Research Article

Motivational Change in EFL Students before and after Entering College: A Complex Dynamic Systems Perspective

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Abstract

Objective: Motivation is not a stable individual difference variable; it changes over time and space. This study investigated changes in motivation among four college students studying English as a Foreign Language (EFL) from a complex dynamic systems (CDS) perspective. It examined how internal factors, immediate learning contexts, and socio-cultural and familial influences impact students' motivation.

Methods: Motivation evolution was assessed through semi-structured interviews, classroom observations, and document analysis. Biweekly interviews were recorded, transcribed, and confirmed by participants. Classroom engagement was compared with interview statements. Additional data included learning journals and exam scores. Hermeneutic and textual data analysis were used to identify keywords and themes, and to assess the impact of factors before and after the university entrance exam.

Results: Learners' motivational paths exhibited significant diversity and context dependence, especially in the absence of strong attractors. These changes were influenced by the interplay between internal factors and immediate learning contexts. Socio-cultural and familial factors also significantly impacted students' motivation at different stages of their learning journey. This study underscores the critical role of the Chinese Imperative, a cultural phenomenon that profoundly affects L2 motivation both explicitly and implicitly. It shapes learners' motivation and drives towards mastering English, evident in both overt demands and subtle influences on their outlook and commitment to language learning endeavors.

Conclusion: This diversity in motivation was attributed to various personal, socio-cultural, and contextual factors that influenced each learner differently. In particular, the Chinese Imperative was

found to exert a salient impact. Based on these findings, the study offered suggestions for pedagogical practices aimed at nurturing and sustaining learner motivation, emphasizing the need for tailored approaches that consider these factors.

1 INTRODUCTION

Mastering a foreign language requires significant effort, and motivation is crucial for learner behavior, duration, and goal achievement[1,2]. However, motivation is not a stable individual difference factor and remains an elusive construct in research on second language acquisition[3]. An empirical paradigm referred to as the dynamic turn[4,5] attempts to capture the essence of motivation and has been attracting more attention, as well as spurring acknowledgment of how well complex dynamic systems (CDS) explains a variety of perplexing phenomena[6]. CDS contributes to the understanding of language acquisition, development[7-9] and variability[10,11]. CDS theory provides insight into the language acquisition process by acknowledging each learner's unique developmental trajectory[11]. Its objective is to explain how the interactions among the components of a complex system lead to the emergence of collective behavior, and how the system as a whole engages with its environment[12].

In Taiwan Region, English education is aligned with the Bilingual Nation 2030 policy, encompassing all educational levels from elementary to higher education. This policy ultimately aims to enhance young adults' English proficiency, stimulate economic growth, and bolster international competitiveness by fostering a bilingual environment through the incorporation of English as a medium of instruction in schools. Proficiency exams such as the Test of English for International Communication (TOEIC) and the General English Proficiency Test are employed to assess academic achievement and are crucial for job prospects. The emphasis on English achievement is particularly pertinent in Taiwan Region's competitive English as a Foreign Language (EFL) context, where the Chinese Imperative[13] plays a significant role. This culturally specific motivator underscores the importance of meeting societal, familial, or teacher expectations for EFL learners. High-stakes exams in Taiwan Region, including the General Scholastic Achievement Tests (GSAT) and the university entrance exam, represent "Dragon Gates"[14] that students must pass to advance in their education and careers. These exams have profound societal implications, shaping educational trajectories and future prospects. Success in these exams influences child-rearing philosophies and is correlated with social status, highlighting the enduring impact of the Chinese Imperative on motivation and learning behaviors[13].

This study explored the motivation dynamics of four college students in Taiwan Region as they transitioned from Grade 12 to their first semester in college. The transition is a critical period for understanding and sustaining student motivation. While high school students often strive to learn English to meet college admission requirements, their motivation may undergo significant changes due to the sudden absence of these requirements. However, in-depth research is limited on how the presence or absence of specific influential factors impacts English language learning motivation in distinct contexts. Understanding the evolution of English language motivation during this critical phase is crucial. Teachers can implement strategies fostering a supportive environment, emphasizing English skills' relevance, and providing ongoing feedback. These efforts can sustain language motivation, enhance engagement, and boost academic success in higher education. To bridge this gap, this study investigates the evolution of these students' motivation over time, considering both internal and external factors through a CDS perspective using a qualitative approach. This study is grounded in the CDS framework and employs Dörnyei's[15] retrodictive qualitative modeling (RQM) as its primary theoretical framework. The main objectives are:

(1) To examine how dominant factors such as the GSAT impact the engagement and goals of learners with different motivational configurations during the transition period from high school to college.

(2) To understand how the absence of original dominant factors, alongside other variables, affects their overall motivation for learning English after graduating from high school through the first semester of college.

The CDS framework provides a robust structure for understanding how internal and external influences interact dynamically to affect L2 motivation over time. RQM models students' motivational learning paths based on their retrospective accounts, offering a comprehensive view of

how motivation evolves and interacts in real-world settings. This theoretical foundation ensures that the problem statement is deeply rooted in established research, providing a clear and structured approach to the investigation. By focusing on this localized context, the study allows for a deeper understanding of how specific educational policies and cultural factors influence L2 motivation, contributing to the global discourse on L2 learning. This contribution highlights the importance of considering both internal and external factors in a holistic and integrated manner, supporting the development of more effective and contextually relevant motivational strategies.

2 LITERATURE REVIEW
2.1 L2 Motivation as A Complex Dynamic System

Complex systems are dynamic networks of interconnected subsystems that continuously interact and evolve over time[16,17]. Human behavior arises from these intricate interactions; actions can rarely be fully explained by cause-and-effect relationships alone[18,5]. Change, and the emergence of new factors and relationships, are central to understanding CDS (Larsen-Freeman, 2014)[19]. This perspective is particularly relevant to language learning, as learners are constantly exposed to and influenced by various factors within their sociocultural milieu. Studies have explored language development within CDS, such as listening[20], L2 lexical use[21], and writing[11]. CDS offers a comprehensive framework to identify and trace the attributes that substantially influence language learning outcomes[22,5].

