

## Research Article

# Navigating Leadership and Engagement in L2 Group Work: A Longitudinal Study From a Complex Dynamic Systems Perspective

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## ABSTRACT

This study explored the relationships between assigned and emergent leadership styles, group dynamics, and learner engagement in second language (L2) group-work activities by employing complex dynamic systems theory (CDST) as its guiding framework. Although collaborative learning is widely recognized as advantageous for language acquisition, the interplay between leadership roles and group dynamics in shaping learner engagement, particularly in long-term group work, has received limited attention. We divided 100 participants into 16 groups with assigned leaders (AL:  $n = 49$ ) and 17 groups with emergent leaders (EL:  $n = 51$ ). Of these, we selected ten groups (five AL groups and five EL groups) and collected quantitative data at three points over one academic semester. Subsequently, one focal group from each of the AL and EL groups was selected for qualitative analysis. Grounded in CDST, we examined interrelationships and co-adaptation of leadership styles, group dynamics, and engagement over time. We found that both assigned and emergent leadership styles shaped group dynamics, particularly regarding cohesion and communication patterns, which influenced learner engagement. Furthermore, leadership mediated the relationship between group dynamics and engagement, suggesting that both leadership styles contributed to strengthening group cohesion and, in turn, enhancing engagement. These results underscore the dynamic and reciprocal relationships between leadership, group dynamics, and engagement, offering a more comprehensive understanding of how these elements interact over time in L2 collaborative learning contexts. From the CDST perspective, this study provides practical insights for educators on utilizing leadership roles to optimize the effectiveness of group-based language learning.

**Keywords:** learner engagement, group dynamics, leadership styles, complex dynamic systems theory; collaborative learning

## INTRODUCTION

Group work and collaborative learning are central to second language (L2) pedagogy, and recent research increasingly emphasizes classroom social dynamics as crucial to learning outcomes (Dörnyei & Murphey, 2003; García Mayo, 2021; Murphey et al., 2021; Sato & Viveros, 2016). Group work in L2 classes provides abundant opportunities for interaction and learning. Nevertheless, the outcomes are not always positive, since they depend on complex interactions among group members' behaviors, feelings, and functions. Productive outcomes, in turn, require a positive group climate in which all members actively contribute and support each other (Joe et al., 2017; Nakata & Gao, 2025; Wang et al., 2020). Groups with greater differential participation and conflict are unlikely to engage many learners, making collaboration less fruitful. In this regard, leadership is a critical determining factor in shaping group performance. This study examined how different leadership styles—comparing groups with teacher-assigned leaders and groups in which leadership emerged organically—affected group dynamics and learner engagement over time in L2 tasks. Guided by Complex Dynamic Systems Theory (CDST) as a framework, we explored the dynamic interactions among leadership style, group processes, and engagement patterns in collaborative language learning.

## LITERATURE REVIEW

### Leadership in L2 Group Work

Social psychologists distinguish between assigned leadership, in which an external authority or group appoints a leader, and emergent leadership, in which leadership structures develop naturally through group interactions (Northouse, 2009). These two leadership styles also exist within the L2 classroom context. Teachers may assign leaders for complex tasks, while students can also emerge as leaders by organizing tasks, mediating, or motivating peers. Emerging evidence in the language education literature addresses these leadership dynamics.

Leeming (2016) found that Japanese students learning English as a foreign language (EFL) valued emergent student leaders, explaining in interviews that groups worked more effectively when a peer naturally took charge and facilitated discussions. Leeming (2019) later provided further evidence of correspondence between higher degrees of emergent leadership (as measured by peer- and self-reports) and higher levels of task engagement in classroom groups. Thus, groups with strong informal leaders also had more active and engaged members. Leeming (2024) extended these findings by examining the temporal stability of emergent leadership and how changes in group membership affect task engagement. Leadership positions typically remained constant in fixed groups, with these leaders exhibiting the highest levels of task engagement. However, when students joined new groups, leadership roles often shifted, significantly influencing behavioral, cognitive, and social engagement. These findings underscore emergent leadership's context dependence and impact on group interaction quality. Yashima et al. (2016) echoed these findings, discovering that L2 student groups with a self-appointed informal leader performed better than those without one. Leaderless groups often stalled with silence and low participation, consistent with research showing leadership sustains focus and prevents lapses (Franz, 2012; Goleman, 2017; Northouse, 2015). Groups in which students lead constructively—by managing tasks, encouraging discussion, and minimizing silence—are likely to be more effective and cohesive. These findings highlight leadership's pivotal role in fostering successful EFL group interactions.

While emergent leadership is common, researchers have also explored the deliberate use of assigned student leaders in L2 classes as a pedagogical intervention that may shape initial group conditions. In a quasi-experimental study, Hiromori et al. (2021) compared groups with and without teacher-assigned leaders in Japanese college English classes and found significant advantages associated with assigned leaders, including high levels of motivation and willingness to participate at the start of the activity and active engagement throughout the task. In contrast, groups without a designated leader experienced difficulties in organizing and working together effectively.

Recent research has highlighted leadership's role in shaping group dynamics and engagement, particularly in Japanese tertiary-level settings. Hiromori (2024) found that assigning leaders in face-to-face and online L2 classes fostered stronger leadership behaviors and more positive group climates, especially online. Mitsugi et al. (2024) compared emergent and assigned leaders using a CDST framework, showing that assigned leaders provided favorable initial conditions that accelerated dynamics and motivation, while emergent leaders promoted more gradual growth. Collectively, these studies underscore leadership's mediating role in group processes and engagement.

In light of these findings, we suggest that a formally designated group leader may provide the structure necessary for cooperation and focus while reducing the confusion and uncertainty often seen in peer collaboration. Assigned leaders clarify roles, start tasks promptly, and provide direction in ambiguity, reducing hesitation. Their presence strongly influences engagement and performance. These findings are consistent with prior observations in general education that assigned leadership helps sustain engagement and harmonize group dynamics (Gano-Phillips et al., 2011; Schaufeli, 2021). Whether emergent or assigned, leadership may mediate members' success in engaging with tasks and peers.

### **Learner Engagement in Collaborative Tasks**

Learner engagement refers to the degree of active involvement, attention, and commitment students exhibit during learning activities. Engagement in L2 tasks is multidimensional, encompassing behavioral, cognitive, emotional, and social aspects (Fredricks et al., 2004; Philp & Duchesne, 2016). Engagement is "motivation in action," the manifestation of motivation that is otherwise latent during the learning process (Mercer & Dörnyei, 2020). Recent studies have shown that individual engagement is simultaneously a condition and consequence of effective group work. Engaged learners participate more, while positive group dynamics further enhance engagement, creating a virtuous cycle (Hiver et al., 2021; Philp & Duchesne, 2016).

However, in group tasks, engagement can also be conceptualized at the group level, as a collectively constructed state that emerges from interpersonal interactions. When members ask questions, provide input, and build on comments, they create conditions for active participation. Conversely, if a few students dominate while others remain passive, group-level engagement suffers.

Similarly, Poupore (2016) reported that groups with positive collaborative dynamics elicit higher task motivation and involvement from members. Using the Group Work Dynamic (GWD) measure, Poupore found group dynamics correlated with task motivation and L2 output. In groups with more active interaction, learners reported higher motivation, participation, and language output. This suggests that engagement is jointly constructed among group members. Recent findings by Sato et al. (2025) also illustrate this view by demonstrating that learner engagement in TBLT tasks is closely synchronized with momentary social relationships in the group, such as smooth turn-taking and positive non-verbal cues. “Group synchronicity” shows that engagement is not just the sum of individual efforts but emerges through affective and social alignment.

