Intelligent-TBLT for EFL Learners' Reading and Writing Skills: A Chaos Complexity Theory Lens

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ABSTRACT

This mixed method exploratory sequential case study examines the integration of generative AI within a task-based language teaching (Intelligent TBLT) framework designed to enhance reading and writing skills through an innovative learning procedure within an informal learning context. In a one shot, one-hour intervention, 15 EFL learners worked in small groups to interpret a complex "deserted island" regulations for survival and collaboratively produced a 180-220 words survival plan for two months. Throughout the task, they relied on generative AI and their peers for clarification and support, with limited teacher interference. The study qualitatively investigated the students' perceptions on how AI's digital scaffolding influences their cognitive load and its perceived impact on learning of reading and writing through open-ended questions. Besides, the study quantitatively investigated the learners' mental, physical and temporal workload, and given effort, their task performance, and frustration levels using NASA Task Load Index which was completed in the mid-task phase. Qualitative analysis examined the degree to which the role of ChatGPT has an effect on the understanding of the difficult text, the quality of written text, emotional, and cognitive reactions of the learners. The results indicate that the utilization of AI can reduce part of cognitive load and anxiety that can provide greater involvement and getting of the tasks. The study can be added to the growing body of research on AI-assisted informal language learning, and provide information about the ways in which technology can be used to assist students.

Keywords: ChatGPT, cognitive load, task-based language learning, Generative AI, reading and writing

Introduction

Over the last few years, technological use in language learning has revolutionized the method of instruction, especially in the process of reading and writing the second language (Zhao and Lai, 2023). The new possibilities of improving language learning are offered by TBLT and digital tools (Smith & Gonzalez-Lloret, 2021). Nevertheless, the mental load imposed on the learners in these settings is a burning issue (Woo et al., 2024). The cognitive workload which is made up of the mental, physical and temporal demand, the level of effort, performance and

frustration are very critical in determining the learning experiences and outcomes (Hart, 2006). The increase in cognitive load can reduce comprehension, decision-making, and task performance, so it is necessary to investigate the means of reducing cognitive load and at the same time preserving the engagement, and effectiveness (Liu, 2024). Meanwhile, the international initiative to improve the quality of education, which is one of the Sustainable Development Goals of the United Nations, presupposes such necessity as innovative pedagogical approaches to the issues related to education.

Task-Based Language Teaching (TBLT) is not a new teaching approach since it allows learners to engage with meaningful and communicative tasks that place language within a real-life setting (Kessler et al., 2021). Nevertheless, students are frequently exposed to difficult reading and writing activities that increase cognitive load, and possibly, decrease motivation and achievement. Task complexity is one of the main factors that determine cognitive workload in TBLT (Luo, 2021). Cognitive overload may be caused by tasks that demand advanced linguistic understanding, quick decision-making, and problem-solving especially when learners are time-bound (Taha Atta et al., 2021). In this regard, the development of generative artificial intelligence applications provides the opportunity to overcome these challenges associated with the intellectual strain involved in complex language tasks (Celik et al., 2024; Octavio et al., 2024; Wang et al., 2024) 2.

Thus, the current work prepares the TBLT lesson and applies and tests it to (1) explore how mental, physical, and temporal needs of EFL students in an AI assisted TBLT setting with a complex text, (2) determine the particular factors that cause cognitive overload, (3) learn how generative AI can help to overcome task-related difficulties and (4) find out how AI facilitates reading comprehension, writing performance, and general task completion.

Literature review

Chaos/Complexity Theory

Traditional theories of second language acquisition (SLA) have tended to describe language acquisition in terms of linear, mechanical theories, which are composed of the predictable developmental sequences. Nevertheless, language acquisition is a complex and dynamic process which is affected by many cognitive, social and environmental factors. In such a way, scholars have resorted to Chaos Complexity Theory (CCT) in the comprehension of nonlinear, emergent, complex, dynamic and hence, unpredictable yet patterned language learning (Larsen-Freeman, 1997). For example, task complexity in EFL writing has been shown to influence syntactic variation but not necessarily lexical development, which suggests that different linguistic subsystems evolve at different rates and in response to different conditions (Zhan et al., 2021). Another example is that the interlanguage structures dynamically shift as learners interact with new linguistic input and adjust their internal language systems (Kong, et al., 2021). This nonlinear nature of learning aligns with TBLT, as task complexity, learner variability, and emergent interactions within language tasks reflect the self-organizing and adaptive principles that are central to CCT.

Task Based Language Teaching

TBLT is an approach to English language teaching that focuses on communicative tasks as the

central of instruction. Unlike traditional methods that focuses on explicit teaching of language rules, TBLT builds on meaningful interaction through authentic language use within learner-centered tasks. TBLT is grounded in cognitive-interactionist theories along with behaviorism and innatism (Barralt, 2023)

The TBLT framework consists of three phases: Pre-task, task cycle, and post-task (East, 2021). In the pre-task phase, learners receive instructions, activate prior knowledge, and familiarize themselves with key vocabulary and structures (Barralt, 2023). The task cycle phase includes three sub-stages: learners perform the task, prepare their work, and present results while receiving feedback (East, 2021). Finally, in the post-task phase learners reflect on their learning, receive corrective feedback, and sometimes repeat the task to reinforce their learning and retention (Spada, 2021).

The research on TBLT, such as a large-scale meta-analysis found that long-term TBLT programs had a strong positive effect on second language learning across 52 studies (Bryfonski & McKay, 2019). While TBLT prioritizes fluency (Spada, 2021), the task can also be shaped in a way to teach any language skills. For instance, in the literature, the scholars used it for enhancing listening skills (Mulyadi et al., 2021), linguistic achievement (Fang et al., 2021), speaking skills (Chen, 2021; Quang et al., 2022; Zhang, 2022), writing skills (Ahmad, 2022; Bagheridoust, 2023), and reading skills (Wibowo & Munir, 2024). TBLT has also been used in online settings, and it enhanced learners' engagement and performance (Jiang et al., 2023). Another recent study showed that mobile-supported TBLT significantly improved students' vocabulary and comprehension compared to traditional TBLT (Fang et al., 2020). However, factors such as task complexity, anxiety, and self-efficacy play a significant role in the outcome of TBLT (Tabari & Goetze, 2024).

Cognitive Load Theory

Since learning languages is a dynamic process, which is complicated by the interaction of cognition and emotion, the cognitive load theory (CLT) provides some useful information to formulate more effective classroom pedagogies. The CLT is made up of three kinds of cognitive load (1) intrinsic load (associated with complexity of the material), (2) extraneous load (brought about by ineffective instructional design), and germane load (supports learning by means of schema formation). Better learning outcomes can be achieved by designing the classes in a manner that it fits CLT (Hornay, 2021; Lan, 2021).

Generative AI (ChatGPT) was also used in this study as a form of digital scaffold that had a direct effect on intrinsic and extraneous cognitive load. Intrinsic load- based on the lingo-lingo complexity of the survival task- was moderated when the ChatGPT assisted learners in decoding complex vocabularies and sentence structures as well as explaining what they needed to do in the task. The instant access to contextualized explanation and lexical suggestions contributed to the reduction of extraneous load, which is usually caused by the inefficient information retrieval or insufficient instructions. This enabled the learners to shift the cognitive focus to schema building and problem-solving, which is essentially facilitative of germane load as the learners wrote and perfected their survival plans. Overload in cognition may have a detrimental impact on listening comprehension (Roussel et al., 2021), focus ability of learners,

(Hughes et al., 2021), learning a language (Roussel, et al., 2021), motivation (Lan, 2021), and skill acquisition (Jiang & Kalyuga, 2022). On the other hand, language input that exceeds a learner's proficiency level increases negative emotions like anxiety, which can hinder learning (Piniel & Albert, 2024). However, challenging yet manageable tasks enhance motivation and engagement, which leads to better learning outcomes (Wang, et al., 2023). Learners with higher cognitive capacity and proficiency see difficult tasks as growth opportunities, while lower-proficiency learners experience low confidence and higher anxiety, impairing progress (Zhang & Wu, 2024). Balancing task difficulty and cognitive load is essential for maintaining motivation and reducing anxiety in language learning (Piniel & Albert, 2024).

Generative AI in Language Teaching

Generative AI (GenAI) refers to a type of artificial intelligence that focuses on creating human-like content often from a text-based prompt (Law, 2024). GenAI uses advanced technologies, such as deep neural networks (Gilboa, 2023). The GenAI has been used in language teaching in various ways and improved students' writing skills (Darvin, 2025), reading comprehension (Çelik et al., 2024) and speaking skills (Wan & Moorhouse, 2024; Tai & Chen, 2024). Despite concerns over academic integrity (Wilde, 2024), or and the fear that AI might kill creativity, a recent study suggests that AI-assisted writing interventions may, in fact, promote creativity (Doshi & Hauser, 2024). Nevertheless, the results on the effects of AI on the cognitive and emotional conditions of learners are inconclusive. Whereas some researchers find that AI can alleviate cognitive overload and anxiety by providing instant feedback and clarification (Woo et al., 2024; Jiang & Kalyuga, 2022), other researchers are concerned that using AI tools too often can impair critical thinking, become more addictive, or even lead to decision fatigue because of the abundance of choices (Zhou et al., 2022; Gupta et al., 2021). The existence of these unresolved tensions shows that there is a need to consider AI and its role in language learning in more context-sensitive ways.

Moreover, as multimodal AI systems such as ChatGPT that can accept text, audio, and visual input become a reality, the possibility of more scaffolding becomes even broader. These features can enable learners to get explanations not just in the form of a text-based response, but also in the form of voice and image engagement, which might help relieve cognitive load and increase understanding in the form of dual-channel processing (Wang et al., 2024; Peng et al., 2023). However, there is still a paucity of empirical studies on the ways of pedagogical application and cognitive implications of such tools.

The Gap and the Present Study

Although TBLT is a communicative method of teaching the language, the cognitive load of the tasks might be high especially when the learners are required to utilize both language and their cognitive/emotional abilities. The studies show that collaboration (Jiang & Kalyuga, 2022) and other scaffolding practices could be used to cope with this load, but not many studies have considered how Generative AI can assist learners in the TBLT scenario through the prism of the Chaos/Complexity Theory. Besides, even though GenAI has demonstrated its effectiveness in enhancing different language skills, the impact of cognitive load on the intelligent TBLT lesson has not been investigated. This research has addressed this gap by introducing generative AI

into a TBLT course and analyzing the experience of learners in a chaos/complexity perspective. Particularly, it delves into the interaction among task demands, cognitive load, and emotional states among EFL learners and provides an insight into how AI tools may be applied to support language learners.

Research Questions

Thus, this study seeks to answer following research questions:

1. What are the Turkish EFL learners' mental, physical, temporal demand, effort, performance and frustration levels in an Intelligent TBLT class?
2. What specific factors contribute to cognitive overload in an Intelligent TBLT environment?
3. How do the learners perceive the role of generative AI in coping with task load (i.e. temporal, cognitive) and the task related challenges?
4. In what ways does generative AI assist learners in reading comprehension, writing performance, and overall task completion?

Methods

Research Design

The research design used in this study was a mixed methods sequential explanatory case study (Creswell & Clark, 2007). Quantitative and qualitative data were used to explore different issues related to the effect of generative AI on the EFL students learning experience in a TBLT classroom. The research design was informed by CCT and it incorporated the dynamism, emergent, and self-organizing aspects of language learning. Instead of using a linear cause-effect approach, the research used several interacting variables: task complexity, time pressure, peer dynamics, and AI integration, to investigate the reaction of learners in real-time. Mid-task surveys and post-task reflections were used to record emotional and cognitive reactions to facilitate the development of patterns of adaptation, co-regulation, and learner-AI synergy. The design is in line with certain major CCT principles like sensitivity to initial conditions, nonlinearity, and dynamic interaction of systems that affect the behavior of learners.

Participants and the Study Context

The respondents of this study were 15 students who had prior experience of using ChatGPT in different high schools of one province in Turkiye. Admittedly, the sample size (N = 15) is small enough to restrict the generalization of the results. Nevertheless, since the research was exploratory and qualitative, the sample was considered to be suitable in terms of capturing the detailed experiences of the learners and creating preliminary insights into the dynamics of the AI-assisted TBLT spaces.

