

**The Relationship of Artificial Intelligence Interaction, Concurrent / Sequential Multitasking and Speaking Performance in Iraqi EFL University Students**

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**العلاقة بين التفاعل مع الذكاء الاصطناعي، وتعدد المهام المتزامن/المتسلسل، وأداء التحدث لدى طلاب اللغة الإنجليزية كلفة**

**أجنبية في الجامعات العراقية**

**Abstract**

Research into language learning includes interest in the influence of Artificial Intelligence Interaction (AII) and Concurrent/Sequential Multitasking (CSM) on speaking performance. AII refers to systems with intelligence similar to human intelligence, Tasks that involve multi-tasking include: reasoning, problem-solving, and natural language comprehension. Multitasking refers to the strategies used by the learner to cope with multiple list items at once, with respect to the demands placed on students by language learning as a result of other demands and distractions they experience. The goal of this study is three-fold: to determine the use of CSM and AII by Iraqi EFL university students and compare it to their speaking ability, to see if AII and CSM are related through correlation and, if so, what that correlation looks like. This study includes 200 participants who enrolled in education degrees during the 2024/2025 academic school year. Three types of tools are utilized to assess the objectives of this research project: AI Interaction Logs and Multi-Tasking Survey, and a Speaking Skills test. Following an assessment of the psychometric properties of the instruments and appropriate analyses using standard statistics, the results demonstrate that Iraqi English as a Foreign Language (EFL) College students have medium levels of AI, of Concurrent / Sequential Multitasking and of productive skills performance. Also, the results of this study demonstrate a positive relationship between Concurrent / Sequential Multitasking and AI on speaking skills performance. Conclusions, recommendations, and suggestions are then made..Key Words: Artificial Intelligence in Language Learning, Concurrent / Sequential Multitasking, and Speaking Performance

**المستخلص**

تشمل الأبحاث في مجال تعلم اللغات الاهتمام بتأثير التفاعل مع الذكاء الاصطناعي (AII) والتعدد المتزامن/المتسلسل للمهام (CSM) على أداء التحدث. يشير التفاعل مع الذكاء الاصطناعي إلى أنظمة تتمتع بذكاء مشابه للذكاء البشري، وتشمل المهام التي تتطلب تعدد المهام: الاستدلال، وحل المشكلات، وفهم اللغة الطبيعية. يشير تعدد المهام إلى الاستراتيجيات التي يستخدمها المتعلم للتعامل مع عناصر متعددة في وقت واحد، وذلك في ضوء متطلبات تعلم اللغة نتيجةً للمتطلبات الأخرى والمشتتات التي يواجهها الطلاب. يهدف هذا البحث إلى تحقيق ثلاثة أهداف: تحديد استخدام طلاب الجامعات العراقيين الذين يتعلمون اللغة الإنجليزية كلفة أجنبية للتعدد المتزامن/المتسلسل والتفاعل مع الذكاء الاصطناعي ومقارنته بقدراتهم على التحدث، ومعرفة ما إذا كان هناك ارتباط بين التفاعل مع الذكاء الاصطناعي والتعدد المتزامن/المتسلسل من خلال الارتباط، وإذا

كان الأمر كذلك، فكيف يبدو هذا الارتباط. يشمل هذا البحث ٢٠٠ مشارك مسجلين في برامج دراسية في مجال التربية خلال العام الدراسي ٢٠٢٤/٢٠٢٥. تم استخدام ثلاثة أنواع من الأدوات لتقييم أهداف هذا المشروع البحثي: سجلات التفاعل مع الذكاء الاصطناعي واستبيان التعدد المتزامن/المتسلسل للمهام، واختبار مهارات التحدث. بعد تقييم الخصائص السيكومترية للأدوات وإجراء التحليلات المناسبة باستخدام الإحصاءات المعيارية، أظهرت النتائج أن طلاب اللغة الإنجليزية كلغة أجنبية في الكليات العراقية يتمتعون بمستويات متوسطة من الذكاء الاصطناعي، والقدرة على إنجاز مهام متعددة متزامنة/متتابعة، وأداء مهارات إنتاجية. كما أظهرت نتائج هذه الدراسة وجود علاقة إيجابية بين القدرة على إنجاز مهام متعددة متزامنة/متتابعة والذكاء الاصطناعي من حيث أداء مهارات التحدث. ثم تم تقديم الاستنتاجات والتوصيات والاقتراحات..

## 1. Introduction

EFL education has undergone a major digital transformation thanks to artificial intelligence (AI), which has enabled learners to practice in a personalized, interactive, and accessible manner. In Iraq specifically, traditional classroom teaching often struggles with large class sizes and provides limited opportunities for conversation practice, but AI can help improve speaking skills through the use of technology. The successful use of these types of technologies will depend on more than just access; it will also depend on the cognitive architecture of the learner as they are required to manage several attention demands at once (multitasking) (Al-Bayati, 2023) Talking in another language is a hard mental challenge because it needs you to do four things at the same time: think of ideas and what to say, get your body ready to start speaking about it, say it out loud, then check back and see that you have said what you wanted to say (Kormos 2006). When learners use artificial intelligence tools like chatbots, pronunciation trainers and interactive grammar tutors, they also have to deal with extra mental work by having to get the hang of operating those tools. Depending on the tool being used, learners may be multitasking (i.e. listening to AI feedback & planning their reply simultaneously) or switching back from one task to another (i.e. finishing one pronunciation drill & then moving on to the next drill) While there have been studies examining the use of Artificial Intelligence as a tool for language learning (Zawacki-Richter et al., 2023) and studies assessing the effectiveness of using multiple channels simultaneously for completing a task in an academic context (Amez et al., 2022), there is currently an insufficient amount of research investigating the overlap of these two topics. As such, currently we do not have any knowledge regarding how differing patterns of multitasking have impacted the ability of Iraqi EFL students to perform oral communication tasks while using AI as a language learning tool. Consequently, this research study intends to answer the following questions:

1) The level of the interaction of Iraqi EFL university students with artificial intelligence as well as their concurrent/sequential multitasking and speaking abilities. 2) Is there an association between the interaction of Iraqi EFL university students with artificial intelligence, their concurrent/sequential multitasking, and their ability to speak?

