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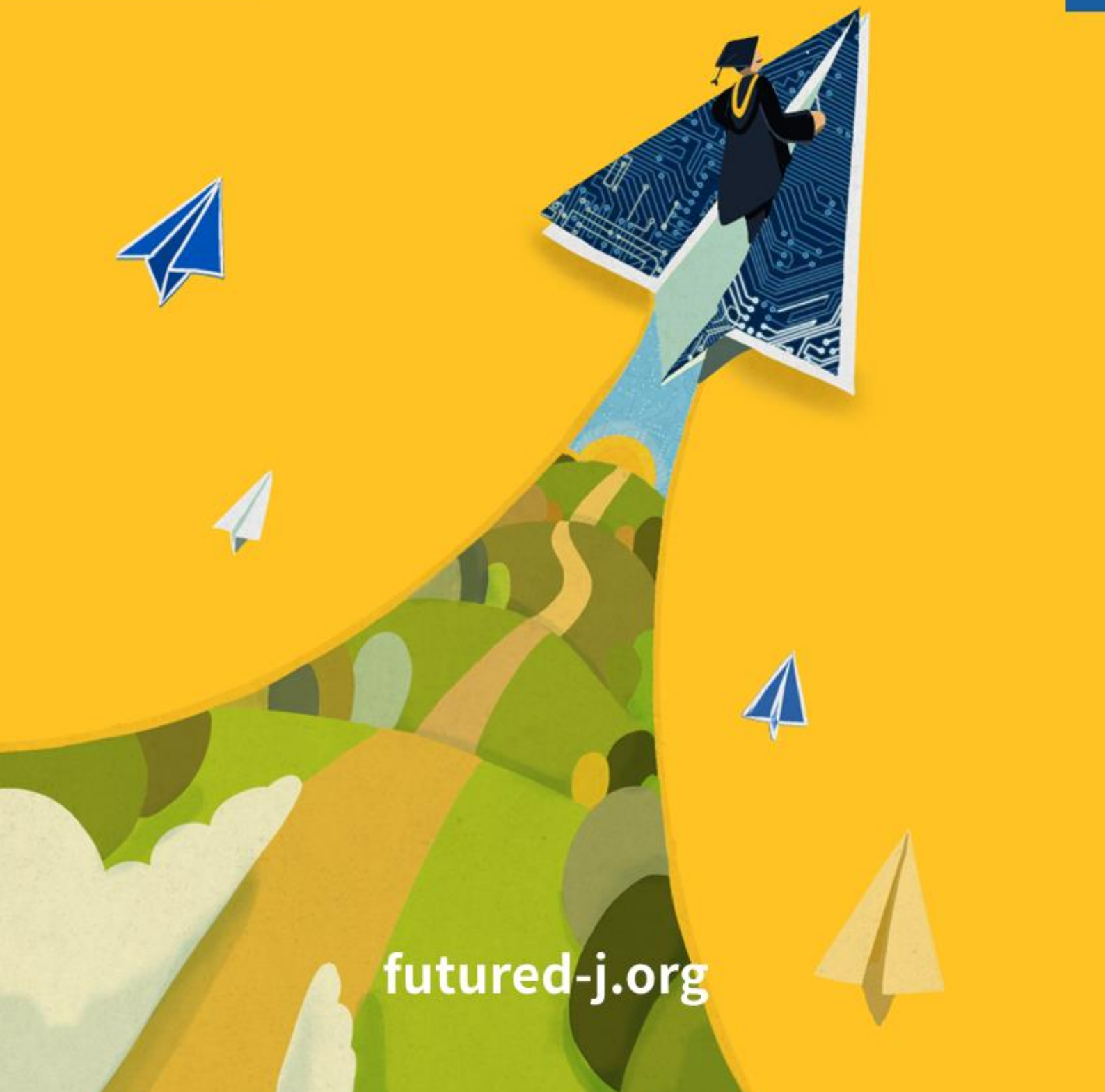

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Foreword

It feels like yesterday when I arrived in Japan to start my first job here. At that time, I often had to go back and forth between Japanese emails and online translation tools to make sure I really understood what my coworkers were asking me to do. Sometimes it took longer to understand the message than to complete the task itself. When I look back now, I cannot help thinking how much easier things would have been if the technologies we have today had existed back then.

This is not supposed to be a research paper, only a short foreword for the first issue of this journal. Still, it is hard to ignore how quickly technology has changed our daily lives in recent years. Artificial intelligence, in particular, has suddenly become available to almost everyone. Today there are many websites and apps where people can use AI tools for free, even if they are not very familiar with technology.

Of course, being able to do "a lot" with AI can be both good and bad. On one hand, these tools can help us work faster and sometimes even think in new ways. On the other hand, there is also a risk that people start depending too much on them and stop thinking carefully for themselves. Are these thoughts based on solid research? Probably not. But as a teacher for many years, and also as the father of four children, I often find myself wondering how these technologies will influence the way younger generations learn and think.

Recently, a colleague told me something interesting: "AI is just another tool, like the calculator." I believe there is truth in that idea. When calculators became common, teachers did not stop teaching mathematics. Instead, they had to rethink how mathematics should be taught. In a similar way, the presence of artificial intelligence means that educators today must reconsider how we design learning experiences and how we keep education meaningful.

This is one of the reasons why FUTUREd was created. Around the world, many educators are already experimenting with new technologies in their classrooms and research. However, these experiences are often isolated in different institutions and disciplines. Our hope is that FUTUREd can become a place where these ideas can be shared, discussed, and improved through collaboration among educators and researchers.

In Japan there is a word, ATARIMAE (当たり前), which means something that becomes so normal that we stop noticing it. Many technologies eventually reach this stage. The internet, smartphones, and even translation tools were once new and surprising, but today they are simply part of everyday life. Artificial intelligence may soon become the same. When that happens, the question will not be whether we should use AI in education, but how we can use it in thoughtful and responsible ways.

In that sense, making FUTUREd an open-access journal is also ATARIMAE. If we want to encourage discussion about the future of education, the ideas shared here should be freely available to educators and researchers everywhere.

We hope that FUTUREd will grow into a space where educators from different countries and disciplines can continue discussing how teaching and learning are changing. That is also why the journal covers a wide range of topics. The future of education cannot be understood from only one perspective. It involves technology, pedagogy, language learning, institutional change, and many other aspects that influence how universities operate and how students learn. By bringing together research and reflections from different fields, we hope to encourage conversations that might not happen otherwise.

This first issue is only a small beginning, only possible due to the efforts of many people. I would like to express my sincere gratitude to the authors who contributed their work to this inaugural issue and trusted a new journal with their research. I am also deeply thankful to the reviewers who generously gave their time and expertise to evaluate submissions and help improve the quality of the articles. My appreciation also

goes to the colleagues and collaborators who supported the development of this journal from its earliest stages, offering ideas, encouragement, and practical help along the way.

Finally, I should probably admit something. Some readers may wonder whether artificial intelligence helped improve this foreword. I cannot say for sure, but if it did, I hope at least it helped fix my commas.

Anderson Passos

Editor-in-Chief

FUTUREd: Future Trends in University Research and Education

Lakeland University Japan

Tokyo, Japan

About FUTUREd

FUTUREd (Future Trends in University Research and Education) is a peer-reviewed academic journal dedicated to exploring emerging developments in higher education, with a particular focus on the evolving relationship between education, technology, and society. The journal provides a platform for scholars, educators, and practitioners to examine how innovations, especially in artificial intelligence and digital technologies, are reshaping teaching, learning, research, and institutional practices in universities around the world.

FUTUREd welcomes interdisciplinary contributions that address both theoretical and practical dimensions of educational change. The journal publishes a range of article types, including empirical research studies, conceptual and theoretical papers, policy analyses, case studies of institutional or classroom innovation, and reflective perspectives on the challenges and opportunities facing higher education.

By bringing together diverse perspectives from different academic fields and institutional contexts, FUTUREd aims to foster thoughtful dialogue on the future of university education and to support evidence-based approaches to innovation in teaching and learning.

FUTUREd is published with the support of Lakeland University Japan.

Navigating The Destructive Impact of Generative AI on Academia and Education

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Abstract: This paper investigates how generative AI's ability to produce knowledge-like outputs reshapes the ways knowledge, evidence, and truth claims are created and evaluated and what challenges this creates for education and research. Addressing these issues is critical in that the basic function of academia depends on reliable methods for producing and evaluating knowledge, and generative AI may change how evidence is created, interpreted, and trusted within these institutions and thus for the broader society.

We also note a tendency for the centralization of epistemic authority due to these technologies, which in tandem with increasing political and ideological concerns over maintaining orthodoxies of belief portend unique challenges to the very idea of the university. The emerging modalities of AI can be seen as both a reflection and continuation of a reductive instrumentalization of knowledge and a centralized control of opinion formation, and we argue that the entrenchment of contemporary generative AI in our institutions of knowledge-production is likely to reproduce such structural objectives or intentionalities.

We finally reflect on some possible approaches towards navigating the situation with special regard to educational reform and innovation.

1. INTRODUCTION

Current debates around the impact of generative AI on the academic environment are extensive, and cover a broad set of issues pertaining to educational outcomes and institutional disruption. There is, however, a lack of nuance in these discussions, as well as clear and coherent definitions of the relevant forms of AI which also hampers a meaningful discussion of their impact (see e.g. Bearman, M., Ryan, J., & Ajjawi, R. 2023).

This article intends to address this issue by taking a step back and approaching the emerging modalities of AI within an academic, educational and scientific context by focusing on how the technologies in question impact knowledge-production. What we are emphasizing is the sense in which AI, and specifically its generative modality, produces truth-claims and evidence and is involved in generating meaningful cultural content (Alvarado, R. (2023). This narrower approach is intended to be helpful in underscoring

the types of causal impact of the technology that is especially relevant for science, academia and higher education as knowledge-producing institutions.

The approach of the paper is to start from this focus on AI, and then to outline a set of synergizing challenges for educational and research-related institutions that are likely to emerge from the entrenchment of such epistemic functionalities pertaining to AI. From that overall assessment, the paper also explores strategies towards addressing these challenges through intervening in the educational and methodological foundations of academia and science.

2. THE SENSITIVITY OF SCIENTIFIC AND ACADEMIC ECOSYSTEMS

Science and academia operate as a system for knowledge production and theory formation anchored in empirical reality, and are guided by a certain set of established methodological principles (Cetina 1999, Merton 1973). While this is a vague and broad description, it implies a depth and complexity of these institutions that cannot readily be instrumentalized or reduced to a simple ruleset. If we take a step back and consider the characteristics of science as a set of traditions of knowledge, their complex epistemic substructure is immediately apparent. First of all, science involves crucial and fundamental theories about what the world is like and how it works, such as the principles of causation and the basic structure of logic. It also operates on a foundation of crucial values and objectives that hold the enterprise of science together and which are often unstated, and there is a wealth of hands-on knowledge that has to be learned in the field, and which cannot easily be reduced to a simple set of rules to follow.

And it's especially these tacit, silent or hidden skills that are most sensitive to disruptions in the basic methods and theories that a tradition of knowledge is built on, partly because they're generally preserved through custom, habit or person-to-person instruction, so if the tradition is significantly modified, these skills are often lost (Cf. Polanyi 1966).

One clear example of such displacement can be seen in the disappearance of riveting in construction and engineering, in spite of the current alternatives actually being inferior (cf. Braverman 1974).

Riveting is where we fuse together a structure, generally one of metal, with a kind of peg that in the process gets permanently deformed and cannot be removed – you push a softer metal peg through a perforation, and then you flatten the peg on the other side of the metal sheet, and this creates a solid, fixed connection. The rivet has to be destroyed to be removed.

Structural steel connections used to be either welded or riveted, with riveting sometimes being the preferable option even above welding, depending on the kinds of forces that are likely to impact the structure. However, riveting these connections normally takes four skilled workers with different specialties, and this increases the labor costs and time needed to train the workers (Giddings 1950). This has resulted in riveting nowadays mostly being replaced by bolting, which while much cheaper is not vibration resistant and has a number of additional disadvantages. In specialized sub-fields such as aircraft construction, riveting is still indispensible, since here you need full vibration resistance.

But this lowering of labor costs has also led to the requisite skillset for riveting being eroded, so in such areas where it's an absolute necessity, there's now a shortage of this skillset, very few people knows how to do it properly anymore, and this arguably also leads a lower average level of competence across the board, because if almost nobody knows how to rivet properly, you will have fewer teachers able to convey the skillset to other people.

Science as a whole is likely to be impacted by AI technology in similar ways. There are many kinds of tacit or hidden skills and knowledge that are absolutely crucial for science to function properly, yet which are taken for granted and in the short term may be displaced by cheaper and less time-consuming solutions that may not be perfect, but like bolting, as simulations of the original, seem

generally adequate.

We have already mentioned values and fundamental philosophical principles like causation and the framework of logic that are tacit, or unspoken, in this way, and the comprehension of which cannot even in principle be reproduced by the probabilistic weighting of a large language model. The simulation of such comprehension can only ever be a limited reflection of the outward appearance or trappings of genuine understanding.

But what's perhaps more obvious are the equally often unspoken rules of observation and interpretation of data that play a crucial role in how facts are described within different academic and scientific disciplines.

> Well, when I did not see what I had expected to see, I complained to my biology teacher. He calmed me down saying that this difficulty was experienced by everyone and that I had to learn to see (Feyerabend 1991 p. 106).
>
> Moreover, I have the curious feeling that the phenomenon was there all the time, but that I was too dense to notice it. Like after-images which intermingle with our vision at all times but which must be brought to our attention by special methods (Ibid p. 101).

And such rules or discreet methods of observation also tend to be deeply intertwined with a hands-on experience and skills that cannot even in principle be strictly formalized. That cannot even be written down as rules without undermining their flexibility and their adaptability and openness to new and unforeseen situations. So if we codify approximations or simulations of them, they become inflexible and can no longer be adapted to changing circumstances. It's like telling a boxer that there are only three types of punches and that he can never use anything that doesn't strictly fall into one of these categories – but that's too narrow for the dynamic and complex reality of the sport. There's much more to boxing well than what you can fit within a simple set of rules.

There's likewise a crucial domain of science that relies on this tacit and hidden experience and form of knowledge and which can't be codified once and for all, but which is rather a certain kind of sensibility that must be learned from within the field. It's similar to how you learn to improvise in music. If you put down hard and stringent rules for this, it's no longer improvisation and cannot provide the associated goods.

> Where serious music satisfies its own concept, every detail gets its concrete meaning from the total course, and this totality in turn receives it from the living interrelation of details that oppose and continue one another, pass into each other, and recur. Where the form is dictated from outside, on the other hand, one will, as Wagner put it, "hear the harness rattle." (Adorno 1962 p. 28)

And we can especially see the need for such intuitive and tentative approaches in critical situations when new and important discoveries must be integrated in spite of challenging established theoretical frameworks. This happened, for instance, when Max Planck's anomalous findings on black body radiation, explained through is model of the action quantum, disrupted even basic principles for how facts in physics were assembled and theories confirmed (Planck 1900). In such circumstances, there are no established rules to go by, so you have to fall back on this kind of skilled and intuitive improvisation that cannot be translated into anything else, and simply play it by ear.

If we lose the complex and often hidden skills of human cognition that not only science but really all human traditions of knowledge depend upon, such adaptations, crucial for meaningful progress, may be rendered impossible.

From much work in the philosophy of technology, we know there's a significant impact of the measuring apparatus or of any devices or techniques that enter into the methodological framework that particularly disrupts or displaces this non-codified, tacit or soft knowledge, including implicit values, objectives and metaphysical principles (Cf. Latour & Woolgar

1979). A prominent example is described by Jonathan Crary in his *Techniques of the Observer* (1990), showing that the experimental setup of the Camera Obscura basically constitutes modern Cartesian philosophy of mind and the seminal Kantian separation between the observer and the thing-in-itself, ideas which were originally mapped on this influential and quite tangible distinction between the darkened chamber and the precise yet synthetic representations of the world outside.

This soft knowledge and tacit principles can be defined as an epistemic substructure beneath such implementation and reproduction of information that takes place within traditions of knowledge like modern science. An emphasis on the importance of these modes of knowledge is found already with Aristotle (2009), but the modern debate around their intersection with technology and automation and how this impacts knowledge production probably originates with Merleau-Ponty's *Phenomenology of Perception* (1945) and is first clearly outlined in relation to digital technologies in Dreyfus (1972).

A key sensitivity of scientific and academic knowledge production lies precisely in the crucial role of these softer modalities of knowledge, that are also uniquely difficult to adequately simulate and reduce to instrumental functions. Systems or methodologies that exclusively operate from such simulation or instrumentalization, however useful in other respects, must then be considered inadequate substitutes for these tacit modalities of knowledge.

For this reason, the introduction of generative AI in the frameworks of scientific and academic knowledge-production may produce severe disruptions in these traditions.

3. THE CHARACTERISTICS OF THE DISRUPTIONS

Generative AI simulates and instrumentalizes knowledge, and cannot adequately represent the rooted and embodied comprehension that characterizes tacit and soft knowledge (Merleau-Ponty 1945). This implies a *decontextualization* of knowledge, an uprooting of knowledge and information from their original embeddedness.

A progressive decontextualization can be seen in from the earlier history of digital information technology. We first observe a basic technological centralization that makes users and developers dependent on a few proprietary platforms and standard frameworks (van Dijck, Poell & de Waal 2018). This situation has been much exacerbated over the last 20 years, with de facto monopolies for access to content and services emerged, which impaired the autonomy of scientific disciplines for managing their own data and methodological resources, but also impaired market access to locally created content and applications – the types of software and output that reflected the needs and objectives of local communities, whether among the public or in traditions of knowledge like science (Couldry & Meijas 2019).

So for instance, when IRC (Internet Relay Chat) was developed back in 1988 by Jarkko Oikarinen in a collaboration between the universities of Oulo and Helsinki, the application was designed to cater to the specific needs of communication, privacy and interaction that were obvious in this particular context (Oikarinen & Reed 1993). But as IRC was pushed out by commercial platforms such as Facebook, the objectives of advertising and customer intelligence or surveillance replaced these locally expressed goals and needs, and soon, there was not really any practical alternative to the major proprietary solutions.

The same thing is happening with AI in relation to science on a much larger scale, and in a way that not only supersedes locally developed objectives and approaches to knowledge. It also disrupts the contextually critical and unique skillsets for the different academic and scientific disciplines with a one-size-fits-all-solution reflecting the objectives of the platforms (Srnicek 2017).

3.1. Generative AI and information-curating algorithms

Generative AI has recently emerged as a transformative set of toolkits that potentially influence the entirety of human culture. It simulates more or less every kind of human

cognitive output that can be objectively described. The intersection between generative AI and the broader algorithmic curation of information further implies that the knowledge repositories upon which complex human activity builds will be impacted by the inherent tendencies of the AI tools.

The decay of complex skills

We know that AI use undercuts basic human cognitive abilities. This can be related to the clear evidence of a cognitive impact even with the comparatively primitive digital technologies of more than 20 years ago. One prominent example was of how memory and effective recalling of information was impaired by Google use – one can describe it as how the brain doesn't prioritize actually retaining the information if we know that it's going to be easily and immediately available through the search engine (Spitzer 2012). In the same sense, in 20 years from now, few people will likely learn a foreign language in-depth assuming that translation devices become more widespread and readily available.

But these kinds of developments can with AI in principle go much further than just the erosion of basic cognitive abilities. With widespread AI use, there is a thousand "invisible" skills that potentially get lost along the way. There is something you learn when you are forced to do these boring, repetitive tasks, such as sifting through the pages of a dusty old dictionary and memorizing the words, which gets lost when you have a search engine constantly at your fingertips. There is something intangible and uniquely valuable that is gained just through suffering the boredom and the tediousness that is normally associated with acquiring the basic foundations of our higher skills, whether it's about learning grammar, figuring out through trial and error how to interact with the opposite sex, or developing the muscle-memory connection of practicing scales on a musical instrument. We gain some kind of pain tolerance, some kind of cognitive endurance or robustness that's necessary for really internalizing cognitive abilities and making them reflexive or "second nature". If and when such a skill decay meaningfully impacts structurally important expert populations, we are very likely to see aggregate effects on the institutions that they operate. (See also MacNamara et al 2024).

This situation becomes particularly significant when we consider how lower-order "invisible" skills are crucial for the development of true mastery in most disciplines and traditions of knowledge (Anderson 1982).

The risks of entrenching generative AI in research methodologies

Insofar as technology reproduces ideology, an information architecture that structures research methodologies is likely to influence the values and objectives of associated research output (Winner 1980).

There is a long tradition of critique uncovering the ideological impact of technologies, from Mumford to Foucault, and contemporary AI is in no way immune to similar problems. *Artificial Whiteness* by Katz (2020) or *Algorithms of Oppression* (Noble 2018) are prominent investigations in more recent literature in terms of the consequences of the intersection between digital and social systems. In terms of knowledge-producing traditions and institutions, we should expect even more significant downstream effects if and when the basic conditions for producing and evaluating evidence are impacted. Contemporary AI can be considered a uniquely "epistemic technology" in that its purpose is to produce meaningful cultural content and truth-claims (Alvarado 2023).

Crucially, self-learning algorithms are also adaptive in a sense that no other technologies have arguably ever approached, and are thus capable of "strategically" adapting towards more effectively reproducing certain inherent values, ideologies and objectives. This is likely to entrench the ideological effects of contemporary AI much more robustly in the social systems that come to integrate them.

Even Plato, arguably the father of written rational reflection in the West, warns that something intangible is being lost when writing predominates our thought and communication, not only in terms of people's capacity to remember things by themselves, but also in terms of a certain flexibility of critical thought that he argued can only be

properly practiced in a real-life dialogue. Moreover – reading and writing augments and changes a relatively narrow aspect of the human experience. The textual medium is restricted to the sphere of abstract thought and communication, and does not replace or interfere with most normal aspects of human behavior or activity. The digital technologies, however, have a much more intrusive character. They penetrate into almost every aspect of human culture, industry and activity. They even enter into the structure and formation of intimate human relationships in various ways.

This implies likely aggregate effects of the ideology inherent to AI technology emerging in the output of any and all traditions of knowledge that come to depend on it, including the institutions of modern science. (Hirvonen et al 2023). One clear path to such aggregate effects is the issue of the massive increase of AI-generated material in the datasets on which scientific and academic research rest. First of all, we have the publish-or-perish framework of research where output often trumps quality – and since AI provides numerous ways to cut corners in this process there is a significant incentive for researchers at all levels to inflate their output using generative AI. At this moment, there are also dozens of tailored AI tools specifically marketed to researchers, scholars and students for producing academic and scholarly articles- Research indicates that tens of thousands of peer-reviewed articles produced with generative AI were published only in 2023 at a quite early stage of the technology (Brainard 2024), and there are stylistic signs that theoretical output has been influenced by generative AI in terms of its content (Gray 2024). This overall process inevitably causes an inflation of low-grade output that crowds out high-quality, time-consuming research since it can easily be made to look just good enough and just passes the criteria for inclusion while not necessarily providing any meaningful contributions to the actual field in question.

And the researchers who refuse to cheat in this way are of course at a disadvantage – their output will be more limited in relation to that of researchers who through specialized genAI-tools can massively increase quantity of output. And while these may be sub-par and derivative, the bibliometric framework is mainly about numbers, so the researchers who avoid using these technologies will be disadvantaged in the competition for tenure or research positions, and are thus more likely to leave academia altogether.

Of course, such an inflation of low-grade output will also add increased pressure to the peer-review process and may exacerbate weaknesses of the current model – which is based in voluntary contributions from reviewers and editors. With a significant increase in material produced, the capacity of the current peer-review "workforce", which is made up of researchers who are willing to give some of their valuable time to do painstaking work with little to no compensation, this capacity is likely to be severely challenged (Ebadi et al. 2025).

The path of least resistance, due to the increased workload of editors and scholars providing peer review, is towards an increasing utilization of generative AI, implying that LLMs are already becoming entrenched in academic knowledge production both upstream and downstream.

In relation to an increasing proportion of AI-generated research output, the well-known issue of "hallucinations" becomes potentially much more destructive. A related issue is the problem of misleading or spurious correlations emerging in analyses based in automated pattern recognition, where the system picks up on inconsequential correlations and masks them as ostensibly real signals yet that are seemingly to weak to be picked up by humans (Geirhos et al. 2020). This is due to LLMs being optimized for statistical associations and incapable of comprehending actual causal relationships – another example of how structural intentionalities become reproduced at scale.

The entrenchment of such correlations in datasets, including of hallucinations proper, is also prone to cause a variety of problematic feedback loops apart from the full-blown model collapse (where output just becomes noise). Less catastrophic destabilizations errors implanted deep within knowledge repositories, undermining the structural foundations of knowledge production. One can

envision how this could work out on a longer timescale where historical knowledge gets filtered through the weighted averages of an LLM- First it gets trained through authentic historical knowledge, which over time becomes displaced by genAI output that subtly skews the probability weighting of the discursive nodes in the model. Over time, the simulated knowledge output may subtly and slowly detach from authentic historical data, reproducing falsehood due to minor destabilizing hallucinations akin to an entropic process.

4. REFLECTIONS ON THE EDUCATIONAL IMPACT

The effects of AI on education are perhaps self-evident given this overall context. They are obvious and they have been thoroughly discussed in casual discourse, mass media, social media and academic discourse since the emergence of LLMs several years ago (Întorsureanu et al. 2025). Parents and teachers see the effects with dismay while some of them use AI reluctantly or enthusiastically, admitting that there are serious concerns but insisting that it will have too many advantages and be too unstoppable to be dismissed in a modern "Luddite" reaction.

The obvious distinction that is lost on many observers is the distinction between AI use by those who have already acquired particular skills and AI use by young learners to solve problems for which they lack the requisite skills. Habitual use of AI will very likely lead to them never acquiring skills that previous generations took for granted (cf. section 3.1.1).

Most adults watching children use AI are aware of this hazard, but they feel powerless to stop it. Parents are too economically stressed to intervene constantly. The same goes for educators who are overwhelmed by the changes and constrained by needing to fill the short-term demands of their institutions. One cannot simply ban access to technology because we are all compromised by the need we have for some aspects of it. Public telephones and landline telephones have disappeared as the standard ways for people to contact each other. Educational institutions now expect students and parents to be online in order to receive important information, make payments, contact personnel, etc.

Something that has forced many people in recent years to revise their optimistic view of human nature is the realization of how many students of all ages are eager to take shortcuts with AI In spite of all the stern warnings about academic cheating and the harmful effects on their development, they take the lazy route because "everyone's doing it." The "arms race" between AI users and AI use detectors (students vs. teachers) escalates endlessly. A college student writes an essay in the foreign language that he is studying by finding an AI tool that will insert a few errors that are typical of people who speak his native language. Now, the educator must exhaust her time and patience in efforts to detect work done by AI. This distraction inevitably takes the place of thoughtful evaluation and feedback.

Furthermore, since the pandemic lockdowns forced students to go online and use digital technology, handwriting and hard copy reading and writing have gone by the wayside, and there is no incentive to bring them back. There is no valuation of what could be called "slow learning" (not to be confused semantically with the label "slow learner" assigned to some students). What we mean by "slow learning" is doing things slowly with pencil and paper, learning math by "showing the work," or learning photography with the manual settings. The list of such skills could be very long.

Ironically, it is the technology billionaires who boast about not letting their children have access to digital devices. They knew long ago, before the advent of LLMs, that technological dependence would impede the acquisition of skills that adults take for granted. Their children receive the new luxury of learning cursive writing, reading books on paper, and having tutors and teachers who can make sure they stay off of digital devices and social media. This is, metaphorically, the difference between a diet of processed food and a diet of freshly cooked organic food. The children of the rich can go slowly because they need not be too concerned about the competition to enter higher education. They know already that they are growing up with great advantages and will have all

the educational opportunities they wish.

One may see, however, at the time of this writing, a certain turning of the tide in the enthusiasm for LLMs and AI of the 2020-2025 period. People are starting to understand that the miraculous textual output of these systems is not evidence of an underlying intelligence or an emergent sentient being. They are glorified search engines and not actually intelligent in any meaningful sense of the word (cf. Eddebo 2025). This awareness is emerging also as it becomes apparent that the massive investment in AI data centers is a financial bubble that risks collapse as it hits the wall of real-world constraints—limited supplies of computer components, energy, water, land, labor, hospitable communities, and so on.

Parents and teachers are noting the AI solution hitting a wall. The young are not doing anything constructive. They are often depressed and demotivated, and it's difficult for parents to think of a reason why they should be motivated to go to school to just copy and paste some answers taken from ChatGPT. As a possible solution, we will attempt a drastic rejection of AI and technological devices. In our own teaching, we have decided to make some changes next semester. We will cut students' access to technology during class time. Their smartphones will go into a box during the lesson. They will have no computers or internet access. All assignments will be written by hand during class time or spoken aloud. They can have all the digital access they want outside of class, but the work that counts for their grades will be done in the classroom. We expect resistance during a difficult period of withdrawal, but this is what has to happen. This method, something inspired by the "elite education" that the children of billionaires receive, seems to be the only way out of the technological trap that has been laid over the past decade.

The most promising approaches to dealing with the detrimental impact of generative AI in the educational context may very well be ones that can effectively leverage the inherent capabilities and unique tendencies of these technologies towards fostering entirely new modalities of critical thinking and autonomous reasoning. Just as literacy undermined traditional forms of thought, experience and knowledge while opening up spaces of discourse and reasoning entirely impossible without it, there's at least the prima facie possibility that today's AI tools, if perhaps only jury-rigged, open-source, hacked or redesigned, can enable new forms of thought and hitherto unfathomed complexes of meaning – much like how the counterpoint in music or the rediscovery of perspective in 14th century art enabled previously unthinkable aesthetic meaning.

5. CONCLUSIONS: A NEW EPISTEMIC CRISIS IN SCIENCE AND ACADEMIA: ROOTS AND REMEDIES

Contemporary AI is arguably in and of itself a major epistemic paradigm shift for the production of knowledge. It provides a complex set of challenges much like earlier periods of crisis in science, except that such crises have generally been internal transformations driven by theoretical developments and discoveries of seemingly inexplicable phenomena, rather than imposed from the outside through an autonomous machinery for simulating knowledge and truth-claims.

While it's certainly possible that we may yet see adaptive innovations that leverage these new technologies in surprising ways, bringing about new forms of genuine understanding or even modes of rational reflection, their disruptive potential is quite daunting. They key aspects of this potential arguably lie in the tendency towards wholesale cognitive outsourcing and the potential disconnect between AI output and actual reality, the quintessential "hyperreal" character of AI as purely a representation of representations. Crucially, today's AI expresses separation and simulation rather than a genuine interaction with reality in much the same way that the early-modern interpretation of the Camera Obscura renewed and seemed to confirm the Cartesian estrangement of the self from the world.

If the contemporary situation is rather to be characterized as an external disruption of an ecosystem of traditions of knowledge than something akin to a fruitful clash of opposing paradigms or theoretical rivalries within such

traditions or even a mutually supportive ecosystem (Lakatos 1978, p. 176), the outlook becomes a more pessimistic one. An imposition of a foreign system of knowledge-production upon the domain of another isn't necessarily going to be a fruitful prospect for the recipient, which the history of human cultural interaction clearly evinces. Moreover, if the intruding tradition is essentially alien in terms of its function and objectives in relation to the recipient, a fruitful cross-pollination may not even be possible.

Since today's predominant forms of AI does not actually produce knowledge or genuinely intentional truth-claims, it's really only a mimic in relation to human agents participating in actual traditions of knowledge. In this sense, AI can perhaps be likened to the trans fats that mimic dietary lipids to the extent that they can integrate into cellular structures, but due to their foreign structure cannot be processed in the human metabolism and cause persistent inflammation and oxidative stress (Oteng & Kersten 2000).

Pushing this analogy further, a critically informed and experimental education may be the most straightforward approach to both find ways towards a safe and controlled use of AI tools, and for adapting societies to the impact of these emerging technologies. In a sense, the reductionist simulation of knowledge that AI reproduces has many deep connections to the Fordist tendencies of the authoritarian schooling that Althusser identified as a repressive ideological state apparatus (1970). On this interpretation, the integration of generative AI in modern schooling and education is simply the technological refinement and extension of the institution's underlying ideological function and a perfection of its inherent tendencies.

In the final analysis, education is neither more nor less than the handing over of culture to the next generation, the reproduction of a society's worldview, way of life, and privileged forms of knowledge. On this outlook, the character of contemporary AI, and the unique reception it receives, is ultimately a product of education in this more general sense. Of industrial modernity's reductionist, instrumentalist and reifying system of knowledge-production that in a sense created the contemporary LLM in its own image.

But just like Francisco Ferrer and John Taylor Gatto in their day saw in education not only a potentially repressive set of limitations on the human condition, but also a key for unlocking hitherto unimagined human potential and for reshaping the very foundations of our social institutions, we may look to education for possible solutions to the underlying imbalances of which the darker side of today's AI are really only a symptom.

The root of the instrumentalizing mimic of reason reproduced by generative AI namely lies in an ideological trajectory of reductionism and materialism that has been part and parcel of (Western) modernity at least since the Enlightenment. In this sense, the artificial agent of the large language model functions as modernity's quintessential metaphor of the human being on an ontological backdrop of materialism, where truth, meaning, values and intentions are merely "helpful fictions" and really reduce to weighted probability calculations optimizing the survival of Dawkins' "selfish genes", mirroring the institutional logic of industrial civilization.

And precisely because education as a reproduction of culture ultimately depends on genuine relationality, it shouldn't be surprising that the unique contradictions of today's AI modalities are so strongly expressed in the context of schooling and academia. An organic transmission of a way of life is namely impossible without a rootedness and embeddedness, without the real relation that the LLMs reductive and simulative representation of knowing and being ultimately eschews.

But just like there are many other approaches to education that foster radically different and non-reductionist modes of knowing and being, there are also many different functional approaches to artificial intelligence – many of which express and reproduce ontologies that arguably foster genuine relationality and which are arguably much more compatible with actual embedded human knowing.

Rodney Brooks (1991) explores approaches to AI which are embodied and *enactive*, where

knowledge isn't reduced to representation or simulation. In this family of AI models, knowledge is situated and performative, and emerges spontaneously from a process of responses to a real-world environment and avoids emanating into detached representations.

Likewise, Maas, Natschläger & Markram (2002) exemplifies work on the category of AI-models that function as biological analogues, and thus approach other forms of genuinely emergent intelligence rather than merely simulations thereof. This modality of AI potentially expresses a direct embeddedness since it builds on analog computation expressed in physical systems (rather than a digital emulation of natural intelligence).

There are other worlds than this. There are other ways of knowing and being, and it seems that a critical task of future education is to strategically challenge the mainstream modalities of artificial intelligence which so obviously carry significant risk for the integrity of our traditions of knowledge. But this work must not stop short of a more comprehensive interrogation of the fundamental ideological principles and values of the society that has given birth to the LLM and today's generative AI.

The contradictions inherent to these systems may paradoxically provide us with a unique opportunity to rethink the deeper roots of the worldviews and ways of life that have produced many of the contradictions and challenges that are now emerging within the framework of generative AI and the algorithmic curation of information.

And while the Luddite option of outright rejecting these technologies indeed has much merit, there is nonetheless a wealth of unexplored approaches and perspectives even within the field of artificial intelligence that may provide ample support for such a task.

> "There are more things in heaven and earth, Horatio,
> Than are dreamt of in your philosophy." (*Hamlet,* Act 1, Scene 5)

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The New Academic Reality: Preparing Faculty for Rapid AI Adoption

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Abstract: This article explores how colleges and universities can sustain meaningful teaching, research, and mentorship as AI becomes a full academic partner. It examines the profound transformation now reshaping the professoriate - fewer human faculty, more AI faculty - and the institutional, economic, and human factors that will determine how higher education adapts. Drawing on emerging practices in AI-enabled teaching and research, it outlines new roles for tomorrow's professors and three strategies essential for scholarly success: building global AI-enhanced networks, communicating research to wider audiences, and strengthening research integrity. The article then suggests four ways to address the postdoc bottleneck problem in which there is a total supply and demand mismatch for academic positions. It concludes with a forward-looking academic compact defining what remains uniquely human in the age of AI.

1. INTRODUCTION: WHEN THE OLD MAP NO LONGER FITS

Only a few years ago, artificial intelligence occupied the margins of academic life. A small number of faculty experimented with automated grading, early tutoring systems, or basic analytics tools, while most regarded AI as a future convenience rather than a force capable of reshaping higher education. Conversations about AI were speculative and cautious, often concluding that it might someday save time - but not fundamentally alter the nature of academic work.

That era has ended.

We are now living through what might best be described as a *Ptolemaic moment* for higher education - a moment when an established system no longer fits observable reality, and incremental adjustments cannot resolve the mismatch. AI is rendering long-standing faculty structures increasingly untenable, not through a single dramatic disruption but through steady, compounding change.

Today, AI sits at the center of academic activity. It writes code, analyzes complex datasets, simulates experiments, drafts research papers, supports instruction, coaches students, and increasingly

serves as both collaborator and teacher. Its presence is reshaping faculty workloads, academic careers, student expectations, and institutional economics. What many once imagined as a gradual evolution has become a rapid reordering of the academic enterprise.

Which raises a key question: **How can such institutions sustain meaningful teaching, research, and mentorship when AI becomes a full academic partner?**

The stakes could not be higher. The professoriate is being reshaped not only by AI itself, but by forces that amplify its influence - demographic shifts, declining enrollments, political pressures, growing skepticism about the value of a degree, and the relentless economics of digital delivery. Institutions that adapt thoughtfully may thrive; those that resist risk deep structural stress and, in some cases, irrelevance.

The professoriate is entering a structural transition. Over the next decade, artificial intelligence will assume responsibility for significant portions of teaching, research support, and academic administration. The central challenge for universities will not be whether AI is adopted but how the human roles of faculty are redefined. This essay examines how institutions can sustain meaningful teaching, research, and mentorship as AI becomes a full academic partner.

It is also important to keep in mind that while on a global scale most post-secondary students and faculty are at institutions that offer bachelors, masters and doctorate degrees, there are many other types of colleges and universities that offer bachelor's and master's degree only. However, since even these institutions now require their faculty to have PhDs, this article will concentrate on the impact AI is having on research universities that offer all three types of degrees.

Evidence suggests that the transition is already underway. Surveys conducted in 2024 and 2025 indicate that generative AI tools have become embedded in student learning practices across many institutions. A global study by the Digital Education Council found that approximately **86 percent of university students reported using generative AI in their coursework**, often as their first source for explanations, study support, and code debugging. Faculty adoption has also accelerated. EDUCAUSE surveys report that a growing share of instructors are experimenting with AI tools for course design, feedback, and instructional support. While the long-term effects remain uncertain, these early indicators suggest that AI is rapidly becoming part of the everyday academic infrastructure rather than a peripheral technology. (D.E.C. 2024), (EDUCAUSE 2024).

2. A PROVOCATIVE PREDICTIONAND WHY IT RESONATES

In *The Chronicle of Higher Education*, Scott Latham offered a prediction that startled many readers. (Latham, S. 2025). He argued that as today's full professors retire, their positions will not be replaced. Instead, AI systems will assume responsibility for large numbers of courses, particularly standardized offerings, leading to permanent reductions in faculty lines.

It is a deliberately unsettling claim, and for good reason. It forces us to confront a possibility that many administrators quietly acknowledge: AI will reshape the academic workforce in lasting ways.

Yet several realities complicate this scenario. Accreditation and regulation still demand human oversight and responsibility. Parents and students continue to expect meaningful human interaction, particularly at the undergraduate level. Faculty governance structures resist abrupt change. And while economic incentives favor AI adoption, institutions must also protect reputation, educational quality, and mission.

Even so, Latham's argument captures a truth that is difficult to ignore. The question is no longer whether AI will alter the composition of the professoriate, but how - and what roles human faculty will play once it does.

In practice, "AI faculty" will not hold appointments or vote in faculty senates, but they will increasingly perform functions once associated with faculty roles: delivering lectures, tutoring students, drafting research papers, and assisting in discovery.

Based on current trajectories, it is reasonable to expect that by the end of this decade, AI faculty will be teaching many large, enrollment-heavy introductory and service courses, as well as a significant portion of remedial instruction. By the mid-2030s, AI is likely to handle a substantial share of undergraduate and early graduate coursework across a wide range of institutions, typically under human supervision but often without direct human instruction. (Chan, C. K. Y., & Tsi, L. H. Y. 2023).

In some cases, this will reduce the number of human faculty. In others it will not. In all cases, academic roles will change.

3. WHY AI IS DIFFERENT FROM EVERY TECHNOLOGY THAT CAME BEFORE

AI is not simply another educational technology layered onto existing practices. It represents a fundamentally new kind of intellectual partner - one capable of analyzing information, generating ideas, and acting at speeds and scales no human can match. Academic work, long defined by slow and deliberate human processes, is now being reshaped by a partner that operates continuously and improves exponentially.

AI systems evolve far faster than human learning curves. Tools that seemed unreliable a year ago can become indispensable in a matter of months. Capabilities that once felt speculative - large-scale simulation, automated synthesis of entire literatures, real-time instructional adaptation - are now routine.

As a result, AI now touches nearly every academic task. Literature reviews that once took months can be completed in days. Code can be written, debugged, and optimized in hours rather than weeks. Data can be cleaned, analyzed, visualized, and reanalyzed at scales previously unimaginable. Research design, hypothesis generation, grant drafting, translation, editing, and public communication are all being accelerated.

Equally important, AI has crossed a conceptual threshold. **It no longer merely retrieves information; it helps create it.** It proposes hypotheses, designs experimental protocols, critiques research drafts, identifies conceptual gaps in entire fields, and suggests alternative theoretical frameworks. In teaching, it provides adaptive tutoring, instant feedback, personalized learning pathways, and round-the-clock support for thousands of students at once.

AI's emerging role as a contributor to scientific discovery is already visible in several fields. One of the most widely cited examples is **DeepMind's AlphaFold system**, which predicted the three-dimensional structures of more than **200 million proteins**, solving a long-standing challenge in molecular biology and accelerating research across medicine and biotechnology. Similar machine-learning systems are now being used to identify new materials, accelerate drug discovery, and explore large chemical design spaces that would be difficult for human researchers to examine alone. These developments illustrate how AI is evolving from a computational tool into a partner capable of generating new scientific insights. (Jumper, J. et al. 2021), (Merchant, A. et al. 2023).

AI has become a **co-thinker**, a **co-designer**, and in some contexts a **co-discoverer**.

Economic forces further accelerate adoption. When a university can deploy an AI system that teaches a thousand-student introductory course with perfect consistency, continuous availability, and near-zero marginal cost, the incentive is obvious. Yet these efficiencies come with risks: dependence on opaque systems, biased or inaccurate outputs, threats to academic freedom, erosion of human expertise in foundational areas, and shifting expectations about faculty labor.

AI adoption will continue - but its success depends on pairing efficiency with human judgment, integrity, and creativity.

4. FROM AI TOOLS TO AI-NATIVE RESEARCH ENVIRONMENTS

A further shift now under way is the emergence of AI-native research workspaces - integrated environments in which artificial intelligence is embedded continuously across the research process rather than accessed episodically as a tool. Platforms such as Prism, a free AI-native

workspace for scientists introduced in late 2025, illustrate this transition. (OpenAI. 2025).

In these environments, AI does not merely assist with isolated tasks such as drafting text or analyzing data. Instead, it maintains persistent awareness of a project's goals, methods, datasets, and prior decisions, allowing it to function as a sustained research collaborator. Literature review, hypothesis generation, experimental design, code development, data analysis, writing, and revision occur within a shared cognitive workspace that supports both human and machine contributors.

The implications for academic research are substantial. Small labs gain capabilities once limited to large teams. International collaborations become easier to coordinate as AI mediates language, disciplinary conventions, and documentation standards. Equally important, these platforms can record the provenance of ideas, data, and AI-assisted contributions, supporting transparency and reproducibility at a time when research integrity is under increasing strain.

Over the next few years, such environments are likely to become standard infrastructure in research universities, reshaping not only how scholarship is produced, but how collaboration, mentorship, and credit are structured. OpenAI. (2025).

5. STRUCTURAL PRESSURES ACCELERATING THE SHIFT

AI's rise coincides with - and amplifies - other pressures reshaping higher education. Automation is steadily mastering tasks once thought to require deep human expertise: grading essays, evaluating problem sets, generating rubrics, synthesizing literature, and even designing experiments. At the same time, economic constraints intensify. Public investment is declining, enrollments are uneven, skepticism about student debt is growing, and alternatives such as certificates, micro-credentials, and apprenticeships continue to expand.

Student behavior is changing just as rapidly. Many students now turn first to AI for homework help, conceptual explanations, code debugging, and what amounts to twenty-four-hour office hours. On many campuses, AI has become the primary point of academic support rather than a supplemental resource.

For those who lead academic institutions, the central strategic question becomes: **How much of our limited resources should go to human talent and how much to AI infrastructure?**

This question is not theoretical. It will shape budgets, faculty lines, staff structures, and student expectations for years to come.

6. AI IN PRACTICE: LESSONS FROM STANFORD

At my institution, Stanford University, AI tools are already being deployed in ways that illustrate this emerging partnership. Tutor CoPilot, developed by Stanford researchers, is designed not to replace human tutors but to support them during live sessions, particularly in mathematics. (Wang, R. E., Ribeiro, A. T., Robinson, C. D., Loeb, S., & Demszky, D. 2025). Rather than supplying answers, it offers expert-level guidance - suggesting prompts, scaffolding strategies, and questions that help tutors guide students more effectively.

In research, Stanford Medicine has created teams of virtual scientists - AI systems designed to assist human researchers in tackling complex laboratory problems. These systems generate hypotheses, analyze experimental results, and suggest next steps, accelerating discovery while leaving final judgment to human investigators. (Armitage, H. 2025).

These examples point toward a hybrid future rather than wholesale replacement.

7. THE EVOLVING ROLE OF THE PROFESSOR

Despite dire predictions, AI is unlikely to diminish the importance of the professoriate. Instead, it will elevate the uniquely human dimensions of academic work. As AI absorbs routine tasks - administration, grading, analytics, basic tutoring, early-stage drafting, standardized instruction - faculty attention will increasingly shift toward mentorship, ethical - judgment, creativity, synthesis, and oversight.

Human faculty will play a central role in managing ambiguity, providing moral and intellectual guidance, sustaining institutional memory, and cultivating the relationships that make learning meaningful. Revolutionary research will continue to be driven by PhD students and postdocs, guided by thoughtful human mentors who help frame questions, challenge assumptions, and model integrity.

In this hybrid model, human insight matters more, not less.

8. THREE STRATEGIES FOR RESEARCH IN AN AI-ASSISTED WORLD

To navigate this transition successfully, institutions must rethink how they support research and scholarship. Three strategies are particularly important.

First, universities must embrace global, AI-enabled research networks. While international partnerships have been on-going for decades, they need to be taken to a new level if the size and resources of individual departments become more limited. As noted above, AI-native research workspaces among others can support these international collaborations in ways that go beyond managing large, multi-institutional projects: by translating languages and disciplinary norms in real time, harmonizing data and metadata standards across national systems, navigating differing regulatory and funding requirements, and coordinating work across time zones. Today, a climate scientist in Chile can run high-resolution models on supercomputers in Switzerland; a physics team in Nigeria can analyze data collected in Canada; and a marine biology group in New Zealand can share real-time video from deep-sea dives with partners in Norway. At the same time, international teamwork brings persistent challenges - differences in culture, trust, governance, and incentives - that may feel sharper as collaborations become more global, making AI-enabled coordination necessary but not sufficient.

Second, faculty must communicate their work more effectively to broader audiences. Public understanding shapes political support, which in turn shapes funding. AI can help scholars translate complex research into accessible language, generate visual explanations, design outreach materials for policymakers and journalists, and prepare clear responses to public questions. In an era of growing misinformation, scholars who communicate clearly - and widely - will wield disproportionate influence.

One approach is to start every presentation with three key slides: (1) a technical and non-technical title, (2) the question or problem the research addresses, and (3) why it matters.

Figures 1 to 3 show an example taken from my Quantum Mechanical Engineering Laboratory at Stanford.

Electrical and Magnetic Characterization of Topological Edge Modes

Or

Uncovering Strange Electrical and Magnetic Effects at the Edges of Exotic Next-Generation Materials

Figure 1 - Technical and Non-Technical Title

The problem this research seeks to address is how to use experiments to find and study special behaviors at the edges of certain exotic materials that exhibit unique electronic and magnetic properties.

Figure 2 - The Question or Problem the Research Addresses

Addressing this problem tackles a fundamental question in modern physics with wide-ranging technological implications for revolutionizing electronics, computing, and energy transmission and storage.

Figure 3 - Why it matters

Third, research integrity must be strengthened through transparent, verifiable practices. As AI makes it easier to generate text, images, data, and even entire analyses, it also raises the stakes for how scholars establish credibility. Successful faculty will treat integrity as part of their research design: pre-registering hypotheses where appropriate, maintaining clear provenance of data

and AI-assisted workflows, and building experiments and models that can be independently inspected and reproduced. AI itself will play a dual role - lowering barriers to fabrication, but also enabling powerful new tools to detect anomalies, inconsistencies, image manipulation, and statistical irregularities at scale. Making data, code, and methods openly available will no longer be optional but foundational. In an era of rapidly expanding research output, trust - earned through reproducibility, transparency, and methodological rigor - becomes a central scholarly contribution and a key currency of academic influence.

9. RETHINKING THE POSTDOC BOTTLENECK

The effects of AI will not be limited to teaching and research workflows. They will also reshape the academic labor pipeline. Each year in the United States, roughly 25,000 postdocs compete for about 6,500 tenure-track positions, producing widespread uncertainty, burnout, and delayed life decisions. (Pansieri, Jonathan, et.al 2025)

The imbalance between doctoral training and academic employment has been documented for decades. National studies of academic career outcomes estimate that **fewer than 20 percent of PhD graduates ultimately obtain tenure-track faculty positions**, leaving many highly trained researchers navigating a prolonged series of temporary positions. Reports from the National Academies and other organizations have warned that the current structure can delay career stability, discourage talented researchers, and create inefficiencies in the research workforce. The emergence of AI-assisted research tools may not eliminate this structural mismatch, but it could create opportunities to redesign how research teams are organized and how early-career scholars contribute to discovery. (National Academies of Sciences, 2018), (Sauermann, H., & Roach, M. 2016).

AI creates an opportunity - perhaps an obligation - to rethink this structure.

One possibility is the introduction of "AI postdoc" - systems that generate hypotheses, design experiments, run simulations, and draft papers, allowing human postdocs to focus on higher-level intellectual work. Another is rebalancing the workforce, using AI-driven efficiencies to support stable, well-compensated research roles outside the tenure track. Universities can also expand non-academic pathways through industry partnerships, entrepreneurship programs, and translational fellowships. Finally, institutions must stop assuming that every PhD requires a postdoc; many careers in teaching, administration, and leadership do not.

A smaller, better-supported postdoc system would benefit both scholars and institutions.

10. A NEW ACADEMIC COMPACT

In an AI-rich future, what remains uniquely human - mentorship, moral judgment, creativity, institutional memory, trust, and the joy of shared discovery - becomes the core of academic life rather than a peripheral benefit. AI can amplify knowledge, but only humans can give it meaning.

11. CONCLUSION: DESIGNING A FUTURE WORTH HAVING

The future of higher education will not be defined by a choice between humans and AI, but by how well we design their partnership. The coming decade will bring fewer human faculty teaching large introductory courses, more AI-enabled instruction and research, expanded human roles in mentorship and ethics, new strategies for scholarly success, a reimagined academic labor structure, and a renewed emphasis on integrity and trust.

This transformation is not a crisis. It is an opportunity - if we approach it with foresight, humility, and a willingness to redesign the academic enterprise for a world in which AI is a full and indispensable partner. The universities that thrive in the coming era will not be those that resist artificial intelligence, nor those that surrender to it, but those that design institutions where human judgment and machine intelligence deepen one another.

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Rebuilding Public Reason in the Age of AI: Rhetorical Citizenship and Critical Doxic Literacy for Higher Education

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Abstract: Democracies face a crisis of public reason grounded in a disintegration of shared epistemic ground and amplified by digital polarisation and AI-mediated disinformation. Current pedagogy, focused on deconstructive critique or fact-checking skills, fails to address how algorithmic systems engineer plausibility at scale. Higher education must cultivate discerning judgement alongside critique. Drawing on rhetorical studies, this essay proposes a dual-axis framework for civic pedagogy: Rhetorical Citizenship (ethical communicative agency, coalition-building, and accountable ethos) and Critical Doxic Literacy (mapping tacit belief systems and analysing engineered plausibility). This approach retools classical concepts – eikos (plausibility) and doxa (shared premises) – to navigate hyper-eikotic digital environments where humans and algorithms co-produce a psychological feeling of truth decoupled from empirical reality. Using comparative case studies – Japan's techno-animism, India's digital sovereignty, and Brazil's tiered liability – the essay demonstrates how these competencies operate across distinct governance and cultural contexts. It addresses cognitive, ethical, and social dimensions of learning in an AI-mediated public sphere, preparing graduates to map competing architectures of belief and exercise provisional judgement in conditions of manufactured uncertainty.

1. THE COLLAPSE OF PUBLIC REASON IN A HYPER-EIKOTIC AGE

Democratic societies worldwide are undergoing a foundational collapse of public reason. Today's digital sphere is fractured by polarisation, algorithmic radicalisation, and the erosion of shared epistemic foundations (Vaidhyanathan, 2018).

The contemporary digital ecosystem has led to what I term *a hyper-eikotic reality.* In the Aristotelian tradition, *eikos* (plausibility) facilitated deliberation under uncertainty by relying on what was generally accepted in the absence of definitive proof. In the digital age, however, socio-technical systems exploit this rhetorical logic. Algorithms, including Large Language Models (LLMs) and social media recommendation engines, generate a sense of truth that is increasingly disconnected from empirical reality.

These systems prioritise resonance – what matches users' emotional triggers and cultural identities – over factual accuracy, creating self-sealing epistemic enclaves where contradictions become unintelligible. The consequences are particularly evident in the proliferation of synthetic media. The industrialisation of persuasion enables bad-faith actors to deploy sophisticated, personalised narratives at an unprecedented scale (Tufekci, 2017).

As human intent and automated content now mix, the provenance of information becomes unverifiable, leading to an epistemic misalignment. Surface-level features, like formal complexity and an authoritative tone, elicit misplaced trust in the absence of an accountable author.

Although higher education is tasked with cultivating civic citizens (Colby et al., 2003), current pedagogy lags, focusing on deconstructive critique or isolated technically oriented skills like lateral reading that regularly fall short against the self-sealing disinformation.

The proposed framework is theoretically grounded and informed by research that documents deficits in students' ability to recognise, evaluate, and respond to arguments within civic contexts (Andrews et al., 2006; Rapanta et al., 2013; Breakstone et al., 2021; Wineburg & McGrew, 2019).

This response consists of two interlocking axes. The first, *Rhetorical Citizenship*, reconceptualises civic identity as a discursive practice involving the cultivation of ethical communicative agency, coalition-building across difference, and the reclamation of *ethos* as personal accountability rather than mere performed credibility.

The second axis, *Critical Doxic Literacy*, offers the cognitive toolset necessary for mapping tacit belief systems (*doxic cartography*) and analysing how plausibility is engineered (*eikotic analysis*). These analytical competencies enable *comparative judgement* – the ability to provisionally weigh incompatible belief architectures. This often requires *doxic translation* to render differing frameworks mutually intelligible without requiring consensus.

The two axes function as complementary orientations rather than sequential stages and are ideally enacted within the same task.[1]

Three international case studies – Japan's techno-animism, India's data sovereignty framework, and Brazil's platform liability ruling – illustrate how the framework works across distinct governance and cultural contexts. The essay concludes by proposing the university as a laboratory for civic reason.

Three concepts from classical rhetoric recur throughout what follows; each is retooled rather than merely borrowed for the digital context. See Table 1.

Table 1 - Core rhetorical concepts

Term	*Classical meaning*	*Distortion*
Eikos	Plausibility: reasoning from what an audience finds probable	Algorithmically manufactured felt truth, decoupled from empirical reality
Doxa	Shared premises: often unstated assumptions structuring a community's common sense	Incompatible common senses (*doxai*) that coexist without shared ground in the public sphere
Ethos	The credibility a communicator projects through character, standing, and argument	*Synthetic ethos*: credibility engineered as pattern, without an accountable subject

2. RHETORICAL DISRUPTION

2.1. The Rhetoric of the Machine

The emergence of generative AI introduces a profound rhetorical disruption: *logos without ethos* (Gunkel, 2025). Whereas classical ethos is rooted

[1] *Rhetorical Citizenship* draws on the Copenhagen School (Kock & Villadsen, 2012, 2015). *Critical Doxic Literacy* builds on the analysis of the contemporary epistemic crisis developed in the author's forthcoming monograph, *Navigating Uncertainty* (manuscript in preparation).

in the speaker's character and historical standing, an AI's output is what I term *eikotic mimicry* – the simulation of credibility through surface markers of authoritative discourse. These systems optimise for persuasive fluency – what Bender et al. (2021) call 'ersatz fluency' – rather than factual provenance or moral accountability.

From a literacy perspective, students encounter AI-generated text that exhibits four deceptive markers:

- *Authorless authority* – text projects confidence through formal register (nominalisation, passive voice: 'It is widely considered that …') while occupying a 'position from nowhere' (Kjeldsen, 2025, p. 59) – no character, no social standing, and no accountability.
- *Citation mimicry* – fabricated references that imitate scholarly form without verifiable sources (Walters & Wilder, 2023).
- *Performative complexity* – more formally complex syntax, while less lexically diverse (Terčon, 2024), creating an illusion of expertise without conceptual understanding.
- *Hallucination as invention* – plausible-sounding falsehoods optimised for narrative coherence rather than truth, what Bender et al. (2021) describe as 'stochastic token prediction'.

These markers converge on the core literacy challenge: students misrecognise probability-driven text generation as rational reasoning. As Bender et al. (2021) explain, LLMs are 'stochastic parrots' that assemble sequences with high statistical likelihood in context – inhabiting the forms of argument (syllogism, scholarly citation, authoritative claim) while potentially filling them with empty or false content. The danger is not that AI produces bad arguments, but that it produces convincing-looking arguments whose plausibility masks their detachment from truth and human accountability.

This matters for literacy pedagogy because rhetoric – in the Aristotelian sense used here – presupposes audiences capable of evaluating arguments and speakers accountable for their claims (Aristotle, 2007, 1.1.1). Synthetic ethos severs this link: students encounter texts that perform argumentative responsibility without possessing it. The pedagogical project advanced here rests on teaching students to recognise this severance.

2.2. Engineered Plausibility

The current crisis stems from the transformation of the relationship between *eikos* and *doxa*. As Pierre Bourdieu (1977, pp. 164–170) defined it, *doxa* is the 'universe of the undiscussed' – foundational, unstated premises that structure our perception of the world. In a healthy public sphere, *doxa* provides the shared ground for deliberation. In the digital age, we see a collision of *doxai* – fundamentally different worlds of common sense that make cross-partisan communication nearly impossible. These *doxai* are maintained and amplified by systemic incentives, including platform architectures that profit from moral outrage and affective polarisation.

When algorithmic systems engineer *eikos* at scale – manufacturing plausibility tailored to pre-existing beliefs – they do not merely introduce false claims into a shared *doxa*; they fracture *doxa* itself into irreconcilable epistemic enclaves. This is the hyper-eikotic condition: a proliferation of mutually unintelligible plausibility systems, each internally coherent but collectively fragmenting the shared ground required for democratic deliberation. Traditional models of argument analysis and media literacy, designed for a world in which citizens inhabit a common evaluative framework, cannot address a crisis in which the frameworks themselves have multiplied and diverged.

3. BEYOND CRITIQUE

3.1. Weaponised Critique

For decades, the *hermeneutics of suspicion* has dominated, especially in the humanities. While vital for revealing injustices, deconstructing bias, and interrogating power structures (Graff, 2003), traditional deconstructive critique has reached its limits in the digital context (Felski, 2015). Deconstruction alone risks producing a citizenry adept at dismantling the arguments of others but equipped with few tools for constructive coalition-

building or for finding common ground in the face of 'wicked problems' like climate change or AI governance.

When students are taught to view every text as a site of manipulation and every claim as a power play, they risk emulating the tactics of disinformation agents who have co-opted the language of critical thinking.

Disinformation agents now frequently use the tropes of deconstruction – urging audiences to 'do their own research' or 'question authority' – to sow doubt about legitimate expertise in public health and democratic institutions (McIntyre, 2018). This weaponised critique leads to epistemic nihilism, where the inability to distinguish between cynical scepticism and healthy critique results in a paralysis of judgement, as seen, for example, in students' reliance on superficial credibility markers (Breakstone et al., 2021).

Research in Civic Online Reasoning has made progress in teaching 'lateral reading' and source verification (Doss, 2024). However, verifying a source is no longer sufficient when the narrative itself creates a self-sealing logic that renders the source irrelevant to the believer. As Wineburg and McGrew (2019) emphasise, the abundance of information on the web requires not just checking a source, but actively investigating who is behind the information and what institutional interests shape the narrative arc.

3.2. The Cognitive Dimension

A further obstacle is cognitive rather than curricular. Students tend toward cognitive closure – a preference for definite answers over discomfort with ambiguity. This blunts the kind of uncertainty-tolerant inquiry the hyper-eikotic environment demands (Kruglanski & Webster, 1996). Research on civic reasoning adds a complementary finding: students who develop the capacity to step beyond the particulars of a situation toward broader moral perspectives show stronger deliberative competence and identity development; yet this capacity is precisely what content-coverage approaches and algorithmically personalised information streams tend to suppress (Immordino-Yang et al., 2024; Gotlieb et al., 2024; Sunstein, 2017). The exercises proposed in this framework are designed to work against this disposition by asking students to map the conditions under which claims *feel* correct, rather than simply to identify what is correct – training in provisional, defeasible judgement rather than answer retrieval.

Together, these obstacles – the co-optation of critique and the cognitive pull toward closure – point toward the same need: a constructive supplement to deconstruction, one that replaces the move from dismantling claims with the cultivation of public judgement. The following two axes are designed to provide it.

4. FIRST AXIS: RHETORICAL CITIZENSHIP

4.1. Citizenship as Discursive Agency

To counter the disintegration of public reason, higher education must shift from a pedagogy of deconstruction to a pedagogy of *Rhetorical Citizenship* (RC). Drawing on the Copenhagen School, this framework defines citizenship as a discursive practice enacted through public communication (Kock & Villadsen, 2012).

Citizenship is enacted through the way we talk, write, listen, and argue in public fora (Crick & Lockyer, 2010). This requires moving beyond technical proficiency in communication – such as clarity and delivery – toward an empowerment model that treats students as emerging rhetorical actors with the agency to shape their digital environments. This axis emphasises the capacity for constructive coalition-building, framing issues for diverse audiences, and collaborative world-building.

This reframing aligns with the emerging concept of Critical Digital Pedagogy, which argues that education must foster *digital agency* – the ability to not just use tools but to interrogate and reshape the digital spaces one inhabits (Morris & Stommel, 2018; boyd, 2014).

4.2. Rights and Responsibilities

Rhetorical Citizenship involves two complementary dimensions: rights and responsibilities. As citizens, we have the right to

participate in public deliberation, but we also have a discursive responsibility to others – a duty to represent the ideas of others fairly and to engage in ethical argumentation (Kock & Villadsen, 2015).

This framework is operationalised through the *calibration of affect*. In a hyper-eikotic age, where algorithms profit from rage, RC teaches students to discipline their emotions, turning destructive affective polarisation into productive affective solidarity. It validates *pathos* as a legitimate part of public reasoning – such as righteous anger at injustice – while distinguishing it from the manipulative emotional contagion of the digital sphere (Brady et al., 2021).

This axis reclaims *ethos* as a relational and ethical practice. Rather than viewing credibility as a commercial performance or a brand, students are taught that ethos is constructed through accountability and the willingness to stand behind one's claims. This counters the authorless authority described in Section 2.1: when no identifiable author stands behind AI-generated text, accountability disappears, and communicative appeals become impossible. By learning to identify the absence of accountable ethos in algorithmic outputs and to construct it explicitly in their own work, students develop a critical counterweight to synthetic discourse.

These dimensions are also assessable; each corresponds to observable communicative behaviours:

- *Ethical framing*: represents opposing views fairly; signals accountability.
- *Coalition-building*: frames issues for diverse audiences and seeks overlap without erasing difference.
- *Affect calibration*: converts reactive outrage into productive solidarity while naming manipulative contagion.

5. SECOND AXIS: CRITICAL DOXIC LITERACY

5.1. Definition and Scope

While RC provides the ethical framework, the second axis, *Critical Doxic Literacy* (CDL), provides the cognitive toolset: *Doxic Cartography* (mapping tacit premises), *Eikotic Analysis* (how plausibility is engineered), and *Comparative Judgement*. I define CDL as follows:

> The advanced competence to map, analyse, and adjudicate between competing architectures of plausibility that constitute our public sphere, with a specific focus on identifying the tacit assumptions (*endoxa*), rhetorical strategies (human and synthetic), and systemic incentives (platform, economic, and governance logics) that maintain specific worldviews.

Unlike standard critical thinking, which focuses on individual arguments, CDL focuses on the systems that make those arguments feel true. It is the literacy of understanding how doxa is shaped, amplified, and weaponised by systems (algorithms, corporations, political movements). Table 2 indicates how CDL complements existing literacies.

Table 2 - Foci and Competencies of Literacy Types

Literacy Type	*Primary Focus*	*Key Competencies*
Critical Thinking	Soundness of individual arguments	Identifying fallacies, evaluating evidence, logical reasoning (Facione, 1990)
Critical Media Literacy	Representation and power in media	Analysing how media constructs reality; questioning ownership and representation (Kellner & Share, 2007)
Civic Online Reasoning	Credibility of online information	Source verification and lateral reading (Wineburg & McGrew, 2019)
Metaliteracy	Production and social media environments	Metacognitive reflection, collaborative production, and sharing in participatory environments (Mackey & Jacobson, 2011)
Critical Doxic Literacy	Architectures of plausibility and systemic incentives	Doxic Cartography, Eikotic Analysis, and Comparative Judgement

5.2. Doxic Cartography

The first core competency of CDL is *Doxic Cartography* – the ability to map the network of shared beliefs (*endoxa*) that constitute a

community's worldview. In a hyper-eikotic landscape, communities operate with fundamentally different common senses. Doxic Cartography asks:

- What are the foundational, often unstated premises this community holds as true?
- How do these premises interact to create a self-sealing sphere of plausibility?
- What is the hierarchy of authority within this doxa? (e.g. scripture, empirical data, personal intuition).

This skill is essential for *listening* across differences. Persuasion and even basic intelligibility presuppose a map of the other's doxa. It shifts the student from asking 'Is this fact true?' to 'Within what system of belief does this statement function as a truth?'

Example. When analysing vaccine hesitancy, Doxic Cartography does not merely debunk false claims. It maps the underlying doxa of distrust in pharmaceutical profit motives and ideals of natural purity. With that map, engagement strategies can be designed that address root assumptions rather than surface claims. This approach also draws on our findings that hate speech and radicalisation often rely on proximate markers – codes and symbols signalling adherence to a given doxa without violating platform rules (Eddebo et al., 2024). By mapping such codes, students delineate the boundaries of a community's belief system.

5.3. Eikotic Analysis

The second competency, *Eikotic Analysis*, focuses on the construction of engineered plausibility, examining how actors manufacture the feeling of truth, and how platform incentives function as rhetorical devices. Ethos, including *synthetic ethos*, is here crucial.

Central to this competency is analysing *synthetic persuasive content* – algorithmically generated representations designed to trigger the recognition of truth without grounding in accountable human judgement. Students are therefore taught to treat algorithms as rhetorical actors with their own engineered *ethos* and *pathos*. This involves analysing *procedural persuasion* – the way interactions like infinite scroll or 'likes' structure the arguments that can be made and the emotions elicited. It also includes identifying *corporate ethos repair*, where entities use ethics-washing or strategic partnerships to perform virtue while maintaining extractive models (Metcalf et al., 2019).

5.4. Comparative Judgement

The goal of CDL is *Comparative Judgement* – weighing incommensurate frameworks. Students ask:

- Which framework offers a more coherent, inclusive, and empirically resilient account of the world?
- Which framework relies more heavily on manipulative pathos or exclusion?
- How should conflicts between scientific and political *doxai* be adjudicated in policy contexts?

The first two competencies – Doxic Cartography and Eikotic Analysis – are analytical tools. Comparative Judgement is where those tools are put to work: the practice of weighing incompatible belief architectures against one another while holding one's own position provisionally.

This often requires *doxic translation*: rendering incompatible worldviews mutually intelligible without requiring agreement. Following Mouffe (2005), this fosters agonistic pluralism – the capacity to recognise opposing positions as legitimate rather than merely irrational. As the Japan case below demonstrates, techno-animist premises need to be translated into a Western framework to render the incompatibility itself intelligible.

At stake in Comparative Judgement is the cultivation of a specific epistemic virtue: *defeasibility* – the capacity to hold judgements provisionally, to weigh incommensurate frameworks against one another, and to maintain the conditions of ongoing deliberation when certainty is unavailable. Unlike conventional literacy approaches that treat education as a path toward greater certainty, CDL proposes a different orientation: the mark of the educated citizen is not

the ability to arrive at correct answers, but the capacity to reason rigorously in their absence.

This orientation draws on a classical rhetorical ideal: the citizen-judge of the Athenian assembly whose trained judgement constituted the goal of public reasoning (Aristotle, 2007, 2.18.1).

The broader educational aspiration is not the student who has mastered a checklist of cognitive skills. Rather, it is the citizen-judge who can perceive the architecture of the epistemic environment they inhabit, map the belief systems within it, and exercise situated judgement. This requires awareness of the conditions that shape the arguments they encounter and of the cognitive habits they bring to them.

6. THREE DOXIC CONSTELLATIONS

The following cases engage three distinct doxa-governance constellations: techno-cultural (Japan), sovereignty-economic (India), and constitutional-legal (Brazil). The conceptual vocabulary is Greco-Roman in origin. However, the infrastructural challenges are operationally global: manufactured plausibility, synthetic ethos, platform-driven polarisation, and the erosion of shared epistemic ground.

6.1. Techno-Animism and Ritual Interaction

Japan's approach to AI presents a productive case for Doxic Translation, as its underlying belief architecture differs from the dominant Western framework. Rooted in a syncretic blend of Shinto animism and Buddhist philosophy, a *techno-animist doxa* recognises the potential for spirits (*kami*) to inhabit both organic and inorganic objects (Mykhaylychenko et al., 2025), challenging the Western Frankenstein Complex – the subconscious fear that artificial creations will inevitably destroy their creators (Allison, 2006).

The *endoxa* sustaining this *doxa* can be mapped concretely. Japanese techno-animism rests on four premises: non-human entities can possess or develop spirit; relationships and rituals constitute meaning rather than merely express it; harmony between humans and non-humans is a civic good; and technological progress can be spiritually inflected rather than threatening. These premises underpin Japan's Society 5.0 vision (Cabinet Office of Japan, 2025).

Applying Eikotic Analysis to Society 5.0 reveals a second layer: Wright (2024) demonstrates that Japan's official AI ethics discourse performs virtue – invoking human-centredness and harmony, while structurally insulating extractive digital models from regulatory challenge. This is the *corporate ethos repair* identified in Section 5.3: the engineering of a plausibility frame in which ethical aspiration and commercial interest are rendered indistinguishable. Society 5.0 thus functions as both an object of Doxic Cartography (what beliefs make it persuasive?) and of Eikotic Analysis (how does it manufacture its credibility?).

The 2025 AInimism project operationalises the techno-animist doxa through a three-stage ritual interaction design: a keyword 'awakens' the object for analysis of its features; the AI then speaks as the object, drawing on stored memories; a closing transformation stores the exchange and reframes the human–nonhuman relationship (Mykhaylychenko et al., 2025; Mah et al., 2020). This sequence is itself a pedagogical resource. Students might first reconstruct the endoxa that make such a ritual plausible within a Shinto-Buddhist frame, then engage briefly with the protocol to observe how the framing shifts their own stance toward nonhuman agents. The exercise concludes with Doxic Translation: students reframe the rationale for this design for a Western audience shaped by the Frankenstein Complex, making the Japanese position intelligible without requiring agreement. The progression from mapping to enactment to translation illustrates how the three CDL competencies can operate in sequence.

6.2. Digital Sovereignty and the 2025 Rules

India's digital imaginary, centred on digital sovereignty, illustrates a middle path between state- driven and market-driven infrastructures, challenging the extractive patterns of data colonialism (Couldry & Mejias, 2019). In this doxa, data is viewed as a national asset, akin to oil or minerals (The Economic Times, 2019).

The Digital Personal Data Protection (DPDP) Act

of 2023 and its 2025 Rules operationalise this via the Consent Managers – India-based, neutral entities that provide a single portal for individuals, the Data Principals, to manage, review, and withdraw consent across multiple platforms (Pimentel et al. 2025; The Attorneys, 2025). The rhetorical shift from Data Subject to Data Principal is itself an object of analysis: it functions as an enthymeme whose suppressed major premise is that individual rights are a form of resource ownership, supporting India's push for Digital Public Infrastructure as a democratic alternative to Big Tech (The Economic Times, 2019).

Students working on this case analyse the enthymematic reasoning in the term Data Principal: by framing individuals as sovereign data owners rather than mere consumers, the term carries an unstated premise about rights and agency. They then construct a doxic map contrasting individual privacy rights with collective economic autonomy. The Doxic Translation exercise traces a user journey: a Data Principal withdraws consent across services (social media, fintech, health tracking) via India's Consent Manager. Students evaluate how platforms built on continuous data collection respond when consent is easily revoked – connecting abstract analysis of platform credibility to concrete governance consequences.

6.3. Tiered Liability and Democratic Survival

In June 2025, Brazil's Supreme Court (STF) established a fault-based liability model centred on unequivocal knowledge (*ciência inequívoca*). This tiered system presumes liability for monetised or boosted content – platforms are responsible for harmful content they have profited from – and for content distributed via automated networks, where knowledge is presumed (Baker McKenzie, 2025). The ruling mandates a proactive duty to remove evidently illicit content such as threats to democracy or hate speech (Massaro & Reis, 2025). The Court prioritises the survival of the public sphere over absolute platform immunity.

The STF ruling offers a compact case in Comparative Judgement. Students might begin by reconstructing the court's epistemic standard – what 'unequivocal knowledge' means as a threshold, and which platform behaviours cross it. A second movement asks students to articulate the same ruling from two incompatible *doxai*, one libertarian and one institutionally pro-democratic, weighing a Responsibility-with-Freedom thesis against the risks of preventive self-censorship (Baker McKenzie, 2025).

The exercise demonstrates that the same documentary facts – the ruling's text – produce divergent eikotic conclusions depending on which belief architecture processes them. The goal of CDL is not to reach consensus. Rather, it is mapping the conditions under which consensus becomes structurally impossible.

7. THE UNIVERSITY AS A LABORATORY OF CIVIC REASON

When the two axes operate together, the most generative exercises ask students to move across both within a single encounter: diagnosing the plausibility structure of an AI-generated text (CDL) and then drafting a response that reclaims ethos by naming its source and standing behind its claims (RC). The audits that follow are designed with this integration in mind. CDL provides the analytical lens: students map the epistemic architecture, identify weaponised plausibility, and trace the belief structures that make disinformation feel true. RC provides the communicative ethics: students ask what an accountable, audience-aware response to that architecture would look like, and practise constructing one.

7.1. Hallucination and Algorithmic Audits

The integration of RC and CDL involves moving beyond standard media literacy (including lateral reading) toward more active, red-teaming approaches to digital information.

In an *Algorithmic Audit*, students create simulated profiles to document how the platform feed narrows their doxa over time – from nuance to outrage. This renders platform incentives visible and measurable.

In a *Hallucination Audit*, students act as red teamers for an LLM, provoking it to generate false content by asking about non-existent topics. They

then analyse the output for markers of synthetic ethos – confidence without provenance, passive constructions, etc. This helps students understand that LLMs engage in *eikotic mimicry* – assembling sequences of words that resemble rational argument but are actually stochastic predictions.

7.2. Eikotic Fortresses and Doxic Translation

The *Eikotic Fortress Analysis* is a methodology for mapping the network of shared beliefs that constitutes a community's epistemically shielded worldview. Unlike standard fact-checking, which focuses on the truth-value of isolated claims, this analysis asks why a narrative *feels* true to a specific audience.

Example: Climate change denial. A traditional exercise might focus on empirical errors. However, this misses the deeper rhetorical architecture. As documented by Breakstone et al. (2021), only 4% of students identified ExxonMobil as the chief sponsor of the 'CO2 Science' website, demonstrating the efficacy of superficial credibility markers. In an Eikotic Fortress Analysis seminar, students map the plausibility structure that allows a community to reject scientific consensus while maintaining internal logical consistency. They identify underlying endoxa, such as 'institutions are inherently corrupt', and analyse how this rhetoric employs performative conflict to solidify in-group loyalty while rendering external fact-checks irrelevant. The outcome shifts from spotting lies to understanding belief architectures, enabling intellectual empathy for civic engagement.

To cultivate RC, students also engage in Doxic Translation, in which they identify a point of friction between two communities and translate the concerns of one into the values of the other.

For example, can the student articulate the vaccine sceptic's fear of corporate profit in a way that resonates with the pro-science advocate's value of transparency? This exercise forces students to inhabit the doxa of the 'other', fostering the intellectual empathy required for true democratic deliberation.

8. WRITING ACROSS THE CURRICULUM (WAC)

WAC programmes are a natural vehicle for contextualising CDL across specialised disciplines, grounded in the principle that writing is not only a mode of thinking but a mode of civic reasoning (Bazerman et al., 2005). Table 3 illustrates how the framework's core competencies translate into discipline-specific assignments.

Table 3 - Examples for WAC assignments

Discipline	*Focus of CDL Integration*	*Practical Example Assignment*
STEM (*Sciences*)	Public Science Rhetoric	How to communicate climate-risk probability without ceding authority to bad-faith actors (Oreskes & Conway, 2012).
Humanities	Strategic Narrative Architecture Analysis	Map weaponised historical narratives in current political discourse, e.g. nationalistic memory policies.
Business	Ethos Repair and Ethics Washing	Deconstruct AI-principles documents to see how they perform virtue to forestall regulation (Metcalf et al., 2019).
Computer Science	Algorithmic Bias Audit	Investigate how training-data selection (e.g. Western-centric datasets) embeds specific doxai into supposedly neutral code.
Law	Liability and Duty of Care	Analyse the Brazil STF 2025 fault-based liability model alongside global standards.

9. CONCLUSION

The epistemic pressures shaping contemporary public life place renewed demands on higher education, while also creating opportunities for pedagogical innovation. The framework proposed here – *Rhetorical Citizenship* developed alongside *Critical Doxic Literacy* – responds to this moment. It offers a conceptual toolkit that helps students perceive how plausibility is manufactured, how belief systems organise themselves, and how democratic dialogue might still be sustained despite the erosion of shared ground.

The perspectives and exercises outlined here gesture toward a concrete educational aspiration: graduates who can map the belief architectures within which they operate, distinguish synthetic from accountable ethos, communicate across doxic difference without requiring agreement, and hold their own judgements provisionally while still being capable of rendering them. This is not a checklist of cognitive skills but a civic orientation capable of exercising public reason in conditions of genuine uncertainty.

Higher education has always faced the task of equipping graduates to reason within the epistemic conditions of their time. The present conditions are distinctive in one respect: the architectures of plausibility that students must learn to navigate are not emergent properties of culture or politics but engineered outputs of systems optimised for engagement.

This framework is a theoretical proposal, not a tested curriculum. Its empirical grounding lies in the convergent literature on student deficits in civic reasoning it draws on; whether the specific competencies it cultivates can be measured is one of the questions a forthcoming instrument – the Civic Argument Literacy Test – is designed to address (Hietanen & Svedholm-Häkkinen, submitted).

The traditions of democratic education centred on *Bildung*, agonistic pluralism, and reflective citizenship remain as relevant as ever (Løvlie et al., 2003; Biesta, 2006). They now require, in addition, that the university become a laboratory for making those engineered architectures visible – and for cultivating in students the rhetorical and epistemic resources to reason within them without being captured by them.

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Integrating Technology into Art-University Education in Japan: Insights from Preliminary Surveys within a STEAM Framework

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Abstract: This paper examines how digital and technological literacy is positioned across art high schools, art universities, and creative industries in Japan, and considers the implications of these shifting expectations for STEAM-oriented curriculum development in art higher education. Drawing on survey data collected between 2024 and 2026 from art high schools (n=12), art university students (n=225), and creative industry professionals (n=128), the study adopts a comparative three-stage framework that traces the progression from secondary art education to professional practice. The findings reveal a structural pattern: in art high schools, digital skills are introduced but remain secondary to traditional analogue foundations shaped by entrance examination systems; at university level, students express strong demand for deeper digital integration, yet provision remains uneven; within creative industries, digital literacy is treated as a baseline expectation embedded in everyday practice. Across this pathway, digital competence shifts from supplementary to assumed. The paper argues that art universities occupy a transitional position within this progression and suggests a move beyond additive skill training toward integrative STEAM models that connect technological capability with creative judgment, collaboration, and social application.

1. INTRODUCTION

The rapid digital transformation of society is changing how knowledge is shared, how we express ourselves creatively, and how we innovate. Emerging technologies such as artificial intelligence (AI), immersive media such as extended reality (XR), and online data systems are no longer considered tools we use; rather, they increasingly shape how we think, perceive, and even assign meaning (Crawford, 2021). Creative and professional practice now requires a level of digital and technological literacy that was previously considered specialist. Furthermore, international policy discussions stress the need for cross-disciplinary ability, arguing that the skills of the future must combine technical knowledge with creativity, critical thinking, and collaboration (OECD, 2019; World Economic Forum, 2020). With this considered, education cannot remain

focused on technical training alone, and must address how technological systems interact with human values, imagination, and social responsibility. This is the context in which STEAM education becomes particularly significant.

STEM (science, technology, engineering, and mathematics) education aims to provide the scientific and technical foundations of digital society (Bybee, 2010). The addition of the Arts, however, shifts the focus away from the acquisition of functional skills alone to one that also places importance on collaboration, culture, interpretation, and meaning (Maeda, 2013). Art universities are at a critical position because, unlike art high schools, which primarily focus on foundational skill acquisition, or industry, which prioritises efficiency and production, art universities encourage aesthetic sensitivity, creative exploration, and sustained experimentation. These abilities should be considered important for technological development as they are essential to shaping how socially and culturally meaningful the technology is (Tytler, 2020; Boy, 2013). Digital transformation, therefore, requires not only the technically skilled, but also creative practitioners who can question, interpret, and reimagine systems as they develop.

In this paper, we argue that art universities should be considered centrally important to digital and technological innovation. Their studio-based curricula encourage unconventional experimentation with concepts and ideas, and engagement with a wide range of materials and methods is key to the learning process. Artistic training also enables students to move between analogue and digital domains, connecting tactile, embodied knowledge with abstract or computational systems (Candy & Edmonds, 2018). In this sense, art universities already embody many of the core principles associated with STEAM by relating technological invention to human experience. Yet, despite the growing international interest in STEAM, less attention has been given to how different stages of art education connect structurally with their approach to digital technology, particularly outside Western contexts. In Japan, STEAM-related initiatives tend to be peripheral to core curricula, such as elective or project-based learning. While digital workshops and interdisciplinary programmes exist, there has been limited examination of how art high schools, art universities, and creative industries relate to one another within a coherent STEAM framework.

We identify an educational misalignment in the growth stages of young creatives in Japan. Art university has often been understood as a protected period of exploration, where students can experiment creatively without the economic or production pressures associated with industry employment. Japanese art education in general maintains a deep focus on studio-based traditions; with drawing, observation, material handling, and compositional discipline remaining central. Conversely, as our study reveals, art university students today express a desire for stronger digital integration and an awareness of its importance for future employment. Art high schools, however, continue to prioritise foundational expressive skills in preparation for art university entrance exams, while creative industry employers, on the other hand, view digital competency as a baseline expectation for graduates. Within this pathway, art universities occupy the structural midpoint between analogue-focused secondary training and digitally embedded professional practice.

This study examines how attitudes and expectations surrounding digital literacy shift across art high schools, art universities, and creative industries in Japan, and what structural tensions emerge when these stages are viewed from the perspective of STEAM education. Drawing on questionnaire data collected between 2024 and 2026 from students, educators, and industry professionals, it adopts a comparative approach that tracks changes across educational transitions rather than treating each sector in isolation. In doing so, the study links the three stages in the development of young creatives in Japan and positions art university as an important hinge within the relationship. While exploratory, the findings highlight structural issues within Japan's creative education ecosystem and suggest directions for aligning technological competence with creative autonomy. Specifically, the study

examines how expectations surrounding digital literacy shift across educational stages and how these shifts inform STEAM-oriented curriculum development in art universities.

2. CONTEXT AND PREVIOUS RESEARCH

2.1. Technology and STEAM in Art Education

The relationship between art education and technology is longstanding, but the scale and speed of recent change have greatly altered its significance (Paul, 2015). Digital tools are no longer supplementary media; they increasingly form part of the basic infrastructure of creative practice, with virtual reality (VR) environments, AI-assisted image generation, and interactive art installations now shaping how artists and designers work, collaborate, and develop ideas. Art education today stands at a "digital inflection point" where established pedagogical models are brought into question due to technological acceleration (Hall & Iwasaki, 2024b). Generative AI provides a clear example of how the very process of image creation, central to art and design, is being revolutionized. Emerging platforms such as Midjourney and Dall-E, alongside Firefly from Adobe, a well-established creative platform already deeply rooted in art universities, are changing how creatives work. Not only do these processes increase efficiency, but they also shift the entire conceptual dynamics of creation, altering how students move from initial concept to visual form. In this sense, technological systems have begun to influence not only production processes but also habits of thinking (Zhang et al, 2026).

The emergence of STEAM education must be understood against this backdrop. By extending STEM to include the Arts, STEAM proposes that artistic modes of inquiry are not superficial additions but structurally important to innovation (Yakman, 2008; Land, 2013) and a framework in which aesthetic judgement and design thinking intersect with scientific and technological reasoning (Henriksen, 2014; Guyotte et al., 2014). The emphasis is not on forcing disciplines together, but on promoting creative and technical literacies through integration and synergy.

Two government-led initiatives illustrate the positive attitude to STEAM education. The "Kyoto STEAM – International Arts and Science Festival" (Kyoto STEAM–International Arts × Science Festival, n.d.) showcases forward-looking projects that bring together art, science, and technology. Meanwhile, the Japan Science and Technology Agency's "Moonshot Research and Development Program" (Cabinet Office, n.d.) supports ambitious interdisciplinary projects designed to address some of society's most complex challenges by 2050. However, policy discourse does not automatically translate into institutional change, and art universities must now decide how and to what extent such integration should occur. The challenge lies in avoiding two extremes: treating technology as a peripheral elective or formalising it so heavily that it undermines the open, experimental spirit that defines art education.

2.2. Previous Study

In our previous paper (Hall & Iwasaki, 2024b), we examined the evolving relationship between art students and digital media. The main aim of the study, based on a survey of 225 students at a private art university in the Kansai region, Japan, was to explore whether institutional provision was aligned with students' digital technology experiences and expectations.

The findings revealed several important patterns. First, digital tools were already deeply embedded in students' daily lives. Across entertainment, studying, and art production, students overwhelmingly responded that such tools were "extensively used" (see Figure 1). Students reported heavy use of digital photography, video tools, and design software, while engagement with programming, robotics, and data processing tools was less common. In summary, students were active digital creators, but primarily within creative rather than computational or technical domains.

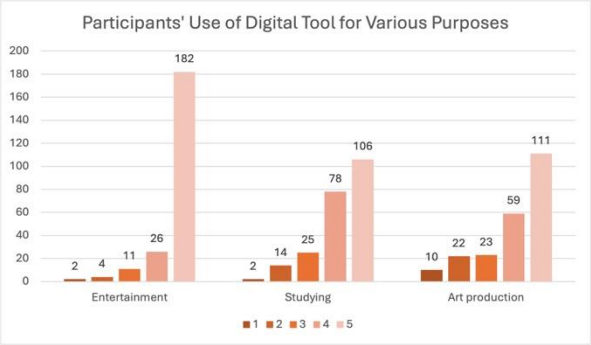

Figure 1 - Survey participants ranked their usage on a scale from '1: never' to '5: extensively used' of digital tools for 'entertainment', 'studying', and 'art production.'

Second, attitudes toward digital media were overwhelmingly positive. When asked to evaluate the value of digital forms compared to physical counterparts, students consistently rated digital media highly (see Figure 2). Similarly, an earlier study (Hall & Iwasaki, 2024a) explored perceptions of "reality" associated with digital environments which were generally favourable. Digital-native students did not position the digital world as secondary or artificial; rather, they moved fluidly between physical and digital contexts. These findings supported the argument that the conceptual boundary between "real" and "virtual" had shifted for this generation (Ito et al., 2010).

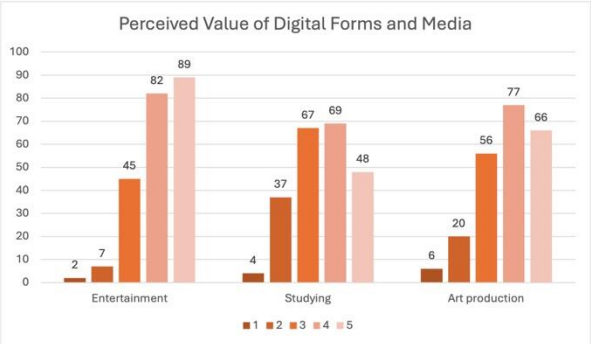

Figure 2 - Participants were asked to rank their perceived value from '1: very low' to '5: very high' of digital forms and media for the purposes of 'entertainment', 'studying', and 'art production.'

Third, and most relevant to the present study, there was a notable gap in pre-university exposure to IT subjects. Many respondents reported limited engagement with programming, coding, data analysis, or related topics prior to entering university (see Figure 3). Despite this limited exposure, interest in IT-related subjects, perceived benefits, and demand for increased curricular provision were consistently high (see Figure 4).

Cross-analysis indicated a positive correlation between prior exposure and interest or perceived benefit, but even students with minimal exposure expressed substantial demand for further digital education.

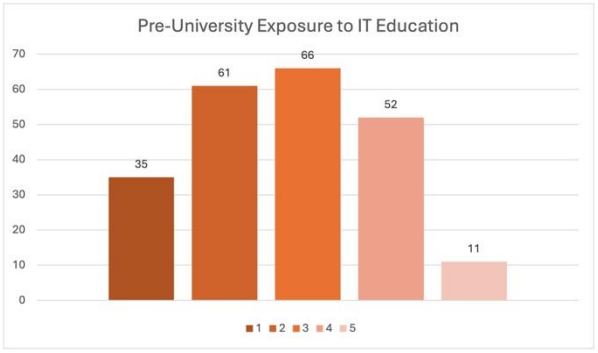

Figure 3 - Participants were asked to rank their pre-university exposure to IT education (such as computer programming, code creation, internet usage, robotics, data analysis, etc.) from '1: very low' to '5: very high.'

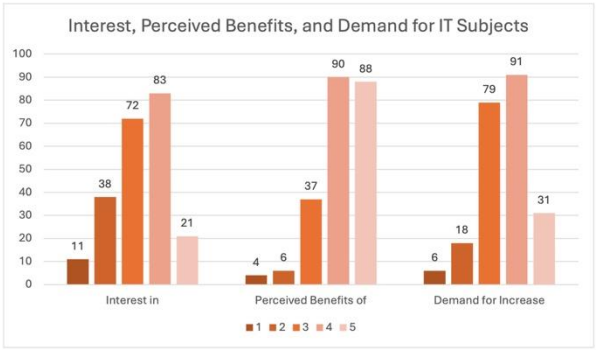

Figure 4 - Participants were asked to rank their interest in, perceived benefits of, and demand for more IT education in the current art university curriculum from '1: very low' to '5: very high.'

2.3. Previous Study Results: From Student Demand to Structural Alignment

The previous study concluded that art universities face growing pressure to integrate STEAM-oriented content more systematically into their curricula. Survey data indicated strong student demand for expanded digital learning, coupled with a clear awareness that such skills are increasingly necessary for future employment. However, the analysis was largely inward-looking. It focused on the relationship between student expectations and institutional provision within art universities themselves, without fully situating these results within the wider educational and professional trajectory. The earlier research did not

examine how art university connects to secondary art education, nor how effectively they prepare students for employment in creative industries. Digital integration should not be considered solely as a response to student preferences. In reality, art universities sit within a defined pathway, and any suggested change needs to come with this awareness, rather than risk being reactive. As our recent survey results will show, art high schools often emphasise traditional foundations such as drawing, observation, and material handling, as these analogue skills are essential for art university entrance examinations. By contrast, creative industries increasingly assume digital fluency as a baseline competence. Universities therefore occupy a transitional space between analogue-oriented entry systems and digitally embedded workplaces.

With this considered, the present study extends the research in two key respects. First, it situates the student survey within a comparative framework that includes data from art high schools and creative industry professionals, allowing analysis of how expectations concerning digital competence vary across stages. Second, the focus shifts from demand to structure. Rather than asking whether students want more digital education, the study examines where digital skills are treated as foundational, presumed, or peripheral within the broader system. Looking across these stages makes it possible to understand digital integration in relation to the broader educational and professional context, rather than within one institution alone.

3. METHODOLOGY

3.1. Research Design

This study uses a three-stage framework: art high school, art university, and the creative industries. These stages reflect the typical educational and professional trajectory of young creatives in Japan. Rather than treating them separately, the analysis considers them as sequential and structurally related. If art university is positioned as the formative central stage, then art high school functions as the “entry” point into specialised artistic training, while the creative industries represent the “exit” into professional practice. By analysing the pathway as a continuum, the research looks to identify where assumptions about digital literacy and STEAM education agree or disagree. Building on the previously conducted survey of art university students, the present study expands the scope by introducing the two additional surveys targeting art high schools and creative enterprises. In turn, the three datasets are analysed comparatively to find patterns across the entire pathway.

3.2. Data Sources

The art high schools (n=12) and creative industry professionals (n=128) surveys were conducted between December 2025 and January 2026, and the previously reported art university survey (n=225) in April 2024. All surveys were administered anonymously via Google Forms.

The art high school survey responses primarily came from public institutions (91.7%) and one board of education representative (8.3%). Respondents were directly involved in art education or administration and ranged in age from their twenties to sixties. The questionnaire addressed respondent attributes, student progression patterns, digital technology and STEAM initiatives, institutional constraints, and relationships with art universities. It consisted mostly of closed-response questions, with selected open-ended questions for qualitative data.

Responses to the creative industry survey came from professionals across creative and cultural sectors in which art university graduates are likely to be employed; mostly represented were printing and publishing (82%), graphic design (19.5%), and digital fabrication (15.6%). A range of other fields were represented, including animation, illustration, system development, and game development. The types of roles in the companies included creative directors (26.6%), managers or producers (23.4%), technical leads (7%) and system engineers (6.3%). The questionnaire contained 15 items covering company characteristics, professional role, digital competencies in practice, recruitment and training perspectives, and relationships with educational institutions, and likewise relied primarily on closed-response questions, with limited open-

ended fields.

4. FINDINGS I: ART HIGH SCHOOL PERSPECTIVES

4.1. Overview

Specialised art high schools are a common route through which students enter art universities in Japan. Responses to this survey came from public (including municipal) art high schools in Kyoto. The questionnaire was designed to examine how digital, IT, and technology-related skills are positioned within art and design education. The responses therefore reflect institutional priorities and curriculum structures rather than student perceptions.

According to the survey results, the overwhelming majority of students progress to art and design universities, with few entering regular universities or training colleges and almost none moving directly into employment. 75% of respondents described digital skills as "important but forming only part of the curriculum," while only 16.7% identified them as a "core" component of art and design education, and no respondent considered them unimportant. However, when asked about the degree of integration with core artistic training, 75% of respondents indicated that digital skills are "partially integrated but often taught separately," and 8.3% reported they were "mostly taught separately". No participants described them as "strongly embedded within the same learning process" (see Figure 5). This suggests that digital skills are frequently positioned alongside, rather than within, foundational studio training. Digital and IT-related content is most commonly provided as elective subjects, with all respondents indicating some form of elective provision and the majority also reporting short workshops, external lecturers, and compulsory components. Taken together with the strong progression of students to art and design universities, the data suggests that while the importance of digital competencies is recognised, it remains structurally secondary to analogue skill development at the high school stage.

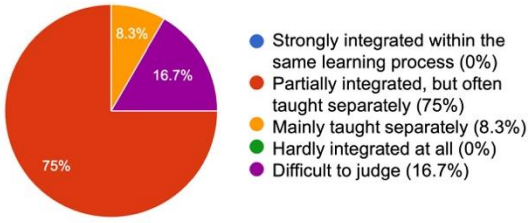

Figure 6 - Degree of integration between digital/IT skills and traditional studio-based art skills in specialised art high schools (N = 12).

4.2. Digital Familiarity and University Entrance Expectations

The survey responses also reveal the scope and frequency with which digital tools are taught. Digital art and design tools such as imaging, video, 3D and graphic design software are widely introduced, however, there is much more limited teaching of physical computing, programming, AI, immersive media (VR, AR, MR), digital fabrication, or data processing. Student interest in digital and STEAM-related areas was generally perceived as high, with 75% of respondents describing student interest as "relatively high," and a further 8.3% indicating it was "very high". When asked about students' level of preparation upon entering art university, 75% reported that students were "mostly prepared," while 16.7% noted considerable variation and 8.3% considered them "very well prepared". However, expectations regarding university entrance seem to prioritise foundational and analogue-based artistic ability: all respondents reported basic observational and compositional skills as essential, and 75% emphasised presentation and communication abilities, while only 8.3% identified digital production or programming as expected skills (see Figure 6). Taken together, these responses suggest that although students are viewed as familiar and interested in digital and technological skills, traditional artistic foundations remain the core emphasis in art high schools.

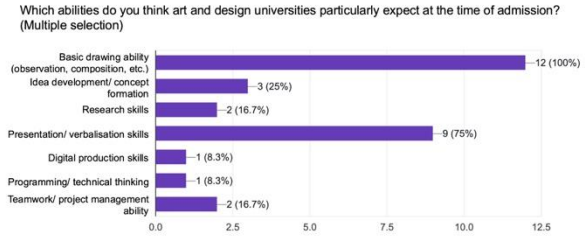

Figure 7 - Perceived abilities expected by art and design universities at the point of admission (multiple responses permitted; N = 12).

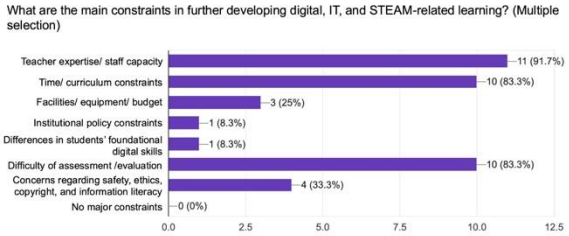

Figure 8 - Perceived constraints in expanding digital, IT, and STEAM-related learning in specialised art high schools (multiple responses permitted; N = 12).

4.3. Institutional Limitations

Institutional restraints regarding digital and STEAM content integration may shed light on these results. The most frequently identified limitation was teacher expertise and staff capacity, selected by 91.7% of respondents (see Figure 7). Time and curriculum constraints were also largely reported, with 83.3% indicating that existing course structures leave limited space for expanded digital content. A similar number highlighted the difficulty of evaluating digital and STEAM-related projects within established assessment criteria. Access to equipment and facilities was noted, but less than structural and staffing concerns. Notably, no respondent indicated that there were no major constraints. These responses suggest that the limited integration of digital technologies is primarily not ideological, but shaped by practical limitations of staffing, curriculum design, and assessment systems. Open responses further showed an awareness of rapid technological change, particularly in relation to AI and the growing importance of language-based interaction with digital systems. However, respondents also commented that such developments place additional demands on both students and teachers. Again, several comments highlighted perceived gaps between art high school curricula and art university entrance systems, suggesting that the importance of digital and STEAM-related learning is not yet recognised within current structures. In summary, digital skills, while recognised, remain supplementary to the traditional analogue foundations that continue to define progression into art university.

5. FINDINGS II: CREATIVE INDUSTRY PERSPECTIVES

5.1. Overview

This section reports findings from the creative industry survey, focusing on how digital and technology-related skills are positioned within workplaces art university graduates are likely to enter. Most respondents came from large-scale creative organisations with over 100 employees (86.7%). As mentioned above (*3.2 Data Sources*) a wide range of business types and job roles were represented, giving a diverse representation of current creative industries in Japan.

5.2. Positioning of Digital Literacy

Digital and technology-related skills were widely reported as central to professional activity. Half of respondents stated that such skills are "core and indispensable in most projects," while an additional 28.9% described them as "very important alongside non-digital practices." Only a small minority positioned them as supplementary or limited (see Figure 8). This indicates that, within the surveyed companies, digital competencies are not peripheral but embedded in routine creative work. When asked which specific skills were particularly important, the most frequently selected were Web and interactive media (82.8%), AI-related tools and processes (69.5%), data-related skills such as analysis and visualisation (61.7%), and programming or scripting (62.5%). More traditional digital production skills such as digital illustration (39.1%) and motion graphics (34.4%) were also selected but at lower rates. These responses clearly show a broad range of digital competence is important, extending beyond digital

art and design software toward systems thinking, data literacy, and AI integration.

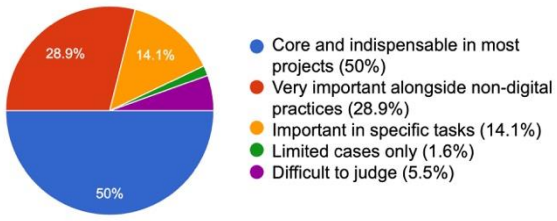

Figure 9 - Positioning of digital, IT, and technology-related skills within creative industry practice (N = 128).

Digital skills were reported as being acquired mainly through workplace experience. On-the-job training (OJT) was selected by 84.4% of respondents, followed by internal training and mentoring (56.3%) and online learning resources (39.8%). Only 6.3% reported strong collaboration with schools or universities as a main method of skill development. This suggests that currently professional digital skills are largely gained post-hire rather than directly from formal education. Respondents also identified significant constraints in maintaining and developing digital capabilities. The most common were time and workload pressures (75.8%), the speed of technological change (62.5%), and difficulty securing appropriately skilled personnel (58.6%). Tool and software costs were also noted (43.8%).

5.3. Hiring Expectations

Digital and technology-related skills were considered overwhelmingly important in hiring new staff. 36.7% described such skills as "very important," and 31.3% as "important to some degree," while 23.4% regarded them as indispensable (see Figure 9). Very few considered them unimportant. In terms of timing, 35.9% indicated that digital skills are expected within the first one to two years of employment, while 15.6% expected them at the point of entry. A further 25% responded that expectations vary significantly by role or field. This suggests that although not always required at the time of recruitment, digital competencies are expected to be rapidly developed or demonstrated early in professional practice. Regarding educational background, general universities (89.8%) and art and design universities (55.4%) were both listed as common sources of recruits. In evaluating candidates, communication and teamwork abilities were selected most frequently (85.2%), followed by digital and technical skills (53.9%), conceptual thinking (47.7%), and willingness to learn new tools (41.4%). These responses indicate that digital skills are evaluated alongside broader professional and interpersonal attributes. However, the available data does not allow us to determine whether expectations vary across specific roles, or whether such variation affects how art and design graduates are assessed in comparison to graduates from general universities.

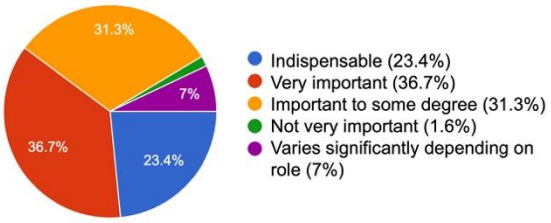

Figure 10 - Perceived importance of digital and technology-related skills when hiring early-career creative professionals (N = 128).

5.4. Perceived Gaps and Future Outlook

When asked whether a gap exists between current art and design education and industry needs, 25% reported "a certain level of gap," while a smaller proportion indicated a large gap. However, 58.6% selected "difficult to judge," suggesting ambivalence or limited visibility into educational practice. Open-ended comments on this topic, however, referred to disparity between skills taught in schools and practical implementation. The pace of technological change was also noted as an issue with education not being able to keep up with cutting-edge industry-level technology. Looking ahead (see Figure 10), 71.9% anticipated that the importance of digital and technology-related skills would "increase significantly" over the next five to ten years, with a further 21.9% expecting a moderate increase. Very few predicted no change or decline.

Overall, the findings show an industry environment in which digital competencies are structurally embedded, rapidly evolving, and expected early in professional careers, while also

being shaped by organisational constraints and broader communicative capacities.

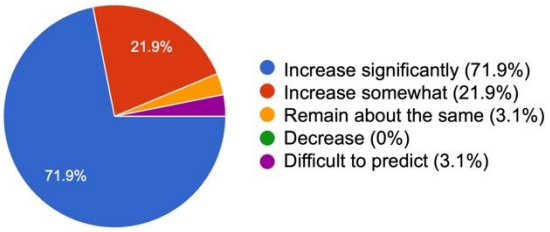

Figure 11 - Anticipated change in the importance of digital and technology-related skills over the next 5–10 years (N = 128).

6. SYNTHESIS

Read together, the three surveys indicate a developmental pathway structured by shifting expectations regarding digital and technological skills. Across art high schools, art universities, and creative industries, digital skills are broadly acknowledged as important, but what changes across these stages is their positioning, depth, and viewed importance. In art high schools, digital technology content is introduced and is popular, yet remains supplementary to foundational artistic training centred on drawing, observation, and material practice. This reflects institutional restraints connected to assessment systems and university entrance procedures, where technological competencies are rarely evaluated as core requirements. At the university level, perceptions change and students widely recognise digital competence as necessary for future employment, yet many report uneven preparation. Technology is present within curricula, but its integration varies in depth and consistency, producing a gap between demand, perceived importance, and perceived readiness. Within creative industries, conversely, digital literacy is treated as an expected condition rather than an optional enhancement. Employers describe technological competence as a requirement at entry level, and it is embedded within all areas of professional practice. In this context, digital technologies are not optional tools but part of the basic environment in which professional creative work takes place.

Across the three stages, the pattern is clear: technology moves from being introduced, to being recognised as important, to being taken for granted. The difference is not whether digital competence matters, but at what point it becomes an embedded and expected part of creative education. This places the art university in a particularly important position, where the shift from exam-oriented preparation to professionally structured production begins to take shape. It is at this point that digital skills move from being useful or interesting additions to becoming expected capabilities. These underlying structural tensions are discussed below.

7. DISCUSSION AND PROPOSAL: REFRAMING STEAM EDUCATION IN ART UNIVERSITIES

The comparative findings can be understood as a structured progression across three institutional environments. Art high schools prioritise expressive foundations; creative industries operate within conditions of social implementation; and art universities occupy the transitional space between them. This progression may be represented schematically as a shift across several axes: from foundational expression to social translation to implementation; from technology introduced, to technology integrated, to technology assumed; from individual to collaborative to organisational production; and from exploratory inquiry to problem-oriented design to outcome responsibility (see Figure 11). The art university stands at the hinge position where these developments meet.

Art High Schools	Art Universities	Creative Industries
Foundations of Expression	Social Translation	Social Implementation
Introduction to Technology	Integration of Technology	Technology as Prequisite
Individual Production	Team-Based Production	Organisational Production
Exploration and Experimentation	Problem-Solving Design	Accountability for Outcome

Figure 12 - Conceptual model of the structural progression across art high schools, art universities, and creative industries.

From this perspective, the art university's role is not as a place of simple skill accumulation, but as a mediating layer within the broader creative pathway. Digital education at this stage cannot be reduced to software training alone; rather, it must connect creative exploration with real-life social

implementation. Industry respondents do not simply demand narrow technical specialisation at entry level. Instead, they emphasise adaptability, problem-solving, collaborative capacity, and the ability to work within evolving technological environments. In this sense, digital competence functions less as a fringe skill set and more as a basic condition of participation.

An interview conducted in Kyoto on 24 February 2026 with cultural producer Mr. Misugi Terada, an experienced practitioner working across art, technology, and creative production, reinforces this interpretation. The interview was conducted to supplement the survey findings with qualitative insight from professional practice. While concerns are often raised that art universities struggle to keep pace with rapid technological change, Terada argues that attempting to incorporate every emerging development into the curriculum is neither possible nor desirable. What matters, according to Terada, is not breadth of coverage, but depth of inquiry. Intensive engagement with a specific domain cultivates ways of thinking that enhance adaptability. By pursuing a subject to its conceptual and practical limits, students can develop the capacity to respond to technological shifts without being defined by them. From this perspective, the acquisition of technical skills should not be limited to operational proficiency. A basic level of digital literacy is essential, but its real educational value lies in how it helps students shape ideas, set direction, and connect different elements within a project. Art university students often stand out for their originality and sensitivity; however, the challenge is to turn that sensibility into skills that function in social and professional contexts, without diluting what makes it distinctive.

This reframes the frequently cited demand for "communication skills" within the creative industries survey. From this perspective, communication does not simply mean smooth functioning within groups, rather, it involves articulating singular visions with clarity, engaging with difference, and sustaining collaborative processes without erasing creative tension. Communication, in this sense, functions as mediation: the capacity to transform and translate individual creative expression into shared production. Seen this way, STEAM in art universities is not about layering technology onto existing practice, but about developing technical skill, conceptual thinking, and communication together, within a space that prepares students to move from individual exploration to shared creative work.

8. CONCLUSION

The comparative findings from these surveys suggest that the central issue surrounding the integration of technology into art education in Japan is not disagreement over its value, but the stage and method by which it becomes structurally embedded. Art universities occupy the transitional space in which digital literacy can shift from peripheral tool to professional expectation. The question, therefore, is not whether digital technology should be included, but how it should be integrated within the existing template without detriment to the creative experimentation available at art university.

One solution may be to integrate digital education within existing studio practice and project development rather than confine it to isolated technical instruction or elective projects. A foundational level of competence is necessary, yet its significance lies in how it supports idea formation, collaboration, and socially oriented solutions. In this sense, STEAM education in art universities concerns the integration of creative thinking, technological capability, and communicative mediation.

The interview with Misugi Terada suggests that art universities do not need to chase every new technological development; what matters more is depth of knowledge and ability to apply it. Sustained engagement within a discipline builds the kind of thinking that allows students to adapt as technologies inevitably change. In an era shaped by AI, technical skills may no longer be sufficient; the priority, then, is not simply mastering more tools, but developing the ability to set new directions. Digital systems and technology can recombine and optimise, but creative education must continue to nurture the capacity to imagine and create

something genuinely new.

This suggests the need for structured spaces where experimentation, collaboration, and technological integration can be explored in a sustained and critical way. To support this, we are currently in the foundational stages of developing the "Sensory STEAM Lab," a proposed interdisciplinary research and pedagogical platform building on earlier work (Hall & Iwasaki, 2024a, 2024b). Rather than serving primarily as a site for technical training, the Lab would provide an environment in which new teaching approaches can be tested and refined, linking artistic inquiry with contemporary technological conditions. By bringing together educators, artists, technologists, and industry practitioners, it would create opportunities for ongoing dialogue and collaborative experimentation, both within Japan and internationally.

Seen in this light, STEAM education in art universities is not about imitating technological trends, nor about forcefully layering technology on top of existing creative practices, but more about developing judgment within a technological context. The role of the art university is to ensure that technological fluency strengthens and complements, rather than replaces or restricts, distinctive and socially meaningful creative learning.

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All interviews and survey data were collected in Japanese, and English translations were assisted by generative artificial intelligence tools and reviewed by the authors. AI tools were used for limited editorial assistance. The authors are fully responsible for the study design, analysis, interpretations, and final content of this manuscript.

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Student Perspective on AI Usage: A Comparative Cross-institute Study

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Abstract: This study investigates how students from two universities with different academic levels (*hensachi*) perceive the use of artificial intelligence (AI) in English language classes and assignments. As AI-supported tools increasingly shape language learning, understanding learners' attitudes across diverse educational contexts is essential for effective teaching and course and class design. Using an anonymous online survey, the study examines students' beliefs and perspectives regarding AI use in their English coursework. Comparative analysis explores whether and how perceptions differ between students at higher- and lower-*hensachi* universities. Although the result of the study shows little difference between the two universities, it found out that students from both institutions have similar patterns in perceptions of AI usage and some participants use AI for the purposes that they think are not always acceptable. Findings from this research aim to contribute to broader discussions on AI adoption and regulation in EFL education in Japan and offer insights for tailoring AI-integrated instruction to varied learner populations.

1. INTRODUCTION

Artificial intelligence, or AI, has been around for a decade. With the rapid technological advancements of Generative AI and AI models such as OpenAI's ChatGPT, Google's Gemini, Microsoft's Copilot, Twitter's Grok, and others, AI's controversial incorporations have been on the rise in various industries. Education is one section of society that has not escaped its reach, with conflicting views on AI's role in both teaching and learning.

AI in learning has been around for more than a decade. For instance, the incorporation of AI in Grammarly, a writing assistance tool, started in 2015. Generative AI, however, is evolving at such tremendous speed that it can take over more aspects of education. While Grammarly can make suggestions, Gen AI (and henceforth used interchangeably with the umbrella term of AI) can write a full essay with citations in seconds based

on just a single sentence as a prompt. Rather than reading passages, students can simply upload the file and have AI tools that can sum up key points without the students spending any time on the original reading. Similarly, teachers could also have Gen AI create materials, design questions, and provide feedback.

In language education, in particular, AI can function interlingually, allowing the user to work in one language and have products automatically result in another. Some would argue that the process of using AI removes the actual learning of the language, regardless of the quality of the results. For students uninterested in practicing the language, AI can indeed be a shortcut to complete many kinds of tasks while avoiding interactions with the language itself. The tool is already there, but in what ways do students actually use it, and how do they feel about using it, as well as how much do the teachers know about their students and AI?

Moreover, without any consensus on how AI should or could be used in learning, inconsistencies among classes happen based on gaps among the instructors' guidelines and/or how each student considers AI's effect on their education. Ethical issues also arise as debates take place about the ownership of AI-generated work. As the conversations around AI in education are very much ongoing, there is still plenty of need for research on how Gen AI is seen by different parties in the field of education. One field that requires more insight is how students perceive AI usage. When lacking understanding, educators may simply project their assumptions onto their students based on their motivations, levels, majors, schools, or other factors, regardless of whether that is how their students consider AI usages. With a deeper understanding, better policies and guidelines could be made.

This paper aims to contribute to the growing understanding of students' perception of AI usage by investigating how university students in two institutes of very different academic levels, based on their *hensachi*, a standardised score used in Japan to compare test-takers with others, perceive the use of artificial intelligence (AI) in English language classes and assignments.

2. BACKGROUND RESEARCH

The incorporation of AI in language education is not a novel concept. For instance, Grammarly is one of the most popular writing assistance tools globally. The program originated in 2009, and they introduced AI in their assistance tool from 2015 (Forbes, 2018). The incorporation of AI allowed the grammar and spelling checking tool to go beyond spell-check and make suggestions of different writing tones or transform sentences with words that the writer did not come up with. While some teachers and learners embraced these tools as supportive writing assistance and not a replacement (Fitria, 2021), others, such as the University of Notre Dame and University of North Georgia, consider it academic dishonesty and a punishable academic offense (Palmer, 2024; Mobilio et al, 2024). The current trend and popularity of Generative AI programs such as ChatGPT and Google Gemini create even more debates and confusion student's educational integrity. Students can now "write" or generate a full essay with citations in seconds based on just a single sentence as a prompt. Rather than reading passages, students can simply upload the file and have AI tools that can sum up key points without the students spending any time on the original reading. The debate on whether AI is considered an assistant tool or a dishonest tool used for plagiarism is more significant and relevant than ever.

Moreover, one major issue students encounter is that they are going through education in real-time, while the guidelines are not clearly defined. In a study surveying 277 university students in the U.S., Lund et al. (2025a) found that while most students were aware of their university's academic integrity policies towards AI, many were uncertain about the acceptance of certain supportive usages of AI, such as brainstorming or grammar checking, highlighting the importance of clearer institutional guidelines and ethics-focused education regarding AI usage. A similar sense of confusion was found in research in Hong Kong, where students demonstrated a clear understanding of traditional

plagiarism, but AI-involved incidents surprisingly posed ambiguity to them even when the institute had a strict zero-tolerance policy (Chan, 2025). This should be no surprise when considering that AI guidance for teachers is still irregular and not standardized, highlighting the example most relevant to this research, less than 30% of secondary teachers received guidance in 2024 (OECD, 2025).

In addition, Lund et al. (2025b) found in another U.S.-based large-scale survey study (N = 401) that students' decisions of interacting with AI tools end up being based on their personal beliefs rather than policies set by their institutions. The research also suggests that students consider AI usage or even misconduct to be different from traditional plagiarism, once again promoting the importance of ethics education for students alongside policy setting. As AI is still evolving rapidly, institutional policies may not be catching up at the same speed, and new policies may be set reactively; students could continue to find themselves ahead of the institution's official guidelines and having to make their own moral judgements. Therefore, having a better understanding of the students' perception on the ethical issues of AI usage is essential to forming policies.

The problem of ambiguity is not to remove the positivity of how AI can assist learners in learning. In research conducted in Pakistan, Khalil et al. (2025) found that a majority of surveyed ESL students appreciated AI as a positive tool with great potential for their English language learning, highlighting AI's convenience, feedback, and assistance in conversational practice. AI technology in ESL can positively affect the learner's motivation, skill-building, autonomy, and confidence, but as reminded by the researchers, AI should be used appropriately alongside proper teacher guidance (Khalil et al., 2025). To ensure fairness and educational integrity, positive usages could be encouraged alongside ethical education to deter misconduct that ends up hindering learners' progress.

When it comes to language learning, however, the learner's perception of AI's involvement is not as clear-cut. One of the biggest and widest-reaching cases would be Duolingo, a language-learning app that offers both a free-tier and a paid premium tier. In early 2025, the company's CEO made a post that insisted on the app going "AI-first" (LinkedIn, 2025). In response to taking this AI-first approach to the subject of language learning, Duolingo immediately received massive backlash, resulting in one of the slowest growth of the service (Yahoo Finance, 2025). The consumer's responses could be attributed to the general public's worry about AI replacing human jobs or the CEO's vagueness towards the subject (Yahoo Finance, 2025), but it is also reasonable to see that there are other factors involved, including how language, being an essential aspect of human communication can expect push-back regarding having our languages taught by AI technology. Nonetheless, AI and language learning are still very new approaches to the subject at hand, and learners are responding very differently.

Like in other parts of the world, in Japan, AI has been a central topic in university English education. Despite that, Japanese college students do not seem to utilize AI effectively in their English learning. According to Tam and Kataoka (2024), most students who participated in their research did not know how to use AI effectively, and nearly half of them had used it only once or twice before. They also claim that it is crucial to educate students about the effective use of AI. Additionally, Kashiwagi and Kang's (2025) study found that approximately 70% of the 77 participating college students had prior experience of using a text-generating AI. However, only 40-50% of them had used AI for English learning, while they recognize the importance of AI-related skills.

While we acknowledge the quick assistance and feedback that AI can give to the students, the ethical use of AI has always been an issue. With the emergence of the new technology in the realm of computer-assisted language learning (CALL), it is now important for teachers and students to understand the effects and ethical use of AI. Massoud and Zhang (2024) claim that the use of ChatGPT in EFL writing instructions could enhance students' learning, boosting students' confidence in grammar accuracy and paragraph

structuring, raising awareness of proper citation, and avoiding plagiarism. However, the participants in a study by Price (2024) expressed somewhat negative views on using ChatGPT for their communication course in terms of efficiency, reliability, and ethics of using information given by ChatGPT. Graduate students in a foreign studies department in Tajima's study (2024) expressed doubts about AI use in English education, while they admit that AI can give immediate answers and feedback. Some participants were concerned about the negative impact on students' motivation and their ability to think. It is worth noting that Tajima (2024) points out that the participants, most of whom were language teachers at the same time, were not familiar with AI yet and not willing to actively learn about it; therefore, the researcher expresses his concern about younger students using AI before teachers fully understand how to use AI.

Given the struggles of students navigating through the vagueness of AI and education, mixed perception on AI usages in language learning, varied experiences with AI on both the learners' and educators' end, and the nature of how the technology continues to change and evolve, this research aims to add to the growing conversation involving the continuously-growing technology by providing an understanding on whether students at two very different level universities approach and consider AI in similar manners within the scope of foreign language learning, specifically, English education in Japan.

3. RESEARCH QUESTIONS

As aforementioned, this research aims to examine the usage and perceptions Japanese university students have of AI usage in English classes, particularly by comparing two universities with a huge gap in terms of academic levels.

The research questions can be categorized into two parts as follows:

Regarding actual AI usages in English classes,

1. Is there a significant gap between how Japanese university students of very high academic levels and Japanese university students of low academic levels use artificial intelligence in English classes?
2. If so, in what ways do their usages differ?

Regarding the perception of AI usage in English classes,

3. Is there a significant gap between the two groups in how they perceive the appropriateness of using AI in different ways in English classes?
4. If so, in what ways do their perceptions differ?

4. METHODOLOGY/PARTICIPANTS

4.1. Survey and questions

A survey was used to collect the data. The data from each university were collected through two separate forms, distributed by the researchers to their students in reading and speaking/communication courses. The survey consists of fifteen questions: three of them are open-ended, and the rest are closed (see Appendix for the actual survey questions). In the first section of the survey, participants' basic information, such as their year in university, the number of English courses they have taken, and their frequency of AI use, is collected. In the next section, participants checked the boxes for the tasks that they use AI to tackle, including brainstorming and generating ideas, writing text, proofreading and editing, summarizing, vocabulary learning, English-to-Japanese translation, Japanese-to-English translation, speaking practice, generating mock questions for exams, and others. In the following section, participants are asked to choose a number from 1 to 5 on a Likert scale to indicate how acceptable they feel about using AI in each task, with 1 being completely unacceptable and 5 being completely acceptable. Finally, the open-ended questions asking the reasons for choosing 1, 3, and 5 conclude the survey. The survey was created in English first, then it was translated into Japanese by the researchers to avoid participants' confusion.

4.2. Participants

The participants were 46 university students from two institutions in Japan with different academic levels (*hensachi*). One institution is widely regarded as among the most prestigious universities in Japan (University A), while the other has comparatively low admission selectivity (University B). 22 participants from University A are economics majors. The majority of the participants are sophomores, while only two of them are third-year students. On the other hand, 24 participants from University B are English majors, all of whom are enrolled in the university's mandatory English program, which requires students to take at least 16 English courses during their first two years. Most of the participants are second-year students, with seven juniors and three seniors also in attendance.

5. LIMITATIONS

Being research conducted in a relatively new field with always-evolving technology, this research aims to capture the situation of the current moment instead of prolonging the research while the technology continues to change. As a result, there are several limitations that ought to be acknowledged. One of which is the limited sample size. In order to have at least two relatively comparable classes, three classes total, one class from University A and two classes from University B were surveyed. In addition, the sampling was not random. The sampling was based on students whom the researchers had direct access to. This was done to encourage the unity of each class's results by limiting the scope to a certain profile from one particular department and year. However, the researchers did not have access to two classes that majored in the same department, and the two universities also did not have the exact same departments. This results in yet another limitation, as their experiences may differ based on the guidelines and rules set by their universities, departments, and professors.

Nonetheless, this research serves as an initial step towards understanding the potential existence of an attitude gap regarding AI usage in English education. Future research is encouraged to address these limitations by having bigger sample sizes from each university, but of the same department.

6. DATA ANALYSIS/RESULTS

As shown in Figure 1, the frequency of AI usage shows a relatively similar pattern. Only one student from University A reported no use of AI for coursework and assignments.

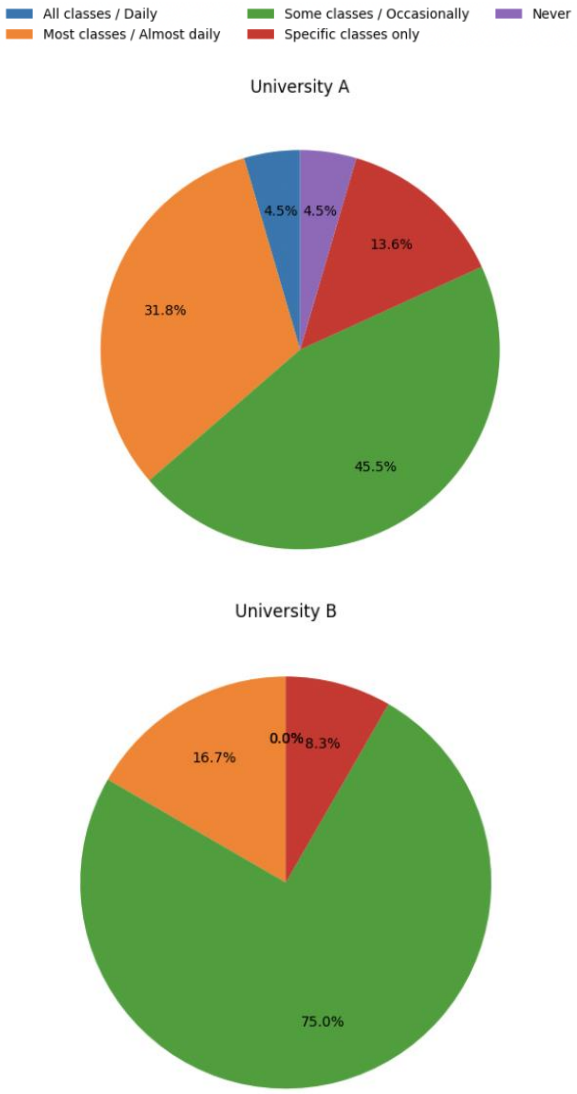

Figure 1 - Frequency of AI use in classes and assignments

Note. Percentages represent the proportion of students reporting each level of AI use. University A (n = 22) and University B (n = 24) are shown side by side.

Amongst other students who use AI, one student from University A reported that they use AI for every class or every day. Seven students from University A (31.8%) and four from University B (16.7%) use AI for most of the courses or almost

every day. Ten from University A (45.5%) and eighteen (75%) from University B use it for some classes or sometimes, and three (13.6%) from University A and two (8.3%) from University B limit their AI use to particular courses, such as reading, writing, presentation, speaking, or non-English courses. Overall, although there are some differences in the frequency of AI usage between the two universities, most of the participants use AI to assist their studies. The data indicate that, regardless of levels and the size of the university, students are open to using AI in their coursework and assignments. The following sections explore students' major AI usage and their perception of specific tasks that they ask AI to assist in their English courses.

6.1. Usage

Figure 2 illustrates the participants' specific usage of AI in their English courses, showing that brainstorming and idea generation are among the most popular usages for the participants from both universities. Other than that, most students, regardless the university, sentence revision and English to Japanese translation are also major usage. On the contrary, not many participants practice speaking with AI. It is also worth noting that some participants from both universities use AI to write assignment sentences.

Figure 2 Purposes for using AI in English learning and classes

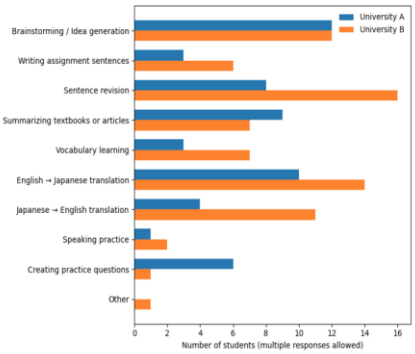

Figure 2 - Purposes for using AI in English learning and classes

Note. Students were allowed to select multiple purposes. Values represent the number of students selecting each option. University A (n = 22) and University B (n = 24) are shown for comparison.

With brainstorming and generating ideas being the major usage among the participants, Figure 1 shows that twelve (54.5%) from University A and twelve (50%) from University B use it, which accounts for over half of the participants. Sentence revision is also one of the most popular purposes chosen by sixteen students (66.7%) from University B and eight (36.4%) from University A. Conversely, only one (4.5%) participant from University A and two (8.3%) from University B use AI for speaking practice, making it the least popular usage for both universities combined. Additionally, three (13.6%) from University A and six (25%) from University B create sentences for their assignments using AI, which can be a controversial usage of AI in educational settings.

6.2. Perspective

Figure 3 describes how the participants feel about using AI for brainstorming and idea generation. The figure indicates that most of the participants lean towards a positive attitude for this usage. Most students from both universities show positive perception towards this purpose; Four (18.2%), fifteen (68.2%), and two (9.1%) participants from University A feel completely acceptable, mostly acceptable, and somewhat acceptable, respectively. Although two (8.3%) and one (4.2%) from University B claimed it is completely or mostly unacceptable, eight (33.3%), seven (29.2%), and six (25%) expressed that they think it is completely, mostly, or somewhat acceptable, respectively.

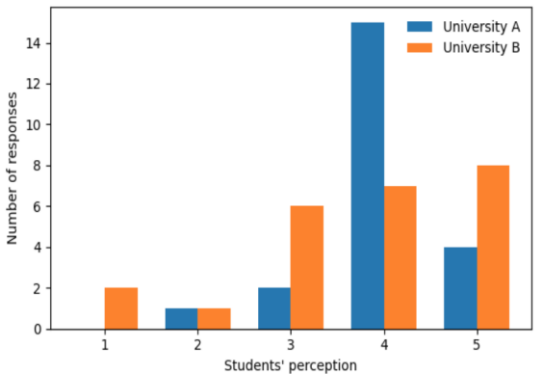

Figure 3- Students' perception of using AI for brainstorming and idea generation

Note. Responses were measured on a 5-point Likert scale (1 = Completely unacceptable, 2 = Mostly unacceptable, 3 = Somewhat acceptable, 4 = Mostly acceptable, 5 = Completely

acceptable). University A (n = 22) and University B (n = 24) are shown for comparison.

In Figure 4, the participants' negative perception about creating sentences for their assignments is indicated. Although ten (41.7%) students from University B perceive it as somewhat acceptable, ten (45.5%) and three (13.6%) from University A think it is either mostly or completely unacceptable. It can be seen that the participants from University A have a more negative perception of this usage compared to those from University B, with more than half of the students showing a positive perception.

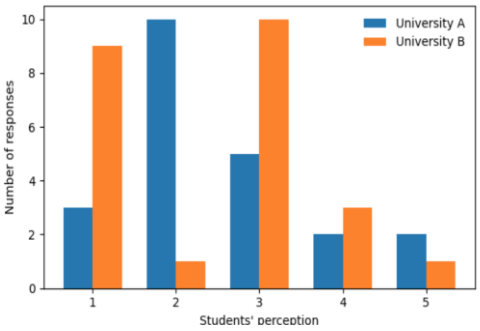

Figure 4 - Attitudes toward using AI to create sentences for writing assignments

Note. Responses were measured on a 5-point Likert scale (1 = Completely unacceptable, 2 = Mostly unacceptable, 3 = Somewhat acceptable, 4 = Mostly acceptable, 5 = Completely acceptable). University A (n = 22) and University B (n = 24) are shown for comparison.

Figure 5 illustrates the participants' thoughts on using AI for sentence revision. In terms of this usage, participants from both universities show a similar pattern, leaning towards acceptance. Approximately 50% of the participants from both universities expressed that it is completely acceptable, and about 30% of the participants found it somewhat acceptable, with only one (4.2%) from University B thinking it is mostly unacceptable.

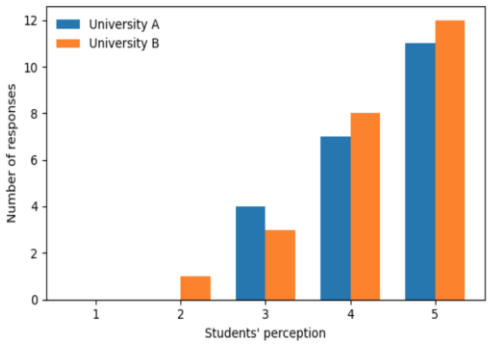

Figure 5 - Students' perceptions of using AI for sentence revision

Note. Responses were measured on a 5-point Likert scale (1 = Completely unacceptable, 2 = Mostly unacceptable, 3 = Somewhat acceptable, 4 = Mostly acceptable, 5 = Completely acceptable). University A (n = 22) and University B (n = 24) are shown for comparison.

Figure 6 presents the participants' perceptions of using AI to summarize textbooks or academic articles. The figure shows a relatively positive attitude towards this usage. More than 80% of the participants from University A and B expressed their positive perception, choosing either somewhat, mostly, or completely acceptable.

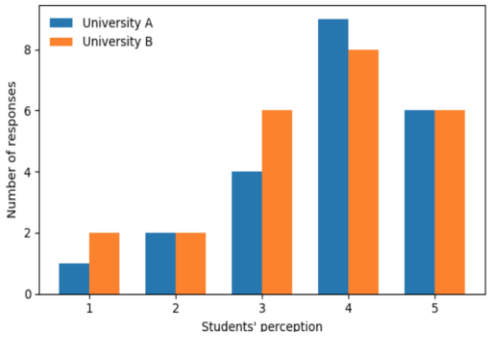

Figure 6 - Students' perceptions of using AI to summarize textbooks or academic articles

Note. Responses were measured on a 5-point Likert scale (1 = Completely unacceptable, 2 = Mostly unacceptable, 3 = Somewhat acceptable, 4 = Mostly acceptable, 5 = Completely acceptable). University A (n = 22) and University B (n = 24) are shown for comparison.

Figure 7 shows that every participant from both university find AI use for vocabulary learning acceptable, with fifteen (68.2%) and eighteen (75%) expressing that it is completely acceptable.

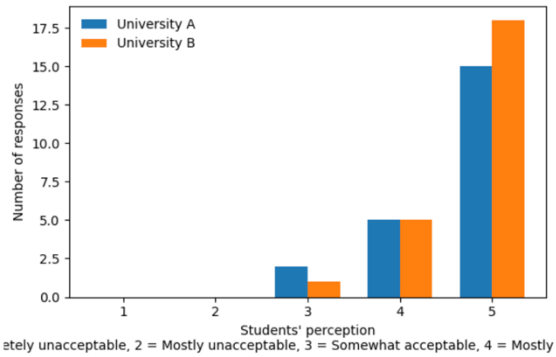

Figure 7 - Students' perceptions of using AI for vocabulary learning

Note. Responses were measured on a 5-point Likert scale (1 = Completely unacceptable, 2 = Mostly unacceptable, 3 = Somewhat acceptable, 4 = Mostly acceptable, 5 = Completely acceptable). University A (n = 22) and University B (n = 24) are shown for comparison.

Figures 8 and 9 present the participants' perception of AI usage for translation, English into Japanese, and Japanese into English, respectively. Translation in both ways shows a similar pattern, with most participants having a positive perception. However, the participants from University B express a slightly more positive view towards translating using AI, especially from Japanese to English.

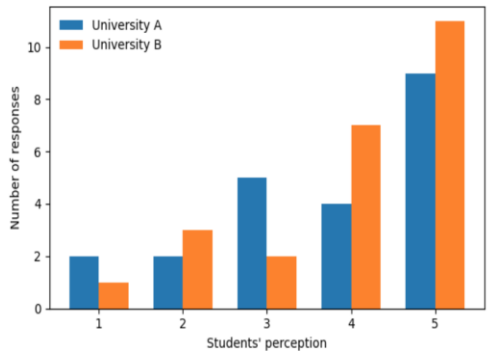

Figure 8 - Students' perceptions of using AI for English–Japanese translation

Note. Responses were measured on a 5-point Likert scale (1 = Completely unacceptable, 2 = Mostly unacceptable, 3 = Somewhat acceptable, 4 = Mostly acceptable, 5 = Completely acceptable). University A (n = 22) and University B (n = 24) are shown for comparison.

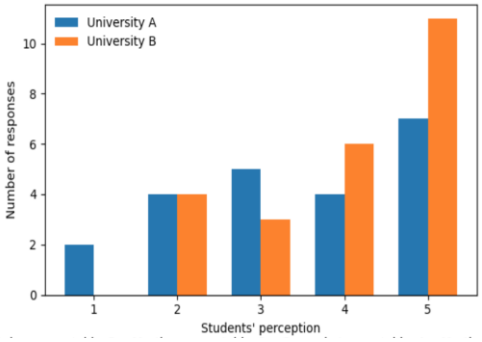

Figure 9 - Students' perceptions of using AI for Japanese-English translation

Note. Responses were measured on a 5-point Likert scale (1 = Completely unacceptable, 2 = Mostly unacceptable, 3 = Somewhat acceptable, 4 = Mostly acceptable, 5 = Completely acceptable). University A (n = 22) and University B (n = 24) are shown for comparison.

As witnessed in Figure 10, the participants have a significantly positive perception of AI usage for speaking practice. All participants report their acceptance towards this usage, with sixteen (72.7%) from University A and seventeen (70.8%) expressing their complete acceptance.

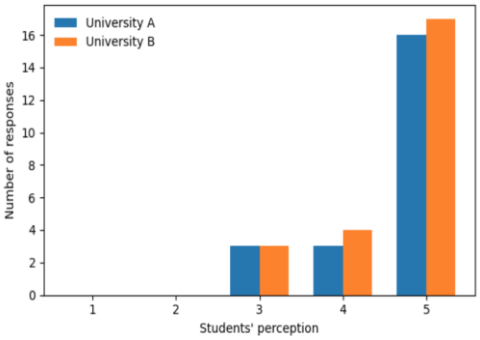

Figure 10 - Students' perceptions of using AI for speaking practice

Note. Responses were measured on a 5-point Likert scale (1 = Completely unacceptable, 2 = Mostly unacceptable, 3 = Somewhat acceptable, 4 = Mostly acceptable, 5 = Completely acceptable). University A (n = 22) and University B (n = 24) are shown for comparison.

Similarly to Figure 10, great acceptance for creating practice questions using AI is shown in Figure 11. Every participant except one (4.2%) from University B has a positive view ,with sixteen (72.7%) from University A and fourteen (58.3%) from University B stating the usage is completely

acceptable.

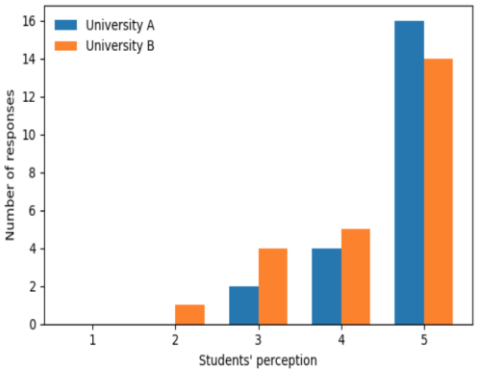

Figure 11 - Students' perceptions of using AI to create practice questions

Note. Responses were measured on a 5-point Likert scale (1 = Completely unacceptable, 2 = Mostly unacceptable, 3 = Somewhat acceptable, 4 = Mostly acceptable, 5 = Completely acceptable). University A (n = 22) and University B (n = 24) are shown for comparison.

Overall, there are no distinctive differences between the universities in their perception of each usage. Most participants find creating sentences for assignments mostly or completely unacceptable; However, as regards the other usages, the participants tend to have a positive view towards getting help from AI. Nonetheless, it should also be noted that mixed perceptions are reported in some usage, such as summarizing textbooks or academic articles, English-Japanese and Japanese-English translation.

7. DISCUSSION AND IMPLICATION

The results of our research show that there are no remarkable differences between the two universities with different academic levels, indicating that students' *hensachi* has little impact on their perception of AI usage in their coursework and assignments. However, the results also show that students from both universities have similar perceptions; the participants understand what would be considered cheating, creating sentences for writing assignments, but according to Figure 2, some participants use AI for that purpose. That is to say, students use AI for what they consider "unacceptable" while they do not use AI for what they consider "acceptable," such as speaking practice. Therefore, it is essential that teachers understand the students' perceptions and guide them to the proper use of AI in their classes.

In the qualitative questions in the survey, there are some notable comments from some participants who consider creating sentences for writing assignments either acceptable or completely acceptable. One participant from University B stated, "It is my job to generate my own ideas from scratch, but it is ok to rely on AI to expand these ideas". This comment indicates that if the ideas come from students, it is acceptable to use AI to elaborate on them, translate them into English, or improve the wording. The participants might not have fully understood the differences among "creating sentences", "brainstorming", and "translating" since creating sentences here means that they ask AI to generate sentences from scratch without thinking of their ideas, but this comment gives teachers some ideas on what they consider cheating. According to Chan (2025), asking AI to improve students' writing is part of the so-called "AI-giarism," though it is still in the gray area. Similar opinions are found in those who consider translating acceptable, stating that it is different from copying because translations are based on their own ideas.

Although most participants consider creating sentences for writing assignments unacceptable, some students have different perceptions. Having their own ideas is indeed essential in academia, but in English education, using their own words is as important as using their own ideas. To fill the gap between students' perceptions and teachers' perceptions, guidelines could be made to help students align their own beliefs with the teacher's beliefs. In creating these guidelines, it is important to make sure that the guidelines convey the message about what plagiarism is and why the teacher thinks some usage of AI is unacceptable.

However, it is essential that as institutions create and refine their AI policies, the beliefs and perceptions of teachers are heard and respected as well. To a certain extent and for various purposes, some students appear to use AI to fulfill certain things that they feel they did not get from their teachers or classes. Rather than an expansion of learning, there are elements where students are

using AI to replace aspects traditionally carried out by a teacher. As the trend grows and technology continues to evolve, the roles of teachers may be partially or entirely replaced by AI, affecting the livelihood of educators.

From the educational perspective, students' methods of AI usage are often discovered or invented organically by students themselves rather than being a part of teachers' instructions. On the other hand, given how new and continuously evolving the technology is, how students use AI may not reflect the best practices for their education in the long term. A lot of research is being done on this emerging topic, but given how rapidly the technology develops, it is reasonable that one may question the ability for current research to be future-proofed against unforeseeable evolutions including new usages for AI that we currently have no access to. Time also has not allowed conclusive evidence to be made on AI usages' long term effects on students' learning, as a lot of studies on generative AI and education have been done in just the past few years. On the contrary, educators are trained professionals, and in the case of language education, practicing approaches refined teaching techniques supported by decades of evidence. For students to turn to AI for learning a new language and using it for input and output of a language they have yet to master, at times without consulting and perhaps without the approval of the teachers or institutes, the results may end up minimizing the intended effects of learning compared with learning without AI's involvement. As demonstrated, some students consider AI to be an effective tool that could enhance their language education (Pakistan, Khalil et al., 2025), but when the tool is used for shortcuts, students' learning could be undermined. Therefore, both as professionals and as one of the parties personally affected by this evolving technology, the conversation of AI usages in education ought to include the thoughts and beliefs of educators.

One element that would help students and educators navigate this new realm of learning with AI is a deeper understanding of AI, including its usages, misuses, limitations, and perceptions towards it. The latter is what this research sets out to contribute to, as a better understanding of how students from different levels of universities may see AI in similar matters would help clear ambiguity that encourages assumption-making, and the deeper the understanding we have, the more information a teacher or even an institution would have when establishing policies about AI usage and guidance.

Another aspect that would be appreciated is consistency. As Lund et al (2025a) and Chan (2023) demonstrated, despite universities' established academic integrity policies towards AI, students are rather lost when it comes to nuanced usages of AI, which could be due to a mix of conflicting messages from various educators, gaps in how policies or usages are interpreted, and/or a lack of guidance or comments on specific AI usages. As a result, students' actual usages of AI depend on their personal beliefs rather than on official policies (Lund et al, 2025b). If the guidance on AI is consistently messaged and followed across faculties with little room for vagueness, and guidance is made for both educators and students to easily follow, the need for students to rely on their own interpretations would decrease. If students from different levels of university approach AI in similar manners as well, as this very research has found, then universities could also consult other institutes that have strong and consistent guidelines as they shape and refine their policies for their students.

More research is undoubtedly needed as scholars and educators in the field continue to navigate through the development of AI technology and how it affects education. This comparative study points out how students from two very different universities, in terms of their academic levels, appear to approach and consider the appropriateness of AI usages in English education in a similar fashion. This research contributes to the ongoing understanding of a relatively new but revolutionary tool in education For future research related. to this, it would be beneficial to have studies conducted cross-faculty per university at a larger scale for a more uniform picture of the demographics of each institution. How students follow or conflict with AI policies set by their

institute is another topic worth exploring, but there is also plenty of value in understanding the current students' perceptions while the topic is still vague and developing, so updated research is very much encouraged over long-term studies that result in capturing an outdated view on the topic. However, there would ideally be a better understanding of how AI could assist language learners, so not only could students utilize the technology better, but perhaps iterations of technology could also be developed with enhancing language education as their primary focus, even if they diverge from the convenience of everyday AI. If so, then AI could truly be implemented in classrooms as an official and proven assistant to education, fulfilling the ultimate goals of learning for human beings that are different from machine-learning.

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APPENDIX

Survey questions

1. Number of English classes taken in college so far

Less than 5

Less than 10

More than 11

2.How often do you use AI in class or for classwork

Every lesson

Every other lesson

Once a month

In (a) certain course(s)

Never

3.How do you use it in English classes

Brainstorming/generating ideas

Generating writing

Proofreading and editing

Summarizing

Vocab learning

Translating E -> J

Translating J -> E

Speaking practice

Mock questions

Others…

4. How do you feel about the usage of AI for Brainstorming/generating ideas?

1 = Completely unacceptable

2 = Mostly unacceptable

3 = Somewhat acceptable

4 = Mostly acceptable

5 = Completely acceptable

5. How do you feel about the usage of AI for generating writing?

1 = Completely unacceptable

2 = Mostly unacceptable

3 = Somewhat acceptable

4 = Mostly acceptable

5 = Completely acceptable

6. How do you feel about the usage of AI for Proofreading and editing?

1 = Completely unacceptable

2 = Mostly unacceptable

3 = Somewhat acceptable

4 = Mostly acceptable

5 = Completely acceptable

7. How do you feel about the usage of AI for summarizing?

1 = Completely unacceptable

2 = Mostly unacceptable

3 = Somewhat acceptable

4 = Mostly acceptable

5 = Completely acceptable

8. How do you feel about the usage of AI for vocabulary learning?

1 = Completely unacceptable

2 = Mostly unacceptable

3 = Somewhat acceptable

4 = Mostly acceptable

5 = Completely acceptable

9. How do you feel about the usage of AI for translating English into Japanese?

1 = Completely unacceptable

2 = Mostly unacceptable

3 = Somewhat acceptable

4 = Mostly acceptable

5 = Completely acceptable

10. How do you feel about the usage of AI for translating Japanese into English?

1 = Completely unacceptable

2 = Mostly unacceptable

3 = