

English Education in the AI Era: Considering Students' Home Study

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Abstract

Generative artificial intelligence (AI) is rapidly becoming an everyday academic tool, reshaping how STEM (Science, Technology, Engineering, Mathematics) students approach English home study. This paper argues that the pedagogically productive role of AI is as Comprehension Aiding Supplementation (CAS)—tools that increase access to comprehensible, interesting, and abundant input while preserving learners' active engagement. Grounded in the Input Hypothesis and the Optimal Input perspective, the study contrasts CAS-oriented uses (vocabulary clarification, sentence paraphrasing, post-editing) with substitution-oriented uses (AI-generated summaries or essays accepted uncritically), highlighting risks such as cognitive passivity, hallucinated facts, and widening learner gaps. The authors propose concrete design requirements and routines: a comprehension-first reading workflow, reading-volume targets with scaffolding, mandatory post-editing and two-version submissions, verification habits (AI → verify → write), prompt banks to promote equity, minimal disclosure norms, peer accountability, and brief in-class micro-checks to confirm comprehension. For STEM-focused higher education, the paper recommends shifting assessment toward reading behavior and comprehension depth and calls for longitudinal research to evaluate learning outcomes under varied AI policies. The central claim is that principled, input-centered integration, rather than bans or unrestricted use, best preserves long-term disciplinary communication skills.

Keywords: English Education, AI Era and Its Use, Students' Home Study

1. Introduction

Generative artificial intelligence (AI) has shifted from a specialized technology to an everyday academic tool ¹⁾. In English language education, students now generally use AI systems to translate texts, generate outlines, rewrite paragraphs, check grammar, and simulate conversation. These functions can reduce the time needed to complete assignments and may lower learners' anxiety when they face dense readings or unfamiliar vocabulary. At the same time, the speed and fluency of AI-generated output raise a basic question: whether students are developing durable language ability or merely producing polished text with minimal processing ²⁾.

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For science and engineering students in Japan, the stakes are high. English is required for reading technical literature, understanding documentation, communicating with international colleagues, and presenting research. Yet, in many programs, English class hours remain limited and must compete with heavy disciplinary coursework. As a result, language development generally depends substantially on home study. In the AI era, home study can either become more effective, through increased access to comprehensible input, or become less effective if AI substitutes for reading, thinking, and drafting.

This paper argues that the key issue is not whether students will use AI, but whether educators design home study so that AI supports the mechanisms of acquisition. We frame AI use through the Input Hypothesis³⁾ and the Optimal Input⁴⁾ perspective. Specifically, we propose that AI can function as Comprehension Aiding Supplementation (CAS)⁵⁾: supports that increase comprehensibility and keep attention on meaning. Conversely, when AI becomes an output substitute (e.g., generating full summaries or essays without engagement), it can encourage passivity and undermine long-term development. Based on this framing, we propose design principles and practical routines for AI-supported home study in STEM-focused higher education⁶⁾.

2. Current Trends and Emerging Challenges

2.1. AI tools in university English learning

AI adoption in Japanese higher education has accelerated because the tools are inexpensive, convenient, and flexible. Students use translation tools to access academic texts, writing assistants to improve clarity, and chat-based systems to generate ideas or practice explanations. University-level practice reports in Japan describe measurable benefits when AI is used as a support⁷⁾: AI-assisted translation can shorten reading time for academic passages, and writing accuracy can improve when students use AI output as a draft and then post-edit carefully. In such cases, students can allocate more effort to content development, organization, and communicative effectiveness rather than spending most of their time on surface-level decoding.

These reported benefits align with classroom observations in which students become more willing to attempt difficult readings if they know they can quickly clarify unfamiliar expressions. For STEM students, this is particularly relevant because technical terms and complex noun phrases often block comprehension. When learners can resolve these barriers efficiently, they may increase the total amount of reading they complete at home. Because input quantity is a central factor in acquisition, any intervention that increases reading volume without reducing attention to meaning is pedagogically valuable⁸⁾.

