater understanding of the Unipus content, but also of their specific functions (Excerpt 2).

Excerpt 1

"After class, I also search videos online to learn English. There is software online and many resources, but the searching is incomplete, troublesome, and time-consuming, and there are very few times when I search." (From Hanging Orchid).

Excerpt 2

"The Unipus (online platform) provides listening, reading, and writing skills practices. There is an optional role-play section, which is usually a very fun part of completing occasionally, and it is also fun to interact with the platform, and I believe I can learn a lot through it." (From Rose)

4.3.2 Interpretation

Second, students in FC interpreted more positively than those in TC, taking into account the wider use of online resources and fragmented time to solve language learning problems. While students in TC were unsure of the effectiveness of the software and would interpret it negatively as a result of the differences between their first-hand experiences. As an example,

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Aloe from TC interpreted the actual use of the learning software negatively in Excerpt 3 in light of her subjective awareness and the experiences of others with the software she had heard about.

Excerpt 3

"I feel the instantaneous memory of the word with the software is fast, but I will forget it soon. Learning software is kind of seductive, and I heard previous classmates had the experience of clocking in but not improving, so I just do not want to use it. I didn't use it, even download Unipus, because it is unnecessary to use online resources. I don't know what my classmates think, but I seldom see them using that software." (From Aloe)

4.3.3 Action

Thirdly, as a result of their more positive actions, FC classroom had a higher level of student engagement than TC classroom. Table 9 suggests the number of positive actions nodes maintained a steady increase in class, and no negative node appeared along the implementation of FC. In addition, the students in TC displayed fewer positive actions than students in FC and took negative actions irregularly (7 nodes in total) across the six observational weeks. Taking a closer look at the results of actions taken outside of the classroom (Table 10), we observed that in spite of the fact that six students demonstrated a high level of self-regulated learning ability within the last six weeks, the three students from FC still demonstrated a stable upward trend in their positive actions outside of class. The table also indicates that in the last observational week, each of them had more than 15 positive nodes. The positive actions of the three students from TC also showed an increasing trend, but the nodes were relatively small,

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and the negative actions emerged almost weekly. Conversely, FC had slightly more positive actions outside the classroom than TC, which agrees with the results of the previous questionnaire study. Additionally, an unexpected discovery was made. Two students (Begonias and Hanging Orchid) voiced their negative actions but didn't mention any negative interpretations before.

Table 9. Nodes of Positive/Negative Actions in Class

Week	week 3	week 5	week 7	week 9	week 13	week 15	Total
Begonias	6/0	6/0	6/0	6/0	6/0	6/0	36/0
Daffodil	6/0	6/0	6/0	6/0	6/0	6/0	36/0
Rose	4/0	4/0	6/0	6/0	6/0	6/0	32/0
Aloe	4/1	6/1	6/0	6/1	4/1	6/0	32/4
Greens	5/1	6/0	6/0	6/1	5/0	6/0	34/2
Hanging Orchid	5/0	5/0	4/0	6/1	5/0	6/0	31/2

Table 10. Nodes of Positive/Negative Actions out of Class

Week	week 3	week 5	week 7	week 9	week 13	week 15	Total
Begonias	10/0	11/0	10/1	10/0	14/0	15/0	70/1
Daffodil	13/0	14/0	15/0	15/0	17/0	19/0	93/0
Rose	12/0	12/0	13/1	17/0	16/0	17/0	87/1
Aloe	9/1	12/0	12/1	12/0	12/0	13/0	70/2
Greens	10/0	11/1	15/0	13/1	15/0	14/0	78/2
Hanging Orchid	14/0	16/0	14/0	16/1	16/1	20/0	96/2

4.4 The Correlation of EA Actualization with Language Improvement

For Questions 2, we found a significant difference (*p=.010>.05; d=.461*) and an increase (*MD=-3.086*) in language test scores in FC between the pretest (*M=33.800*) and posttest *(M=36.886)* (see Table 11). It should be noted, however, that there was no significant

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difference and a lower mean value difference (*MD=-1.285*) within tests in TC. FC showed more improvement, demonstrating its benefits to language acquisition to some extent.

Table 11. Result of Language Proficiency Between and Within Groups

Class	Pretest (n=35) *M*	Post-test (n=35) *M*	paired sample t-test		d	Test	independent sample t-test		d
			t	*p*			*t*	*p*	
FC	33.800	36.886	-2.728	.010*	.461	Pretest	-1.820	.073	.435
TC	36.029	37.314	-1.247	.221	.211	Post-test	-0.371	.712	.089

4.5 Correlation of Language Proficiency Change and Outcome of EA

A summary of the correlation coefficients between the language proficiency group and the affordances variables can be found in Table 12. The three positive variables (positive perception, positive interpretation and positive action) in FC correlated significantly with language proficiency scores (*p<.01*), but there was no significant correlation between language proficiency and the negative variables (negative perception, negative interpretation and negative action) in FC (*p>.05*). It is noteworthy that the negative variables in TC were negatively and mildly correlated with language proficiency (*r=-0.351*; -0.374*, p<.05*). This may explain why EA actualization was more positively influencing learners' language level in FC, whereas in TC, negative affordances played a greater role in changing learners' language proficiency.

Table 12. Correlation of Language Proficiency and Variables

	PFC	PIFC	NIFC	PAFC	NAFC	PTC	PITC	NITC	PATC	NATC
LPFC	.476**	.442**	.291	.479**	.138					
LPTC						-.032	-.073	-.351*	-.208	-.374*

Note: LPFC=language proficiency in FC; LPTC=language proficiency in TC; PFC = perception in FC; PIFC =

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positive interpretation in FC; NIFC = negative interpretation in FC; PAFC =positive action in FC; NAFC = negative action in FC; PTC = perception in TC; PITC = positive interpretation in TC; NITC = negative interpretation in TC; PATC =positive action in FC; NATC = negative action in TC.

***p < .01; *p < .05*

4.6 The Correlations Between the Three Elements of EA in Positive and Negative Modalities

In response to question 3, Table 12 summarizes Pearson's correlation coefficients among the measures of EA in FC. The positive variables are significantly correlated with the mean score, among which perception, positive interpretation, and positive action are highly correlated with the mean score with the coefficients of *r=.892***, *r=.898***, and *r=.905*** (*r>.80, p<.01*). Negative interpretations and negative actions are moderately (*r>.50*) correlated with the mean score, with *r= .675*. In addition, the study indicates that perception and negative interpretation are weakly correlated, suggesting that students' perception of affordances does not always lead to positive actions, learners were very likely act negatively due to different interpretations of perceived EA.

Table 13. Correlation of Affordance Variables

	PFC	PIFC	NIFC	PAFC	NAFC
PFC	1	.892**	.361*	.898**	.071
PIFC		1	.269	.905**	.051
NIFC			1	.272	.675**
PAFC				1	.110
NAFC					1

Note: ***p* < .01; **p* < .05; PFC=Perception in FC; PIFC=Positive Interpretation of FC; NIFC=Negative Interpretation of FC; PAFC=Positive Actions in FC; NAFC=Negative Actions in FC.

Also, the results indicated that there were instances where the same type of affordance (e.g., internet resources, learning software) was interpreted both positively and negatively. By

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implementing online learning in FC, the negative interpretations of students gradually decreased and shifted to positive interpretations. For example, Rose (from FC) initially interpreted the perceived online resources negatively, as shown in Excerpts 4 below.

Excerpt 4

"I know the internet is a very helpful tool, but there is a lot of misinformation when using it to find what we need on our own… I would get confused about studying strategies and find those materials online annoying." (Interview of Rose)

In the online context, Rose shifted her negative interpretation onto a positive one with the support of learning online resources, which gave her the opportunity to reflect on her interpretations previously and to identify and resolve them. It is likely that she would perceive some new affordances after her checking actions. The following extract 5 illustrates this:

Excerpt 5

"Then, when I found out that everyone was using online resources quite well, I reflected myself to find out why. Maybe it's just my prejudice, so I took a chance to find out that it was quite helpful to do some reading exercises as my reading ability is also low." (Interview of Rose).

5. Discussion

The current inquiry was undertaken with the aim of evaluating the effectiveness of flipped and traditional EFL classes through EA approach. This study also set out to compare the efficiency and quality of flipped and traditional EFL classes. The research outcomes are fully presented in the following sections.

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5.1 Development and Validation of the Questionnaire of EA Actualization to Measure Learning Effectiveness

As a result of expanding the research focus from learning results to learning process, we find the EA actualization is an effective instrument for measuring learning effectiveness. As a result of all three aspects of EA, flipped classroom students achieved greater academic success than traditional classroom students. This reflects previous studies on the utilities of flipped classrooms (Sahin et al., 2015). First, the questionnaire survey revealed that EA did not differ significantly between teaching contexts in terms of perceptions of technological affordances (such as attitudes and features of the e-platform, Lambton-Howard et al., 2020; Barret et al., 2022), implying that students in traditional classroom may have also developed themselves in the traditional classroom context (Sahin et al., 2015). A second observation is that students' interpretations of EA do not differ significantly from classroom setting to classroom setting (Lai et al., 2017). However, students' negative interpretation of flipped classroom teaching decreased significantly. This could be due to the effect that, students got more familiar with the functions of the technology in the latter period of the term, specifically with the platform adopted. In addition, the teacher in Flipped classroom designed some interactive classroom activities linking online and offline learning, could also be another reason the students turn more engaged in the class, hence becoming more supportive to the FC mode (Kern 2014; Lai et al. 2017) and reduction of the negative interpretation nodes. Flipped classroom teaching is more appealing to students in interactive circumstances, whereas traditional classroom teaching is less effective in stimulating students' enthusiasm for learning

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though they have the same innovative design of teaching tasks, their less familiarity with the teaching content without learning beforehand the class with the online platform (Zhang et al., 2020) demotivate them a lot to get invovled in the activities. The participants' equal IT-literacy can justify the results. As found in the EA questionnaire, positive actions taken in flipped classroom were comparatively more effective than those taken in traditional classroom, while negative actions were significantly fewer in flipped classroom, in agreement with previous research findings (Muir, 2017; Murillo-Zamoranoa et al., 2019; Qin et al., 2026). The engaging atmosphere of technology-mediated L2 education can explain the reduction of negative actions and interpretations (Pindee et al., 2024; Geiger, Bennison & Abidin, 2024). Considering the above findings, stakeholders should not rely solely on final grades or language tests to measure effectiveness, but instead encourage teachers to employ EA as a measurement to identify what problems exist.

5.2 Examination of the Predictive Effects of Affordances on Language Improvements

As reported by previous studies (Balzotti & McCool, 2016; Muir, 2017; Murillo-Zamoranoa et al., 2019; Nsyengula et al., 2024; Qin et al., 2026), learners' actualized EA directly supports language learning. We provide new insight into the specific predicted effect of affordances on language improvement in the quantitative study. Flipped classroom had a significant improvement in language proficiency test scores but not traditional classroom. The positive correlation between EA actualization and language proficiency in flipped classroom suggests that positive affordances are most predictive of learning and language proficiency. This agrees with Murillo-Zamoranoa et al. (2019) research. Qualitative findings also show

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language improvement through positive affordances. Additionally, traditional classroom students did not perceive online affordances (especially Unipus) deeper than flipped classroom students at the end of the semester, consistent with Balzotti and McCool (2016) and Mirzaei et al.'s (2022) conclusion that flipped classroom would provide students with more accessible affordances. In addition, flipped classroom students interpreted online sources and fragmented time more positively than traditional classroom students. Since they had been influenced by flipped classroom and had become used to studying in the technology mediated language teaching environment (Zheng et al., 2017), they continued to search for useful online resources regardless of difficulty in finding them (Sahin et al., 2015). The flipped classroom students were more engaged and improved their language proficiency in the end (Muir, 2017; Murillo-Zamoranoa et al., 2019). The students' passion for novelty and technology can explain this correlation.

In contrast, it is noteworthy that the negative variables in TC were negatively and mildly correlated with language proficiency esp. between negative interpretation and language proficiency, as well as between negative actions and language proficiency as shown in Table 8. This means, when students' language proficiency is higher, their actualization of negative affordances will be fewer. By closely observing the interviews, we reckon that this is an enormous implication that FC is a viable solution for teachers to design a more enjoyable and interactive class for learners to participate in (Al-Hoorie et al., 2021). As in FC, learners have access to online learning in their fragmented free time after-class, when they come back to the classroom, they are more familiar with the task topic and more willing to join in the activities.

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However, in TC, learners, though have access to online learning platform, the teacher did not require them to learn before class and when the same tasks were implemented in class, their participation or engagement into the activities are constrained, which is probably why students are more motivated in FC and less motivated in TC (Mirzaei et al., 2022; 2024), since negative EA impeded flipped classroom's learning (Nsyengula et al., 2024).

5.3 Clarification of the Process of Actualizing EA in Language Learning

Researchers have previously studied technology-mediated language teaching environments from an EA perspective using one element (perception, Young et al., 2002) or two (perception and action, McNeil, 2014; Song & Ma, 2021). Zhang, Zou and Cheng (2024) and Bahari and Li (2024) have both recently justified the theory as a viable theorectical tool to investigate technology-enhanced classroom. In reality, EA consists of three intertwined strands: perception, interpretation, and action (linked bi-directionally), which is beyond van Lier (2004)'s description since he only used one-direction arrows in his EA model (see Figure 1). A significant correlation was found between perception, interpretation, and action in flipped classroom by incorporating these three elements in conceptualizing EA actualization. The switch from interpreting technology affordances negatively to positively illustrates EA's complexity and dynamic nature. The process of actions can result in a new interpretation, either positive or negative, as well as a new perception of affordance, as positive or negative interpretations do not necessarily correspond to positive and negative actions. Finally, we would like to conclude that the three elements are fluid in interaction and dialectical in influencing each other; therefore, we would rather modify van Lier's (2004) model of

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actualization as follows. As affordance is clearly a cyclic interaction of the three, bidirectional arrows have been used rather than one-directional ones to indicate dialectical relationships. There is no distinction between positive or negative perception of affordance, but rather whether perceived or not. In addition, we have to clarify that positive elements do not linearly lead to positive elements, i.e., negative interpretation of the UNIPUS platform may leads to positive actions, or vice versa. The transformation of different processes is more determined by individual differences, such as technology literacy, personal interest etc.(Lambton-Howard et al., 2021). Therefore, the interaction between the three original elements were extended to the nonlinear and complex interaction between five as indicated in Figure 2.

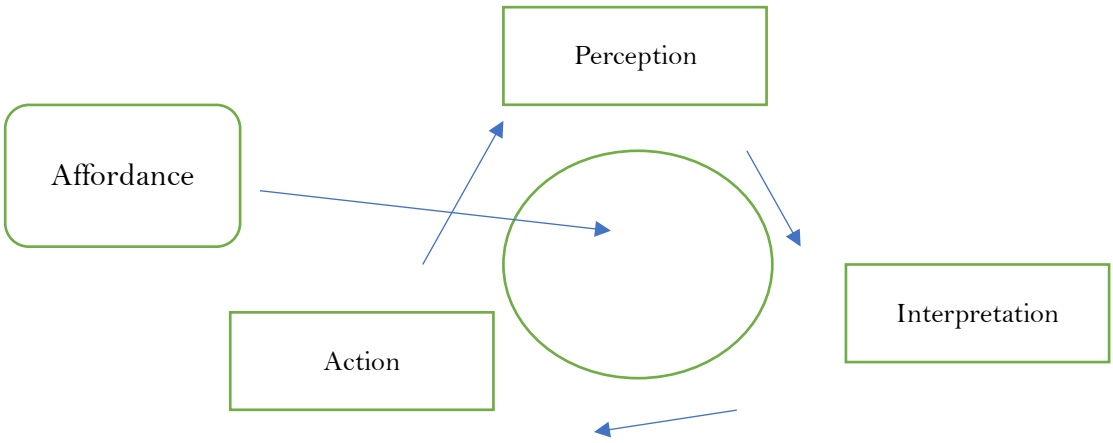

Figure 1. Emergent of Affordance by van Lier (2004, p. 92)

