

Examining the Role of Basic Psychological Need Satisfaction in Communication in Online Language Learning: A Comparison of Synchronous and Asynchronous Modes

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Abstract

Although the role of psychological needs in supporting language learning is well established, less is known about how these needs operate in different online learning modes. This study investigates how basic psychological needs satisfaction (i.e., autonomy, competence, and relatedness) is associated with students' willingness to communicate (WTC), as well as their communication quantity and quality, across asynchronous and synchronous online language learning. Using the experience sampling method (ESM), data were collected from 104 students over multiple time points during real-time online classes. Multi-group path analysis was then conducted to compare structural relationships across the two learning modes. Results showed that while competence and relatedness needs were positively associated with WTC in both modes, autonomy need satisfaction was associated with WTC only in asynchronous settings. WTC was associated with communication frequency and fluency in both modes, but its link to complexity and accuracy emerged only in synchronous sessions. These findings highlight the differentiated roles of psychological needs in shaping communicative engagement across online instructional formats.

Keywords: Basic psychological need satisfaction; Willingness to communicate; Asynchronous learning; Synchronous learning; Complexity; Accuracy; and Fluency (CAF); Frequency of communication

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Introduction

Instructional modes play a key role in shaping the student learning experience in online learning environments. Asynchronous and synchronous learning environments offer different opportunities for interaction and engagement (Jiang et al., 2022). Asynchronous learning, with its flexible structure, allows students to engage with diverse input resources at their own pace and construct output through reflection and revision (Stein et al., 2009). Synchronous learning, by contrast, facilitates real-time oral communication, immediate feedback, and interaction that resembles face-to-face classroom communication (Hrastinski, 2008; Blake, 2011). While each mode brings pedagogical opportunities, students still struggle with sustaining motivation and engagement, particularly when instruction is misaligned with their psychological needs.

Self-Determination Theory (SDT) provides a powerful framework for understanding student motivation by focusing on basic psychological need satisfaction (BPNS): autonomy, competence, and relatedness (Ryan & Deci, 2017). When these needs are met, learners are more likely to experience autonomous motivation and sustained engagement. From a situational perspective, SDT is especially relevant for asynchronous and synchronous learning contexts, where differences in pacing, structure, and social interaction may differentially support or hinder these needs. While SDT has been applied in various online learning settings, research has rarely examined how need satisfaction functions specifically within online language learning. Although recent studies have proposed SDT-based design principles to improve motivational support in online environments (Martin et al., 2018; McEown & Oga-Baldwin, 2019; Jiang & Xie, 2022), there remains limited understanding of how the effects of autonomy, competence, and relatedness differ across asynchronous and synchronous modes and what challenges this poses to tailoring online instructional designs to better support learners' psychological needs in practice.

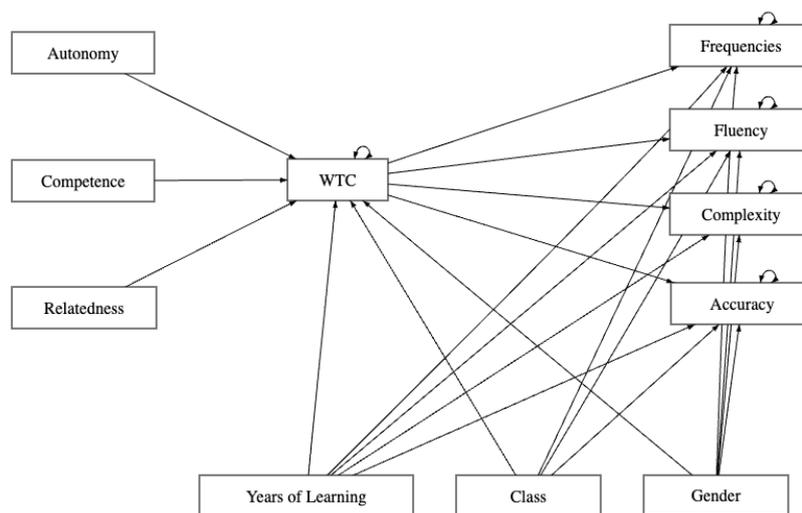
Willingness to Communicate (WTC) is another key construct for understanding language learning success. Defined as a learner's readiness to initiate communication when given the opportunity (MacIntyre, 2007), WTC has been consistently linked to language development, including both the quantity and quality of language use. Factors such as self-perceived competence, task value, and classroom climate have been shown to influence learners' WTC (Cao, 2013; Joe et al., 2017). However, most research on WTC has focused on traditional or general online settings, with limited attention to how it functions across different online learning modes. Even fewer studies have explicitly examined how psychological need satisfaction affects WTC in asynchronous and synchronous language learning environments. This gap limits our understanding of how motivational components shape learners' communicative behavior in online classrooms.

If these needs are supported differently in asynchronous and synchronous environments, they may trigger distinct patterns of willingness to communicate and, ultimately, different communicative behaviors. Investigating the distinctive role each BPNS plays can help inform mode-specific motivational design strategies that promote students' engagement and achievement in online learning. To address these gaps, the present study investigated how the satisfaction of autonomy, competence, and relatedness needs relates to learners' willingness to communicate and, in turn, how WTC influenced the quantity and quality of communication across asynchronous and synchronous online learning contexts. The study was guided by the research question: How do the relationships among basic

psychological need satisfaction, willingness to communicate, and communication outcomes differ across asynchronous and synchronous online learning modes (see Figure 1)?

Figure 1

Models Tested for Multiple Group Comparison



To address this, the following questions are examined: (a) How are autonomy, competence, and relatedness needs satisfaction associated with students' willingness to communicate? (b) How does willingness to communicate relate to the quantity of communication across learning modes, measured by the frequency of communication? (c) How does willingness to communicate relate to the quality of communication, measured by complexity, accuracy, and fluency (CAF)?

Literature Review

Asynchronous and Synchronous Modes in Online Language Learning Environments

Asynchronous learning has offered advantages in providing input-based language tasks (Li & Jiang, 2017; Tseng et al., 2016). Students can access the learning platform at their own pace and convenience and engage with a wide range of learning inputs through diverse multimedia resources while taking their time to process the information by reviewing materials, replaying videos and audios, and revisiting challenging topics. The extended engagement allows more opportunities for students to consolidate their understanding of the materials and internalize language content. The text-based format of online discussion boards also provides students with an opportunity to become more aware of their lexical and syntactic knowledge gaps when generating language output. As learners contemplate the content before posting their responses, they engage with the material at a deeper level that supports reflection on their own thoughts (Stein et al., 2009) and improvement of writing skills (Rigo & Mikuš, 2021; Saeed & Ghazali, 2017). While text-based communication is the most prevalent mode of asynchronous communication, audio-based discussion has also been implemented in practice, for example, social-media community group oral discussion (e.g., WeChat; see Wang et al., 2016), or oral discussion platforms (e.g., VoiceThread, see Sato et

al., 2017). Incorporating oral practice opportunities in asynchronous communication can balance the focus on different language skills. Moreover, the asynchronous nature allows students ample time to review instructions, organize their thoughts, and prepare materials before engaging in communication (Bailey et al., 2020; Payne & Whitney, 2002). This time flexibility and the ability to carefully craft responses can alleviate the immediate pressure of real-time interactions.

While asynchronous learning offers more flexibility, it also requires the learner to regulate their participation behaviors (Zhang et al., 2023). Students need to stay active to keep track of course progress. Insufficient real-time communication can be another frustrating factor for students who want to practice interpersonal communication in the target language (Rigo & Mikuš, 2021). Students may value an online language course less when they feel they have less opportunity to use the target language in real-time communication (Chism & Graff, 2020). Additionally, maintaining motivation to engage with course topics and content can be challenging without immediate feedback and support (White, 2017). The lack of real-time interaction and the potential delay in receiving guidance or assistance may require learners to be proactive in their learning journey.

Synchronous learning offers valuable social interactions and allows learners to negotiate meanings in the target language (Sauro, 2011). Joint attention to the communicative event in synchronous sessions has been identified as a key feature that enhances social presence in online learning environments and resembles traditional language practice (O'Rourke & Stickler, 2017). The immediacy of the synchronous session allows teachers to monitor the learning progress, identify areas of difficulty promptly and provide immediate support to address learners' needs (Perveen, 2016). In comparison to asynchronous learning, synchronous learning has demonstrated a higher level of language output from learners (Lamy & Hampel, 2007). Engaging in synchronous sessions allows students to interact with their peers more actively; they have the opportunity to observe other classmates' responses during the discussion, leading to higher motivation to engage in communication (Hrastinski, 2008).

Despite the increased quantity of target language output in synchronous sessions, concerns arise regarding the quality of interaction. Time constraints and the pressure to engage in rapid exchanges may lead students to prioritize fluency over accuracy (Lee, 2002). Differences in proficiency also affect learning experiences: students with higher proficiency levels tend to enjoy synchronous sessions more (Spring et al., 2019), while lower-proficiency learners may struggle to produce sufficient language output, resulting in limited interaction with shorter and simpler sentences (Lamy & Hampel, 2007). When students perceive their listening and speaking skills in the target language to be weak, they may feel less enthusiastic about participating in synchronous sessions (Perveen, 2016). The structured and less flexible nature of synchronous learning can also affect student satisfaction, especially if peer interaction is perceived as mandatory (Thurmond et al., 2002). When students feel pressured or perceive a threat to their self-image, their motivation to participate may decline (Le et al., 2018).

While synchronous and asynchronous learning modes differ in delivery, what remains consistent is the critical role of students' psychological states in shaping engagement. It is therefore essential for educators to create psychologically supportive learning environments that promote autonomy, reinforce competence, reduce perceived pressure or threat, and foster meaningful connections with others.

The Roles of Basic Psychological Need Satisfaction in Online Learning Environments

According to BPNS, learners who experience effective psychological support in the learning environment are more likely to become autonomous and demonstrate greater persistence in their activities (Ryan & Deci, 2017). In the context of language learning, autonomous learners will be “willing to use the new language to interact and learn without requiring constant effort from the teacher” (McEown & Oga-Baldwin, 2019, p. 1). When learners exhibit such autonomous behavior, they have the potential to achieve better learning outcomes (Comanaru & Noels, 2009; Ryan & Deci, 2017).

The need for autonomy, defined as a sense of choice and control, is essential for fostering student engagement. Language programs that emphasize autonomy are likely to promote the potential development of language competence (Reeve & Jang, 2006). When students feel that participation is driven by their own volition, they are more likely to engage willingly in the learning process (Xie, 2006). An autonomy-supportive environment nurtures willingness, allowing students to transform intention into active engagement, which in turn contributes to improved learning outcomes. Research suggests that such environments help students internalize their learning goals (Dincer et al., 2012), foster persistence (Noels, 2001), and encourage proactive use of diverse learning strategies and seeking assistance (Najeeb, 2013).

The need for competence encompasses students’ feelings of mastery and their perception of their own abilities. Students who feel more competent tend to be more self-determined (Noels, 2001). When the instructional environment is designed to support competence through clear goals, structured feedback, and tasks that align with students’ skill levels, it creates conditions where students feel capable of meeting learning challenges. When students perceive themselves as competent, they become more inclined to engage actively in language communication (Joe et al., 2017). Additionally, feeling competent motivates students to adopt effective language learning strategies to monitor their learning process (Mills et al., 2007). The competence-driven engagement contributes significantly to language proficiency. For instance, Tanaka (2017) found that students who felt competent in their language skills demonstrated greater vocabulary knowledge and a stronger interest in language learning overall.

The need for relatedness refers to feeling connected, supported, and valued by others. When learners feel welcomed within a learning community, they are more likely to develop a sense of belonging, which fosters their willingness to participate (Deci & Ryan, 2000). In online learning environments, relatedness can be fostered through meaningful interactions with teachers, peers, and native speakers. As learners strive to become members of a language community (Norton, 2001), their behaviors are often driven by a desire to connect and engage with others within that group. A study by Akbari et al. (2015), which examined online language learning on Facebook, revealed that a well-structured learning community enhances access to both peers and teachers while also providing opportunities to practice language with native speakers. This increased interaction strengthens learners’ sense of relatedness within the online environment, which, in turn, positively influences their autonomous regulation of behaviors.

People’s BPNS varies from task to task, day to day, and setting to setting. Research has investigated how individuals’ situational needs satisfaction fluctuates. For instance, an early study conducted by Reeve and Sickenius (1994) developed a nine-item short survey to measure ephemeral need satisfaction. It captures individuals’ satisfaction with their

psychological needs over a relatively short period of time when students were doing tasks. Participants engaged in various educational activities, such as solving spatial relations puzzles, and reported their feelings regarding the satisfaction of their needs during these tasks. Similarly, Ma (2009) examined the relationship between task motivation and need satisfaction among second language learners. The study highlighted the importance of considering need satisfaction at the task level, as it can differ from the more stable trait-like need satisfaction observed in general language learning. Specifically, tasks that provided encouraging feedback were associated with higher levels of autonomy and competence need satisfaction among the students. This temporal view has also been applied to the study of classroom environments to capture the nuanced relationship between different classroom setting variables and need satisfaction (Jang et al., 2016).

Since the dynamics of interaction differ between synchronous and asynchronous learning modes, the influence of each psychological need may also vary. Understanding the extent to which each need is satisfied is essential for explaining how students' experiences and outcomes are shaped across these distinct learning environments.