2.2. Risks of unstructured use: passivity and integrity

Despite these benefits, unstructured AI use can produce the opposite outcome. When students rely on generative AI to produce answers, summaries, or reports without reading the source material, they bypass the comprehension process. Learners may submit fluent text while failing to build the competence needed for future independent reading or speaking. In addition, generative AI may produce hallucinated facts, fabricated references, and inappropriate academic register. If students accept output uncritically, academic integrity is threatened and misunderstandings become embedded in their work. These risks, including hallucinated information and uncritical acceptance of AI output, have also been observed in recent classroom-based reports⁹⁾.

Another risk is the possible widening of learner gaps. In practice, students with stronger metacognitive skills and better prompt-writing ability may be more likely to use AI strategically, for clarification, for revision

options, and for exploring alternative phrasing, while weaker students may use AI as a shortcut (See Table 1 for details).

Table 1. Patterns of AI Use in English Home Study

Structured AI Use (CAS-Oriented)	Unstructured AI Use (Substitution-Oriented)
Clarify vocabulary and paraphrase difficult sentences while reading	Generate summaries/essays without reading the source
Use translation as a temporary scaffold, then re-read and confirm meaning	Copy-paste AI output as the final submission
Ask for brief background explanations to make texts comprehensible	Treat AI output as reliable facts without verification
Use AI feedback to revise a self-written draft (post-editing)	Skip drafting; accept AI phrasing uncritically
Disclose AI use and reflect on what was learned	Hide AI dependence and focus only on grades

3. Theoretical Framework: Input Hypothesis and Optimal Input

3-1. Input-centered acquisition and the role of home study

The Input Hypothesis ¹⁰⁾ proposes that language acquisition develops when learners understand messages in the target language. In this view, acquisition is driven primarily by comprehension rather than by the conscious study of rules. Because understanding requires exposure, the quantity and quality of input become central. In EFL contexts with limited classroom contact, home study strongly determines whether learners reach a threshold where they can read and listen independently. This is particularly true for STEM students whose academic workloads reduce available time for language study; if home study becomes inefficient, the cumulative input deficit becomes difficult to overcome.

For STEM students, input must include both general English and discipline-relevant language. If students only practice isolated grammar items or short test-like sentences, they may not gain the capacity to process extended discourse found in research abstracts, manuals, and reports. Home study that prioritizes sustained reading and listening increases exposure to authentic structures, recurring technical vocabulary, and academic discourse patterns. Over time, repeated exposure supports automaticity, allowing students to process longer texts with less cognitive load. Empirical studies in Japanese EFL contexts have also shown a strong relationship between reading volume and TOEIC score gains ¹¹⁾.

3-2. Optimal Input: understandable, interesting, and abundant

Optimal Input ¹²⁾ refines the comprehensible input idea by emphasizing that not all comprehensible input is equally effective. Input becomes optimal when it is understandable, compelling or interesting, and available in sufficient volume. These conditions matter because attention and motivation are not optional: students will not accumulate input if materials are consistently boring or frustrating. In practical settings, the “interesting” condition is often the most neglected, yet it determines whether learners continue reading when no test is immediately attached.

An optimal input environment provides learners with many easy-to-understand texts and stories, encourages choice, and makes reading and listening a normal routine. When students experience frequent success in comprehension, they develop confidence and are more likely to read voluntarily. This produces a positive cycle: more reading increases vocabulary and fluency, which makes reading easier and more enjoyable, which further increases volume. From a program design perspective, the main goal of home study should

therefore be to establish sustainable routines that generate large amounts of comprehensible input over time. Furthermore, recent findings suggest that significantly fewer hours of input-based instruction can yield outcomes comparable to substantially longer traditional instruction ¹³⁾.

3-3. CAS and post-editing as learning processes

Comprehension Aiding Supplementation (CAS) ¹⁴⁾ refers to supports that increase comprehensibility while keeping attention on meaning. Examples include brief explanations, visuals, background knowledge, and paraphrases. CAS is not the same as replacing the task. Instead, it reduces barriers that prevent learners from continuing to read or listen. When a learner uses a tool to clarify a term and then returns to the original passage, the learner remains central and the input remains primary.

Post-editing is a related process relevant to AI. When learners draft text and then use AI tools to suggest improvements, educational value comes from evaluating, accepting, rejecting, and revising. This process encourages noticing, promotes reflection on meaning and form, and strengthens ownership of communication. In contrast, submitting unedited AI-generated text eliminates opportunities for noticing and reduces ownership of meaning. Therefore, if AI is used in writing tasks, post-editing should be explicitly required and taught as a skill ¹⁵⁾.

3-4. AI in an input framework: what to encourage and what to avoid

From an input-centered perspective, AI is valuable insofar as it increases access to comprehensible input and supports sustained engagement. AI can quickly clarify unknown words, simplify sentences, and explain background concepts that block understanding. These functions are especially useful for STEM students, because technical texts often contain dense nominalizations, long noun phrases, and discipline-specific terminology that can overwhelm learners at lower proficiency levels.

However, AI cannot replace the internal process of building a language system through repeated comprehension experiences. If AI generates the “meaning” for the student while the student does not read, the learner does not receive input in any meaningful sense. Therefore, policy discussions should avoid a binary debate about whether AI is good or bad. The crucial question is whether AI use leads to more input and more comprehension, or whether it reduces the amount of genuine input processing by substituting output.

4. Design Requirements for AI-Integrated Home Study

4.1. Preventing cognitive passivity

The first design requirement is to prevent cognitive passivity. If home study tasks can be completed by prompting AI for a summary, students will be tempted to do so, especially under time pressure. Tasks must therefore be structured so that the easiest path is the learning path. This includes requiring evidence of engagement with specific passages, personal responses that are difficult to automate, and in-class follow-ups that rely on genuine comprehension. The goal is not to create a punitive environment, but to build routines that make authentic engagement the default.

A practical approach is to define AI as a comprehension tool rather than an answer generator. Teachers can model acceptable prompts (e.g., “Explain this sentence in simpler English,” “What does this term mean in this context?”) and explicitly label unacceptable prompts (e.g., “Write my summary,” “Write my report with citations”). In addition, teachers can demonstrate “before and after” examples showing how comprehension

improves when AI is used for clarification and then followed by re-reading. This makes the learning rationale visible.

4.2. Academic integrity, hallucinations, and verification routines

The second requirement is to address academic integrity. AI can hallucinate facts and fabricate references; students may not recognize these errors. Therefore, home study should incorporate verification routines: checking sources, comparing multiple references, and treating AI output as a draft or suggestion rather than as authority. Verification routines should be taught as part of academic literacy, especially for STEM students who must learn to evaluate evidence and cite sources appropriately ¹⁶).

A simple routine is “AI → verify → write.” Students may consult AI to generate possible keywords or alternative explanations, but they must confirm claims through credible sources (textbooks, peer-reviewed articles, instructor-provided materials, or trustworthy institutional sites). When writing is required, students should base it on verified information and disclose how AI was used (e.g., vocabulary clarification, sentence simplification, feedback on phrasing). Disclosure encourages transparency and reduces the adversarial dynamics that often accompany new technology.

4.3. Teacher literacy and consistent course policy

The third requirement is teacher AI literacy and consistent course policy. If students receive mixed messages, some classes permitting extensive generation and others banning any AI use, confusion increases and compliance decreases. Faculty collaboration can establish a shared baseline: acceptable use, disclosure expectations, and common assessment approaches that emphasize comprehension evidence. Even within a single institution, consistent norms reduce student uncertainty and help teachers maintain fairness.

Teacher literacy does not require technical expertise, but it does require familiarity with typical AI strengths and failure modes. Instructors should be able to demonstrate how to use AI for clarification and post-editing, how to detect likely hallucinations, and how to guide students to maintain ownership of meaning. In practice, teacher collaboration (e.g., sharing prompt examples, classroom activities, and observed problems) can function as ongoing professional development.