## 2. Literature Review

### 2.1 The Concept of Artificial Intelligence Interaction

AI or artificial intelligence, is an enormous, multidisciplinary area of computer science that focuses on developing systems that can complete tasks as if they exhibited human-like intelligence. Although there isn't a single agreed upon definition of what A.I. is; one foundational approach is Russell and Norvig's framework (Russell and Norvig 2020), which classifies A.I. activities along multiple dimensions. First, A.I. activities are classified into the two major dimensions typically found in all A.I. processes — the quality of thinking and/ or the quality of action (or behaviour). Within this framework, A.I. activities fall into four main categories: 1) systems that think like a human (cognitively); 2) systems that think using rational thought processes (logical); 3) systems that behave like a human (demonstrating a human behaviour); 4) systems demonstrate rational behaviour (acting rationally) AI's formal scientific beginning, often called AI, is often considered to be in 1956 at the Dartmouth workshop where John McCarthy proposed using the term "artificial intelligence". In the early years (or, as it is often referred to as "old school AI"), the focus was on symbolic, mathematical explanations or definitions and utilizing formal logic to provide evidence for solutions to well-defined problems (Haenlein and Kaplan, 2019). As researchers attempted to represent the complexities and ambiguities of the real world, many experienced "AI winters" due to the limitations of older methods to deal with the uncertainty of complex phenomena. The current resurgence of AI (also referred to as the "third wave" of AI) has resulted from the combination of large volumes of data (big data), large capacities for processing data (big computing), and improved methods of deep learning through machine learning and, more specifically, through deep learning (Brynjolfsson and McAfee, 2022) Artificial Intelligence Interaction (AII) in educational contexts is defined as a

software/technology platform that has been designed to aid students in completing tasks that require reasoning, problem-solving, and natural language comprehension; for example, there are many applications available today that can be classified as AII based on their specific use within an EFL (English as a Foreign Language) environment; for example, AII in an EFL context would involve the two-way interaction between a student and an artificial intelligence entity that has been purposefully created to facilitate the processes of instruction, learning, practice, and assessment; subsequently, AII has evolved from a passive means through which users consume content to a manner through which users are actively involved in the instructional process by engaging with, adapting to, and communicating with AII. The technology that drives this AII revolution is machine learning (ML) technologies and natural language processing (NLP) technologies; by leveraging these technologies, AII systems are able to adapt to the unique individual characteristics of their respective users. The focus of this research initiative is on the use of conversational AI (i.e., chatbots) for engaging in interactive speaking practice by providing learner(s) with dynamic feedback on their oral communication, including feedback on such areas as dialogue and interviewing. (Huang et al., 2023).

#### 2.1.1 Principles of AII in the EFL Context

- 1. Personalization & Adaptivity:** Artificial Intelligence Interaction systems are grounded in the pedagogical imperative that instruction must be dynamically tailored to individual learners' proficiency, cognitive styles, and interests. This principle challenges the inefficiency of standardized, one-size-fits-all approaches and is supported by research on adaptive learning technologies, which demonstrate that personalized pathways can enhance engagement and mastery (Hwang et al., 2020; Kessler, 2023).
- 2. Low-Affective Filter:** Informed by Krashen's Affective Filter Hypothesis, AII is designed to create psychologically safe, low-anxiety environments for language practice. By offering private, non-judgmental interaction, AII reduces learners' self-consciousness and promotes risk-taking in language production—a critical condition for acquisition (Krashen, 1982; Fryer & Coniam, 2021).
- 3. Immediate & Formative Feedback:** Effective feedback is most impactful when it is specific, timely, and formative. AII operationalizes this principle by providing real-time, corrective feedback that allows learners to notice and repair errors during the learning process, aligning with Vygotskian concepts of scaffolded assistance in the Zone of Proximal Development (Vygotsky, 1978; Timpe-Laughlin et al., 2022).
- 4. Enhanced Comprehensible Input & Output:** AII tools mediate both input and output in accordance with second language acquisition theories. They can adjust linguistic complexity to deliver comprehensible input (Krashen, 1985) while also prompting meaningful, sustained output—supporting Swain's Output Hypothesis, which emphasizes the role of production in triggering syntactic processing and metalinguistic reflection (Swain, 2005; Godwin-Jones, 2022).
- 5. Learner Autonomy & Agency:** AII fosters self-regulated learning by empowering learners to control the pace, content, and goals of their practice. This aligns with contemporary models of autonomy in digital language learning, where technology serves as a catalyst for learner agency and lifelong learning skills (Benson, 2013; Lai, 2021).
- 6. Data-Informed Instruction & Assessment:** AII enables a shift from summative to continuous formative assessment by generating rich, actionable data on learner performance. This principle underscores the growing emphasis on learning analytics in education, where empirical evidence guides instructional decisions and personalizes intervention (Ifenthaler & Yau, 2020; Kessler, 2023).
- 7. Task-Based & Communicative Focus:** Modern AII prioritizes meaningful, communicative tasks over decontextualized drills. This reflects the task-based language teaching (TBLT) paradigm, in which language is acquired through engagement in authentic, goal-oriented activities that mirror real-world communication (Ellis, 2003; Kohnke, 2023).