The sampling strategy was a convenience sampling of the learners who were keen on learning new teaching methods in settings other than their educational environment. The participants were not in any planned lessons at the study date and engaged in the study on a Saturday, which gave the study a casual and less formal environment. The TBLT session was planned as a non-

formal learning setting where the educational process was a casual one; thus, the participants wore informal attire and did not carry any textbooks or other official learning materials instead of their cell phones. Table 1 presents the demographic of the participants including age range, genders, and particular language proficiency levels.

Table 1. Participant Demographics

Variable	Categories	N	%
Age (years)	15	5	33.3
	16	10	66.7
Gender	Female	9	60.0
	Male	6	40.0
		15	100
Comfort with using AI	Somewhat Comfortable	4	26.7
	Very Comfortable	11	73.3
Previous AI Experience	Yes	15	100.0
Proficiency Level	B1+	8	53.33
	B1	7	46.67

Data Collection Tools

NASA Task Load Index (NASA-TLX): The scale was created by Hart and Staveland (1998) to gather quantitative information about the workload of the students when performing the task of iTBLT. The NASA-TLX is a self-report tool that is a 21-point Likert type scale and is designed to produce data regarding six workload dimensions, which include mental demand, physical demand, temporal demand, performance, effort, and level of frustration (Hart, 2006). In the current study, Cronbachs Alpha was used to determine the internal consistency score (0.752), which is acceptable.

The Demographics Questionnaire: The questionnaire included four items: (1) age (in years), (2) gender, (3) self-reported level of comfort when using computers and new technology, and (4) personal experience with the use of the generative AI-based tools such as ChatGPT. These questions were background questions to get the information about the related background of the participants.

Intelligent TBLT Written Reflection Form (iTBLT-WRF): This study employed a 16-question written reflection form as the primary qualitative data collection tool. The questions were designed by the researcher to capture in-depth insights into participants' experiences with generative AI during the iTBLT lesson considering the Cognitive Load Theory. The form focused on understanding how learners managed cognitive overload, comprehended complex information in the foreign language, and how AI contributed their writing performance and reading comprehension and how they coped with the challenges of both reading and writing tasks with the support of ChatGPT. The targeted dimensions of the form with the questions and their purposes are given in Table 2.

Table 2. Overview of iTBLT-WRF

Dimension	Interview Questions	Purpose
Managing Cognitive Overload	- If you had, how did you manage when you had too much information to think about?	To understand the strategies that learners use to handle an overload of information during the task.
Clarification and Comprehension	- If it did, how did ChatGPT help you when you did not understand something in the text or writing task? Can you give an example? - If it did, how did ChatGPT help you understand the reading instructions better? - Did ChatGPT help you notice the main points in the text? If yes, please explain.	To examine how ChatGPT supports learners in clarifying complex information and identifying key ideas in the task content.
Task Facilitation and Performance	- Did ChatGPT make the task feel easier? How so? - If it did, in what ways did ChatGPT help you plan or write your survival plan? - Do you think your writing was better because of ChatGPT? Why or why not?	To assess the perceived impact of ChatGPT on easing the task, aiding planning and writing, and improving the overall quality of the written output.
Emotional and Affective Responses	- Did you feel nervous or anxious during the task? If yes, can you tell me when? - Which part of the task (reading or writing) made you feel more anxious? - If it changed, how did using ChatGPT change your feelings? Did it help you feel less anxious? If yes, can you give an example of a time when ChatGPT helped you feel calmer?	To explore the emotional responses during the task, particularly in relation to anxiety, and to understand how ChatGPT may alleviate negative emotions.
Engagement and Collaboration	- Did ChatGPT make you more interested in the task? If yes, how did it keep your attention? - How did your group use ChatGPT during the task? - Did ChatGPT help your group work better together? If yes, please explain. - Was there any time when	To evaluate ChatGPT's role in maintaining learner engagement and its effect on group collaboration, both positively and negatively.

	ChatGPT made group work harder? If yes, what happened?	
Overall Impact and Recommendations	- Overall, if it affected, how did using ChatGPT affect your reading and writing skills? - What would you suggest to make the use of ChatGPT even better for reading and writing tasks in the future?	To obtain an assessment of ChatGPT's perceived influence on language skills and to get suggestions for future improvements in AI-assisted learning tasks.

The iTBLT-WRF was reviewed and approved by two experts, one from the applied linguistics and the other from the field of educational technology to ensure that the questions effectively captured the intended dimensions. Three learners (outside the study sample) completed the from to verify question clarity, relevance, and appropriateness for the target population. We made minor adjustments to improve clarity based on their feedback. The participants also reviewed the summaries of their responses to confirm that their experiences were accurately captured.

Procedure

The research used a one-hour one-shot intervention to recreate a simulated real-world time-sensitive language task environment to minimize extraneous variables with time. This design was deemed to be suitable to measure the immediate dynamics of cognitive load and emotional response because it was possible to measure workload (through NASA-TLX) and perceptions (through iTBLT-WRF) in a limited yet realistic learning environment. Although longitudinal data may be able to show trends over time, the one-shot format was appropriate to identify changes in the cognitive and affective state of tasks on a single, intensive task cycle.

After getting the ethical approval from the Ethics Review Board, informed consent from the participants' parents/legal guardians and from the participants. The students were divided into two classes based on their reported proficiency levels (Class 1: 8 students in B1+ level; Class2: 7 students in B1 level). Then, the students in each class were paired, except for a group in the second class which had three students (they work in a group of three). All students were provided with pencils and two sheets of white a4 papers and they were informed that they could take more from the table whenever they needed more. The task was adapted from the traditional TBLT activity that is designed to enhance students' language skills (reading, writing, listening and speaking) and 21st century skills (creativity, critical thinking, collaboration, communication). In the task, three key interventions were aimed (Table 3).

Table 3. Interventions and their aims

	Intervention	Purpose
1	Advanced reading text	To introduce task load
2	Allowing Generative AI use	To introduce scaffolding
3	Setting time limit	To introduce temporal load

After asking a warm up question about a tv show related to the task (Have you ever watched Survivor? What do the competitors do?) to activate their background knowledge. Next, the teacher started by explaining the instructions slowly with a clear tone: *"Imagine that you are on a ship in a far-away ocean, passing by a small island with your friends. A ship passes by this island once in two months. Suddenly, something happens and the ship starts to sink. You have a waterproof backpack that can carry items from the ship but no more than 10 kilograms (kg)."* Students were then provided with the list in Figure 1.

1. Compact Mirror – 0.1 kg	**13.** Rope (50 meters) – 1.0 kg
2. Emergency Whistle – 0.1 kg	**14.** Mini Drone – 1.0 kg
3. Helium Balloon – 0.2 kg	**15.** Inflatable Life Vest – 1.0 kg
4. Fire Starter Kit – 0.3 kg	**16.** Survival Knife – 1.2 kg
5. Waterproof Notebook and Pencil – 0.3 kg	**17.** Solar Charger – 1.5 kg
6. Signal Flares (pack) – 0.4 kg	**18.** Fishing Net – 1.5 kg
7. Compass – 0.5 kg	**19.** Portable Stove – 1.5 kg
8. Flashlight – 0.5 kg	**20.** Fishing Rod – 1.8 kg
9. Portable Radio (hand-crank) – 0.7 kg	**21.** Cooking Pot – 2.0 kg
10. Multi-tool – 0.8 kg	**22.** Sleeping Bag – 2.0 kg
11. Solar-Powered LED Lantern – 0.8 kg	**23.** First Aid Kit – 2.5 kg
12. Water Filter – 1.0 kg	**24.** Emergency Rations (pack) – 3.0 kg
	25. Tent – 4.0 kg

Figure 1. Equipment list for iTBLT task

After answering any clarification questions, the teacher then continued *"Your task is to write a 180–220 words survival plan for two months with your teams but this island has some rules that you need to be careful about."* These rules were specifically designed by using advanced English structures, and vocabulary to make it challenging to comprehend for learners to introduce challenge. An example rule included in the text: *"You are permitted to engage in controlled foraging and limited faunal collection to secure additional sustenance. It is essential, however, that any gathered botanical or zoological material be subjected to thorough safety assessments prior to consumption."* The text that contains the rules were shared with the students. The students were warned that they were not allowed use any kind of AI, if they got caught, they will be eliminated. They were also informed that they were free to use internet but not AI. They were given 40 minutes to complete the assignment and told to start with reading the instructions.

Five minutes later, the students were told to stop and informed that time counter was also stopped. They completed the questionnaire (NASA-TLX) to provide information about their task load levels. After they completed the form. They were told that they could now use GenAI (ChatGPT 4o) for anything but not for generating the final survival plan. They were informed that their text would be checked using AI detectors and the timer started again. To operationalize the scaffolding, generative AI (ChatGPT) was used by learners during the second half of the

task. ChatGPT served as an on-demand assistant, helping students clarify unfamiliar vocabulary, rephrase complex rules, and generate example structures and thereby acting as a real-time cognitive aid. This would directly influence cognitive load in two primary ways: first, it would reduce intrinsic load by supporting learners' understanding of linguistically dense material; second, it would minimize extraneous load by eliminating the need for inefficient searches and guesswork. As a result, learners could allocate more mental resources to germane load, including organizing ideas, drafting coherent arguments, and revising collaboratively with peers. This design aligned with Cognitive Load Theory and aimed to promote schema development within an AI-supported TBLT framework. All the students completed and delivered the full survival plan at the end of the intervention. Next, they were told to complete the iTBLT-WRF.

Data Analysis

Quantitative data were analyzed using descriptive statistics. Demographics questionnaire data were analyzed in SPSS 27, and NASA-TLX data were analyzed using JASP. Qualitative data was analyzed using the six-steps thematic analysis of Clarke & Braun (2013) using MAXQDA 24 (Figure 2). Windows 11 operating system were used during the analyses.

Figure 2. Steps of thematic analysis adapted from (Clarke & Braun, 2013)

To enhance the reliability of qualitative findings, an intercoder validation process was conducted. A second coder with a background in applied linguistics independently coded approximately 30% of the iTBLT-WRF responses using MAXQDA. Discrepancies were discussed and resolved through consensus, and the finalized codebook was then applied consistently to the full dataset.

Results

RQ1

Table 4 presents the descriptive statistics for the six workload dimensions measured: mental demand, physical demand, temporal demand, effort, performance, and frustration level, as well as an overall workload score.

Table 4. Descriptive statistic of NASA-TLX

	N	M	SD	Min.	Max.
Mental Demand	15	11.53	4.44	3	20
Physical Demand	15	12.13	6.98	1	20
Temporal Demand	15	12.87	6.26	3	20
Effort	15	13.27	5.24	3	20
Performance	15	12.33	6.92	1	20
Frustration Level	15	9.27	5.31	1	20
Overall	15	11.9	3.96	5.66	19.33

Overall, the learners reported a moderate level of workload, with an overall mean score of 11.90 (SD = 3.96). Learners perceived the task as moderately demanding in terms of mental (M = 11.53, SD = 4.44) and physical (M = 12.13, SD = 6.98) efforts. Temporal demand showed a n(M = 12.87, SD = 6.26), which meant that time limitation mattered a lot in carrying out the task. On the other hand, it was the dimension of effort that was rated the highest (M = 13.27, SD = 5.24). Performance and frustration levels were moderate (M = 12.33, SD = 6.92 and M = 9.27, SD = 5.31 for frustration, respectively). To give better understanding, we prepared a figure to depict the workloads of the participants on an individual basis (Figure 3).