Feedback in CDS involves adjustments and corrections, driving state changes and self-organization[23]. Learners' states can stabilize over time through feedback[24]. Self-organization, the emergence of order from system interactions, occurs naturally without external guidance[19,25]. Interconnected systems influence each other through co-adaptation[12,8]. Self-organization and emergence explain phase shifts in systems, leading to significant transformations[12]. Interactions between learners' states and learning contexts are complex, dynamic, and interdependent in the learner-context ecosystem[26,27].

Key aspects of changes in learner motivation from the CDS perspective are attractor and repeller states. These states represent stable and unstable phases, respectively, within the system's evolution[23]. Attractor states are outcomes towards which the system gravitates, formed through collective principles, while repeller states indicate a system in transition between attractor states[16,28]. Subsystems within the system mutually evolve, causing unexpected outcomes to emerge from complex interactions[12]. If the system reaches a critical state, all nested levels may become chaotic and unpredictable[19]. The open nature of complex systems exposes them to perturbations or disturbing forces[23]. Perturbations, or external disturbances, can lead to changes in states, often

disproportionate to their causes—Highlighting how minor influences can drive significant developments[12]. Although motivation is not stable, it is not necessarily always in flux. Researchers argue that if an attractor state is strong, the system will be in a state of balance or equilibrium[15,23,29]. Though non-permanent, a steady equilibrium will last indefinitely until the presence of another perturbation jolts the attractor out of the current state and into the next successive state. Larsen-Freeman[30,8] concluded that state change is an iterative process that, through interaction, tends toward stabilization via adaptation to the changing environment.

Several studies have shed light on the dynamic nature of language learning from the perspective of complex systems. MacIntyre and Serroul[31] conducted research on the motivation trajectory of 12 Canadian undergraduate students, examining the per-second fluctuations in learners' motivation during communication tasks. Their findings indicated that learners' motivation can vary from one moment to another due to various influencing factors. Zheng[21] found diverging paths in English lexical development among university students over ten months, supporting CDS as an effective framework for understanding long-term linguistic development. Similarly, Chang and Zhang[20] explored the listening development of three university EFL learners, finding varying levels of stability and unexpected patterns in learning trajectories due to inter-individual and intra-individual variability. These studies collectively underscore the complexity and variability in language learning, demonstrating the utility of CDS in understanding linguistic development dynamics.

The significance of contextual variables in explaining individual motivation has been emphasized in several studies[32-35]. From a CDS perspective, learners are dynamic subsystems within a social system, interacting with various dynamic systems[16]. These interactions continuously influence and transform the learner's state while maintaining connections to the broader social system[5]. Contextual factors are thus integrated into the dynamics of the entire system. Even stable subsystems remain dynamic, constantly adapting to contextual changes, which can also induce internal transformations[12].

The studies reviewed were conducted in a variety of sociocultural contexts and disciplines. Their converging results strongly endorse CDS for explaining long-term development, influenced by multiple internal and external factors, in individual learners. Despite the valuable contributions CDS offers for studying complex and dynamic language learning processes, there have been calls for enhancing methodological rigor to ensure the validity and reliability of related research findings[33,28]. A primary challenge in CDS research is study design limitations. Many studies rely on data or analyses that

are not well-suited for investigating the dynamic nature of change and development. Hiver et al.[36] noted that using static data to study evolving phenomena can lead to incomplete or misleading conclusions. Additionally, analyses that do not account for contextual connections may fail to capture the full complexity of the systems under study. To address these challenges, Al-Hoorie et al.[37] propose adopting a comprehensive substantiation framework called substantiation research to enhance result interpretability. This framework involves repeating experiments (traditional replication), expanding the scope (extension), replicating different aspects of the study to confirm results (reproduction), and exploring new ideas and possibilities to discover additional insights (exploration). These approaches collectively enhance the validation of research findings within complexity theory. Moreover, the proposed framework emphasizes the need for methodological diversity and adaptive strategies to capture the multifaceted interactions within CDS. This critical perspective underscores the importance of moving beyond simplistic replication models and toward more sophisticated approaches that reflect the complexity of real-world educational and social systems.

In summary, the CDS framework enables the simultaneous consideration of continuous multifaceted interactions between environmental and learner factors, along with the resultant evolving changes in both the learner and the environment Dörnyei[38]. Through the analysis of system activity traces, we are able to reconstruct historical learner motivation processes, thereby gaining a deeper understanding of the complex interplay between learners and their environments. This, in turn, enhances our grasp of how individuals' motivation changes over time within varied educational and social contexts.

3 METHODOLOGY
3.1 RQM

CDS researchers conducting empirical research face significant methodological challenges[39,36,40]. Dörnyei and Ushioda[33] recommended a qualitative approach to uncover the complex interactions of social, cultural, and psychological factors that influence learners. Chan et al.[39] investigated the signature dynamics of a language learner in Hong Kong and verified his dynamic motivational trajectory by drawing on the RQM method proposed by Dörnyei[15]. Wang[41] also employed RQM in looking into the language motivation of five Chinese students in a one-year academic exchange program and found that the study abroad students majoring in Bulgarian experienced fluctuating motivation. These examples demonstrate RQM's validity in tracing complex developmental processes over time. Additional studies (e.g. Dörnyei et al., 2014; Muir, 2019)[6,42] argue that motivation is context-dependent and temporal, requiring detailed analyses to understand unique motivational trajectories. Therefore, this study employed RQM, a

method that initially analyzes the outcomes or end-states and subsequently traces the developmental trajectories that culminate in these results[15].