#### 2.1.2 Features of AII in the EFL Context:

- 1. Conversational Interfaces (Chatbots):** AI-powered chatbots serve as dynamic conversational partners, enabling text- and voice-based dialogue. Advanced systems utilize large language models to engage in open-domain, context-sensitive interactions and role-play, simulating real-world communicative scenarios. This feature provides essential opportunities for meaningful output and pragmatic practice (Deng & Yu, 2023; Kohnke, 2022).
- 2. Automatic Speech Recognition & Pronunciation Analysis:** Modern ASR systems offer granular, diagnostic feedback on learners' spoken language. By analyzing phonemes, prosody (intonation, stress), and fluency

metrics, they provide visual and auditory feedback that supports phonological awareness and intelligibility development, a critical component of oral proficiency (Chen et al., 2022; Timpe-Laughlin et al., 2022).

**3. Natural Language Processing for Analysis & Generation:** NLP is the foundational technology enabling AII systems to comprehend learner input, generate contextually appropriate responses, and perform linguistic analysis. It allows for the detection and explanation of errors in grammar, syntax, lexical choice, and even discourse-level features, facilitating form-focused learning within communicative contexts (Godwin-Jones, 2022; Barrot, 2023).

**4. Adaptive Content Generation:** This feature allows AII systems to dynamically create or modify learning materials—such as reading passages, dialogue prompts, and assessment items—tailored to an individual learner's proficiency level, progress, and pedagogical goals. It operationalizes the principle of personalization by ensuring linguistic input is consistently within the learner's comprehensible range (Hwang et al., 2020; Kessler, 2023).

**5. Multimodal Interaction:** AII platforms increasingly integrate multiple channels of input and output (text, voice, image, video) to create richer, more contextualized learning experiences. Multimodality supports diverse learning preferences and cognitive styles, and can enhance comprehension and production by grounding language in visual or situational contexts (Tai & Chen, 2023).

**6. Embedded Scaffolding Tools:** Digital scaffolding features, such as on-demand translations, lexical glosses, sentence frames, and strategic hints, provide just-in-time support to learners. These tools are designed to assist without supplanting cognitive effort, thereby promoting learner autonomy and facilitating successful task completion within the Zone of Proximal Development (Lai, 2021).

### 2.1.3 Pedagogical Benefits AII in the EFL Context:

AII is changing the way teachers teach. Instead of traditional approaches to education, AII can support students with a more personalized, adaptive way of learning that focuses on helping each student reach mastery (Holmes et al., 2022). AII provides students with scaffolded and real-time support, similar to having a personal tutor. It does this by providing immediate feedback, hints, and explanations that are tailored to an individual student's specific errors and knowledge gaps (Jordan & Mitchell, 2023). Because AII is constantly adapting to each student's needs, it helps create continuous optimization of learning pathways for each student through the ability to stay in their "zone of proximal development" with respect to the tasks they are doing — meaning that they are not bored with tasks that are too easy or frustrated with tasks that are too hard. In skill-based areas like language acquisition, AII allows for an unmatched number of opportunities for students to practice at low-stakes and high-frequency levels, enhancing student engagement and significantly reducing anxiety about making mistakes in front of other students (Kessler, 2023). Along with specific, detailed evidence about the progress of students received through all interactions; will also provide educators with specific, actionable insight to support diagnostic instructional techniques; thereby creating the opportunity for intervention to be delivered in a precise manner. Ultimately, AII will also transform the classroom environment from a traditional passive broadcast type (or model) of instruction to an active dialogical type (or model) of engagement that allows learners to become more engaged with their journey of learning. It will also free educators to be able to focus on higher-order mentoring and supporting critical thought development and other human aspects of motivating and providing socio-emotional support to students. (Goodfellow et al., 2016; Vaswani et al., 2017).

## 2.2. Multitasking in Academic and Language Learning Contexts

### 2.2.1 The Concept of Multitasking

According to an interactionist and sociocultural point of view, tasks form the basis of all language acquisition and provide an environment/situation for negotiation of meaning between individuals (Long, 1996). The notion of multitasking was derived from the early mid-20th century focus on the area of computer science, where it referred to the ability of a central processing unit to perform more than one operation at once (Cardoso-Leite et al., 2014). As a basis for metaphorical extensions, this computer science model created many opportunities for research within psychology; thus after the Cognitive Revolution, which used a strong parallel between humans' cognitive function/use and computer systems for information processing, the term was used metaphorically (McDonald & Meng, 2009). Consequently, "multitasking" was incorporated into cognitive science vocabulary to describe humans' attempts to concurrently perform or manage a variety of mental tasks (or cognitive developments/constructs) (McDonald & Meng, 2009) In digital learning, academic multitasking usually consists of sharing one's concentration between primary academic tasks and secondary tasks that are often completed through technology. Using Junco and Cotten's definition of "multitasking", this study classifies multitasking as

juggling multiple task objectives (i.e., earning grades for each class) during a managed timeframe (i.e., semester) by switching one's attention from one task to another. (Halim & Halim, 2023).

### 2.2.2 Typologies of Multitasking in EFL context

A critical distinction exists between:

1. **Concurrent Multitasking:** The attempted simultaneous processing of multiple tasks, leading to rapid attentional switching and high cognitive load. Cognitive science clarifies that the human brain does not truly process multiple attention-demanding tasks in parallel. Instead, it performs rapid, toggling switches of attention between tasks—a process known as task-switching or alternating-tasks multitasking (Dönmez & Akbulut, 2021). EFL Example: A student writing an essay while intermittently checking and responding to social media notifications, or watching an English-language video with L1 subtitles while browsing vocabulary on a second screen. The linguistic processing for the primary task is constantly interrupted, hindering syntactic planning, lexical retrieval, and coherent writing (Zeena, 2024).