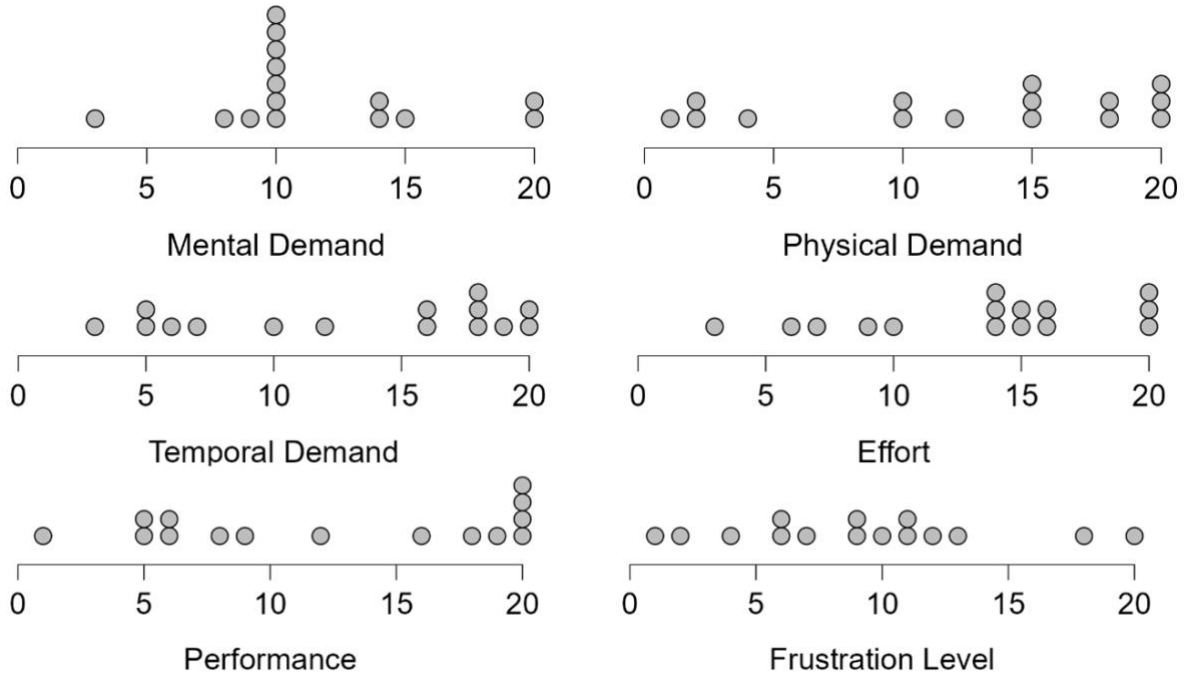

Figure 3. Distribution plot of participants' answers

The finding of moderate workload levels holds important implications for EFL instruction. It suggests that although the task was cognitively and temporally demanding, it did not overwhelm learners. This balance is crucial in task-based environments, as it indicates that students were challenged enough to remain cognitively engaged without experiencing debilitating frustration.

Such an optimal workload supports language development by fostering perseverance, motivation, and deeper processing of language input. For practitioners, this suggests that integrating complex, real-world tasks with support systems like AI can sustain productive cognitive effort without exceeding learners' thresholds.

RQ 2

Using the frequencies of words from the participants' iTBLT-WRF data, a word cloud was created with higher frequency words are written in bigger fonts (Figure 3) to provide an overview of the nature of the data.

Figure 4. Word Cloud for overviewing iTBLT-WRF data

Comprehension Difficulty

The data was that the learners were overwhelmed by the survival instructions most of which were written in the superior language. The majority of the participants went on to say that the text was either "too hard" or "very advanced," and they had to struggle with the comprehension of the rules. One of the participants said, "Half of it was pretty hard for a student," and another confessed, "The English of the instructions was so advanced that I couldn't get the meaning of most of it." The results from this study indicated that high-level vocabulary and complex sentence structures raised the cognitive load of the learners.

Time Pressure Impact

Time constraints, along with linguistic challenges, were experienced as major sources of the overload by the learners. A few of the participants referred to their feeling as "overwhelmed in the last minutes" or "rushed because I didn't have enough time to transfer all my ideas to paper." One of the learners expressed, "I think all of them were easy, but if there was no time constraint, I could have done better." This particular finding indicates that task content though if moderately manageable, still strict time pressure could affect mental workload.

Decision-Making and Idea Formulation Difficulties

A number of the participants said they could not decide which items to select equal to or under the 10 kg limit. This was a decision-making challenge. One of the learners mentioned, "I had a hard time, especially how to use the items." The others faced the issue of idea formulation and said they "had no clue where to begin" or were "struggling while creating the story and putting ideas into words." These challenges signify that the complexity of the task, not merely in terms of language comprehension, also led to cognitive overload.

Language Overload

A few learners pointed to "language overload" that is, not only were the texts advanced, but the writing part also required producing coherent English text under time constraints. One participant told, "*I felt overwhelmed in the last minutes... I skipped so many parts, and I was really upset about it.*" Such statements suggest that reading and writing in a foreign language, when combined with limited time, can increase the sense of overload.