3.2 Context

The participants were interviewed and observed in two settings—Grade 12 of high school and their first semester of college. On the hard road to university admission the most critical checkpoint is the GSAT held in late January, about half-way through Grade 12; for students not satisfied with their GSAT score, the Advanced Subjects Test takes place six months later. Grade 12 students, therefore, typically lead a tightly scheduled life under the constant pressure of exams, let alone the expectations laid on them by society and family.

Under these circumstances, it is not difficult to imagine the relief students feel when all the tests are over and admission to a university they had hoped for is granted. At this stage, proficiency exams are still part of their college life. First, students are required to pass the Freshman English for Non-English Majors (FENM) requirement. Then, as graduation approaches, gaining high scores on other proficiency exams, such as the TOEIC is important for students wishing to pursue further studies or to enter the job market. However, perspectives change in the university environment, where students can envision a future where English serves as a medium for meaningful communication.

3.3 Participants

The study ultimately enrolled four participants—Two male and two female students. The demographic information of the participants is presented in Table 1. These students were evenly distributed across two FENM classes, each comprised of approximately fifty students from different departments. The decision to select participants from non-English majors stemmed from our anticipation of uncovering greater motivational diversity. The recruitment process ensured voluntary participation. Ethical guidelines were strictly followed, guaranteeing participant anonymity and the right to withdraw at any time.

To establish a solid foundation for this retrospective study, the researchers selected GSAT, which is a primary and pivotal milestone on the road to college admission. At this critical phase, there is generally robust and consistent language learning motivation among students. Consequently, the GSAT was deemed suitable as a baseline measure due to its widespread impact on high school students in Taiwan Region. Through data collection during this stable period and subsequent observations of the ensuing perturbations, the researchers aimed to document shifts in students' language motivation and discern patterns within their motivational paths.

3.4 Data Collection and Analysis

To thoroughly evaluate the evolution of participants'

Table 1. Participants' Demographic Information

Participants	Pseudonyms	Age	Gender	Major
1	Wen-Ming	19	Male	Department of Mechanical Engineering
2	Chung-Han	18	Male	Department of Mechanical Engineering
3	Jing-Jing	18	Female	Department of Forestry
4	Meng-Ru	18	Female	Department of Forestry

English motivation, diverse data collection techniques were utilized, including face-to-face semi-structured interviews, classroom observations, and analysis of artifacts like participants' notes. Interviews served as a primary source of information for this assessment. Utilizing various techniques enhanced the validity of the study, as suggested by Creswell & Creswell[43], and facilitated a thorough exploration of participants' motivation. Semi-structured individual and group interviews were conducted at regular intervals of approximately one to two weeks to obtain the participants' reflections. A range of questions addressing their English study experiences and motivation for learning was prepared. All interviews were meticulously transcribed and provided to participants for validation. Insights into the participants' motivational dynamics were developed by comparing their engagement in activities during classroom observations with their interview statements. Additionally, documents such as learning journals, notes, and exam scores were scrutinized to supplement an understanding of motivational shifts from GSAT-takers to Freshman English-learners.

To enhance validity, we employed the hermeneutic approach[44] alongside techniques of textual data analysis[45,46]. The data analysis processed in two stages. Initially, we scrutinized audio files and transcripts to identify keywords, essential points, and significant events. Subsequently, themes were systematically coded to evaluate factors influencing language learning motivation, aiming to capture participants' perspectives and the evolution of their L2 motivation. In the second stage, we analyzed content to discern the impact of specific factors pre and post-GSAT, categorizing relevant sections into distinct groups and examining their interactions. Emphasis was placed on the second stage to gain an in-depth understanding of L2 motivation dynamics. Our goal was to identify and explore causes of events or perturbations, shifts between states, features of emergence, and subsequent changes in motivation, guided in part by Hiver's[47] outline of system dynamics or signature dynamics, which emphasizes the robust causal mechanisms within a system arising from the interactions among its components or parameters.

4 RESULTS

This section examines and discusses the learning motivation demonstrated by participants from Grade 12 through their initial semester at university. Figures are used to illustrate the motivational dynamics of English learning for each participant at various stages, aiming to capture the complex nature of their motivational changes. Extracts from interviews are included to further elucidate the participants' motivational evolution.

### 4.1 Analysis of Wen-Ming's Motivational Evolution

When asked about English learning motivation as a high schooler, Wen-Ming explained the additional benefits of studying for the GSAT beyond securing university admission.

Extract 1. "*For me, there were two good reasons to study English. Surely, the most important reason was the GSAT because it is related to my future career. But, on the contrary, I could also learn to better communicate with native speakers in the future from the exam.*"

Wen-Ming's motivation for learning English extended beyond solely achieving high scores on the GSAT, although the GSAT was his primary driving force. To enhance his performance, he actively sought supplementary options, such as attending a test prep center on weekends. However, during this period, his objective of communicating accurately with native speakers remained secondary to his main goal. Although Wen-Ming perceived his English studies as a way to address both objectives, his prioritization also meant that the GSAT requirements imposed limitations on his inclination to develop his speaking proficiency, as speaking skills are not evaluated on the examination. Additionally, Wen-Ming emphasized the pivotal role teachers played in his English learning journey:

Extract 2. "*I had two English teachers in my high school days. My first English teacher seemed to be inexperienced in teaching. So, even though I liked English, I did not know whom to ask for help, and my grades suffered. Then, in Grade 11, we had this experienced and hard-working teacher who always encouraged us, even when we did poorly. Her attitude inspired me, and I started asking her grammar questions.*"