Engagement is dynamic, fluctuating within and across tasks and lessons. For example, learners may be demonstrably unengaged when beginning a task, yet become fully engaged as it progresses, depending on what the group is doing. Learners’ engagement levels may be related to their initial conditions and subsequent interactions, which again relates to leadership. Engagement is likely to increase and remain high when a leader (either assigned at the outset or emerging early) delineates and attempts to clarify the task and actively involves all group members (Hiromori et al., 2021; Mitsugi et al., 2024). Without clear leadership, groups may flounder with low engagement until a leader emerges or members find roles. The mediating role of leadership between group dynamics and engagement is of particular interest. Capable leaders may change a group’s processes (e.g., ensuring that everyone contributes), consequently increasing engagement. Good leadership transforms group potential into engagement, whereas poor leadership can suppress it; this study therefore

explored the mediating role of leadership by comparing engagement patterns in groups with different leadership structures.

### **A Complex Dynamic Systems Perspective**

CDST provides a framework for examining learning as complex, nonlinear, and emergent systems shaped by many interacting factors (de Bot et al., 2007; Larsen-Freeman & Cameron, 2008). Rather than a simple cause–effect view, CDST sees multiple influences forming relatively stable “attractor states” (Geveke et al., 2017; Hiver, 2014; van Geert & Verspoor, 2015). Within the framework of L2 group work, the CDST perspective implies that a group is a dynamic system comprising individual learners, task conditions, social relationships, and contextual factors. This system has the key properties of openness (e.g., teacher input or prior experiences), adaptability (capacity to adjust to circumstances), changeability (group behavior shifts over time), and nonlinearity (small changes, such as an encouraging comment, can greatly affect engagement) (Hiver et al., 2022; Sampson & Pinner, 2020; Verspoor et al., 2008). A CDST perspective allows us to conceptualize the initial leadership style (assigned vs. emergent) as a group condition that influences how the system develops. According to de Bot et al. (2007), dynamic systems can settle into preferred behavioral patterns or attractor states, which may be favorable (e.g., group interaction flows smoothly and everyone is engaged) or unfavorable (e.g., group stagnation with minimal interaction). These attractors are not permanent; systems may “phase-shift” when parameters change.

We hypothesized that groups with an assigned leader would more readily enter a “positive attractor” of stable engagement because leadership provides structure from the outset. Conversely, groups without an assigned leader might, at least initially, slip into a “less organized” or even a negative attractor state of lower engagement or more disordered activity characterized by overlapping talk, uncertainty, or silence. Emergent leadership groups are expected to self-organize, with dynamics improving as leaders emerge and cooperative patterns solidify. CDST emphasizes that such changes are

nonlinear and may require slow changes (e.g., repeated cooperation or a few successful interactions) before the system leaps to a new state (Larsen-Freeman, 2017). We anticipated nonlinear engagement trajectories, especially in emergent leadership groups, with engagement first decreasing then increasing as equilibrium emerged. We aimed to capture these dynamic patterns by examining quantitative trends and qualitative observations.

It also lies at the intersection of several L2 literature streams, including group dynamics (Dörnyei & Murphey, 2003), classroom motivation/engagement (Dörnyei et al., 2015; Philp & Duchesne, 2016), and complexity-informed research on second language acquisition (de Bot et al., 2013; Mercer, 2011). Our study extends previous research by analyzing assigned and emergent leadership within a longitudinal mixed-methods framework. Few studies have tracked group dynamics and engagement over multiple sessions while manipulating leadership styles; hence, the current understanding of how leadership mediates engagement trajectories is limited. Employing the CDST framework, we respond to calls for research that holistically and temporally examines interaction processes (Hiver & Al-Hoorie, 2020; Larsen-Freeman, 2019). We consider leadership, group dynamics, and engagement as facets that evolve collectively within a system, rather than separate elements. The results will advance understanding of how initial conditions (leadership assignment) shape engagement trajectories and provide practical guidance for structuring group tasks to sustain learner participation.

### Research Questions

We formulated three research questions to guide this study:

**RQ1:** How do assigned and emergent leadership styles influence the development of and fluctuations in group dynamics during L2 group work?

**RQ2:** How do shifts in group dynamics affect learners' engagement in collaborative L2 tasks over time?

**RQ3:** In what ways does leadership mediate the relationship between group dynamics and learner engagement?

## Method

### Participants and Context

Participants were 100 students (aged 18–20) majoring in foreign languages or business, enrolled in EFL courses at two Japanese universities. They worked in small groups for collaborative tasks. Participants were divided into two conditions. In assigned leader (AL) groups, a teacher designated a leader, whereas in emergent leader (EL) groups, no leader was assigned and leadership emerged naturally. The AL condition included 49 participants across 16 groups, and the EL condition included 51 participants across 17 groups. For longitudinal analysis, we selected 10 focal groups (five AL and five EL; 31 students) whose members attended all three sessions and completed all measures, ensuring consistent data. Groups remained the same across sessions, but the teacher's approach varied: AL leaders were designated before tasks, while EL groups had no formal leader, a typical practice in L2 group work. Groups were generally mixed by gender and proficiency, with most having three members (one had four due to class size). Because tasks were collaborative writing, writing ability (and to some extent speaking) was considered more relevant to group performance than receptive skills. Although standardized tests (e.g., TOEIC S/W) would have provided a more direct measure of proficiency, they were not feasible; therefore, collaborative writing performance in Session 1 was used as a proxy for baseline proficiency. All participants provided informed consent for the use of their anonymized data.

### Leadership Assignment and Identification

One week before Session 1, AL students completed a short survey on leadership capability, which included items on self-rated English proficiency, confidence in group work, experience living in an English-speaking country for more than three months, and willingness to take responsibility. Based on these survey results, the teacher identified one student per AL group with high scores (e.g., a student with relatively strong English skills and high self-confidence). These students, designated as group leaders, were informed of their roles immediately before Session 1. Group members were not informed of the leader at the outset of each task. Leaders were instructed to encourage participation and moderate rather than control discussions (see Appendix A in Mitsugi et al., 2024). In contrast, no leaders were assigned in EL groups. Emergent leadership was retrospectively analyzed with the General Leadership Impression (GLI) Questionnaire (Leeming, 2019). After each session, EL groups anonymously evaluated whether they perceived anyone as taking a leadership role (e.g., who guided the group, made suggestions, or resolved issues). An EL leader was identified as the student who was perceived as a leader in at least two sessions and had the highest composite GLI score. This procedure allowed us to determine retrospectively which students acted as *de facto* leaders of the EL groups. Emergent leaders were typically those who naturally stepped up to ask questions, summarize ideas, or coordinate tasks.

### Tasks and Procedure

Data were collected over one semester, with three collaborative task sessions (Sessions 1–3) held about a month apart (early, mid, late semester). All sessions took place in class, each lasting about 20 minutes. The same task type was used across sessions to compare group processes. In each session, students engaged in collaborative writing tasks based on sequenced pictures (Heaton, 1975; see Appendix A) and accompanying instructions to produce a coherent story. The tasks encouraged discussion in English. For example, one task showed pictures of a painting mishap with humorous outcomes, requiring students to agree on a storyline and explain the

humor. Tasks involved sharing information, negotiating content, and jointly producing a composition, thereby encouraging students to use English during both writing and discussion. ALs were responsible for supporting these processes and were briefed to ensure that they understood the task requirements, monitored its productivity, and drew out more reticent participants. The teacher did not intervene in group discussions. Group interactions were audio-recorded and transcribed for group dynamic analysis. After each session, students completed a questionnaire on task engagement.