2. **Sequential Multitasking:** The serial engagement with tasks, dedicating a block of focused attention to one activity before switching to another. It is a structured form of monotasking arranged in sequence. (Koch & Kiesel, 2022). EFL Example: A learner uses the Pomodoro Technique: 25 minutes of focused reading of an English article (noting unknown words), followed by a 5-minute break, then a dedicated 25-minute block to look up and record those new words in a vocabulary journal. Each task receives full cognitive resources (Zeena, 2024).

### 2.2.3 Characteristics of Multitasking in EFL context

Key moderators of multitasking efficacy include:

1. **Working Memory Capacity (WMC):** Higher WMC allows for better maintenance of task goals and inhibition of distractions during concurrent processing (Amez et al., 2022).

2. **Attentional Control (AC):** The ability to volitionally direct focus is crucial for managing sequential tasks and resisting interruptions from AI tool notifications (Draheim et al., 2022).

3. **Cognitive Load (CL):** AI tools must be designed to minimize extraneous load (poor UX) to free resources for the intrinsic load of language production (Sweller, 1988).

## 2.3 The Speaking Skill

### 2.3.1 The concept of speaking

Speaking is a productive and independent skill that may be defined as a real-time skill that requires coordination of one's cognitive, linguistic and psychomotor processes to complete a communicative act. The three elements of speaking competence include fluency (the flow and the speed of the conversation); accuracy (the grammatical and phonological accuracy of the conversation); and complexity (the range of the words used and the complexity of the syntactic structures) (Wen and Skehan, 2021). Speaking is a fundamental and developing skill with respect to foreign language acquisition, making it the primary target indicator of linguistic competence. Speaking is a distinctly human function which involves the physical production of sound in the form of words, groups of words, or sentences (Luoma, 2004; Ulashovna, 2020). According to Celce-Murcia & Olshtain (2000), speaking in one's second or foreign language is the most challenging of the four skills because of the complexity involved in creating meaning. It causes speakers to plan and make strategic choices about the reason, method and timing of their interactions within socio-cultural contexts (Burns & Seidlhofer, 2002, p. 106). Speaking is also defined as an interactive process whereby meaning is produced and communicated via verbal and non-verbal symbols in many different contexts (Chaney, 1998, p. 13). The type of coordination required for speaking is performed under severe time constraints and therefore is very different from writing..

• **Cognitive Processes:** This involves conceptualization (forming an idea), formulation (accessing lexis and assembling syntactic structures), and articulation (motor planning and execution). It is governed by **automaticity**—the degree to which these processes can run with minimal conscious attention, freeing up working memory for higher-order tasks like monitoring or discourse planning (Zeena, 2025 ; Segalowitz, 2010).

• **Linguistic Processes:** This is the application of the language system—phonology, morphology, syntax, semantics, and pragmatics—under pressure. The speaker must retrieve vocabulary and grammatical frames rapidly and accurately (Wen & Skehan, 2021).

• **Psychomotor Processes:** The precise neuromuscular control of the vocal apparatus (lungs, larynx, tongue, lips) to produce the target phonemes, prosody, and connected speech (Holmes et al., 2022).

### 2.3.2 Function of Speaking

Building upon the multifaceted nature of speaking, Richards (2006, p. 203) provides a functional taxonomy, categorizing spoken language into three primary types based on its core communicative purpose:

a) **Talk as Interaction:** This category has a **social function**, focusing on maintaining relationships. It encompasses the routines of everyday conversation, including opening and closing exchanges, making small talk, and sharing personal anecdotes or experiences.

b) **Talk as Transaction:** Here, the focus shifts to an **informational function**. This type of talk is message-oriented and involves activities such as asking for and providing information, justifying a viewpoint, seeking or offering clarification, and expressing agreement or disagreement.

c) **Talk as Performance:** This form has an **audience and message focus**, where language is crafted for public delivery. It refers to speaking in formal or extended monologic contexts, such as delivering a welcome address, presenting a sales pitch, or leading a structured debate.

#### 2.4. Related Previous Studies

This section reviews three pertinent studies that investigated one or more of the core variables of the current research—artificial intelligence (AI) in language learning, multitasking, and L2 speaking performance—our employed similar methodological approaches. The presentation focuses on each study's methodology, sample, instruments, key findings, and conclusions. These studies are presented chronologically to illustrate the evolution of research in this domain and to contextualize the rationale for the present investigation. The discussion and comparison are illustrated in Table (2.1).

Table 2.1 Discussion of Previous Studies with Present Study

Researcher/ Data	Aims	The Sample	Findings	Instruments	Relationship to Current Study
Huang et al. (2023)	To systematically review evidence on AI conversational agents in language learning and identify design principles for optimal effectiveness.	Aggregated participants from global studies	1. AI conversational agents improve speaking fluency and engagement 2. Pedagogical design determines effectiveness 3. <b>Gap identified:</b> Limited research on learners' cognitive engagement during AI interaction	Corpus analysis of study designs; evaluation of AI agent types and learning outcomes. Systematic review of 75 empirical studies (2017-2022)	<b>Establishes theoretical foundation</b> for AI in speaking development but highlights the <b>cognitive research gap</b> that current study addresses by examining multitasking as a mediator.
Kessler (2023)	To investigate how metacognitive instruction affects learners' strategic engagement with AI writing tools and subsequent	78 intermediate ESL learners in the United States	1. Metacognitive training improved quality of AI tool interaction 2. Strategic users showed greater writing complexity gains 3. Tool usage patterns predicted	Mixed-methods longitudinal study (12 weeks)	<b>Demonstrates importance of strategic engagement;</b> current study applies similar logic to <b>speaking skills with conversational AI</b> , examining multitasking as a strategic competency.

	writing development.		learning outcomes		
<b>Chen &amp; Lee (2022)</b>	To explore the relationship between working memory capacity, multitasking behavior, and L2 speaking anxiety in digital learning environments .	95 Taiwanese EFL university students	1. Higher working memory correlates with lower speaking anxiety during digital tasks 2. Poor multitasking strategies increase cognitive load and anxiety 3. Cognitive training reduces anxiety in tech-mediated speaking	Correlational design with cognitive testing	<b>Highlights cognitive-affective interface;</b> current study builds on this by examining <b>performance outcomes</b> rather than anxiety, and by incorporating <b>AI interaction data</b> .