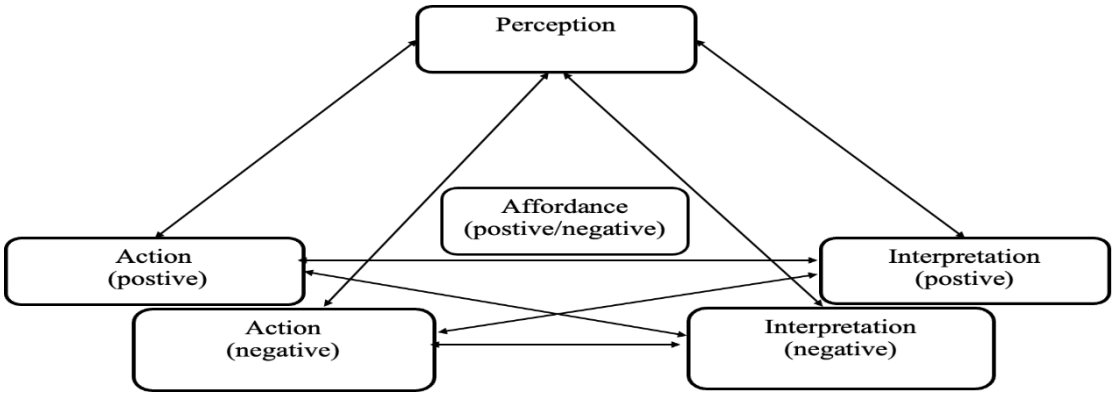

Figure 2. Modified Model of Ecological Affordance Actualization

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Thus, the results of this study may assist teachers in prioritizing the design of flipped classroom teaching models. However, flipped classroom cannot be considered a panacea (Bahari& Li, 2024; Lee & Wallace, 2018; Qin et al., 2026) as students in flipped classroom still encounter confusion and negative affordances when selecting resources or using technology, although technology provides richer affordances to be perceived and motivates them to interpret and act positively (Sahin et al., 2015). Teachers should exert agency and utilize EA as a diagnostic tool for language intervention design and implementation in order to assess language learning and develop better pedagogical strategies (Meihami, 2023). When students are confused or ignore about what they perceive, teachers should design tasks that assist them in interpreting the resources available positively which will lead to positive actions of language learning. In this regard, teachers are highly suggested being aware of the design of teaching arrangements to reduce the negative affordances that may occur.

6. Conclusion, Limitations and Future Research

In this inquiry, the primary purpose was to assess the effectiveness of two instructional methods, namely flipped and traditional classroom, in language education environments. Another purpose of this inquiry was to compare the efficiency of these two instructional methods. As a result of this study, it is validated that the EA actualization could be used as a method of measuring teaching effects in the technology mediated language teaching environment rather than just treating language proficiency or other psychological indicator as a measure. Researchers have concluded that the greater the number of positive affordances actually realized by learners, the greater their ability to improve their language proficiency. As

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a consequence, there may be a deeper understanding of language learning by monitoring how perception, interpretation, and action interact in the cycle of EA actualization, thus modifying the interrelationships among the three aspects. In addition, the study suggests that teachers need to help their students activate more positive perceptions, interpretations, and actions in their pedagogical design and practice.

Despite its interesting outcomes, the current study suffers from some limitations and shortcomings, which necessitate further empirical investigations into this topic (Rahayu et al., 2026). The first limitation of this study concerns the sample of the study, which was restricted to sophomore students. To promote the transferability of outcomes, future investigations should select their participants from different educational levels. The second shortcoming of this inquiry is about the research context. The present research solely assessed the effectiveness of flipped and traditional classrooms in EFL settings. To locate any discrepancy in the outcomes, future researchers need to evaluate the effectiveness of these two instructional methods in other language classes. Another shortcoming of this study is related to the research experiment, which was carried out during one semester. Since the perceptions and interpretations of students may change over longer time, future studies are suggested to employ longitudinal research designs.

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