## Instruments

### *Group Work Dynamics*

Group dynamics were captured using Poupore's (2016) GWD coding scheme (Table 1). This instrument categorizes transcripts of group interactions according to indicators of group dynamics. The scheme included positive interaction behaviors, such as P1 (leadership direction; directing or organizing group work), P4 (providing help; supporting peers in clarifying ideas or task content), and P5 (contributing ideas; offering new content or ideas), and negative behaviors (e.g., off-task talk or discouraging remarks). GWD incorporates elements of equity of contribution, but its primary purpose is broader: to capture and quantify the qualitative and socioemotional features of interaction in small groups. Rather than simply counting contributions, GWD captures the overall group climate and interactional qualities. For example, P1 (leadership direction) is coded as a positive behavior because it often facilitates group progress, especially when combined with behaviors such as P4 (providing help) and P6 (asking for others' ideas). Following Poupore (2016, 2018), two trained coders independently examined transcripts for the ten focal groups and counted each code. The coding was then compared, and inter-rater reliability computed using Cohen's kappa ( $\kappa = 0.81$ ). Disagreements were resolved through discussion.

**Table 1.** *Positive and Negative GWD Characteristics (Based on Poupore, 2016, 2018)*

Positive GWD		Negative GWD	
Characteristic	Weight	Characteristic	Weight
P1. Leadership direction	3	N1. Negative remarks	3
P2. Positive remarks	3	N2. Decision without checking for agreement	3
P3. Jokes	3	N3. Sarcastic or cynical humor	3
P4. Providing help	3	N4. Saying something but being ignored	3
P5. Contributing ideas	2	N5. Incoherent responses	2
P6. Asking for others' ideas	2	N6. Irrelevant responses	2
P7. Asking for clarification	1	N7. Rushing the task	2
P8. Asking for help	1	N8. Foul language	2
		N9. Refusing or avoiding to share ideas	2
		N10. Impersonal responses	1
		N11. Superiority responses	1
		N12. Cutting a speaker off	1
		N13. Overlapping talk	0.30
		N14. Off-task talk (30s or more)	*
		N15. Group member exclusion	**

*Note.* GWD – group work dynamics; \*Off-task talk for 30–34s – 3, 35–39s – 3.5, etc; \*\* Exclusion for 1–20s – 3, 21–40s – 6, etc.

Although the scheme encompassed positive and negative characteristics, negative behavior was minimal across the data. This suggests that participants generally engaged in tasks collaboratively and constructively. Given this observation, to analyze the most salient features of group interactions, we focused exclusively on positive GWD characteristics. This analytical decision reflected observed patterns and theoretical interest in constructive processes underlying successful GWD in collaborative L2 contexts.

### **Task Engagement Questionnaire**

Learner engagement was measured with the Task Engagement Questionnaire (TEQ; Zare & Derakhshan, 2024), a self-report scale assessing engagement in L2 tasks. The original scale contains 25 items; however, we used a 12-item version to reduce participant burden and minimize inattentive responding in repeated administrations. Three items were selected from each of four engagement dimensions: behavioral (e.g., “I worked as hard as I could to complete the task”), cognitive (e.g., “During the

task, I tried to connect the ideas in the task with what I already know”), emotional (e.g., “I felt interested when doing the task”), and social (e.g., “I asked the other students to help me do the tasks”). Students rated the items using a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). Due to sample size constraints, factor analyses could not be conducted. Instead, we relied on the conceptual framework of the TEQ and internal consistency indices to justify the multidimensional interpretation. To avoid conflation, total scores were treated as supplementary indicators, while the main analyses and interpretations were based on the four distinct engagement dimensions. We used a validated Japanese version of the TEQ, which had been back-translated to ensure accuracy. TEQ scores provided complementary insights into student engagement, supplementing the behavioral and interactional data obtained through GWD coding.

### **Data Analysis**

We conducted both quantitative and qualitative analyses to examine the dynamic interplay among leadership style, GWD, and learner engagement across the three task sessions. To address RQ1, GWD scores derived from coded transcripts were aggregated by group and session and compared over time within and between leadership conditions to explore stability or fluctuation of group dynamics. To explore RQ2, TEQ scores were analyzed for each session. Given the small sample size and the non-normal distribution of the data, non-parametric tests were applied: Spearman’s rank-order correlations were used to examine the consistency of engagement levels across sessions within each group. Differences in engagement between leadership conditions were assessed using the Mann–Whitney *U* test. Changes within groups over time were analyzed using the Friedman test, followed by Wilcoxon signed-rank post-hoc tests. These analyses provided insights into how shifts in GWD relate to changes in learner engagement. For RQ3, particular attention was paid to the relationship between leadership behaviors and subsequent changes in group dynamics and engagement. This involved examining whether leadership

mediated the relationship between GWD and engagement, especially in groups with notable shifts across sessions. Specifically, we selected one focal AL group and one EL group, and analyzed transcripts from all sessions to trace leadership behaviors and their influence on interaction dynamics. The analysis also addressed the co-development of GWD and engagement, as well as members' shifts from passive to active roles.

## Results and Discussion

### How Leadership Styles Shape Group Dynamics Over Time (RQ1)

To examine how GWD developed under different leadership styles, GWD scores were aggregated for AL and EL groups across all sessions. When the AL group's average scores were standardized to 100%, the corresponding EL group scores were approximately 48%, 57%, and 45% in Session 1–3, respectively (Table 2). To determine whether these differences reflected proficiency rather than leadership style, a Mann–Whitney  $U$  test was conducted on Session 1 writing scores from five AL and five EL groups to check comparability between the conditions. The results showed no significant difference between the two conditions ( $U = 9.50$ ,  $p = .56$ ,  $r = -.21$ ), suggesting comparable English proficiency levels. These findings indicate that the higher AL group activation levels were at least partly influenced by the structured presence of assigned leadership. This suggests explicit leadership, rather than linguistic competence, played the central role in shaping the trajectory of collaborative behavior in these groups.

**Table 2.** Differences in Average GWD Scores for AL and EL Groups Across Sessions

GWD scores	AL group (n = 5)	EL group (n = 5)	Difference (%)
Session 1	116.80	60.50	56.30 (48%)
Session 2	108.20	46.40	61.80 (57%)
Session 3	122.40	67.40	55.00 (45%)
Average	115.80	58.10	57.70

*Note.* GWD – group work dynamics; AL – assigned leader; EL – emergent leader. GWD scores for each group were calculated by subtracting negative scores from positive scores. Negative behaviors included N1 (Negative remarks), N4 (Saying something but being ignored), and N7 (Rushing the task). These behaviors were infrequent, averaging fewer than six per group per session across both AL (Session 1: 3.0; Session 2: 5.0; Session 3: 5.8) and EL groups (3.0, 3.8, and 4.2, respectively).