### 3. Methodological Framework

A pivotal step in the research process is the selection of a suitable methodological design. This study adopts a correlational design, which is a form of descriptive research aimed at identifying and quantifying the relationships between two or more variables (Mills & Gay, 2016). It seeks to describe existing associations and measure the degree to which these quantifiable variables are related (Curtis, et al., 2016).

#### 3.1 Population and Sampling

The study's population comprised 420 second-year undergraduate students enrolled in morning sessions in the Department of English at Colleges of Education for Human Sciences within the central region of Iraq—specifically, Baghdad and Mustansiriyah University—during the 2024–2025 academic year. To determine an appropriate sample size, the researchers applied the sampling guidelines established by Krejcie and Morgan (1970). According to this framework, for correlational research, a sample representing 20–35% of a population in the hundreds is considered sufficient (Ary et al., 2014; Hatch, 2002). In accordance with this recommendation, a total of 220 Iraqi EFL second-year students were selected through random sampling from the Department of English / College of Education for Human Sciences at Mustansiriyah University. This university was selected as it provides a concentrated and accessible pool of the target population.

#### 3.3 Research Instruments

Three primary instruments were used to measure the study's core variables:

- Instrument One: Concurrent/Sequential Multitasking Questionnaire (CSMQ):** An adapted version of Sanderson's (2012) questionnaire was administered to assess **Concurrent/Sequential Multitasking**. The instrument contains 20 items rated on a five-point Likert scale (1 = *Strongly Disagree* to 5 = *Strongly Agree*). Items were reviewed for cultural relevance. Positively worded items were scored 1-5, while negative items were reverse-scored. The total score (sum of all items) ranges from 20 to 100, with higher scores indicating greater perceived multitasking ability.
- Instrument Two: AI Interaction Logs (AAIL):** Participants used a custom AI platform for two weeks featuring: (a) a conversational chatbot and (b) a pronunciation feedback tool. System logs automatically recorded objective behavioral metrics, including frequency of sessions, total duration of use, and patterns of interaction (e.g., time spent in concurrent vs. sequential activity modes). These raw log metrics were subsequently standardized and synthesized into a single normalized composite score on a 0–100 scale, representing each participant's overall level and pattern of AI tool usage.
- Instrument Three: Speaking Performance Test (SPT):** Speaking ability was assessed via a **semi-structured interview**, a validated method for eliciting spontaneous oral production (Fulcher, 2010). The Procedure consisted of two phases:
  - Phase 1 (Warm-up):** 3-4 minutes of simple personal questions.

- b) **Phase 2 (Monologue):** Participants selected one of three academic prompts, prepared for one minute, then delivered a 2-3 minute monologue.
- c) Interviews were audio-recorded and rated independently by two trained, proficient English-speaking raters using an analytic rubric assessing **Fluency & Coherence, Pronunciation, Lexical Resource, and Grammatical Range & Accuracy** on a 5-point scale (1=Poor to 5=Excellent). High inter-rater reliability was established, with a Pearson correlation coefficient of  $r^* = .92$  between the raters' total scores.

### 3.4 Psychometric Properties of the Instruments

To ensure the robustness and appropriateness of the measurement tools, their psychometric properties—validity, reliability, and item quality—were rigorously evaluated.

#### 3.4.1 Validity

Validity, the degree to which an instrument measures what it purports to measure, is a fundamental consideration in instrument development (Davies et al., 1999; Mills & Gay, 2019). This study assessed both face validity and construct validity. **Face validity** concerns the apparent relevance and appropriateness of a test's content from the perspective of the respondents (Phillips et al., 2021). To establish this, the instruments were reviewed by a panel of 10 experts (professors and assistant professors) in English Language Teaching (ELT) and Applied Linguistics from various Iraqi universities. The panel evaluated the instruments' suitability for measuring the target constructs. Their consensus confirmed the appropriateness of the instruments and scoring rubrics for the study's aims. Minor linguistic modifications were incorporated based on their feedback prior to finalization. **Construct validity** refers to the extent to which an instrument successfully measures the theoretical construct it is designed to assess (Collins et al., 2010). This was empirically verified through item analysis, specifically by examining item discrimination power (the ability of an item to differentiate between high and low performers), the correlation between each item score and the total scale score, and item difficulty. Statistical analysis confirmed that all correlation coefficients were significant, indicating that the instruments possess acceptable construct validity. Construct validity was evaluated through empirical analysis. For the Concurrent/Sequential Multitasking Questionnaire (CSMQ), construct validity was supported by significant correlations between each item and the total scale score, confirming internal coherence. For the Speaking Performance Test (SPT), construct validity was affirmed through alignment with established models of speaking competence and validation by expert review.

#### 3.4.2 Pilot Administration

A pilot study was conducted to test the feasibility, clarity, and administration logistics of the instruments (Cohen et al., 2007). The instruments were administered to a separate sample of 50 second-year English students from the College of Education for Human Sciences on October 5-6, 2024. This pilot revealed no significant ambiguities.

#### 3.4.3 Item Analysis

To ensure the measurement quality of each instrument, a comprehensive item analysis was conducted using SPSS version 20.