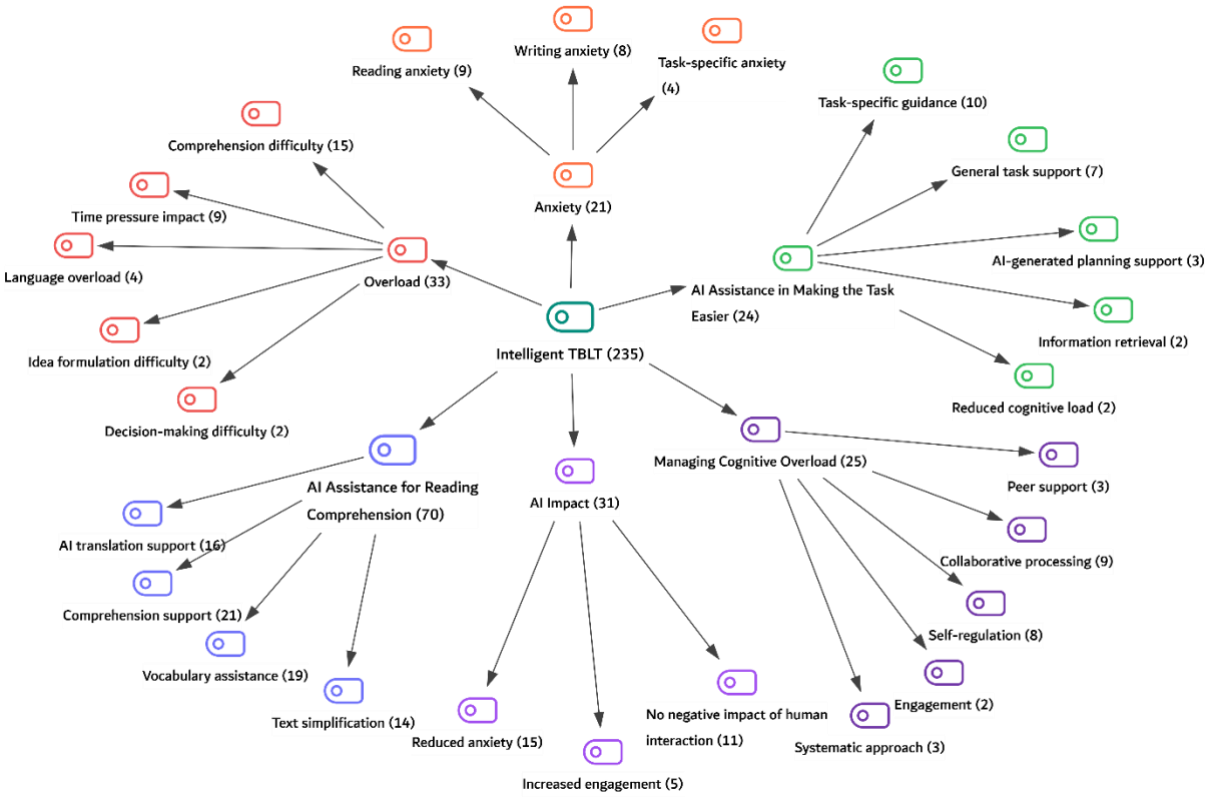

Figure 5. Hierarchical Code-Subcodes Model

As illustrated in Figure 4, "Overload" emerged as a central node with subcategories such as comprehension difficulty, time pressure impact, decision-making difficulty, and language overload. This underlines the multifaceted nature of cognitive overload in the Intelligent TBLT context.

RQ 3

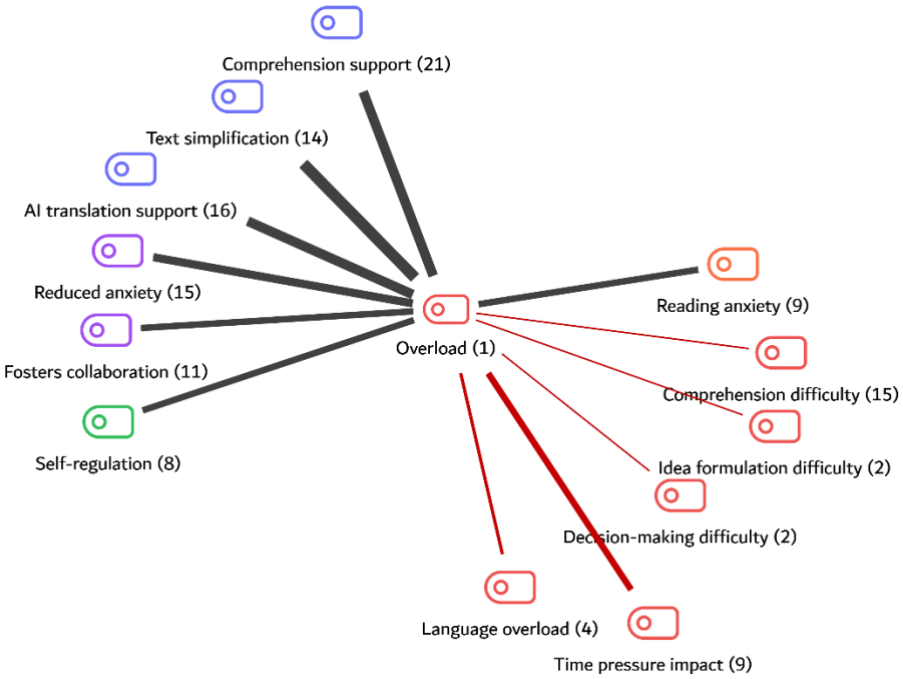

Figure 6. Code proximity model for overload

Reduced Cognitive Load and Anxiety

A large number of participants shared that through text simplification, comprehension support, collaboration encouragement, fast translations, and vocabulary suggestions, ChatGPT was able to effectively lower their cognitive load and anxiety levels (Figure 6). One student said, "ChatGPT made it feel easier, so we spent more time thinking," which indicates that generative AI released cognitive resources that the participants could then direct towards finishing the task. One learner said, "Before using ChatGPT, I was anxious because I didn't want to make mistakes. But after it helped me check a few things, I felt more confident." Another one was like, "I panicked when I didn't understand the text. But ChatGPT helped me slow down and breathe, it reduced the stress." Another participant mentioned, "When we were allowed to use AI, it explained words, and I felt calmer," thus linking AI support to a decrease in anxiety.

Self-Regulation and Systematic Approaches

Learners also described personal strategies, such as "trying to stay calm" or "checking the restrictions and permissions one by one" to manage their overload (Figure 6). However, when their own strategies were insufficient, many participants used ChatGPT as *a safety net,* particularly under strict time pressure. Figure 4's nodes labeled "managing cognitive overload" illustrate how self-regulation, peer support, and AI assistance often helped learners to reduce their cognitive overload. One participant shared, *"It explained difficult parts like a friend would. Not just giving answers, but helping me understand step by step."* Another added, *"I typed a sentence and asked if it sounded natural. It gave better suggestions than I could think of myself."*

Collaborative Processing and Peer Support

Although AI supported the learners, participants frequently mentioned that they combined it

with peer collaboration. For instance, statements such as "*I asked my friend for help when I got stuck*" and "*I coped with it by doing it together with my teammates.*" indicate that while ChatGPT provided scaffolding, it did not replace peer interaction but rather supplemented it. Another learner emphasized the value of collective thinking: *"We first asked each other before turning to ChatGPT. If we still didn't understand, then we used AI. This helped us stay focused together."* Similarly, a participant noted, *"We had different ideas about which tools to take. Talking with my group helped me see other options I hadn't thought of."* As seen in Figure 4, "collaborative processing" and "peer support" often co-occurred with ai related codes such as "text simplification" and "vocabulary assistance".

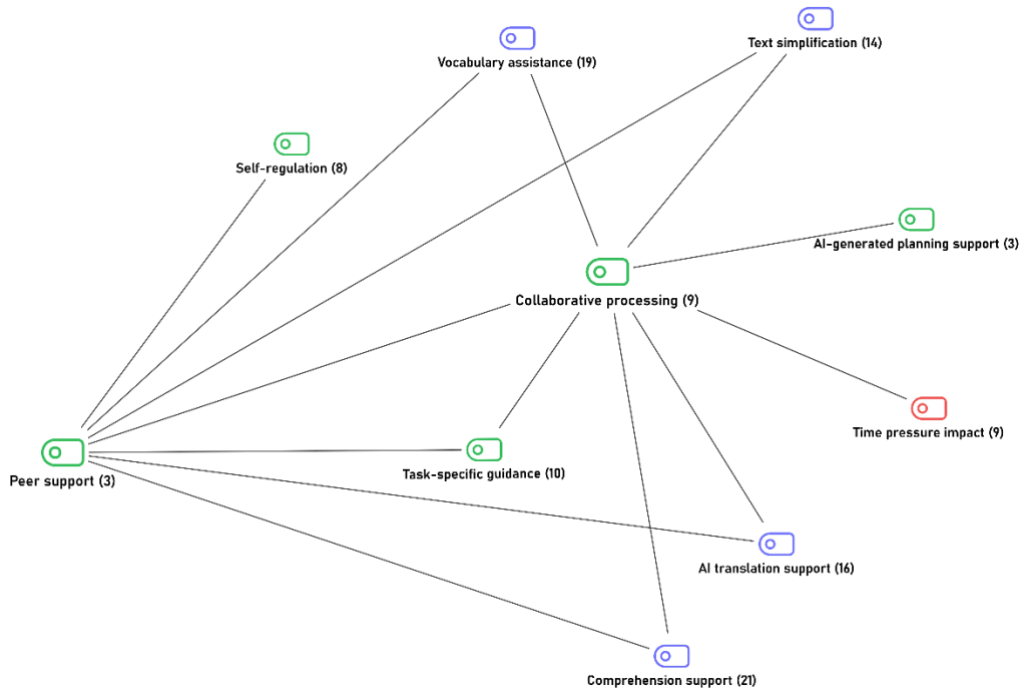

Figure 7. Code co-occurrence for peer support, collaborative processing and AI related themes

Across the reflections, no participants reported that ChatGPT replaced or negatively affected peer collaboration. Common statements included, "*We didn't have any issues because of ChatGPT during the task*" and "*It never slowed us down or made things complicated.*" These excerpts suggest that AI integration did not diminish the social aspect of TBLT; instead, learners continued to rely on each other for brainstorming and decision-making, and more. Some participants noted that AI allowed them to "focus on team discussions rather than dictionary checks". This may have potentially enhanced the group collaboration. Although none of the learners explicitly compared Intelligent TBLT to traditional TBLT (as they did not know), the consensus was that AI functioned as a helpful supplement, rather than a competitor, to peer collaboration. As one participant stated, "*We did it together with my teammates, and ChatGPT just helped when we were stuck.*"

RQ 4

Respondents kept on repeating that they had text simplification, translation and vocabulary support offered by AI to help them enhance their understanding when reading the high level instructions. The fact that they could understand the text easier and more simply by translating

using ChatGPT, that it breaks down the words we found difficult to understand into a form that made sense, and that they find it easier to understand difficult words with the assistance of AI points to how AI helped them overcome comprehension difficulties. The term cloud (Figure 3) presents the high presence of such words as help, understand, and text which refer to the comprehension support.

Improvement and Error Correction in Writing

On the topic of writing, most learners highlighted that ChatGPT provided them with correction of errors, structure of sentences, and vocabulary (Figure 5). One of the participants stated that it has assisted me in using better words when writing and one participant stated that it had helped in correcting errors and made my writing more precise. These passages suggest that generative AI gave writing feedback in real time and, therefore, allowed students to develop their ideas and come up with more coherent texts.

Overall Task Completion

Another important use of AI by learners was to obtain task-specific instructions, including what items to pack under the 10 kg weight limit or how to use some survival equipment. One respondent said, It provided us with ideas about the topic and recommended what we could bring, an aspect of task facilitation that AI has in general. Figure 4 depicts various codes in the category of AI assistance in making the task easier such as task-specific guidance and general task support which revealed how AI assisted them in the completion of the survival plan.

Combination of Qualitative and Quantitative Results.

Quantitative NASA-TLX findings indicated the moderate mental, physical, and temporal demands, whereas qualitative data demonstrated that learners proactively coped with these demands by collaborating with peers, being assisted by AI, and regulating emotions. An example is the top-rated category, which is Effort, and was reflected in reflections in which learners stated that they pushed themselves to overcome cognitive difficulties but that ChatGPT helped them. Similarly, moderate scores of Frustrations were elaborated by the participants who admitted that some situations of anxiety occurred but they mentioned that with the help of AI and peer support the situation improved with time. Therefore, the qualitative data not only put workload data into context, but enhanced the interpretation of the workload data as observed in Table 5.

Table 5. Mapping Qualitative Themes to NASA-TLX Workload Dimensions

NASA-TLX Dimension	Related Qualitative Themes	Illustrative Quotes
Mental Demand	Advanced vocabulary, comprehension difficulty, AI clarification	"The English was too advanced… I used ChatGPT to understand."
Physical Demand	Handwriting under time pressure, switching between devices and paper	"It was tiring to write and check phone at the same time."
Temporal Demand	Time stress, rushed writing, AI time relief	"I was overwhelmed in the last minutes before AI was allowed."
Effort	Planning, idea formulation, constant referencing of AI/peers	"We had to think hard about what to take and how to survive."
Performance	Confidence in writing output, AI-supported revisions	"ChatGPT helped improve my writing… I felt better about it."

Frustration	Initial anxiety, alleviated by AI/peer support	"I panicked, but ChatGPT made me feel calmer."

Discussion

This research study involved the analysis of the mental, physical, and temporal demands, effort, performance and frustration levels of EFL learners during Intelligent TBLT environment. It further examined the causes of cognitive overload, how learners perceived generative AI as a coping mechanism during task-related difficulties, and how AI could help learners comprehend reading and write better and complete their tasks.

These findings of the present research showed that cognitive workload is not predetermined but varies depending on task complexity and could be influenced by the ability of the learners to adapt and respond to it. The learners were subjected to moderate mental and physical requirements, and a relatively high degree of effort. The results are consistent with the studies that investigate the cognitive consequences of TBLT. As an example, Tajeddin and Mansouri (2024) indicated that the implementation of TBLT by EFL teachers may affect numerous dynamics that determine the learning process.

The perceived workload and anxiety were influenced by the presence of an advanced text that was combined with a time limit which was consistent with the work of Kastaun et al. (2021), and Han et al. (2022). Besides, Silva, et al. (2021) wrote that writing tasks with a higher cognitive demand slows down the production and adds to the errors. Nonetheless, these difficulties were overcome in our research with the assistance of peer cooperation and GenAI support. Although linguistic complexity was also one of the major causes of overload in the current study, the previous studies suggest that over-simplified tasks may decrease engagement and motivation (Mukhrib, 2021). In such a way, the adjustment of the task difficulty according to the level of proficiency of learners may improve its efficacy (Luo, 2021). Finally, it has been proposed that visual and audio AI-generated explanations can be used to decrease cognitive load (Kaczorowska et al., 2021) and this paper found textual simplifications and vocabulary support by GenAI to be helpful.

The other supporting finding is that the moderate levels of frustration were witnessed in the study. The level of their frustration was taken before the introduction of AI into the TBLT. This can indicate that though learners struggled and their workloads were impressive, they were not intimidated by this aspect because of peer collaboration that could have provided them with a sense of security and self-esteem. Nevertheless, according to the qualitative data analysis, the results can also suggest that AI support might have contributed to them also reducing their workload. Indicatively, Abdolrezapour and Ghanbari (2022), who reviewed articles on AI-based pedagogy in online learning, proposed that AI can alleviate the level of frustration. Hence, one can say that the human-human interaction, where the human-AI interaction contributes to it, can assist the learners in overcoming mental and emotional challenges that the latter encounter.

Also, time factor and high level of input language contributed significantly towards cognitive overload. Learners tended to feel anxious and have limited working memory capacity when participating in tasks that require complex reasoning, grammar, and vocabulary and have strict

deadlines (Gupta et al., 2021; Zhou et al., 2022). It is therefore necessary to balance intrinsic, extraneous, and germane cognitive load (Luo, 2021). Simplified tasks can also act as an obstacle to motivation (Mukhrib, 2021), These results support the idea that TBLT tasks should be planned with time constraints that are well-tuned to ensure performance without stress.

Regarding the performance of writing, the support of generative AI allowed correcting mistakes in real time, formatting feedback, and vocabulary proposals. Such functions are consistent with (Maier, 2022) evidence that AI-driven frameworks allow organizing ideas much more efficiently. Additionally, the ability to contemplate the mistakes in systematic manners as (Elkin & Devabhaktuni, 2019) note implies that the contribution of AI to writing tasks refinement can go beyond the superficial accuracy and entail more profound involvement in the writing activity.

Limitations

This study has a number of limitations even though it has contributed. First, the sample size (N = 15) is too small, and it is suitable to conduct a detailed qualitative exploration study, but it does not provide the ability to generalize the results to other EFL populations. Second, the research was based on self-reported data in the form of workload scales and reflection forms, which can create subjectivity bias. Third, there is no control group that would allow making direct comparisons between AI-supported and traditional TBLT conditions. In the absence of a control group, the effect of AI can barely be separated in relation to other potential contributory variables, including group dynamics or previous experience. Fourth, novelty effect might have been related to the use of generative AI. Given that learners knew that they were doing a new and technology-enhanced activity, their motivation and interest might have been temporarily increased, regardless of the teaching quality of the AI tool. Finally, it was a single intervention, which might not be reflective of long-term effects or learning behavioral trends. Future research must use longitudinal or repeated measures research designs to determine long-term effects of Intelligent TBLT and generative AI integration.

Conclusion

The present research contributed to the existing body of work on cognitive workload in TBLT by presenting a novel kind of TBLT (AI-assisted TBLT, iTBLT or Intelligent TBLT) by examining how AI can be used to minimize task requirements and aid reading and writing activities of the learners. The findings showed that AI-mediated scaffold can reduce part of the mental, temporal, and emotional complexities that may be the cause of overload. Finally, iTBLT facilitated collaboration among learners and not diminished it. Students kept collaborating and brainstorming with others, and they strategically used GenAI to simplify the text, assist with vocabulary, and ideate on reading and writing problems. Thus, the incorporation of generative AI into the language learning settings promises to alleviate the cognitive load but maintain the collaborative and social interactionist aspect of TBLT. All in all, the key conclusion made in the course of this research is that although an impressive cognitive demand is necessarily involved in difficult reading and writing tasks that compel learners to operate outside of their comfort zones, AI integration can be used to ensure a balanced degree of difficulty. This, in its turn, is

capable of maintaining task engagement and decreasing anxiety.

To enhance the effectiveness of Intelligent TBLT, educators could adjust task complexity in alignment with students' proficiency levels, and ensure that advanced materials can be used but should still be manageable with the help of more knowledgeable others as suggested in Vygotskian theory, this can be their peers, teachers or even GenAI. Moreover, educators should keep a balance between imposing time constraints to increase engagement and avoiding excessive pressure that increases anxiety, perhaps by allowing flexible deadlines in response to real-time observations of student progress. Future longitudinal research can investigate by replicating this study's intervention protocol to collect quantitative data from a large sample size on anxiety, enjoyment, task load, academic engagement, task engagement, self-efficacy, and other dynamics that influence the iTBLT process, and model the interplay of these dynamics using structural equation modeling or latent growth curve modeling.

Based on these findings, language teachers could consider gradually integrating AI tools into post-task or during-task phases, offering students structured opportunities to seek clarification, explore vocabulary alternatives, or brainstorm collaboratively. For example, curriculum designers might develop Intelligent TBLT modules where AI tools are used during the idea generation stage, but final outputs are produced independently to balance support with learner agency. Training sessions on ethical and strategic AI use could further support successful implementation.

Additionally, to validate and expand upon the findings of this one-shot exploratory study, future research should adopt longitudinal or large-scale experimental designs. This would allow scholars to examine the sustained impact of AI-assisted TBLT on learners' cognitive load, engagement, and academic development across time and diverse educational settings.

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Biodata

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