BPNS and WTC in Online Learning Environments

How to get language learners to talk in the target language has always been a challenge for language teachers in the classroom. Why do some learners participate, while others avoid communication in the classroom? Dörnyei (2005) used the expression “crossing the Rubicon” as a metaphor for learners' decision to communicate at the moment. This momentary choice reflects their WTC, a construct that captures learners' intention to use the target language in a given situation. Educators and researchers have thus become increasingly interested in identifying the factors that influence learners' willingness to communicate and in designing interventions that can support learners to “cross the Rubicon,” shifting from silence to speech, and ultimately improve their language learning performance. Understanding how WTC operates in real classroom contexts is therefore essential for promoting meaningful interaction and long-term language development.

WTC is a volitional construct that refers to an individual's readiness to engage in communication in a second language (L2) in a specific situation (MacIntyre, 2007); the key characteristic of WTC is whether the learner chooses to initiate communication when there is a choice. For example, MacIntyre et al. (2007) examined the differences between extroverts and introverts in terms of WTC and found that both types of students' WTC decreased when they were unable to choose the task they were most happy with. Moreover, even introverts were found to have a higher WTC than extroverts when given introvert-preferred tasks.

WTC is strongly related to students' perceived competence. It is more directly related to subjective self-evaluation of one's ability to communicate (Gregersen et al., 2014). In a meta-analysis conducted by Jin and Lee (2022), they confirmed that L2 competence was the most significant predictor of WTC. Lack of confidence in task performance has a detrimental effect on WTC (Cao & Philp, 2006). Kang (2005) suggested that after experiencing difficulties or problems, students may feel discouraged and thus become less willing to communicate. However, Eddy-U (2015) pointed out that extremely simple tasks could also be demotivating. Thus, students' perceived competence is influenced by the appropriateness of task difficulty; tasks that are neither too difficult nor too easy, are most likely to promote state WTC.

Researchers also found social factors in the classroom are significantly related to WTC. Support from teachers and peers has been found to positively be related to situational WTC. A low-threat positive classroom atmosphere is crucial to getting students to talk (Dewaele & Dewaele, 2018). Peng (2012) interviewed four Chinese university students six times over one and a half semesters and suggested that teacher support and immediacy behaviors seemed to facilitate state WTC in L2 classrooms. Cao (2013) found that peer support (e.g., classmates or group members who are cooperative) could also bring higher state WTC. Similarly, Joe et al. (2017) examined the social climate in the language classroom by testing classroom mutual respect, teacher academic support and teacher emotional support. The result showed that students' WTC was positively related to the positive social climate, and the relation was mediated by students' need satisfaction.

Studies have shown that WTC fluctuates based on classroom conditions and interactional opportunities, suggesting that its relationship with other constructs may vary across different environments. Although there is evidence linking WTC to BPNS, few studies have directly examined how each psychological need functions in relation to WTC, and the relationship between these constructs remains unknown in online language learning environments.

Communication Quantity and Quality

Communication quantity can be measured by the frequency of using the target language. Several studies have examined the relationship between WTC and the frequency of L2 use, highlighting a consistent trend in the field of second language acquisition. MacIntyre and Clément (1996) conducted a study in a monolingual Canadian context, revealing that motivation positively influenced WTC, which led to an increased frequency of L2 communication. Building on this, Clément et al. (2003) examined individual and contextual variables among Canadian university students, confirming that WTC significantly predicted the frequency of L2 use. Similarly, MacIntyre and Charos (1996) explored various factors impacting L2 communication and found that WTC, motivation, and perceived competence collectively influenced the frequency of L2 communication. Furthermore, studies conducted in Japan from Yashima et al. (2004) and Hashimoto (2002) provided further evidence that WTC shapes the frequency of L2 use inside and outside classrooms.

Communication quality can be evaluated through CAF measures, that is, complexity, accuracy, and fluency (Larsen-Freeman, 2006). CAF measures are performance indicators applied to second language (L2) oral and written production. Complexity refers to the extent to which language users produce sophisticated or elaborated structures and vocabulary (Wolfe-Quintero et al., 1998). Accuracy describes how much error-free production is made (Jiang et al, 2023; Jiang, 2013). Fluency refers to the production of language without undue pausing (Ellis & Barkuizen, 2005), characterized by the rapid production of language (Wolfe-Quintero, et al., 1998). Past studies have approached the examination of language learning performance from different perspectives, such as oral assessment (Buckingham & Alpaslan, 2017), and language accuracy and fluency (Yousefi & Ahmad Kasaian, 2014).

The relationship between L2 WTC and L2 achievement remains complex and less direct than often assumed. For example, Leeming et al. (2024) explored the role of WTC in a task-based learning environment, specifically focusing on its association with spoken language task production. Using structural equation modeling, Leeming and colleagues found that WTC not only directly predicted the quantity of words produced but also mediated the effect of students' perceived communicative competence on word output. Similarly, Yousefi

and Ahmad Kasaian (2014) found that learners with higher WTC displayed greater fluency and accuracy in their spoken language in the Iranian EFL context. However, in Kim et al.'s (2022) study in English training programs in Australia, though they found WTC directly influenced L2 contact frequency, it did not predict fluency improvements. Joe et al. (2017) also did not find a predictive relationship between general WTC and language achievement using final exam score as the outcome. One possible reason could be that the measurements for WTC and language performance were situated from different perspectives. Language performance was measured by in-class achievement and WTC instruments were focused on the general level of willingness to communicate with strangers, friends, and acquaintances. Thus, to capture the situational WTC in the classroom, the measurements targeting the classroom activities will be optimal. Previous studies show that WTC's impact on L2 learning outcomes is context-dependent and influenced by various factors. There remains a need for further research on how WTC shapes L2 use and learning outcomes in different contexts in online learning.

Based on the literature reviewed above, several key gaps emerge that this study aims to address. While research has established the importance of basic psychological need satisfaction in online learning and the role of WTC in language learning success, limited research has examined how these constructs interact specifically within different online language learning modes. The literature suggests that asynchronous and synchronous environments offer distinct affordances that may differentially support learners' psychological needs, yet empirical evidence comparing these relationships across modes remains scarce. Furthermore, while WTC has been linked to language learning outcomes, the specific pathways through which WTC influences both the quantity and quality of communication in online contexts require further investigation.

To address these gaps and test the theoretical model presented in Figure 1, this study examines the relationships among basic psychological need satisfaction, willingness to communicate, and communication outcomes across asynchronous and synchronous online language learning environments. Based on the theoretical foundations and empirical findings discussed above, the following hypotheses are proposed:

H1. Autonomy, competence, and relatedness need satisfaction are each positively associated with students' WTC in both asynchronous and synchronous learning modes.

H2. The strength of the associations between need satisfaction and WTC differs by learning mode:

- **H2a.** Competence need satisfaction has a consistent effect on WTC across both modes.
- **H2b.** Autonomy need satisfaction is more strongly associated with WTC in asynchronous learning.
- **H2c.** Relatedness need satisfaction is more strongly associated with WTC in synchronous learning.

H3. WTC is positively associated with both the quantity of communication (measured by frequency) and the quality of communication (measured by complexity, accuracy, and fluency) across both learning modes.

Methods

Context

The study was conducted in an online Chinese learning program for high school students, offered by a midwestern university in the United States. The program provided language courses ranging from novice to AP levels through Design2Learn. To earn credits, students were required to complete both asynchronous and synchronous learning tasks. The asynchronous assignments included review tasks for previously covered topics and preview tasks for upcoming topics. These assignments, often managed independently by students, typically involved activities to familiarize students with new content, check their understanding (e.g., using Quizlet flashcards), engage in interpretive communication (e.g., reading or listening exercises), and participate in presentational activities (e.g., writing). Most of the asynchronous assignments were writing-based, and students were expected to complete them by the end of each week. In the following week, students could sign up for 50-minute lab sessions conducted via Zoom, with a maximum of eight students per session. These synchronous activities aimed to enhance students' speaking skills through structured drills and meaningful communicative tasks. The sessions provided learners with opportunities to apply what they had learned in real-life contexts, reinforcing their oral proficiency.

Participants

Study participants were recruited from all five levels of online classes, with class difficulty ranging from beginning classes to AP classes. A total of 104 students engaged in asynchronous learning, and 98 students participated in synchronous learning. While completion of both asynchronous and synchronous learning tasks was a course requirement, a number of students did not attend the synchronous sessions, resulting in a discrepancy in participant numbers between the two modes. The analytical sample for each time point ranged from 80–84 participants for asynchronous sessions and 79–80 participants for synchronous sessions, representing stable retention rates of 76.9%–80.8% and 80.6%–81.6% respectively.

Most participants were female, comprising 60% of the sample, while male students accounted for approximately 36% of the sample. The median age was 16 years, ranging from 11 years to 18 years. The majority of participants were between 15 and 17 years old (82.3%). Students had diverse prior experience in learning Chinese, with about 60% of participants reporting 0 to 4 years of learning, and approximately 29% having more than five years of Chinese learning experience.

Procedures

The study employed Experience-Sampling Methods (ESM) to capture participants' experiences in the moment and in context (Csikszentmihalyi & Larson, 2014). ESM offers a significant advantage by providing enhanced ecological validity (Xie et al., 2023). It grants educational researchers access to real-time information, thereby reducing biases associated with one-shot questionnaires. By capturing the "present self," ESM enables students to reflect more accurately on their experiential feelings. Considering the study's specific focus on students' perceptions of specific learning events, the event-based sampling technique was chosen. In this study, the term "event" pertains to both asynchronous learning activities and synchronous learning activities. Data were collected across six time points over three content units, each consisting of one asynchronous and one synchronous learning session. Surveys were administered after students completed asynchronous assignments (typically due on

Sundays) and again after synchronous Zoom sessions. Each survey measured students' satisfaction of autonomy, competence, and relatedness needs, willingness to communicate, and frequency of language use. Performance data included weekly writing artifacts and oral scores from synchronous sessions.

Measurements

Basic Psychological Need Satisfaction

Items assessing students' situational autonomy, competence, and relatedness needs were adapted from the Intrinsic Motivation Inventory (IMI; Deci et al., 1994) and the Activity-Feeling States Scale (AFS; Reeve & Sickenius, 1994). The IMI autonomy items, originally developed for computer-based tasks, captured perceptions of choice and volition. Three items were used, yielding a reliability (ω) of 0.65. To supplement this, AFS items were used to measure competence (e.g., "...competent," "...my skills are improving") and relatedness (e.g., "...I belong and the people here care about me"). Each subscale included three items rated on a 7-point Likert scale, with $\omega = 0.90$ for competence and $\omega = 0.82$ for relatedness.

Willingness to Communicate

WTC was measured using nine items adapted from Peng and Woodrow (2010) to reflect situational WTC in online classroom contexts. The items assessed willingness to present, interact with peers, and communicate with teachers. Two additional items were created to capture teacher-student communication, a key feature of online learning. Responses were rated on a 7-point scale, and the scale demonstrated good reliability ($\omega = 0.85$).

Frequency of Communication

To assess the quantity of communication, students reported how frequently they used the target language during both asynchronous and synchronous learning activities. A self-report scale was developed, consisting of six items that asked students to estimate the percentage of time they engaged in communication with peers and instructors using the target language, ranging from 0% (never) to 100% (always). Items captured students' perceived engagement in a range of communicative behaviors, including participating in discussions, asking and answering questions, and initiating conversations.

Asynchronous Performance (Writing—CAF)

Asynchronous performance was assessed using Complexity, Accuracy, and Fluency (CAF) measures. Students were asked to write a post in response to the given topic as the asynchronous assignments. Writing from discussion posts was segmented into T-units. A total of 3,032 T-units were analyzed.

Accuracy was calculated as the proportion of error-free T-units. Fluency was assessed by the total number of characters, and complexity was measured as the average T-unit length (Pan, 2018; Kusyik, 2017; Plakans et al., 2019). Standardized scores were calculated for asynchronous complexity and accuracy variables; fluency scores were log-transformed and used in the path analysis. See Appendix A for technical details.

Synchronous Performance (Speaking – CAF)

To evaluate Chinese oral CAF in Zoom sessions, we followed the method proposed by Wang et al., (2018), which involved using the International English Language Testing System (IELTS) band descriptors for speaking. Among various language proficiency criteria (e.g., HSK, TOFEL), the IELTS descriptors were considered the most appropriate subjective measures for assessing oral proficiency in Chinese CAF, as they were the only CAF-focused measures. We adapted and simplified these descriptors into three dimensions to ensure consistency in the evaluation criteria during synchronous sessions. Teachers rated students' performance after each session. The "Fluency" dimension corresponded to the fluency and coherence category, the "Complexity" dimension aligned with the lexical resource and grammatical range, and the "Accuracy" dimension encompassed the measures of lexicogrammatical accuracy and pronunciation accuracy. Standardized scores were calculated for synchronous language performance variables and used in the path analysis.

Covariates

Years of learning experience were included as a control variable in the path analyses, given their potential influence on students' communication behaviors and language performance. In addition, class-level comparisons using one-way ANOVA and Welch ANOVA revealed significant differences across psychological needs, WTC, and performance measures, with students in higher-level classes generally demonstrating stronger outcomes. Gender comparisons also showed that male and female students differed significantly in autonomy and competence satisfaction, WTC, and communication frequency. To account for these systematic differences, class level and gender were included as covariates in the model. While we acknowledge that developmental stage can influence language learning outcomes, the present study focused on high school students with a narrow age range. Age was not included as a covariate due to limited variability and lack of significant differences in preliminary analyses.

Data Analysis Plan

Multiple group path analyses were used to investigate the differences in the relationships between two modes of learning. Robust standard errors were used to account for the non-independence of repeated measures from the same participants. This estimator adjusts the standard errors and chi-square test statistics using a sandwich estimator when data deviate from normal distribution and have a nested structure. This approach handles the analyses of multiple groups simultaneously. The group variable of interest in the study refers to the learning mode, which is a categorical variable representing asynchronous learning and synchronous learning. By employing this method, this study investigated whether the proposed relationships were identical in asynchronous learning mode and synchronous learning mode. We first estimated a fully constrained model in which all parameters were constrained to be equal and proceeded with a fully unconstrained model in which all parameters were freely estimated. A Satorra-Bentler scaled (mean-adjusted) chi-square test (S-B χ^2) was conducted to determine if the unconstrained model fits the data better than the constrained model. The computation of S-B χ^2 incorporated a scaling correction for the χ^2 statistic (Satorra & Bentler, 2010). S-B χ^2 is a robust test statistic for assessing mean and covariance structure models across different distributions and sample sizes. If the S-B χ^2 test is found to be significant, it indicates that there is a significant difference between the

unconstrained model and the constrained model, suggesting that the unconstrained model fits the data better and captures the relationships among the variables.

Model fit was assessed using several indices. A non-significant model chi-square test indicates good fit. RMSEA values between 0.05–0.08 suggest reasonable fit, and values below 0.05 indicate good fit (Browne & Cudeck, 1992). CFI values above 0.95 are considered good, with 0.90–0.95 being acceptable (Hu & Bentler, 1999). TLI values above 0.95 indicate acceptable fit, and above 0.97 indicate good fit (Schermelleh-Engel et al., 2003). SRMR values below 0.08 suggest good fit, while values above 0.10 indicate poor fit (Schermelleh-Engel et al., 2003).

Results

Descriptive Statistics

The following table lists the descriptive statistics for the observations in asynchronous learning and synchronous learning. For need satisfaction, WTC, and communication frequency questions. 246 observations were collected during asynchronous learning while 239 observations were collected in synchronous learning. In general, participants reported moderate to high levels of need satisfaction and willingness to communicate in both asynchronous and synchronous learning modes. Although the mean scores of each type of need satisfaction and WTC were higher in asynchronous learning compared to synchronous learning, t-tests did not reveal any statistically significant differences between the two learning modes. Participants in the asynchronous learning mode demonstrated a wide range of fluency scores. To reduce the impact of extreme values, scores were log-transformed using the natural logarithm.

For variables collected through the survey, the number of observations in synchronous sessions were slightly lower compared to the asynchronous session, but the missing rate is negligible (Schafer, 1999), which is 0.2%; Missing data for asynchronous learning writing and synchronous learning speaking scores occurred because some students did not complete the assignment or attend the lab sessions, resulting in the absence of the scores. The missing rate of writing scores and speaking scores was not substantial, which were 22% and 13%, respectively. To minimize potential bias resulting from missing data, we used Full Information Maximum Likelihood (FIML) estimation in the path analysis, which incorporates all available information from the observed data to estimate the statistical model instead of excluding cases with missing data.

Table 1

Descriptive Statistics for Variables

Variable Names	<i>N</i>	Mean	<i>SD</i>	Min	Max	Skewness	Kurtosis
Asynchronous							
Autonomy	246	4.37	1.11	1.33	6.67	-.22	2.54
Competence	246	4.92	1.17	1	7	-.87	3.72
Relatedness	246	4.31	1.29	1	7	-.13	2.81
WTC	246	4.67	1	1.67	7	-.25	2.95
Frequency	246	60.03	23.9	3.33	100	-.24	2.15
Fluency	191	146.07	125.47	14	482	1.08	2.77

Fluency - Log Transformed	191	4.63	.85	2.64	6.18	.16	2.11
Complexity	191	8.79	2.24	4	15.23	.29	2.48
Accuracy	191	.77	.2	0	1	-1.28	5.35
Synchronous							
Autonomy	239	4.28	1.1	1	7	1.2	.04
Competence	239	4.81	1.19	1	7	-.84	3.81
Relatedness	239	4.26	1.37	1	7	1.87	-.04
WTC	239	4.62	1.04	1.44	6.89	-.5	3
Frequency	239	60.38	24.96	0	100	-.23	2.14
Fluency	207	4.1	.83	2	5	-.65	2.8
Complexity	207	3.55	1.15	1	5	-.16	1.74
Accuracy	207	3.99	.9	1	5	-.67	2.93

The correlations of the variables were summarized in Table 2. The correlations in two learning modes exhibited the same pattern. WTC, all need satisfaction variables, and frequency of communication were positively correlated with each other. Fluency and complexity were positively correlated with WTC. Accuracy was only found to be correlated with WTC in synchronous sessions.

Table 2

Correlations of Study Variables

	1	2	3	4	5	6	7	8	9	10	11
Asynchronous	1. Autonomy	-									
	2. Competence	.45**	-								
	3. Relatedness	.43**	.34**	-							
	4. WTC	.52**	.64**	.58**	-						
	5. Frequency	.49**	.47**	.43**	.69**	-					
	6. Fluency	-.03	.16*	.08	.17*	.23**	-				
	7. Complexity	0	.20**	.09	.16*	.23**	.64**	-			
	8. Accuracy	-.1	.03	-.04	-.07	-.13	.03	-.03	-		
	9. Years of Learning	-.08	.13*	-.04	.01	.10	.47***	.42***	0.2	-	
	10. Class Level	-.13*	.13*	-.04	.13*	.19**	.84***	.65***	.10	.61***	-
	11. Gender (Female)	-.12	-.08**	-.11	-.27***	-.29***	-.03	-.05	.18*	.18**	0
Synchronous	1. Autonomy	-									
	2. Competence	.36**	-								
	3. Relatedness	.49**	.38**	-							
	4. WTC	.48**	.59**	.62**	-						
	5. Frequency	.44**	.48**	.46**	.66**	-					
	6. Fluency	.06	.13	.00	.16*	.24**	-				
	7. Complexity	-.07	.15*	-.06	.20**	.28**	.59**	-			
	8. Accuracy	.09	.19**	.03	.20**	.30**	.67**	.43**	-		
	9. Years of Learning	-.14*	.09	-.12	-.01	.12	.36***	.60***	.28**	-	
	10. Class Level	-.10	.08	-.10	.09	.19**	.41***	.83***	.26**	.61***	-
	11. Gender (Female)	-.14*	-.13*	-.07	-.26***	-.29***	-.01	-.02	-.12	-.19**	.00

* $p < .05$ ** $p < .01$ *** $p < .001$

Model Selection

The comparison showed that the unconstrained model (in which all paths were freely estimated) exhibited a better fit to the data compared to the fully constrained model (in which all structural paths were set to be equal across the two modes). The fully constrained model did not fit the data well, with undesired values of all index measures (see Table 2). As for the unconstrained model, the fit indices provided evidence of a good model fit, with the CFI indicating a satisfactory fit. The RMSEA suggested an acceptable fit, and the SRMR indicated a good fit. Although the chi-square test remained significant, it is important to note that the chi-square test is sensitive to sample size. Therefore, the overall fit indices suggested that the unconstrained model can better capture the complex dynamics of the relationship among the variables.

Table 3

The Fit Indices and the Satorra-Bentler χ^2 Difference Test for Model Comparison

Model	χ^2 (df, p-value)	CFI	TLI	RMSEA	SRMR	Satorra-Bentler χ^2 Difference Test (df, p-value)
Fully Constrained Model (1)	238.274 (58, <.001)	.79	.71	.12	.14	
The Unconstrained Model (2)	60.316 (24, <.001)	.96	.86	.08	.04	
1 vs. 2						187.89 (34, <.001)

Based on the modification suggestions provided in the Mplus output, a path from autonomy need to frequency of communication was added to the model. When students felt their autonomy need was respected and supported, they experienced a sense of freedom to express themselves and perceived having choices in determining their participation. This autonomy and perceived control allowed them to take ownership of their communication behaviors. As a result, they participated more frequently in communication activities. After incorporating the path from autonomy need to frequency of communication, the model demonstrated a satisfactory fit to the data: χ^2 (22, 434) = 25.694, $p = .26$, RMSEA = .03, CFI = 1, TLI = .99, SRMR = .03.

The model results were presented in Figure 2 and Figure 3. Both figures presented the standardized coefficients. Only significant paths were included in the figure to ensure a clear presentation. The standardized coefficients were also presented in Table 4.

Figure 2

Standardized Path Coefficients of the Final Model for Asynchronous Learning Mode

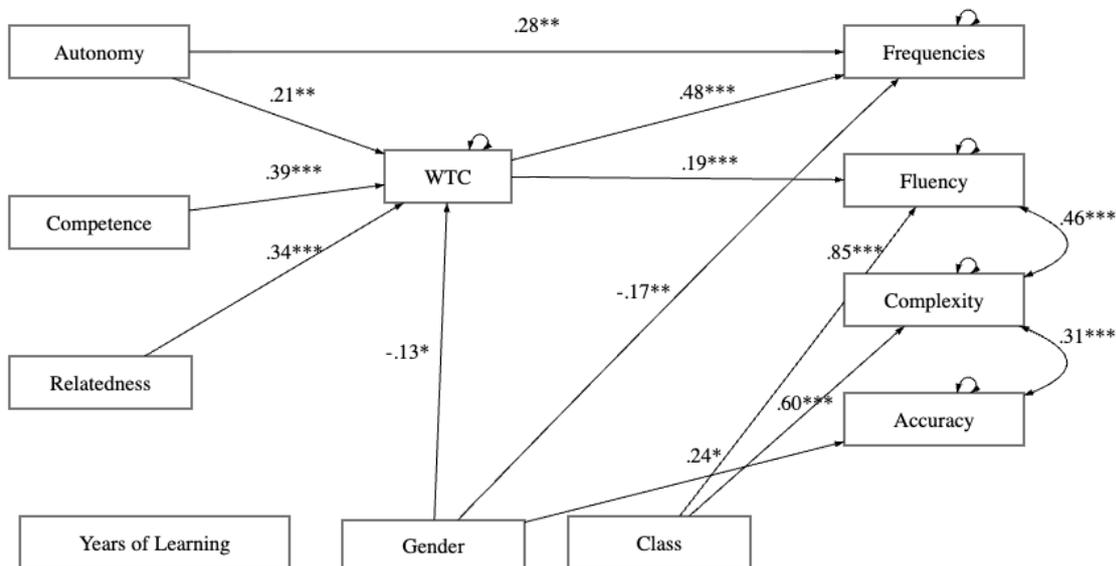


Figure 3

Standardized Path Coefficients of the Final Model for Synchronous Learning Mode

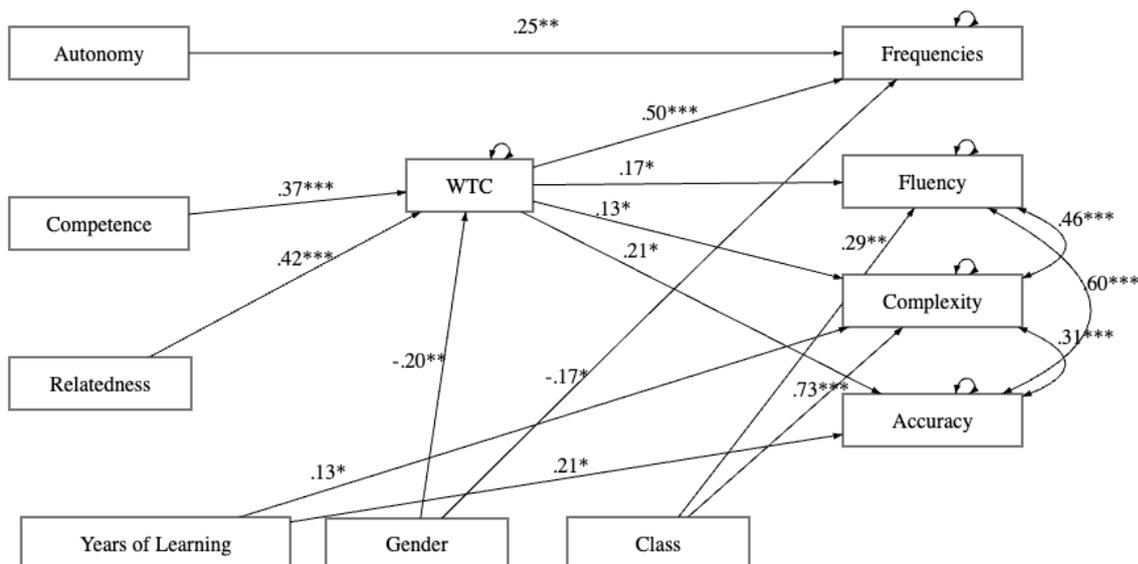


Table 4*Summary of Path Coefficients Among Variables between Modes*

Standardized Paths			Asynchronous			Synchronous		
			β	<i>SE</i>	<i>p</i>	β	<i>SE</i>	<i>p</i>
Autonomy	→	WTC	.21**	.07	0.003	.12	.08	.140
		Frequency	.28**	.08	0.001	.25**	.09	.005
Competence	→	WTC	.39***	.07	<.001	.37***	.08	<.001
Relatedness	→	WTC	.34***	.08	<.001	.42***	.10	<.001
WTC	→	Accuracy	-.03	.09	0.718	.21**	.08	.013
		Complexity	.10	.08	0.218	.13*	.07	.045
		Fluency	.19***	.05	<.001	.17*	.09	.049
		Frequency	.48***	.09	<.001	.50***	.09	<.001
Class	→	WTC	.12	.07	0.086	.09	.07	.196
		Accuracy	.03	.10	0.783	.10	.11	.359
		Complexity	.60***	.07	<.001	.73***	.05	<.001
		Fluency	.85***	.05	<.001	.29**	.11	.005
		Frequency	.08	.06	0.179	.06	.08	.487
Gender	→	WTC	-.13*	.06	0.047	-.20**	.06	.002
		Accuracy	.24*	.10	0.022	-.07	.09	.489
		Complexity	.05	.06	0.381	.00	.06	.980
		Fluency	.11	.06	0.071	.02	.09	.835
		Frequency	-.17**	.07	0.009	-.17*	.07	.011
Years of Learning	→	WTC	-.05	.06	0.395	.01	.07	.929
		Accuracy	.11	.08	0.155	.21*	.10	.041
		Complexity	.06	.07	0.374	.13*	.05	.017
		Fluency	-.09	.07	0.193	.14	.10	.174
		Frequency	.10	.08	0.197	.15	.09	.073

p* < .05 *p* < .01 ****p* < .001

The hypothesis H1 proposed that all types of need satisfaction are positively related to WTC in both learning modes. The findings did not fully support H1. Controlling for students' gender, class levels, and years of learning experience, while both competence need satisfaction and relatedness need satisfaction were found to be significantly related to willingness to communicate, the significant relationship between autonomy need satisfaction and WTC was only found in asynchronous learning mode.

However, the findings provided substantial evidence for H2 hypothesis, in which the effect of need satisfaction on WTC was assumed to vary across learning modes. Competence showed similar effects in both modes, while autonomy had a stronger relationship with WTC in asynchronous learning. In contrast, relatedness showed a slightly stronger relationship with WTC in synchronous sessions.

According to the results, one unit increase in autonomy need satisfaction in asynchronous learning mode yielded a .21 increase in the WTC level, *p* = .003. The relationships between competence need satisfaction and WTC were very similar in asynchronous learning ($\beta = .39$, *p* < .001) and synchronous learning ($\beta = .37$, *p* < .001). The relationship between relatedness need satisfaction and WTC was relatively higher in

synchronous learning ($\beta = .42, p < .001$) as compared to asynchronous learning ($\beta = .34, p < .001$).

H3 hypothesis suggesting associations between WTC and communication quantity and quality was partially supported. WTC showed a positive relationship with communication participation frequency in two learning modes, with comparable effects observed in asynchronous mode ($\beta = .48, p < .001$) and synchronous mode ($\beta = .50, p < .001$), though the coefficient observed in synchronous learning was slightly stronger.

Similarly, WTC was also positively related to the fluency of language performance in both learning modes. A stronger relationship was observed in asynchronous learning ($\beta = .19, p < .001$) than in synchronous learning ($\beta = .17, p = .049$). However, significant associations between complexity and accuracy and WTC were only found in synchronous learning mode ($\beta = .13, p = .045$; $\beta = .21, p = .013$).

Although there was no hypothesis involving the relationship between autonomy need satisfaction and communication frequency, autonomy need satisfaction was found to be associated with communication frequency in both asynchronous learning ($\beta = .28, p = .001$), and synchronous learning ($\beta = .25, p = .005$).

In addition, the control variables (gender, years of learning, and class levels) were found to have different relationships in different learning modes. In both asynchronous learning and synchronous learning, gender was related to frequency of communication. Female students showed lower communication frequency than male students in both asynchronous ($p = .009$) and synchronous learning ($p = .011$), and lower WTC in both modes (asynchronous: $p = .047$; synchronous: $p = .002$). Female students also demonstrated higher accuracy in asynchronous learning ($p = .022$). Class levels were significantly related to language fluency and complexity in both modes, but the relationship was not observed with accuracy. In asynchronous learning, as the class level increased, students' language complexity ($\beta = .60, p < .001$) and fluency ($\beta = .85, p < .001$) tended to increase. Similarly, higher class levels were associated with increased scores in complexity ($\beta = .73, p < .001$) and fluency ($\beta = .29, p = .005$) in synchronous learning. Years of learning was positively related to complexity ($\beta = .13, p = .017$) and accuracy ($\beta = .21, p = .041$) in synchronous learning mode. But it was found to have no significant relationship with language performance in asynchronous learning when controlling for all other effects in the model.

Discussion

Same Relationship Patterns in Asynchronous and Synchronous Learning

The findings align with previous studies emphasizing the importance of creating a motivational environment to support students' psychological needs in online learning (Jiang & Xie, 2022; Martin et al., 2018). The correlational results confirm that a positive relationship between all BPNS and WTC existed in both modes, suggesting the consistent important role of need satisfaction in promoting language engagement.

The present study also revealed several common findings regarding the relationships between the variables in both asynchronous and synchronous learning modes. Firstly, competence and relatedness were consistently found to be significantly related to WTC in both modes. Students who reported higher levels of competence and a sense of connection with others were more willing to engage in communication activities. This suggests that

fostering students' perceived competence and creating a supportive social environment are crucial factors in promoting WTC, regardless of the learning mode (Shi et al., 2023). The findings further underscore the consistent roles of these needs in influencing WTC in two modes of learning.

This finding is consistent with research on WTC in traditional classrooms. Learners who perceive themselves as competent and feel connected with others or local communities are more likely to seek opportunities for language practice and initiate conversations instead of waiting for someone to start conversations (MacIntyre et al., 1999; Yashima, 2002). It should be noted that competence need satisfaction refers to the perception of whether one's abilities are satisfied by the environment. An individual who was a capable communicator does not always perceive their needs were satisfied. While they possess necessary skills to complete tasks, their subjective evaluation of their competence need could be affected by the online environmental affordances. When competence need are thwarted, they may feel reluctant to engage in communication. Instructors would need to consider individual differences in competence levels and design tasks that provide opportunities for individuals to experience success and stimulate communication intentions. The stronger relationship between relatedness and WTC observed in synchronous sessions could be related to the unique characteristics of synchronous sessions. In previous research, it has been shown that social presence and immediacy foster engagement (Bowers & Kumar, 2015). With synchronous sessions, students can interact and receive feedback in real-time, which promotes a stronger sense of connection with the instructor and among students.

Moreover, the relationship between WTC and communication frequency, WTC and fluency of communication were consistent in both learning modes. This further highlighted the significance of fostering WTC as a vital component of language learning development in an online learning context. Studies have consistently demonstrated the positive relationship between WTC and frequency of communication (e.g., McCroskey & Charos (1996)). In asynchronous sessions, learners with high WTC tend to make more discussion posts, post questions and comments, and share relevant resources. In synchronous sessions, the positive relationship can be observed through active participation in responding to teachers' questions, sharing their opinions, and engaging in group discussions.

Unique Relationship Patterns in Asynchronous and Synchronous Learning

A key finding of this study is the differential role of autonomy need satisfaction in relation to WTC across learning modes. Autonomy was significantly associated with WTC in asynchronous learning, but not in synchronous settings. This aligns with the nature of asynchronous learning, where learners have greater control over their pace and participation, allowing for more individualized engagement and decision-making (Moore, 2019). In contrast, the synchronous environment in this study was highly structured and teacher-led, limiting students' opportunities to exercise autonomy. Real-time interactions, limited speaking opportunities due to class size, and the presence of an authoritative instructor may have constrained learners' sense of agency, weakening the autonomy -WTC link.

The association between WTC and language performance also varied by mode. In asynchronous learning, WTC was related only to fluency, while in synchronous settings, WTC correlated with fluency, complexity, and accuracy. Task type also appeared to mediate the WTC - performance relationship. The use of creative tasks and rehearsal tasks can lead to variations in language performance outcomes (Wright, 2020). Synchronous learning may have provided more opportunities for holistic language development, likely due to its

interactive and feedback-rich nature. The structured tasks in synchronous classes, such as guided sentence construction and example-based responses, gave students immediate support and clearer targets, contributing to better performance outcomes (Buckingham & Alpaslan, 2017). Moreover, the interactive nature of synchronous sessions encouraged students with higher WTC to actively participate, dominate discussions, and take advantage of authentic communication moments. These experiences offered more opportunities for elaboration and real-time feedback, fostering greater accuracy and complexity.

In contrast, asynchronous tasks in our context focused on semi-creative writing. Although students were encouraged to generate original content, the lack of immediate feedback may have limited opportunities for refining language structures. Learners were less likely to restructure their interlanguage systems without direct interaction or correction, which is necessary for sustained development of linguistic complexity (Hsu, 2016).

Implications

From a practical standpoint, the findings of this study can inform instructional practices aimed at promoting students' needs satisfaction and enhancing their engagement in language learning. Instructional design should consider aspects that satisfy learners' needs.

Autonomy need satisfaction plays a more influential role in fostering willingness to communicate in asynchronous learning, as the self-paced nature of this mode allows learners to have greater control over their learning process. This finding is particularly relevant for adolescent learners, who are developing independence and benefit from autonomy-supportive environments that sustain their engagement over time (Jang et al., 2016). Instructors should consider creating a supportive environment that balances learner autonomy with guidance and structure. Instructors can limit task imposition and provide choices and flexible options for learning activities, which allow learners to have a sense of ownership and agency in their learning journey (Jiang & Xie, 2022; Martin et al., 2018). Additionally, instructors should emphasize the learners' perspective by highlighting the relevance and meaningfulness of the activities to their individual goals and interests.

To enhance competence support and promote effective language communication, it is recommended to provide structural guidance with optimal challenges, and personalized feedback (White et al., 2021). In asynchronous learning, instructors can design structural practices that make input comprehensible to learners. This can be achieved through clear instructions, visual aids, and scaffolded learning materials. Breaking down complex tasks into manageable steps can help learners retrieve information and understand the input more effectively. In synchronous learning, it is beneficial to design communicative activities that gradually progress from meaning-based activities to fully communicative activities using task-based language learning approaches in adolescent language classrooms (Jiang et al., 2022; Lai et al., 2011; Tseng et al., 2016). This step-by-step approach allows students to build up their language skills and confidence in a supportive environment. Starting with activities that focus on understanding and expressing meaning, such as discussions or role-plays, and gradually moving towards more authentic communicative tasks can help learners develop their speaking and listening abilities.

To support the relatedness need, it is important to provide sufficient opportunities for interactions while also establishing a caring environment. The need for connection is especially pronounced among adolescent learners, who are at a developmental stage where social relationships significantly influence their willingness to participate in academic

activities (Balfanz, 2023). This is particularly important in synchronous learning environments where learners are required to interact with teachers to practice their oral skills. However, it is important to acknowledge that learners may experience anxiety when speaking in a foreign language. Therefore, creating a risk-free environment is key to encouraging learners to actively participate and speak (van der Zwaard & Bannink, 2014). This can be achieved through various strategies, such as fostering a supportive and non-judgmental atmosphere, providing constructive feedback, and offering encouragement and praise for learners' efforts.

Limitations

Several limitations should be considered when interpreting these findings. First, this study employed a correlational design using survey data and performance measures, which limits our ability to establish causal relationships between psychological need satisfaction, WTC, and communication outcomes. Moreover, we employed ESM with self-report surveys, attrition rates affected our sample across the six time points, with some participants missing data due to non-completion of assignments or absence from sessions.

Second, our sample consisted entirely of adolescent learners in high school program. Adolescents may experience psychological needs and communication patterns differently than learners at other ages due to developmental and social factors, thus, findings may not generalize to young or adult language learning contexts.

Third, the study focused specifically on Chinese language learning, which presents unique challenges with character-based writing and tonal pronunciation. Results may differ for other language learning contexts, particularly those more linguistically similar to learners' first language.

Fourth, our findings emerge from a specific online program structure with particular teaching approaches and technological platforms. Different instructional settings may yield different patterns. Future research should examine similar models in varied instructional environments and with more diverse student samples to enhance the generalizability and applicability of the findings.

Conclusion

This study investigated how the satisfaction of basic psychological needs (autonomy, competence, and relatedness) relates to students' WTC and how WTC, in turn, predicts the quantity and quality of communication across asynchronous and synchronous learning modes. It not only further confirms the state-like nature of situational need satisfaction and WTC, but also discovers the specific role that need satisfaction plays in various learning mode in relation to WTC. The results highlight that while competence and relatedness consistently support WTC across both learning contexts, autonomy exerts a stronger influence in asynchronous settings where learners exercise greater control over participation. Moreover, WTC was a significant predictor of communication frequency and fluency in both modes, but its association with complexity and accuracy emerged only in synchronous sessions. The results contribute to the existing theoretical knowledge by highlighting the importance of considering the specific context and circumstances in which needs satisfaction operates.

Declarations

The authors declare no conflicts of interest. The authors declare no funding for this research. Permission to collect data from human subjects was granted by the Institutional Review Board (IRB) at The Ohio State University, USA.

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Appendix

Asynchronous Performance CAF Measures

Dimension	Operational Definition	Measurement Unit	Calculation Method	References
Complexity	Syntactic sophistication of language production	Average T-unit ^a length	Total characters / Total T-units	Pan (2018)
Accuracy ^b	Error-free language production	Proportion of error-free T-units.	Error-free T-units / Total T-units	Jiang (2013)
Fluency	Quantity of language production	Total character count	Sum of all characters in writing sample	Kusyk (2017); Plakans et al. (2019)

Note.

^a All measures were calculated based on T-unit segmentation of student writing posts. T-units were defined as simple sentences regardless of being subject-less or with one subject (Jiang, 2013). The identification of T-units often relies on the subjective judgment of researchers. In Chinese, the length of T-units is typically measured in characters, which serve as the fundamental unit in the Chinese language system (Pan, 2018). We used punctuation to guide the initial segmentation and adjusted through manual review and corrections. A total of 3,032 T-units were analyzed across all participants and time points.

^b Each coder individually examined and evaluated all units, assigning a label of “1” to each error-free unit. Inter-rater reliability for accuracy coding was .93. For cases where discrepancies arose, the two coders discussed and resolved disagreements to ensure complete consensus.