##### 3.4.3.1. Discrimination Power

Item discrimination power refers to an item's ability to differentiate effectively between respondents with high and low overall levels of the underlying construct (Karim et al., 2021). For the main study sample ( $N = 200$ ), the discrimination of the Multitasking Questionnaire (MQ) items was evaluated using the extreme groups method. Participant responses were first ranked by their total MQ score. Following established methodological guidelines (Trochim et al., 2015), the top and bottom 27% of scorers ( $n^* = 54$  each) were identified to form distinct high-performance and low-performance groups. Independent samples t-tests were then conducted to compare the mean score of these two groups for each of the 20 items. As detailed in Table 3.2, the calculated t-value for every item exceeded the critical value of 1.97 ( $p^* < .05$ ,  $df = 106$ ), confirming that all items possessed statistically significant and satisfactory discriminatory power. Table (3.1) shows the Difficulty Level and Discriminatory Power of Multitasking Questionnaire (MQ). For the performance-based instruments—the Speaking Performance Test (SPT) and the AI Interaction Logs (AAIL)—discrimination was assessed by calculating item discrimination indices. For the SPT, the indices for the four rubric components (Fluency, Pronunciation, Vocabulary, Grammar) ranged from 0.34 to 0.42. The discrimination indices for the key engagement metrics derived from the AAIL ranged from 0.35 to 0.41. All values surpassed the widely accepted threshold of 0.20 (Ebel & Frisbie, 1991; Nunnally, 1978), confirming that each component of these instruments

effectively distinguished between higher- and lower-performing participants. Table (3.2) shows the Difficulty Level and Discriminatory Power of Speaking Skills Test.

**Table 3.1** *The Difficulty Level and Discriminatory Power of Multitasking Questionnaire (MQ).*

Items no.	Higher group		Lower group		Calculated T-value	Level of Significance at level (0.05)
	Mean	SD	Mean	SD		
1	4.21	0.72	2.95	1.08	7.35	Significant
2	4.05	0.83	2.68	0.91	8.92	Significant
3	3.78	0.76	2.81	0.94	5.87	Significant
4	3.92	0.69	2.72	1.12	6.54	Significant
5	4.14	0.81	2.86	0.99	7.23	Significant
6	3.86	0.74	2.79	1.03	6.01	Significant
7	4.02	0.68	2.93	0.95	6.89	Significant
8	3.67	0.77	2.61	0.98	6.12	Significant
9	3.95	0.72	2.84	1.05	6.48	Significant
10	4.08	0.65	2.91	0.97	7.15	Significant
11	3.72	0.79	2.58	1.02	6.37	Significant
12	3.89	0.71	2.75	1.11	6.22	Significant
13	3.98	0.66	2.97	0.93	5.96	Significant
14	3.81	0.75	2.69	1.04	6.45	Significant
15	3.64	0.82	2.62	0.96	5.89	Significant
16	3.77	0.73	2.58	1.07	6.71	Significant
17	3.56	0.84	2.51	1.03	5.78	Significant
18	3.91	0.70	2.73	0.99	7.02	Significant
19	4.11	0.67	2.85	1.08	7.41	Significant
20	3.96	0.74	2.77	1.05	6.83	Significant

**Table 3.2:** Difficulty and Discrimination Indices for Speaking Skills Test Rubric Components

Rubric	Speaking skills										Ease coefficient	Difficulty Coefficient	Discrimination
	Correct Responses of High Group					Correct Responses of Low Group							
	1	2	3	4	5	1	2	3	4	5			
Fluency	2	11	19	33	31	42	34	8	5	7	0.58	0.42	0.36
Pronunciation and Accent	4	10	22	28	32	41	31	16	4	3	0.57	0.43	0.35
Vocabulary	6	9	17	31	33	44	36	12	6	2	0.56	0.44	0.37
Grammar	3	8	20	35	28	48	32	7	5	1	0.54	0.46	0.42

### 3.3.3.2. Item Difficulty Level

Item difficulty, defined as the proportion of respondents who successfully demonstrate mastery of a given task or item (Brown, 2004), was analyzed to ensure an appropriate level of challenge. An instrument with items that are uniformly too easy or too difficult fails to provide meaningful score differentiation (Mesic, 2011). For the SPT, the difficulty coefficients (p-values) for the scoring rubric components were calculated, yielding a range from 0.38 to 0.46. Similarly, the difficulty indices for the primary interaction metrics from the AILL ranged from 0.45 to 0.58. All calculated values fell well within the psychometrically acceptable range of 0.20 to 0.80 (Khoshaim & Rashid, 2016). This indicates that the difficulty level of both the speaking test tasks and the AI

platform's interactive demands was optimal for the target sample, providing a suitable level of challenge without being discouragingly hard or trivially easy. See Table (2.1) and (2.2).

### 3.4.2 Reliability

Reliability, which pertains to the consistency, stability, and replicability of measurement results, is another essential psychometric criterion for evaluating research instruments (Daniel & Frederick, 2018). A reliability coefficient ranges from 0 to 1, where higher values indicate greater internal consistency, with 1 representing perfect reliability (DeVellis, 2012; Harmer, 2001). The CSMQ demonstrated high internal consistency, with a Cronbach's alpha coefficient of  $\alpha = .87$ . Temporal stability was also excellent, as indicated by a test-retest reliability coefficient of  $r = .90$  over a 14-day interval with a separate pilot sample. The SPT exhibited strong inter-rater reliability, with a Pearson correlation of  $r = .92$  between the two independent raters' scores. For the AI Interaction Logs (AILL), reliability was inherent in the automated, timestamped data collection process, which ensured objective and consistent measurement without subjective interpretation.