In contemporary L2 classrooms, teachers are expected to fulfill multiple roles, as facilitators, monitors, and counselors. As a symbol of authority, particularly in Taiwan Region, providing correct answers to questions, managing the class, and giving instruction learning content are only part of the daily teaching routine. Teachers' responsibilities extend beyond academics to include attending to students' physical and psychological well-being. As shown in Figure 1, the multifaceted role of teachers significantly influences
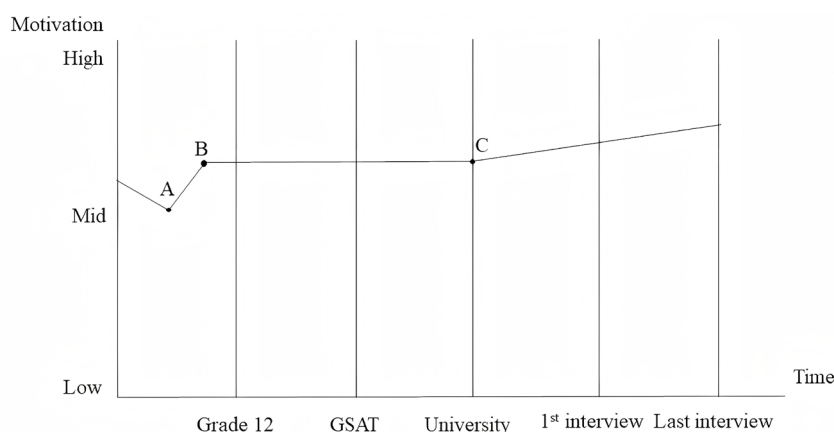
Note. A: First English teacher
B: Second English teacher
C: Personal development with English

Figure 1. Wen-Ming's motivational changes from Grade 12 to the first semester of university.

students' learning experiences[33,48,49] and motivation of young adults[50].

Wen-Ming quickly adapted to college life and its academic demands, including the FENM course pressures. His motivation for learning English shifted towards a more experiential and personalized approach, aligning with broader trends among college students' language learning motivation in Taiwan Region. This shift reflects a deeper engagement with English as a tool for personal and academic growth rather than merely a requirement.

Extract 3. "*For me, the main purpose in learning English is for sightseeing. My whole family has always enjoyed travelling very much, but my parents cannot speak English at all. I often end up being the translator when travelling with them. I know I still need to improve my English, but I do not mind my low scores anyway.*"

Notably lacking in the data on Wen-Ming is a desire to achieve high scores on any college English proficiency exams. His motivation had changed to a state where individualized goals were in operation.

A factor that initially had only partial influence became prominent once the GSAT was completed. Extract 1 provides evidence of the presence of Wen-Ming's nascent goal of using English for real-life communication, while Extract 3 confirms his sustained commitment to this goal over time. The GSAT was perceived as a stepping stone toward a greater purpose. The data also suggests the involvement of a subsystem, specifically the family context, which played a significant role in shaping this evolving path. This finding resonates with the research conducted by Papi and Hiver[35] and Liu[51], which highlights the influential role of family members on participants' L2 motivation. Wen-Ming's parents' affinity for travel appears to have positively influenced his attitude toward English, despite

any unsatisfactory grades he may have received. Moreover, Wen-Ming mentioned that his parents maintain an open-minded perspective on his academic performance as long as he demonstrates effort, which helps explain his relatively stable motivation. Wen-Ming's goal of effective English communication now anchors his ongoing motivation, reflecting a positive integration into the L2 community, a crucial component of integrative motivation[52,53]. This shift was notable when Wen-Ming began exploring English-language biological journals during leisure time at university, a behavior that was constrained during GSAT preparation. These qualitative changes signify a deepening of his motivational orientation and adaptive behaviors in English learning.

4.2 Analysis of Chung-Han's Motivational Evolution

Chung-Han quickly adapted to high school, demonstrating effective self-organization. His language learning motivation remained stable, reflecting an ability to engage with new academic challenges efficiently. This stability aligns with broader research indicating that successful adaptation and self-regulation are critical for maintaining motivation in new educational settings.

Extract 4. "*To improve my English scores, I went to a test prep center twice a week after school. Sometimes, I had exams at school and the center in the same week. Of course, it was exhausting. I had to do it this way to achieve my dream.*"

As expressed in the excerpt above, Chung-Han's motivation during his high school years was primarily fueled by an unwavering desire to achieve good grades. Consequently, he prioritized attending the test preparation center over regular high school English classes. There, he found key learning points, test-wise strategies, and mock exams more effective for familiarizing himself with the test items on the GSAT. Chung-Han demonstrated remarkable
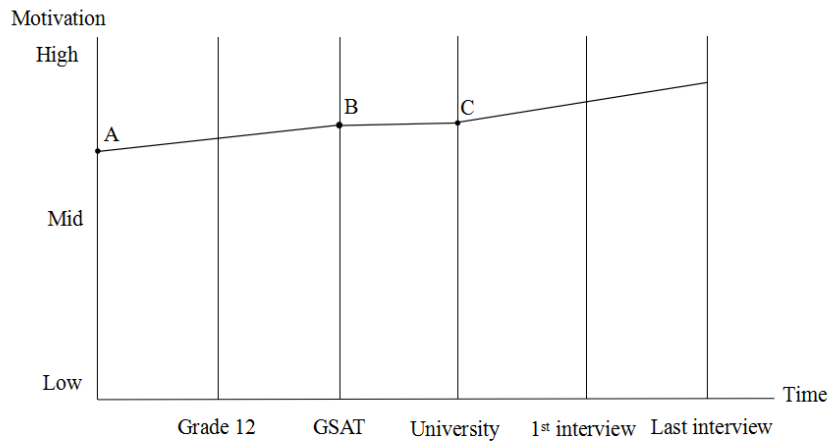
Note. A: Determination to study abroad
B: Goal-oriented English learning
C: Utilize English for personal and professional growth

Figure 2. Chung-Han's motivational changes from Grade 12 to the first semester of university.

resilience and stability in meeting the challenges of a heavy study load and long hours of test preparation. His ability to persist through the pressures of both school and the test prep center highlights his strong determination. Hence, Chung-Han's high school experience was characterized by considerable stress; however, it was underpinned by a stable motivational drive, primarily influenced by the critical importance of the GSAT examination for his future aspirations.

Chung-Han's motivation to learn English was mainly fueled by his future-oriented goals. Starting from the 9th grade, his aspirations of pursuing a career overseas began to take shape. Similar to Wen-Ming, Chung-Han recognized the importance of diligent preparation for the GSAT, not just for entering university but also as a stepping stone towards the fulfillment of more profound and meaningful long-term aspirations.

Extract 5. "*While preparing for the GSAT, my desire to study abroad grew stronger. Scoring high on the exam was vital, but attending a cram school was just a step. Entering university was a significant challenge, yet not my ultimate goal. Now, I am immersing myself in English magazines and NBA games to enhance my language skills in my free time.*"

Chung-Han's approach to achieving his goals was strategic and adaptable, reflecting a conscious effort to break down his primary objective into manageable sub-goals. This systematic approach allowed him to avoid physical and mental exhaustion, demonstrating his resilience in pursuing each goal to progress towards broader aspirations. This method echoes Miller and Brickman[54], who highlight the efficacy of future-oriented motivation in enabling individuals to monitor their progress and make necessary adjustments in pursuit of their goals. After high school,

Chung-Han shifted from traditional learning methods, opting for alternative approaches to enhance his English proficiency by engaging with English media such as NBA games and magazines. This holistic approach not only enhances language skills but deepens understanding and application of English across diverse contexts. This shift suggests a change in his motivational attributes towards a more integrative mindset.

Although both Chung-Han and Wen-Ming demonstrated high English motivation, the extract provided by Chung-Han highlighted both differences and similarities in their profiles.

Extract 6. "*Till now, my final goal has been pretty specific. I have been dreaming of going abroad since my last year in junior high school. Now, I think I have to focus on the posttest first. Then, I will probably start to prepare for TOEIC next year.*"

Chung-Han's language learning journey parallels Wen-Ming's yet retains a distinct focus on instrumental motivation. Wen-Ming emphasizes authentic language use, and Chung-Han consistently aims to study abroad, demonstrating a concrete objective. Unlike Wen-Ming, Chung-Han's motivation centers on future success and test scores. His interest in U.S. culture supports his language motivation, highlighting a multifaceted approach. Despite evolving aspirations, Chung-Han's commitment to excelling on exams like the TOEIC underscores his enduring instrumental motivation.

Chung-Han consistently demonstrated determination to achieve his goals for the future, as shown in Figure 2. However, our observations reveal nuanced fluctuations in his motivation during the FENM course. Instances of occasional absentmindedness in class and incomplete
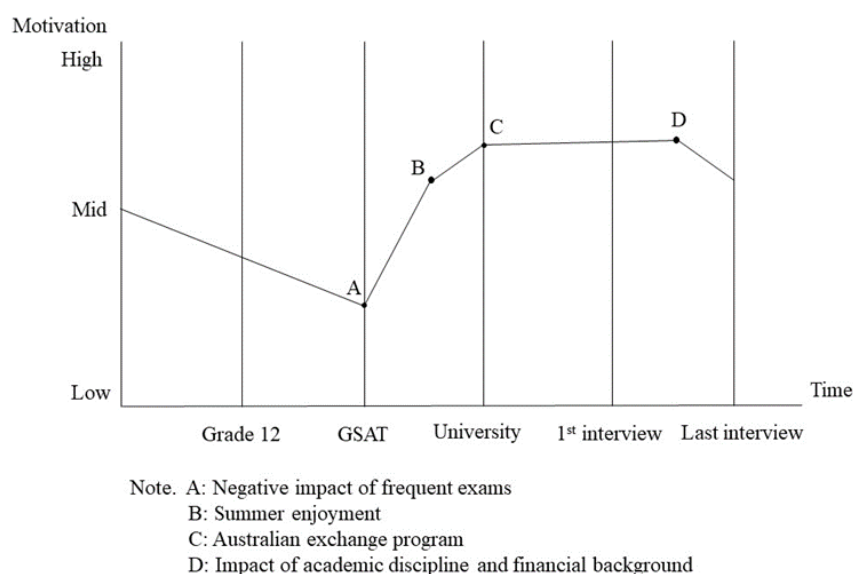
Figure 3. Jing-Jing's motivational changes from Grade 12 to the first semester of university.

textbook exercises suggest varying engagement levels. However, it is important to interpret these fluctuations cautiously, as they do not necessarily indicate significant changes in motivation[55].

4.3 Analysis of Jing-Jing's Motivational Evolution

During high school, Jing-Jing's initial English learning motivation was unstable due to her emphasis on GSAT exams. This intense pressure resulted in a pessimistic view of English learning, hindering her ability to see its relevance beyond exam requirements:

Extract 7. "*During high school, we had English quizzes before morning classes, in regular classes, and even during weekly meetings if we were behind. These "small yellow exam papers" and other examinations made me want to pull my hair out. I was tired all the time, so thinking about studying or working abroad seemed unrealistic.*"

Examinations and class quizzes are widely acknowledged as highly effective strategies for promoting extrinsic motivation among students. These assessment methods are commonly employed by teachers to evaluate students' comprehension of course content and reinforce their adherence to the course schedule. Yet prioritizing assessments aligned with standardized tests can lead to adverse effects, termed the overt backwash effect[56]. This phenomenon profoundly impacts students' language motivation, potentially resulting in passive conformity, as observed in cases like Jing-Jing's. The overwhelming frequency of assessments, including weekly quizzes during class, engenders exhaustion and diminishes intrinsic motivation.

Extract 8. "*Illustrates how engaging in authentic English communication prompted a reevaluation of the significance of English after Jing-Jing's high school graduation. Her newfound ability to use English authentically spurred a*

desire to explore American culture. This highlights the transformative power of genuine language interactions in shaping individuals' perceptions and priorities beyond formal education."

"*I had a part-time job selling food at an amusement park last summer vacation. While I was taking orders, some foreign customers would chat with me. I could chat with them and deal with their requests with ease, but the interactions spurred me to start watching American TV dramas.*"

Jing-Jing's part-time job at an amusement park led to a significant realization about the practicality of English at work. This initial perturbation drew her into a new state of motivation, as shown in Figure 3. This proactive learning behavior indicates a subconscious awareness—A growing desire to further develop her communicative competence. It represents a subtle indication of a shift towards integrativeness, where the individual seeks to more holistically integrate into an English-speaking environment.

Upon entering university, Jing-Jing's interest in English-speaking cultures grew, motivated by the prospect of participating in an Australian exchange program. Initial interview notes revealed her initial excitement and eagerness about this opportunity. However, several contextual factors influenced her English learning motivation and posed challenges. One such factor was the program's requirement for a certain level of English proficiency, which initially motivated her to sustain her English study goals. However, upon further inquiries about the program, Jing-Jing expressed hesitation and a need to prioritize attention and effort toward her major and the FENM posttest. Moreover, her parents highlighted the cost of the program, which she had not fully considered initially. These observations
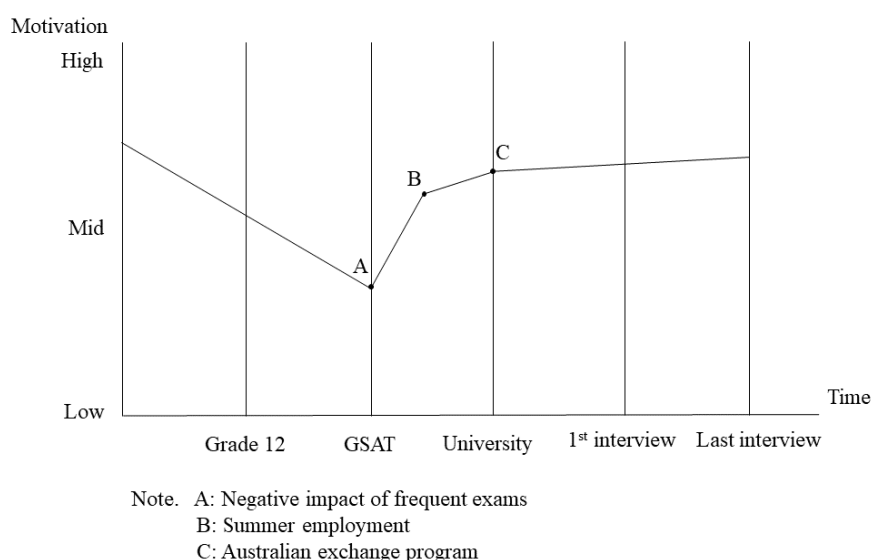
Figure 4. Meng-Ru's motivational changes from Grade 12 to the first semester of university.

underscore the significant impact familial expectations and concerns can have on a student's language learning motivation. Classroom observations and journal analyses further confirmed Jing-Jing's motivational fluctuations during the FENM course. Initially, her summer job acted as a positive perturbation, elevating her motivation and desire to join the exchange program. However, intervening variables, particularly familial factors, subsequently redirected her motivation. This dynamic interplay illustrates how both personal experiences and external influences shape language learning motivation.

4.4 Analysis of Meng-Ru's Motivational Evolution

Meng-Ru found studying English in junior high school enjoyable, yet her experience in senior high school mirrored Jing-Jing's. Her motivation centered on excelling in the GSAT, resulting in ongoing challenges in her progress.

Extract 9. "*Every time I took quizzes and exams, new words popped out all the time. Then I had to memorize these words over and over again. I felt extremely exhausted memorizing these words because it seemed that there was no end to them. Sometimes, it seemed my English was getting worse despite my efforts. But I did not want to give up, so the only thing I could do was keep studying.*"

Her motivation decreased due to anxiety over a lack of vocabulary, which is not unexpected. Research has shown that the development of lexical richness can slow or stagnate—A condition often referred to as lexical stabilization or lexical plateau[57,21]. The process is influenced by a learner's motivational state[57,58]. In Meng-Ru's case, she faced a lexical plateau combined with frequent quizzes, which led her to focus on achieving high scores as her primary English learning goal. This approach is common among learners facing high-stakes exams, where the pressure to perform can overshadow intrinsic

learning motivation.

Analysis indicated the negative influence and overt washback effect of testing had a detrimental impact on Meng-Ru's motivation, as expressed in Figure 4. Like Jing-Jing, who experienced a significant motivational shift after a perturbing event, Meng-Ru also had a summer experience that dramatically changed her motivation after high school. Both participants showed renewed motivation to study English, if for slightly different reasons.

Extract 10. "*Last summer, I worked part-time as a waitress at a hotel restaurant. Sometimes, foreign customers would chat with me while ordering, but I struggled to communicate fluently. It made me feel regretful and embarrassed about my English skills. To get better, I borrowed books from my older brother, who was studying a related field.*"

Meng-Ru's motivation surged upon realizing the practicality of English for communicating with native speakers. Initially, like Jing-Jing, she did not perceive herself as a language user, seeing English as a tool for passing exams, and she felt self-conscious during interactions with foreign customers at her part-time job. Unlike Jing-Jing, Meng-Ru felt negative emotions during these interactions due to perceived communication inadequacy. However, the joy and excitement derived from meaningful interactions outweighed the negative affective factors, as her limited English proficiency paradoxically fueled her motivation for further learning. Notably, frustration or embarrassment during unsuccessful communication attempts can paradoxically enhance motivation to learn the language. Pavelescu[59] suggested that factors influencing a learner's willingness to communicate are unique to each individual, implying varied impact of such emotions. Additionally, Dewaele et al.[60] asserted that both positive and negative

emotions can facilitate language learning, contributing to overall language acquisition and development. Meng-Ru's language learning journey prompted her to adopt a new outlook on learning English. Her experiences, both positive and negative, underscored the intrinsic value of meaningful communication and the potential for personal growth and motivation that can be derived from overcoming the challenges associated with language acquisition.

Meng-Ru now sets goals for herself in terms of passing examinations and also envisions using English effectively for communication. In Extract 11, an air of confidence is apparent in her claims that living or studying abroad is definitely a possibility:

Extract 11. "*I think I will prepare for the posttest next semester first and then the TOEIC. I want to go to Australia because the scenery and the trees are beautiful there. I am not sure yet, but I may go there for further study or work.*"

Similar to Jing-Jing's experience, Meng-Ru's response to discovering the exchange program illustrates the dynamic and evolving nature of her motivation for learning English. Initially driven by score-oriented goals, her motivation was disrupted during her employment as a waitress. However, upon entering university, her motivation was revitalized by the prospect of participating in an exchange program. Contextual factors exerted a substantial influence on her motivation. While her motivation underwent slight fluctuations, she did not consider the exchange program an immediate priority. Nonetheless, her existing motivation to learn English was, at least in the short term, sustainable.

5 DISCUSSION

The transition from high school to university is a critical period for students, marked by profound adjustments in their academic environment and expectations. This study's findings indicate that, despite varying configurations for learning English, the imperative of college admission impels students to diligently study English to meet academic and future career demands. For our participants, the exams functioned as a strong attractor factor that substantially affected their motivation through self-organization. After the GSAT, participants became more adept at handling university-level English courses and exhibited greater diversity in their learning motivation. This shift highlights the complexity of individual motivation in response to changing educational requirements and personal aspirations. As students navigate the challenges of university life, their evolving motivations reflect a dynamic interplay of internal and external influences, uniquely shaping their language learning journey. This exploration reveals the intricate interplay of internal psychological processes, the dynamic nature of motivation over time, and how learners' motivational frameworks self-organize. Examining these dynamics provides deeper insights into the diverse factors influencing students' language learning.

5.1 Complex Behavior

The motivation of students striving for a high GSAT score resembles the determination of carp battling upstream in narrow, tumultuous streams, persisting despite the challenges. These students face a sink or swim situation, adapting to a new ecosystem dominated by high-pressure exams to achieve the best GSAT score possible. This analogy captures their unwavering commitment and perseverance as they tirelessly strive for success until they reach a crucial turning point known as the Dragon Gate[14]. The GSAT significantly influences learner behavior, despite varying motivational configurations and states. However, when examining motivation through CDS, researchers emphasize examining the interdependence of motivational factors[19]. Considering the significance of the context-specific factor, the Dragon Gate, and its close association with the GSAT, we engaged in a fine-grained examination and uncovered evidence of the Chinese Imperative[13]. In Chung-Han's case, despite his parents' limited English proficiency, they enrolled him in a bilingual kindergarten at an early age, underscoring their recognition of the importance of English and their determination to ensure his future success. Conversely, Wen-Ming's case highlights the complex interactions between parental involvement and learner perception of English learning. Wen-Ming's parents determined that they would not interfere with his studies as long as he exerted effort. This suggests that his parents were attentive to his attitude towards English learning and, if necessary, would adapt their approach based on Wen-Ming's behavior. This parental behavior exemplifies the implicit impact of the Chinese Imperative on Wen-Ming, explicitly shaping his perception of learning English. This illustrates that the GSAT factor alone may not fully explain learners' behavior and English learning motivation.

The influence of the Chinese Imperative goes beyond the GSAT examination. The career opportunities linked to the GSAT evoke parental anxieties about their children's future, as illustrated by Meng-Ru and Jing-Jing's situations. Nonetheless, compromises are eventually achieved (in these cases, the daughters' decisions were honored), underscoring the complex interaction between contextual factors and individual decisions in molding language learning motivation. Exploring the interplay between these factors and influences yields a deeper comprehension of the complexities of language learning motivation, providing insight for educational practices by suggesting that integrating familial support and contextual relevance into language learning programs can foster holistic student language development.

5.2 Motivational Dynamics

By retracing motivational paths, the analysis revealed that all participants experienced motivational fluctuations.

Chung-Han and Wen-Ming had relatively stable motivation toward learning English with minor fluctuations before and after the GSAT. These findings align with studies by Miller and Brickman[54] and Dörnyei and Ushioda[33], which highlight how learners' present actions often serve as indicators of their future goals. As for Meng-Ru and Jing-Jing, although both of their initial motivational states were unstable and negative, they still managed to achieve success on the GSAT. Their learning paths before the GSAT showed us how persistent disturbances (e.g., unsatisfying grades) can destabilize motivation over time. The perturbation of summer part-time job experiences unexpectedly boosted their motivation, and interest in their university department's international exchange program further enhanced this motivation. For Jing-Jing, the development of her motivational state was limited by her family's economic status, which unexpectedly kept her from pursuing a dream.

It could be inferred that before the GSAT, disturbances or perturbations mainly came from the classroom environment, with parental support minimizing external factors. Post-GSAT, perturbations emerged from outside sources, indicating increased interaction with social networks and the growing impact of peripheral influences on student motivation. In broad terms, the participants experienced a transition from instrumental orientation to integrative orientation[61] over the course of the study. This shift towards integrative motivation aligns with the research conducted by Waninge et al.[5] and underscores the significant role of contextual factors in shaping learner motivation, either by propelling individuals towards or diverting them from their prior motivational states. The students demonstrated a resurgence of previously acquired knowledge and skills, driven by their current personal interests such as engaging with foreign YouTube channels or reading English-language journals. These findings suggest teachers should consider employing strategies like integrating social media into classroom activities to bridge formal and informal learning contexts, thereby capitalizing on students' digital literacy skills and enhancing engagement[62], or promoting collaborative projects that leverage online platforms to cultivate students' sense of community and purpose, aligning their educational goals with real-world applications.

5.3 Self-organization

The initial motivational conditions of the four participants varied to some degree, despite the similarity of English learning settings in their respective high schools. However, as products of a culture that measures success by examination scores, all four found their own ways to stay the course through self-organization. Both Chung-Han and Wen-Ming went to a test prep center to improve their English grades because not doing so posed a threat to their GSAT success. In fact, the simple decision to attend the center emerged from the complex interaction of external factors (e.g., familial, socio-cultural) and internal factors (e.g., valency, self-efficacy). With thoughtful consideration of contextual and personal elements, Chung-Han and Wen-Ming made appropriate adaptations and achieved a period of motivational stability characterized by sustained high grades.

Jing-Jing and Meng-Ru employed alternatives like online English learning websites and sample tests, appraising and reappraising their performances and adjusting their learning strategies for further improvement, indicating another form of self-organization. Both students displayed behavioral patterns that resulted from the dynamic interplay of multiple social, psychological, and contextual components. Dörnyei[63] indicated that during the language learning process, students manage to balance various internal and external influences through self-organization, giving rise to a somewhat dynamic pattern of commitment and effort. This suggests that as learners engage with diverse personal and contextual factors, their motivational systems assume new configurations and transition to different states through self-organization, ultimately giving rise to the emergence of novel learning behavior. Learners, by engaging with personal and contextual variables, can reshape their motivational frameworks and shift their learning behaviors. Teachers can leverage these findings to create learning environments that support self-directed learning and support diverse learning styles. Implementing strategies that encourage students to assess their progress, adjust strategies accordingly, and take advantage of learning resources can significantly enhance motivation and engagement in educational settings[64].

5.4 Summary of Findings

These findings highlight how context-specific and person-specific factors interact and evolve, leading to diverging and unique motivational paths within nested ecosystems. The results align with Waninge et al.[5] and Yaghoubinejad et al.[65], who claim that individual learners go through a series of ebbs and flows in their language development, which group data may be incapable of capturing. Second, apart from direct influences, sociocultural and socioeconomic factors implicitly influenced learners' L2 motivation, causing fluctuations in their learning behavior. Familial factors significantly shaped L2 motivation within the societal context in Taiwan Region. Moreover, the findings provide a comprehensive understanding of how participants, with distinct learning behaviors yet similar perceptions, were affected by influential attractor states. Notable shifts in motivation occurred during transitions from the initial attractor state represented by the GSAT to subsequent states. The participants' use of English for personal interests extended beyond the classroom, highlighting the expansion of their English learning pursuits. Third, the findings offer a reflection of the Chinese Imperative among college students

and contribute a novel perspective to existing research by demonstrating the significant influence of deeply rooted cultural and societal norms on individual motivation. The imperative impacts learners' L2 motivation both explicitly and implicitly, potentially facilitating or impeding the acquisition of English in various ways. Finally, this study supports previous quantitative investigations and provides insight into the evolving nature of various factors within a specific context over time.

5.5 Limitations and Future Research Directions

Despite providing a deep understanding of learners' dynamic motivation, this study had some potential subjective limitations. First, the number of participants was limited; further research with a larger and more diverse sample could provide more insight into the variability of language motivation. Specifically, further studies could investigate how different contextual factors such as cultural background or educational settings influence language motivation. This would aid in effectively tailoring motivational strategies to specific contexts. Additionally, the dual role of the interviewer as both the researcher and the participants' English teacher may have influenced the responses. While this relationship could have introduced bias, it is also possible that it facilitated a more comfortable and open communication environment, potentially leading to more candid answers. These dual considerations should be taken into account when interpreting the findings. Nevertheless, these limitations do not necessarily undermine the overall validity of the results.

6 CONCLUSION

6.1 Conclusion

Adopting a CDS perspective, this study examined the evolving motivational dynamics of four English language learners, emphasizing the interaction of various influential factors over time. By employing a retrodictive approach, we effectively illustrated each participant's unique motivational process and their distinct linguistic subsystems across different timescales. The qualitative approach grounded in CDS proved advantageous in explaining instabilities or unexpected fluctuations, prompting consideration of both significant and subtle perturbations. Overall, these findings robustly demonstrate the dynamic and complex nature of learner motivation, as language learners themselves are active and multifaceted agents in the learning process.

6.2 Teaching Implications

This study offers several implications for language teachers. To help learners like Jing-Jing and Meng-Ru, who face stressful initial conditions, it is crucial to create a friendly classroom climate that encourages feedback and reduces anxiety. This supportive environment allows students to adapt quickly and flourish. Wen-Ming's interview underscores the significant influence of experienced teachers on efficient English learning[66,67].

For students motivated to travel or live abroad, diverse activities, from everyday topics to cross-cultural awareness, are beneficial. By diversifying teaching practices and considering the impact of methods on motivation, teachers can integrate new strategies to motivate students lacking intrinsic drive. Meng-Ru and Jing-Jing's experiences underscore the importance of real interactions with English speakers. Thus, teachers should consider providing such opportunities to emphasize the primary purpose of language learning—Effective cross-cultural communication. Engaging students in various learning tasks is essential for successful outcomes, whether inside or outside the classroom[68,69]. Considering the stable motivation displayed by Chung-Han and Wen-Ming, the study suggests employing strategies such as goal setting, positive thinking, and a reward system may be effective. These strategies sustain student engagement, assist learners in developing personal interest in learning English, and enable them to pursue higher goals. In conclusion, language teachers should prioritize creating a supportive classroom, offering diverse activities, facilitating real interactions with native speakers, and implementing motivational strategies to support learners in their language learning journey. By applying these insights, teachers can help students overcome initial challenges and thrive in language acquisition.

Conflicts of Interest
The authors declared no conflict of interest.

Author Contribution
Chen KH was responsible for data collection, conducting the interviews, and writing the original manuscript. Chang SM took charge of conceptualization, supervising the draft, and approving the final version. Kimber L contributed to proofreading, refining the sentence structure, and providing feedback on the clarity of the content.

Abbreviation List
CDS, Complex dynamic systems
EFL, English as a Foreign Language
FENM, Freshman English for Non-English Majors
GSAT, The General Scholastic Achievement Tests
RQM, Retrodictive qualitative modeling
TOEIC, Test of English for International Communication

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