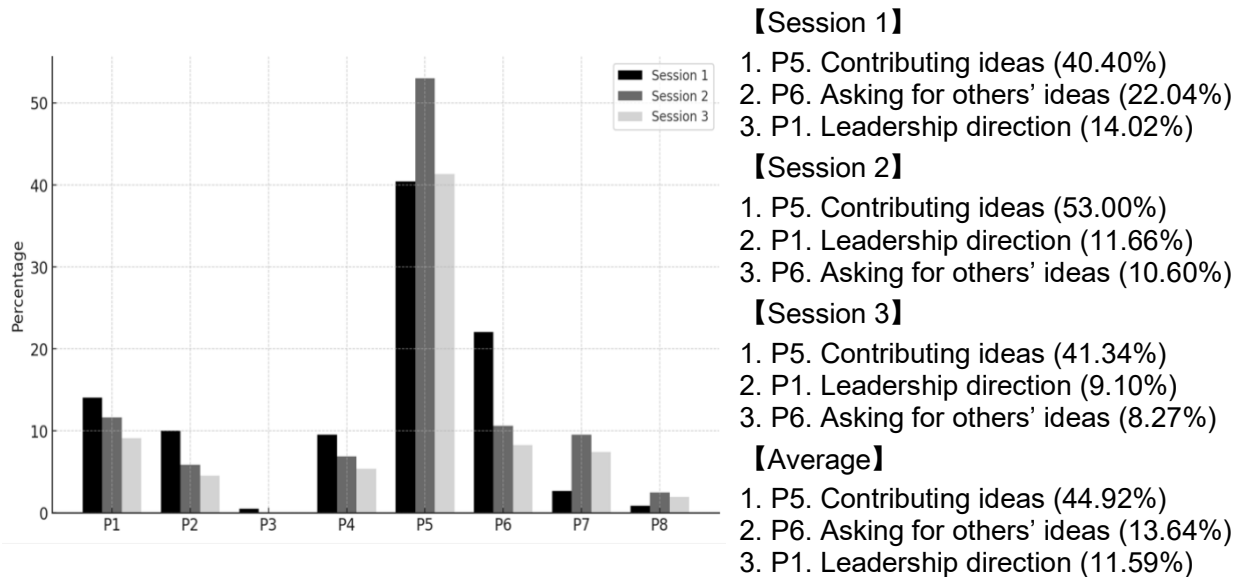
We subsequently analyzed positive GWD behaviors in the AL and EL groups for each session (Table 3). To describe the group profiles, we identified the three most frequent behaviors in each session (Figure 1). In the AL group, the same three behaviors consistently ranked highest across all sessions. The most frequent behaviors were P5 (contributing ideas), P6 (asking for others' ideas), and P1 (leadership direction), respectively. P1 (leadership direction) remained among the top three behaviors in every session (Session 1, 14.02%; Session 2, 11.66%; and Session 3, 9.10%), indicating that AL leaders regularly guided task progress and managed interactions.

**Table 3.** Positive GWD Behaviors per Session for AL and EL Groups (%)

AL group	P1	P2	P3	P4	P5	P6	P7	P8
Session 1	14.02	10.02	0.50	9.52	40.40	22.04	2.67	0.83
Session 2	11.66	5.83	0.00	6.89	53.00	10.60	9.54	2.47
Session 3	9.10	4.55	0.00	5.37	41.34	8.27	7.44	1.93
Average	11.59	6.80	0.17	7.26	44.92	13.64	6.55	1.74
EL group	P1	P2	P3	P4	P5	P6	P7	P8
Session 1	3.50	4.67	0.00	7.00	52.92	24.90	5.06	1.95
Session 2	8.37	3.59	1.20	7.17	65.34	5.58	7.17	1.59
Session 3	5.03	7.54	0.84	24.30	41.90	14.53	2.51	3.35
Average	5.63	5.27	0.68	12.83	53.39	15.00	4.91	2.30

*Note.* P1 – leadership direction; P2 – positive remarks; P3 – jokes; P4 – providing help; P5 – contributing ideas; P6 – asking for others' ideas; P7 – asking for clarification; P8 – asking for help.

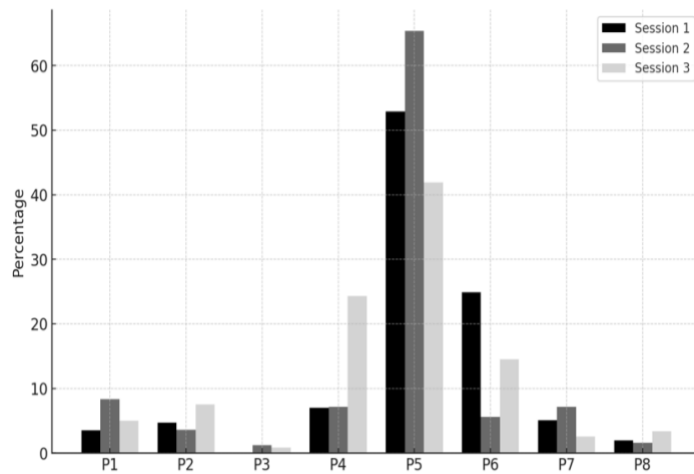
**Figure 1.** Percentages of Positive GWD Behaviors and Most Frequent Behaviors per Session for AL Groups



*Note.* P1 – leadership direction; P2 – positive remarks; P3 – jokes; P4 – providing help; P5 – contributing ideas; P6 – asking for others’ ideas; P7 – asking for clarification; P8 – asking for help

The EL group exhibited more varied behavioral patterns (Figure 2). Similar to the AL group, P5 (contributing ideas) consistently accounted for the largest proportion across all sessions (mean = 53.39%). In contrast, other behaviors showed notable differences in frequency. In Session 1, P6 (asking for others’ ideas) and P7 (asking for clarification) stood out as frequent behaviors. In Session 2, P1 (leadership direction), P4 (providing help), and P7 (asking for clarification) emerged as salient behaviors. In Session 3, P4 (providing help) and P6 (asking for others’ ideas) became more prominent, indicating that dominant behaviors shifted from session to session. These results suggest that whereas the AL group developed a stable, task-oriented behavioral pattern under assigned leadership, the EL group, though consistently centered on P5 (contributing ideas), showed more fluid patterns. This fluctuation may be attributable to less consistent leadership across sessions.

**Figure 2.** Percentages of Positive GWD Behaviors and Most Frequent Behaviors per Session for EL Groups



**【Session 1】**

1. P5. Contributing ideas (52.92%)
2. P6. Asking for others' ideas (24.90%)
3. P7. Asking for clarification (14.02%)

**【Session 2】**

1. P5. Contributing ideas (65.34%)
2. P1. Leadership direction (8.37%)
3. P4. Providing help (7.17%)
3. P7. Asking for clarification (7.17%)

**【Session 3】**

1. P5. Contributing ideas (41.90%)
2. P4. Providing help (24.30%)
3. P6. Asking for others' ideas (14.53%)

**【Average】**

1. P5. Contributing ideas (53.39%)
2. P6. Asking for others' ideas (15.00%)
3. P4. Providing help (12.83%)

*Note.* P1 – leadership direction; P2 – positive remarks; P3 – jokes; P4 – providing help; P5 – contributing ideas; P6 – asking for others' ideas; P7 – asking for clarification; P8 – asking for help

From a CDST perspective, these contrasting patterns reflect different system trajectories shaped by initial conditions (de Bot et al., 2007; Larsen-Freeman & Cameron, 2008). The AL groups, anchored by pre-assigned leaders, quickly settled into a stable attractor state, characterized by consistent leadership direction and balanced member contributions across sessions. This initial structural intervention functioned as a control parameter (Hiver, 2014), guiding the system toward early coherent and cooperative group dynamics. In contrast, leadership instability in the EL groups represented a transitional phase before settling into a stable attractor state. Without a clear organizing force, such as established leadership, group dynamics remained fluid and nonlinear, as seen in the EL groups where dominant behaviors shifted across sessions (e.g., Session 1: P6, Session 2: P1, Session 3: P4). These patterns align with CDST's assertion that dynamic systems often undergo periods of increased variability before converging to relatively stable interaction configurations (Verspoor et al., 2008). For the EL groups, this initial instability reflects a formative adaptation phase in which repeated social interactions gradually fostered stability.

### Impact of Group Dynamic Changes on Learner Engagement (RQ2)

To investigate how fluctuations in group dynamics influenced engagement over time, TEQ scores were analyzed in relation to GWD changes. Table 4 presents the mean overall engagement scores of the AL and EL groups across sessions. A Mann–Whitney  $U$  test compared engagement levels between the AL and EL groups in each session. The results showed that the AL group ( $n = 16$ ) scored significantly higher than the EL group ( $n = 15$ ) in Session 1 ( $U = 68.50$ ,  $p = .04$ ,  $r = .37$ ). This suggests that having a clearly assigned leader at the outset may have contributed to more stable group processes and greater task involvement early on. In contrast, no significant between-group differences were observed in Sessions 2 and 3. This indicates that although engagement was initially lower in the EL group, it improved over time and reached a level comparable to that of the AL group. This nonlinear pattern was evident in the engagement data: the EL group showed low engagement in Session 1, a sharp increase in Session 2, and stabilization in Session 3, whereas the AL group maintained consistently high levels.

In addition, Table 5 presents descriptive statistics and reliability coefficients (Cronbach's  $\alpha$ ) for each engagement dimension (behavioral, emotional, cognitive, and social), enabling comparisons across groups. Behavioral and social engagement remained consistently high, suggesting learners generally maintained active participation and collaboration. Emotional and cognitive engagement showed greater variability. Emotional engagement was initially higher in the AL groups (Session 1:  $M = 3.94$ ,  $SD = 0.85$ ) than in the EL groups (Session 1:  $M = 3.33$ ,  $SD = 0.98$ ), likely reflecting the stabilizing effect of an assigned leader in fostering interest and enjoyment. EL groups appeared to require more time for such affective involvement to develop. In contrast, cognitive engagement fluctuated more across sessions (e.g., AL Session 1:  $M = 3.38$ ,  $SD = 0.72$ ; Session 2:  $M = 3.94$ ,  $SD = 0.44$ ), and internal consistency was low ( $\alpha = .53$ ), indicating that deeper mental effort was relatively unstable and sensitive to task demands and interactional patterns (Mitsugi et al., 2024; Sato et al., 2025).

**Table 4.** Mean Overall Engagement Scores of AL and EL Groups by Session

Engagement levels	Session 1	Session 2	Session 3
AL group	4.04	4.10	4.21
EL group	3.61	4.08	4.09

**Table 5.** Descriptive Statistics of Four Engagement Dimensions per Session by Leadership Style

Engagement Dimension	Session	AL			EL		
		Mean	SD	$\alpha$	Mean	SD	$\alpha$
Behavioral	Session 1	4.50	0.52	.79	4.00	0.53	.66
	Session 2	4.25	0.45		4.53	0.52	
	Session 3	4.56	0.63		4.60	0.63	
Emotional	Session 1	3.94	0.85	.85	3.33	0.98	.68
	Session 2	3.69	0.60		3.80	0.77	
	Session 3	4.00	0.89		3.87	0.74	
Cognitive	Session 1	3.38	0.72	.53	3.27	0.70	.83
	Session 2	3.94	0.44		3.45	0.74	
	Session 3	3.81	0.66		3.60	0.63	
Social	Session 1	4.38	0.62	.81	4.00	0.65	.81
	Session 2	4.44	0.51		4.53	0.64	
	Session 3	4.56	0.51		4.60	0.63	

Subsequently, changes in learner engagement and the interrelations among sessions were analyzed. Spearman's rank correlations were calculated to assess associations among engagement levels across sessions (Table 6). In the AL group, significant correlations were found between all session pairs (Session 1–2:  $\rho = .84$ , Session 2–3:  $\rho = .67$ , Session 1–3:  $\rho = .77$ ; all  $ps < .01$ ), indicating that learners in this group maintained relatively high and consistent engagement across sessions. However, for the EL group, a significant correlation was observed only between Sessions 2 and 3 ( $\rho = .81$ ,  $p < .01$ ), suggesting that although engagement was relatively modest in Session 1, it became more consistent over time through emergent leadership and increased collaboration.

For the EL group, we performed the Friedman test as an additional analysis to compare engagement levels across sessions, finding a statistically significant difference in engagement over time ( $\chi^2(2) = 9.92$ ,  $p = .01$ ). Wilcoxon signed-rank tests indicated a significant increase between Sessions 1 and 2 ( $Z = -2.94$ ,  $p = .01$ ,  $r = .76$ ),

but no significant difference between Sessions 2 and 3. These findings suggest that although engagement was initially low, a notable shift after Session 1 reflected the onset of group self-organization, leading to greater stability and higher engagement in later sessions.

**Table 6.** *Correlations of Engagement Level per Session by Leadership Style*

TEQ scores	Session 1	Session 2	Session 3
Session 1	—	.49	.33
Session 2	.84**	—	.81**
Session 3	.77**	.67**	—

*Note.* TEQ – Task Engagement Questionnaire; The results for the Assigned Leader group ( $n = 16$ ) are shown below the diagonal (shaded). The results for the Emergent Leader group ( $n = 15$ ) are shown above the diagonal; \*\* $p < .01$ .

These findings underscore the contrasting developmental patterns of engagement associated with different leadership styles. Assigned leadership appeared to foster early stability in interactions and engagement, likely due to the structural clarity early on. In contrast, emergent leadership required more time to develop but eventually supported similarly high levels of engagement through collaborative adaptation within groups. These trajectories highlight the influence of leadership style on engagement development, interpreted through the lens of CDST (Hiver et al., 2022; Larsen-Freeman & Cameron, 2008). In particular, the early stability observed in AL groups and the gradual consolidation seen in EL groups accord with evidence that leadership roles often remain with the same individual within a group over time, supporting sustained coordination and higher engagement (Leeming, 2019, 2024). Analysis of the AL groups revealed that GWD remained relatively stable across sessions, likely because of the presence of clearly assigned leaders from the outset. This structural intervention supported sustained and coordinated group activities from the beginning, contributing to consistently high engagement. From a CDST perspective, this pattern represents a system entering a positive attractor state early, with the assigned leader functioning as a control parameter that promotes stability in GWD and engagement

(de Bot et al., 2007). Once this attractor state is established, the group system exhibits path dependence and resilience, maintaining consistent engagement over time.

In contrast, the EL groups exhibited greater fluctuations in dynamics, with a notable decrease in Session 2, where engagement was lower than in the AL groups. These results suggest that the EL groups may have initially entered a less stable or negative attractor state, where the link between dynamics and engagement was not yet firmly established. Without a clear organizing agent, the EL groups initially lacked the internal alignment necessary to stabilize engagement and collaborative interaction. However, over time, the EL groups showed clear signs of self-organization, with GWD and engagement improving in later sessions. For example, in several groups, one member gradually assumed a guiding role by initiating discussions and encouraging contributions, which helped establish clearer interactional routines (see Appendix B). These scores indicate that emergent leaders either showed increased GLI ratings across sessions or maintained relatively stable levels. Although some fluctuations were observed, the overall pattern was for leadership impressions to consolidate through repeated collaboration. This supports the interpretation that emergent leadership was gradually strengthened as interaction unfolded, contributing to greater group stability. This developmental shift represents a phase shift in the system (Hiver et al., 2022). As emergent leadership behaviors took hold, the group system reorganized and moved toward a new, more stable attractor state, characterized by coordinated dynamics and elevated engagement.

These findings suggest that leadership style influences both the stability and trajectory of group dynamics and learner engagement in collaborative tasks. Assigned leadership provides an exogenous stabilizing force, enabling early coherence and sustained engagement. In contrast, emergent leadership reflects an endogenous process that, although slower, can yield productive engagement once sufficient interactive alignment is reached. These patterns not only validate CDST predictions regarding initial conditions, attractor states, and nonlinearity but also highlight the

importance of longitudinal, interaction-sensitive approaches to studying engagement in L2 learning environments.

### Mediating Role of Leadership Between Group Dynamics and Engagement (RQ3)

To further explore how leadership mediates the relationship between GWD and learner engagement, a qualitative analysis was conducted using two case examples: one from the AL condition and the other from the EL condition. As Table 7 shows, both focal groups demonstrated increased group work dynamics over the sessions. They were also the only groups within their respective conditions to exhibit consistent improvements in GWD scores. To gain a closer understanding of what occurred in each group, we examined individual members' GWD behaviors across sessions together with qualitative transcript data, tracing developmental changes in group dynamics and task engagement over time.

**Table 7.** Average GWD Scores for AL and EL Focal Groups Across Sessions

GWD scores	AL focal group	EL focal group
Session 1	132	38
Session 2	142	67
Session 3	189	87

*Note.* GWD – group work dynamics; AL – assigned leader; EL – emergent leader. GWD scores were calculated for each group by subtracting negative scores from positive scores.

#### AL focal group

The AL focal group consisted of four members: Haruki (the assigned leader), Sota, Yuna, and Mei (all pseudonyms). Table 8 summarizes their GWD behaviors across sessions.

**Table 8. Positive GWD Behaviors of the AL Focal Group Members Across Sessions**

Session 1	P1	P2	P3	P4	P5	P6	P7	P8	Total
Haruki (AL)	15	0	0	3	12	6	1	0	37
Sota	3	12	0	3	20	12	4	0	54
Yuna	3	3	0	0	12	4	0	2	24
Mei	6	0	0	3	14	2	0	0	25
Session 2	P1	P2	P3	P4	P5	P6	P7	P8	Total
Haruki (AL)	15	6	0	0	18	10	7	1	57
Sota	6	0	0	3	20	6	2	1	38
Yuna	3	3	0	0	22	6	2	0	36
Mei	0	0	0	3	14	2	1	1	21
Session 3	P1	P2	P3	P4	P5	P6	P7	P8	Total
Haruki (AL)	39	6	0	9	36	14	5	1	110
Sota	0	6	0	0	26	4	0	1	37
Yuna	3	0	0	6	26	2	2	1	40
Mei	0	3	0	3	2	2	0	0	10

Note. P1 – leadership direction; P2 – positive remarks; P3 – jokes; P4 – providing help; P5 – contributing ideas; P6 – asking for others' ideas; P7 – asking for clarification; P8 – asking for help

In Session 1, Haruki relied heavily on P1 (leadership direction), mainly giving simple task instructions (e.g., “Okay? Now, see section number two.”) with limited use of facilitative behaviors such as P4 (providing help) and P6 (asking for others' ideas). His leadership appeared formal and directive, with little evidence of group coordination. Only Sota actively contributed to P5 (contributing ideas), whereas Yuna and Mei remained passive, mostly offering acknowledgments. The interaction was fragmented, characterized by isolated contributions and limited collaboration. Sota's GWD score was more than double that of Yuna and Mei, indicating imbalances in behavior and engagement within the group. The group's overreliance on one member and lack of cohesion were evident in Excerpt 1:

**Excerpt 1**

Sota : Do you see this? Is it a family?

Mei : Maybe.

Sota : Maybe. Whatever, but there's four people eating lunch or dinner together, and...

Mei : Okay.

Sota : One mosquito or flying? They come from outside. That is section one.

Mei : Okay.

Haruki : That's all.

In

Session 2, Haruki's leadership became more facilitative, evidenced by his increased use of P2 (Positive remarks), P6 (Asking for others' ideas), and P7 (Asking for clarification). He combined task direction with efforts to elicit peer interaction, asking questions like "What do you think?" while encouraging collaborative idea generation. The frequency of P5 (Contributing ideas) increased among all members, and exchanges became more interactive and collaborative, in contrast to the one-sided nature of Session 1. Sota's contributions decreased, while Yuna and Mei became more engaged, suggesting a shift toward balanced participation. This emerging cooperation is illustrated in Excerpt 2:

**Excerpt 2**

*Haruki : But the other is not angry, looks like...*  
*Mei : He's smiling.*  
*Haruki : And the cameraman is surprised, and...*  
*Mei : Who's this?*  
*Haruki : Police? Policeman?*  
*Sota : Yeah, police. It might be police.*

By Session 3, Haruki showed a marked increase in P1 (leadership direction), setting the overall task direction while actively contributing through P5 (contributing ideas). His leadership evolved into a supportive, coordinating role in which he contributed ideas while affirming and developing others' contributions through P4 (providing help) and P6 (asking for others' ideas). Group discussions became smoother and more interconnected, with Sota and Yuna taking more active roles and Mei offering complementary support. Members' interactions became self-sustaining and distributed, reflecting a naturally emerging collaborative system. Leadership was no longer the sole driving force; instead, teamwork unfolded organically, as illustrated in Excerpts 3 and 4:

**Excerpt 3**

- Sota : *There's a family.*  
Haruki : *In the room? Okay.*  
Sota : *There's a family.*  
Haruki : *There's a family in the room. They try to reform the room. Okay?*  
Sota : *Yes. But we should use another word because reform is...*  
Haruki : *Japanese?*  
Sota : *Or that this was angry too much, so they cannot have black.*  
Haruki : *Okay.*  
Yuna : *So can we just say that they're trying to paint the room because, you know, other stuff?*  
Haruki : *So, they're trying to paint the room? Okay.*

**Excerpt 4**

- Yuna : *But this woman is somehow smiling.*  
Haruki : *Why?*  
Yuna : *Maybe she thought it was funny that they didn't know that they couldn't get out of room if they started painting from the door side.*  
Sota : *Or that she was angry too much, so they cannot have black.*  
Haruki : *Now let's write the sentence.*  
Sota : *Okay.*

Overall, members made mutual contributions rather than working in isolation. This shift marked a higher-quality engagement process characterized by constructive shared participation. Their supportive leadership and mutual responsiveness led to the co-development of group dynamics and engagement, which mutually reinforced each other and culminated in a self-organizing, autonomous team structure. Table 9 summarizes the changes in the AL focal group over the sessions. However, in Session 3, Mei's GWD scores declined considerably, suggesting that while the group-level pattern moved toward greater coordination, one member in particular experienced reduced participation. This may reflect social loafing in this four-member group, which tends to increase when group members are familiar with one another (Leeming, 2014). This coexistence of mutual contribution and individual under-participation reflects the CDST perspective that stability at the system level can accommodate variability and imbalance at the individual level (Larsen-Freeman & Cameron, 2008; Poupore, 2018).

**Table 9.** *Changes in Leadership, Group Dynamics, Engagement, and CDST Conditions Across Sessions in the AL Focal Group*

Category	Session 1	Session 2	Session 3
<b>Leadership Style</b>	Formal and directive, limited facilitation	More balanced, task direction and facilitation emerge	Supportive and coordinative, central but inclusive
<b>Group Dynamics</b>	Fragmented, one-sided, AL dominant	More interconnected, wider participation	Collaborative, natural coordination
<b>Engagement</b>	Uneven, AL highly active, others passive	Improved, more balanced participation	Stable, with minor shifts in participation
<b>CDST Conditions</b>	Initial attractor, structured but rigid	Transition, adaptive leadership, interactive gains	Stabilized attractor, self-organizing group system, with flexible individual adaptations

### *EL focal group*

The EL focal group consisted of three members: Hina (emergent leader), Riko, and Ami (all pseudonyms). Table 10 presents their GWD behaviors across sessions.

**Table 10.** *Positive GWD Behaviors of the EL Focal Group Members Across Sessions*

Session 1	P1	P2	P3	P4	P5	P6	P7	P8	Total
Hina (EL)	0	3	0	0	14	2	0	0	19
Riko	0	0	0	0	10	4	0	0	14
Ami	0	0	0	0	2	2	1	0	5
Session 2	P1	P2	P3	P4	P5	P6	P7	P8	Total
Hina (EL)	3	3	3	6	16	0	0	0	31
Riko	0	0	0	0	12	4	3	0	19
Ami	0	0	0	3	16	0	0	1	20
Session 3	P1	P2	P3	P4	P5	P6	P7	P8	Total
Hina (EL)	3	3	0	12	22	4	0	2	46
Riko	0	0	0	6	12	2	0	1	21
Ami	0	0	0	6	12	2	3	0	23

*Note.* P1 – leadership direction; P2 – positive remarks; P3 – jokes; P4 – providing help; P5 – contributing ideas; P6 – asking for others' ideas; P7 – asking for clarification; P8 – asking for help

In Session 1, Hina actively contributed through P5 (Contributing ideas); however, her input mainly reflected individually generated ideas, with little evidence of group coordination. Interactive behaviors, such as P6 (Asking for others' ideas), were rarely observed, and her leadership was not yet evident. Riko occasionally responded to Hina's statements, but rarely extended the dialogue, while Ami's involvement was

minimal. Overall, the interactions lacked cohesion, with contributions largely disconnected and imbalanced among members. This group did not demonstrate a collaborative construction of meaning, as Excerpt 5 illustrates:

**Excerpt 5**

- Riko : *She thought...*  
 Ami : *She...*  
 Riko : *Thought the...*  
 Hina : *The annoyed. Fly... a fly flying.*  
 Riko : *The family is looking at his move.*  
 Hina : *Fly is going to stop somewhere... something... around...like a dome? A dome?*  
 Ami : *Dome?*  
 Hina : *Dome.*  
 Riko : *He is hitting dome? Hitting the fly?*  
 Hina : *But a fly is not die, so he missed... missed it. And his father thought he uh... The son was kill it. And others clapping? He is successful.*

During Session 2, Hina continued to contribute actively but engaged more intentionally with others, prompting input and shared decision-making. This shift marked a transition toward more facilitative leadership. Group interactions became increasingly reciprocal, with Riko responding more constructively and Ami playing a visibly larger role. Ami's GWD score notably increased, reflecting improved engagement. These developments suggest that Hina's evolving leadership helped activate group dynamics, leading to greater collaboration and mutual involvement. All members contributed to building shared meanings, as shown in Excerpt 6:

**Excerpt 6**

- Hina : *Catch up with him, and passenger, audience, audience...*  
 Ami : *Laugh.*  
 Hina : *Laughing. Celebrate... not celebrate. Laughing.*  
 Riko : *Smiling.*  
 Hina : *Celebrate... not celebrate.*  
 Riko : *Laughing.*  
 Hina : *Laughing.*  
 Ami : *Audience looked at this situation. And they were laughing.*  
 Hina : *Laughing.*

By Session 3, Hina's leadership was supportive and well-coordinated. She continued to guide the task progression while increasingly providing help through P4

(providing help) and P6 (asking for others' ideas). Group interactions became more fluid, with members jointly constructing content and supporting each other's contributions. Riko and Ami were consistently involved, actively contributing ideas and support. The differences in engagement observed in earlier sessions narrowed, and all members played meaningful and active roles. The group operated collaboratively and self-directedly rather than relying completely on the leader. The co-development of leadership, group dynamics, and engagement culminated in a balanced, mutually supportive system. This change in leadership style is evident in Excerpt 7:

**Excerpt 7**

*Hina* : Ladder, like a bridge. He...lying?

*Riko* : Lying.

*Hina* : Okay, lying.

*Riko* : He was lying on the bridge like...

*Hina* : A board.

*Ami* : Between...

*Hina* : Between ladder...

*Ami* : Ladder.

Table 11 summarizes the changes in the EL focal group throughout the sessions. The EL focal group gradually shifted from fragmented individual contributions to more coordinated and collaborative interactions. As Hina's leadership evolved from task-focused input to a more supportive and facilitative style, other members became more engaged by contributing ideas, offering support, and responding to each other. This shift marked a qualitative improvement in engagement, characterized by shared responsibility and mutual involvement. The dynamic interplay between leadership, group interaction, and learner engagement reinforced these processes over time, ultimately resulting in a more cohesive and autonomous group structure. The qualitative analysis of the EL focal group further illustrates this process. Fragmented and unbalanced interactions in Session 1 gradually reorganized into more reciprocal exchanges in Session 2. By Session 3, these stabilized into coordinated collaboration. This trajectory reflects a process of self-organization, consistent with CDST principles, in which initially unstable group dynamics evolved into a more stable attractor state over time.

**Table 11.** *Summary of Changes in Leadership, Group Dynamics, Engagement, and CDST Conditions Across Sessions in the EL Focal Group*

Category	Session 1	Session 2	Session 3
<b>Leadership Style</b>	Unclear, individual initiative by EL	Transition to facilitative, starts guiding interaction	Supportive, co-constructive with peers
<b>Group Dynamics</b>	Disjointed, low mutual exchange	Increased mutual interaction, EL leads coordination	Flexible and supportive, active co-construction
<b>Engagement</b>	Low and fragmented	Noticeable improvement, one member becomes active	High mutual commitment, balanced contributions
<b>CDST Conditions</b>	Initial state, weak structure, individual efforts	Micro-level adaptation, signs of reorganization	New attractor, emergent leadership leads stable engagement

Collectively, the trajectories of both focal groups suggest that leadership in collaborative tasks operates as a flexible element within a dynamic system. The CDST framework explains these patterns, offering an insightful lens for interpreting the co-development of leadership, group dynamics, and engagement. Rather than functioning in a fixed role, leadership gradually evolved into an influence shaping group activities over time. In both AL and EL groups, shifts in leadership corresponded with changes in dynamics and engagement, illustrating the system's sensitivity to internal interactions. This interdependence was also observed in the AL group. Although pre-assigned, leadership was not merely procedural but gradually adapted to the group's interactional patterns. For example, in the AL focal group, the leader progressed from providing direct instructions to adopting a supportive, inclusive leadership style. This illustrates that even under assigned leadership conditions, adaptive change can occur, supporting CDST's assertion that stability and flexibility coexist (Hiver, 2014). The initial assignment may have functioned as an attractor, guiding early coordination, but the group also demonstrated self-organization as it adapted to emerging needs. These findings highlight leadership not as a fixed role but as a dynamic influence shaping the broader system of group collaboration.

In the EL group, leadership emerged gradually through reciprocal interactions rather than being established in a single moment. This developmental process aligns with the CDST's emphasis on self-organization, in which new roles and behavioral patterns

arise through sustained interaction rather than external imposition (Poupore, 2018). The leader's role evolved in response to group needs, contributing to a co-regulated and supportive environment. These observations illustrate that learning groups function as dynamic systems in which roles, behaviors, and engagement co-adapt over time in response to social and contextual conditions (Verspoor et al., 2008). Leadership in the EL group was not predetermined but shaped through ongoing exchanges and mutual influence, rather than being fixed from the outset. The leader's function emerged incrementally, reinforcing the view that leadership, group dynamics, and engagement are interconnected subsystems that evolve simultaneously. In this context, leadership acted not as a static mediating factor but as a responsive influence that adjusted to shifts in group dynamics while fostering engagement. The interactions among these subsystems highlight the system's capacity to self-organize and adapt to internal and external conditions, a key principle of CDST. Therefore, leadership in collaborative learning environments should be understood not as a prerequisite but as an emergent outcome shaped by the continuous interplay among group members.

## Conclusion

Guided by the principles of CDST, this study investigated how assigned and emergent leadership styles shaped group dynamics and learner engagement in L2 collaborative tasks over time. Through a mixed-methods longitudinal design, we explored how leadership mediated the co-development of interactional behavior and engagement in group work settings. Results revealed that an assigned leader acts as an immediate catalyst, moving the group into a stable task-focused "attractor" state from the outset. The AL group exhibited consistently high behavioral cohesion, positive group dynamics, and engagement throughout the sessions. Our observations further illustrate how AL leaders evolved from directive to facilitative and inclusive figures. These findings suggest that leadership in such contexts is adaptive and shaped by group development.

In contrast, groups without assigned leaders initially struggled to self-organize, exhibiting fragmented interactions and lower engagement in the early sessions. As emergent leadership began to take shape through iterative peer interactions, these groups gradually formed more cohesive dynamics and reached engagement levels comparable to the AL group in the final session. This delayed but positive trajectory highlights the adaptability of the system and the role of leadership in co-constructing learning within group processes. Such shifts align with CDST's notion of "phase shifts," where a group transitions from less favorable to more organized states as microlevel behaviors accumulate.

Taken together, the quantitative and qualitative data suggest that leadership, whether assigned or emergent, functions as a key attractor that stabilizes and enhances group collaboration. Leadership mediates the relationship between group dynamics and engagement by facilitating participation, maintaining focus, ensuring task progression, and promoting responsiveness. Notably, leadership behaviors are not fixed traits but evolve in response to group needs, echoing CDST's emphasis on adaptability and nonlinearity.

Our findings have important theoretical and pedagogical implications. While most previous CDST-based studies focused on individuals, the present study examined groups, demonstrating the framework's applicability to group-based research and its theoretical potential. In particular, the results illustrate that the CDST principle of stability–variability coexistence can be observed not only at the level of individual learners, as has often been emphasized in previous studies, but also at the level of small groups engaged in collaborative L2 tasks. This extension highlights the potential of CDST to account for group-level processes in addition to individual trajectories. Practical suggestions can also be proposed from a pedagogical perspective. The AL group was close to the attractor state from the start, whereas the EL group gradually self-organized over time. This suggests that effective group work involves two distinct routes: a top-down initiated order and a bottom-up evolving order. Thus, neither route is inherently superior. The ideal approach is to balance both routes, either

simultaneously or as appropriate to the situation. This could manifest as assigning a leader, but allowing the leader's role to evolve alongside the situation. Specifically, when group tasks are set with the same members for each class, a spontaneous system is likely to form, whereas when members change frequently, some structural support, such as assigning leaders and clarifying roles from the outset, might be desirable.

This study has several limitations. First, the group tasks were uniform in structure and modality, which may have constrained the range of leadership behaviors observed. Different leadership styles might be needed depending on task type. Second, we could not capture how leaders and members themselves perceived changes in leadership, group dynamics, and engagement. Future work should include varied task types, broader participant samples, and longer observations to explore these processes more fully. Third, negative group dynamics were observed in both AL and EL groups, but their low frequency prevented systematic analysis. Even rare incidents may strongly affect group climate, so future research should investigate them more closely. Fourth, we used Session 1 collaborative writing outcomes as a proxy for initial proficiency. Because such performance also reflects group processes, it cannot fully represent individual proficiency. More direct measures of speaking and writing (e.g., standardized tests) are needed to separate proficiency effects from interactional influences. Finally, the reliability of the TEQ presents a limitation. While overall internal consistency was acceptable, the cognitive engagement subscale for the AL group showed a relatively low  $\alpha$  value, likely due to the small number of items and limited variability. Findings from this subscale should be interpreted with caution. Nevertheless, the multidimensional approach still provides a more nuanced view of engagement than reliance on total scores alone.

Overall, this study emphasizes the importance of leadership, group dynamics, and engagement not as isolated factors but as interdependent components of a dynamic system. By situating these elements within the CDST framework, we contribute to a deeper understanding of how collaborative language learning unfolds over time.

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## Authors' Contributions

MM, TH, and MY participated in the design of the study, and MM and MY completed the data collection. MM, TH, and MY worked on data analysis, and were involved in the writing of the manuscript. MM, TH, and MY drafted the manuscript and participated in the interpretation of the results. All authors read and approved the final manuscript.

## Ethics Approval & Consent to Participate

Institutional ethics approval was not obtained for this classroom-based study. All participants provided written informed consent prior to enrollment and data collection in the study.

## Declaration of GenAI and AI-Assisted Technologies

The authors confirm that generative AI or AI-assisted technologies were not used for the research design, data analysis, interpretation, or the creation of original text. AI-assisted tools were employed solely to refine English expressions and clarify theoretical explanations, including suggesting alternative phrasings and improving clarity. The authors reviewed and edited the manuscript and take full responsibility for the final content.

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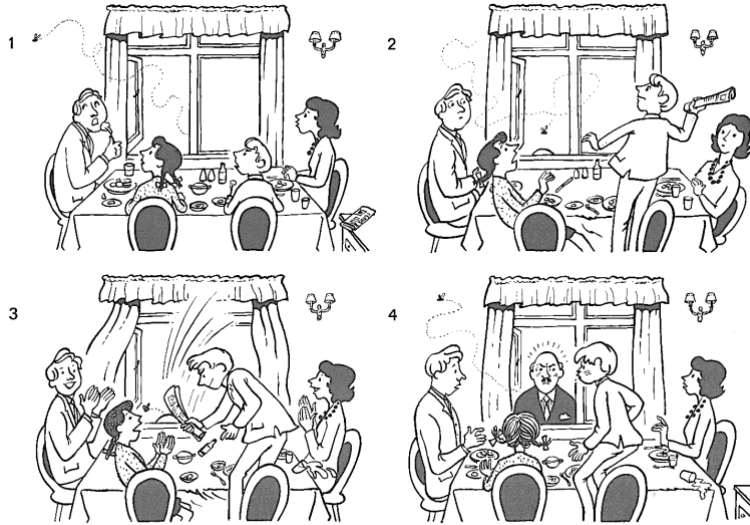
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## APPENDICES

### APPENDIX A. Sequenced Pictures Used in Each Session (Heaton, 1975)

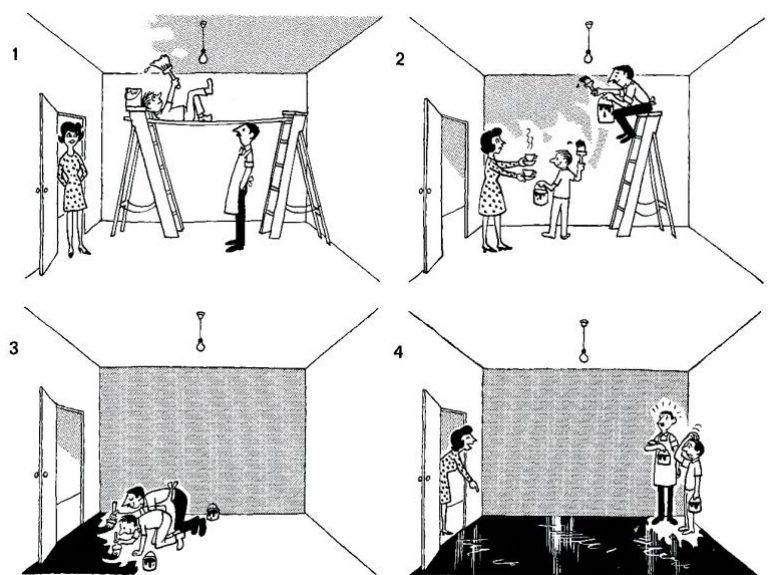
#### Session 1



#### Session 2



### Session 3



### APPENDIX B. GLI Scores of Emergent Group Members Across Sessions

EL group	Student No.	Session 1	Session 2	Session 3	Total
1	1	28	30	32	90
	2	35	38	40	113
	3	37	35	37	109
2	4	30	39	34	103
	5	30	32	38	100
	6	30	34	33	97
3	7	24	37	39	100
	8	38	40	40	118
	9	28	37	31	96
4	10	35	33	33	101
	11	36	36	38	110
	12	30	33	33	96
5	13	34	35	31	100
	14	38	37	39	114
	15	33	33	30	96

*Note.* The shaded cells indicate the Emergent Leader.