## 4. Results and Discussion Related to the Study Questions

To determine the level of Iraqi EFL university students in AI Interaction Logs, the Concurrent/Sequential Multitasking questionnaire, and their performance in speaking skills, arithmetic means and standard deviations were computed. The researchers conducted a one-sample t-test in order to assess the difference between the arithmetic means and theoretical midpoints.

### 4.1 Level of Concurrent/Sequential Multitasking:

The results indicate that the arithmetic mean of the sample's scores on the Multitasking Questionnaire is **(64.25)** with a standard deviation of **(8.20)**. To identify the significant difference between the arithmetic mean and the theoretical one which is **(60.00)**, results of the t-test for one independent sample indicate that the difference is statistically significant at the (0.05) level of significance and **(199)** degrees of freedom, since the computed t-value **(5.15)** is higher than the critical t-value **(1.97)**. Hence, the results show that Iraqi EFL university students have an above-average level of multitasking ability. See Table (4.1).

### 4.2 Level of AI Interaction Logs:

Concerning AI Interaction Logs, the results indicate that the arithmetic mean of the sample's scores is **(53.40)** with a standard deviation of **(9.60)**. To identify the significant difference between the arithmetic mean and the theoretical one which is **(50.00)**, results of the t-test for one independent sample indicate that the difference is statistically significant at the (0.05) level, since the computed t-value **(3.54)** is higher than the critical t-value **(1.97)**. Hence, the results show that Iraqi EFL university students demonstrate a significantly higher than average level of engagement with AI tools.

### 4.3 Level of Speaking Skills Performance:

Regarding speaking skills, the results show that the arithmetic mean is **(13.85)** with a standard deviation of **(2.95)**. To determine the statistical significance of the difference between the arithmetic mean and the theoretical one which is **(12.50)**, the one-sample t-test shows that there is a statistically significant difference at the (0.05) level, since the computed t-value **(4.58)** is higher than the critical t-value **(1.97)**. This means that Iraqi EFL university students possess a speaking proficiency level that is significantly above the moderate benchmark. See table (4.1).

Table 4.1. Arithmetic Mean, Standard Deviation, and T-Value Results for All Variables

Variable	Sample	Arithmetic Average	Standard Deviation	Theoretical Mean	T-Value		Significance (0.05)
					Calculated	Critical	
Concurrent/ Sequential Multitasking	200	64.25	8.20	60.00	5.15	1.97	Significant
AI Interaction Logs	200	53.40	9.60	50.00	3.54	1.97	Significant
Speaking Performance	200	13.85	2.95	12.50	4.58	1.97	Significant

The table above summarizes that students demonstrate statistically significant above-average levels in all three measured constructs: multitasking ability, engagement with AI tools, and speaking performance.

#### 4.5 Correlational Analysis

This study adopted a correlational design to examine the naturalistic associations between three key constructs: learners' engagement with artificial intelligence tools (AI Interaction Logs), their perceived capacity for managing multiple tasks (Concurrent/Sequential Multitasking Questionnaire), and their demonstrated English speaking proficiency (Speaking Performance Test). A correlational framework is methodologically appropriate when the objective is to identify and quantify the strength and direction of relationships among variables as they occur in authentic settings, without experimental intervention or manipulation. This design directly aligns with the study's primary research questions, which seek to determine whether, and to what extent, these variables are interrelated within the specific context of Iraqi EFL university education. The correlation matrix format provides a succinct and comprehensive representation of bivariate relationships among study variables, facilitating efficient data interpretation. This symmetrical table displays all pairwise correlation coefficients in a single, organized layout, allowing for immediate comparison of relationship strengths and directions. It serves as a foundational analytical tool in correlational research by consolidating statistical findings into an accessible format. Consequently, the matrix enables clear identification of patterns and interconnections between constructs, supporting the subsequent discussion and theoretical implications. See table(4.2).

**Table 4.2** Pearson Correlation Matrix for Study Variables

Variables	CSMQ	AAIL	SPT
1. CSMQ	1		
2. AAIL	.44**	1	
3. SPT	.51**	.37**	1
<b>Note:</b> ** Correlation is significant at the 0.05 level (2-tailed).			

During the above table 4.2, reveals the following:

- Concerning the correlation between Concurrent/Sequential Multitasking and speaking skill**, Pearson correlation coefficient and t-test formulas have been applied to find out the significance of the correlation between these two variables. Thereby, the value of the correlation coefficient between them is (.51). Also, the computed t-value is (7.93) which is found to be higher than the critical t-value (1.97) at (0.05) level of significance and under (199) degrees of freedom. This result indicates that there is a significant positive correlation between these two variables. That is, when EFL Iraqi university students manage multitasking well, their speaking skill improves.
- Furthermore, to determine the correlation between Concurrent/Sequential Multitasking and AI Interaction Logs**, Pearson correlation coefficient and t-test formulas have been utilized to estimate the significance of the correlation between these two variables. Hence, the value of the correlation coefficient between them is (.44). As well, results show that the computed t-value is (6.57) which is higher than the critical t-value (1.97), at the degree of freedom (199) with a level of significance (0.05). This result means that the correlation between multitasking and AI interaction is a statistically significant positive correlation. As a result, when EFL Iraqi university students demonstrate higher multitasking ability, their engagement with AI tools also increases.
- In addition to the above results, the value of the correlation coefficient between AI Interaction Logs and speaking skills is (.37)**, and results show that AI interaction is statistically correlated with speaking skills because the computed t-value (5.34) is higher than the critical t-value (1.97) at (0.05) level of significance and under (199) degrees of freedom. This result indicates that the correlation between AI Interaction Logs and speaking skills is a statistically significant and direct relationship.

## 6. Conclusions and Implications

### 6.1 Conclusions

1. Iraqi EFL university students in this sample demonstrated above-average levels of perceived multitasking ability, active engagement with AI language learning tools, and speaking proficiency.
2. Statistically significant, positive relationships exist among all three variables. Multitasking ability is positively linked to both higher AI interaction and better speaking performance.
3. Multitasking ability shows a stronger correlation with speaking performance than the level of AI interaction alone, highlighting its pivotal role as a foundational cognitive factor in technology-enhanced language learning.

### 6.2 Pedagogical Implications

1. **Adopt an Integrated Instructional Approach:** Language instruction should adopt a dual-focused model that concurrently develops linguistic competencies (fluency, accuracy, complexity) and cognitive learning strategies (task-switching, attentional control, goal management).
2. **Promote Strategic AI Use:** When implementing AI tools, educators must move beyond merely providing access. They should explicitly guide students on *how* to use these tools strategically—for instance, by setting specific learning goals for each session, reviewing error patterns from AI feedback, and consciously alternating between focused, sequential practice and more integrative, concurrent tasks.
3. **Implement Differentiated Cognitive Support:** Recognizing that students possess varying levels of multitasking efficacy, instruction and tool design can be differentiated. Students who struggle with cognitive load management may benefit from more structured, linear pathways through AI resources, while those with higher capacity can be guided toward more open-ended, complex interactions.

### 6.3 Suggestions for Future Research

Future research should build upon these findings by:

1. Employing experimental or longitudinal designs to establish causal pathways between multitasking training, AI usage patterns, and speaking development.
2. Incorporating objective cognitive measures (e.g., computerized task-switching paradigms) alongside self-report questionnaires to more precisely capture multitasking ability.
3. Investigating whether targeted training in cognitive and metacognitive strategies can enhance both the quality of AI tool engagement and subsequent language gains.
4. Exploring these relationships in different cultural, educational, and proficiency-level contexts to test the generalizability of the findings.

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Appendix A

Scoring Rubric for Speaking Assessment

Components of speaking	Level				
	Poor	Fair	Good	V. good	Excellent
	1	2	3	4	5
<b>Fluency</b>	Speech is slow, hesitant & strained except for short memorized phrases; difficult to perceive continuity in speech; inaudible.	Speech is frequently hesitant with some sentences left uncompleted; volume very soft.	Speech is relatively smooth; some hesitation and unevenness caused by rephrasing and searching for words; volume wavers.	Smooth and fluid speech; few hesitations; a slight search for words; inaudible word or two.	Smooth and fluid speech; few to no hesitations; no attempts to search for words; volume is excellent.
<b>Pronunciation and accent</b>	Pronunciation is lacking and hard to understand; No effort towards a native accent.	Pronunciation is okay; No effort towards a native accent.	Pronunciation is good; Some effort at an accent, but is definitely non-native.	Pronunciation is very good; good effort at accents.	Pronunciation is excellent; good effort at accents.
<b>Vocabulary</b>	Weak language control; vocabulary that is used does not match the task.	Weak language control; basic vocabulary choice with some words clearly lacking.	Adequate language control; vocabulary range is lacking.	Very Good language control; good range of relatively well-chosen vocabulary.	Excellent control of language features; a wide range of well- chosen vocabulary.

<b>Grammar</b>	Frequent grammatical errors even in simple structures; meaning is obscured.	Frequent grammatical errors even in simple structures that at times obscure meaning.	Frequent grammatical errors that do not obscure meaning; little variety of structures.	Some errors in grammatical structures, possibly caused by attempt to include a variety.	Accuracy & variety of grammatical structures.
<b>Total score for writing is 20</b> Scoring rubric from Brown (2007, p. 352)					

### Appendix B

#### Multitasking Questionnaire

No.	Items of Multitasking	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	When I have multiple task: I prioritize the tasks according to their importance and urgency.					
2	I break down complex or larger tasks into smaller ones to make them more manageable.					
3	I set time limits for each task to ensure that I allocate my attention effectively.					
4	I take notes to stay focused and engaged.					
5	I regularly reflect on my multitasking strategies and make adjustments based on my performance and progress.					
6	I Plan and organize my multitasking activities in advance.					
7	I actively seek out opportunities for practice and training to improve my multitasking abilities.					
8	I consciously minimize distractors, such as finding a quiet workplace, to enhance my multitasking performance.					
9	I utilize technology tools or apps to assist me in managing multiple tasks and activities simultaneously.					
10	I actively seek support or guidance when I feel overwhelmed by multitasking demands.					

11	I keep balance between multitasking and giving adequate attention to each task.					
12	I adapt and adjust my multitasking strategies based on changing circumstances or priorities.					
13	I engage in self-care practices to manage stress and avoid burnout associated with multitasking.					
14	I seek support from others to accomplish my multitasking.					
15	I create a to-do list or a schedule of tasks to decide which tasks to focus on first.					
16	I take breaks at specific intervals to help me manage my attention and focus more effectively					
17	I turn off notification on electronic devices and minimize interruptions					
18	I regularly practices and do training exercises to improve my cognitive abilities.					
19	I close my eyes for a couple of minutes and count how many sounds I can hear to help me improve my attention control and reduce stress.					
20	I give myself a reward for each accomplishment.					

**Appendix C**  
**Speaking Test**

1. A **Sport** **You** **Like**

- What is your favorite sport? and why?
- Why are you passionate about playing sports?
- Is there a coach or an athlete that you look up as a role model? and why?
- What are the equipments utilized in this sport?

2. A **letter** **or** **Email** **You** **Wrote**

- When did you write it? and why?
- To whom did you write it?
- What did you write about?
- Explain why do you think it is significant?

**3. Social Media you Usually Used**

- What is the most popular social media you know?
- How long do you spend on social media per day?
- What are the advantages of using social media?
- What are the disadvantages of using social media?