5. Strategic Proposals for Home Study (Input-Centered AI Integration)

5A. Proposal 1: A comprehension-first reading workflow

Home study should be organized around a comprehension-first workflow. Students begin by reading (or listening) without AI assistance for a short period, marking only the points that block comprehension. After this initial attempt, students use AI selectively for CAS functions: paraphrasing difficult sentences, explaining unfamiliar terms, or providing brief background knowledge. Students then return to the original text and re-read it, aiming to confirm understanding without dependence. This design preserves the central role of input while still leveraging AI efficiency.

To make the workflow concrete, instructors can provide a template with three required fields: (1) a sentence or phrase that was difficult, (2) the AI clarification used, and (3) a short explanation of what the student learned. This shifts AI use from “getting an answer” to “removing obstacles to comprehension.” Over time, as vocabulary grows and reading fluency increases, the number of obstacles should decrease, and AI use should naturally become lighter.

5B. Proposal 2: Reading volume targets with self-selection and scaffolding

Because acquisition depends on quantity, programs should set realistic reading volume targets and treat them as a core outcome. For example, students might aim to read a certain number of pages per week or complete a certain number of short graded readers per term. Targets should be flexible to account for differences in student level and schedule. The objective is consistent exposure, not competition. Importantly, volume targets should be paired with guidance to prevent students from selecting overly difficult texts that lead to frustration and dropout¹⁷⁾.

Self-selection is essential for motivation. STEM students should be encouraged to select texts connected to their interests, technology news, popular science writing, lab safety guides, biographies of inventors, or simplified research summaries. AI can assist by recommending easier texts on the same topic, generating a short glossary of key terms, or explaining background concepts that make the reading more engaging. In this way, AI supports the “interesting” and “understandable” conditions of optimal input while preserving student choice.

5C. Proposal 3: Post-editing routines for writing assignments

When writing is assigned for home study, the educational value should come from post-editing rather than from generation. Students should produce an initial draft, however imperfect, based on their reading. They may then use AI to suggest improvements in clarity, structure, or grammar. The key requirement is that students compare versions and make decisions, rather than accepting AI output wholesale. This aligns with the idea that students should remain responsible for meaning and argumentation.

A practical implementation is a two-version submission: students submit both the original draft and the revised draft, along with a brief annotation of three to five changes they adopted. Annotations can include: what the AI suggested, what the student changed, and why the change improved clarity or accuracy. This encourages noticing and reflection and provides teachers with insight into student development. It also discourages pure AI generation, because the original draft must exist and must plausibly connect to the student’s reading log.

5D. Proposal 4: Accountability measures that confirm comprehension

Assessment should be redesigned so that students are rewarded for genuine engagement and not punished for responsible AI support. A realistic approach is to include small in-class components that confirm comprehension. Examples include a handwritten micro-summary of a short passage the student read at home, a quick oral explanation of a chosen sentence, or a brief quiz that tests understanding of key ideas rather than memorized grammar rules. These checks do not require long class time, but they create strong incentives for authentic home reading.

These measures make substitution difficult without requiring intrusive monitoring. At the same time, they allow students to use AI responsibly for clarification and revision. This balance is important because strict bans may reduce transparency and increase the likelihood of misuse. When students know that comprehension will be checked in person, the value of reading increases and the temptation to delegate everything to AI decreases, reducing the likelihood that AI use is pushed underground.

5E. Proposal 5: AI literacy as part of home study training

AI literacy should be taught explicitly. Students should learn that AI output is not guaranteed to be correct, that citations may be fabricated, and that responsible use requires verification. They should also learn practical prompt strategies for CAS: asking for simpler English, requesting examples, or clarifying meaning in

context. Teachers can provide short workshops showing effective prompts, common mistakes, and how to respond when AI produces uncertain or inconsistent answers.

An AI literacy component can be integrated into the first weeks of a course. Students practice using AI to clarify a short text, then compare their comprehension before and after. They also practice post-editing a short draft and identifying which changes improve clarity. By framing AI as a learning partner that requires critical thinking, the course establishes norms that persist throughout the term.

5F. Proposal 6: Linking classroom input activities to home routines

To maximize continuity, classroom input activities should directly feed into home study routines. For example, short teacher-led readings, Story Listening, or guided discussions can introduce topic vocabulary and discourse patterns in a low-stress setting. Students then continue at home by selecting a related easy text and applying the comprehension-first workflow. This linkage reduces the startup cost of home study because students already have background knowledge and an emotional connection to the topic. It also supports consistency: students are less likely to postpone reading if the next step is clearly connected to what they just did in class.

A common failure point in home study is inconsistency: students intend to read, but they postpone due to uncertainty about what to read or fear of difficulty. Classroom-to-home linkage addresses this by making the next reading step obvious and achievable. Over multiple weeks, the repeated routine can normalize reading as a daily academic habit, which is essential for accumulating optimal input.

5G. Proposal 7: Prompt banks for equitable CAS use

Because students vary in their ability to formulate effective prompts, instructors can reduce inequality by providing a prompt bank, short, reusable prompts aligned with CAS functions. Examples include: “Explain this sentence in simpler English,” “Give two examples of this word in a science context,” “What does X refer to in this paragraph?” and “List the key nouns and verbs in this sentence.” Students can copy and adapt these prompts during reading. Prompt banks should be framed as learning tools rather than as ways to outsource thinking.

Prompt banks also make teacher expectations transparent. If students know which prompts are acceptable, they are less likely to cross boundaries unintentionally. Over time, students can contribute successful prompts to a shared class document, building a culture of responsible AI use.

5H. Proposal 8: Peer collaboration that strengthens accountability

AI can support collaboration if structured carefully. Students can form small reading pairs or triads and share short reflections in an online forum. Each student posts (a) one sentence they found difficult, (b) the AI clarification they used, and (c) their own rephrasing of the meaning. Peers then comment by asking a question or adding an alternative explanation. This model keeps the focus on comprehension and creates social accountability without requiring long written products.

To prevent free-riding, collaboration should be paired with in-class micro-checks. For example, a teacher can randomly ask a student to explain the sentence they posted or to paraphrase the key idea from their reading. Because the student chose the sentence, the task feels fair, but it still requires genuine engagement.

5I. Proposal 9: Minimal disclosure norms for student work

A minimal disclosure norm can normalize responsible AI use. Rather than requiring complex reporting, students can include a short line at the end of assignments such as: “AI use: vocabulary clarification; sentence simplification; revision suggestions.” This practice encourages honesty, helps teachers interpret student output, and reduces adversarial dynamics that often accompany new technology. Disclosure also reinforces the idea that AI is a tool whose value depends on critical use.

Disclosure should be paired with instruction on what must not be delegated: selection of sources, verification of claims, and creation of personal reflections or interpretations. When students understand that the goal is learning, not punishment, disclosure becomes more feasible (See Table 2 for details).

Table 2. Sample Weekly AI-Supported Home Study Plan (Comprehension-First)

Step	Student Action	Permitted AI Support (CAS)
1	Read 10–15 minutes; mark comprehension blockers	None (first attempt)
2	Clarify blockers; record the clarification used	Paraphrase / vocabulary explanation / background
3	Re-read; write a 3–4 sentence personal reaction	Check wording only (no content generation)
4	Draft a short explanation for class sharing	Revision suggestions; post-editing
5	In class: share orally / do a micro-check	Not applicable

6. Implications for STEM-Focused Higher Education

The proposals above imply a shift in what is valued in English education. If AI makes surface-level accuracy cheaper and faster, then classroom time and evaluation should emphasize comprehension depth, reading volume, and the ability to explain meaning. For STEM students, this aligns with real academic needs: understanding research articles, summarizing findings accurately, and explaining processes and results clearly. An input-centered approach also aligns with the time constraints of STEM curricula because it focuses on high-yield activities that can be sustained outside class.

Institutions should support input-rich environments: access to level-appropriate reading materials, time allocated for sustained reading, and guidance for self-selection. AI can strengthen such environments by lowering the cost of comprehension, especially at early stages when technical vocabulary and complex syntax discourage learners. But for this to work, AI must be framed as CAS and paired with accountability measures that maintain the learner’s active role. Without accountability, the same tools can be used to avoid engagement.

At the program level, evaluation should include measures of reading behavior (volume, frequency, persistence) and comprehension performance, not only end-of-term writing products. If an AI-supported model increases reading volume and reduces anxiety, it may produce long-term benefits not visible in short-term product-focused assignments. Institutions should also provide faculty time and support to align course policies, create shared prompt banks, and develop common templates for reading logs and post-editing notes, so that students experience consistent expectations across classes.

6.1. Limitations and practical constraints

Implementing AI-supported, input-centered home study also involves constraints. First, not all students have equal access to devices or reliable internet; programs may need to provide on-campus access or low-tech alternatives. Second, teacher workload is a concern: reviewing reading logs and post-editing notes requires time. A practical compromise is selective checking (e.g., random sampling, short spot checks, or rotating focus students) combined with in-class micro-checks. Third, students may initially resist reading volume targets if

their prior learning experiences focused on discrete test items. Therefore, early orientation and clear rationale are necessary.

6.2. Directions for future research

Future research should examine the longitudinal impact of structured AI-supported home study on reading behavior, anxiety, and discipline-relevant communication performance. Studies can compare cohorts under different policy conditions (e.g., disclosure required versus optional; prompt banks provided versus not provided) and measure whether reading volume increases over a full academic year. Qualitative data such as student reflections and interviews can also clarify how learners perceive AI support, how they develop prompt skills, and where misunderstandings arise (See Table 3 for details).

Table 3. Implementation Checklist for AI-Supported Home Study (Instructor Use)

Design Element	Concrete Practice
Acceptable AI use defined	Provide examples of CAS prompts and unacceptable 'answer' prompts
Reading materials available	Offer level options; allow self-selection; include STEM-friendly texts
Reading log template	Require difficult sentence + AI clarification + student rephrasing
Post-editing routine	Two-version submission + short change annotations
Integrity routine	AI → verify → write; use a short disclosure line
Comprehension check	In-class micro-summary or oral explanation linked to reading log
Equity support	Prompt bank and short training to reduce prompt skill disparities

7. Conclusion

Generative AI is now an unavoidable feature of students' academic lives. In English education, it can either support acquisition or undermine it. The determining factor is design: whether AI use increases access to optimal input and supports reflection, or whether it replaces reading and thinking through output substitution.

Grounded in the Input Hypothesis and Optimal Input perspective, this paper proposed a structured approach to home study in which AI functions as Comprehension Aiding Supplementation. The approach emphasizes comprehension-first workflows, reading volume targets with self-selection, post-editing routines, prompt banks, disclosure norms, and accountability measures that confirm engagement without punishing responsible AI support. These proposals aim to maintain academic integrity, reduce cognitive passivity, and promote sustainable development for STEM students.

As AI tools evolve, educators must continue refining designs that preserve the core mechanism of acquisition: meaningful comprehension through abundant input. The most productive path forward is not a ban or unrestricted adoption, but a principled integration that uses AI to make input more accessible while keeping learners responsible for understanding and expression.

Notes

- 1) In this paper, "AI" refers primarily to widely accessible translation and generative text tools used for comprehension and writing support. The recommendations are intended for typical classroom settings where full AI bans are unrealistic.
- 2) 安永美穗 (2026).
- 3) Krashen (1985).
- 4) Krashen & Mason (2020).
- 5) Krashen, Mason, & Smith (2018).

- 6) The paper also emphasizes design principles rather than specific brand tools, because AI platforms and interfaces change rapidly. The central distinction is functional: CAS-oriented support versus substitution-oriented generation.
- 7) 安永美穂 (2026).
- 8) Krashen, 1985; Krashen & Mason (2020).
- 9) 安永美穂 (2026).
- 10) Krashen (1985).
- 11) Mason & Krashen (2017).
- 12) Krashen & Mason (2020).
- 13) Mason & Ae (2023).
- 14) Krashen, Mason, & Smith (2018).
- 15) 安永美穂 (2026).
- 16) 安永美穂 (2026).
- 17) Krashen, 1985; Krashen & Mason, 2020; Mason & Krashen (2017).

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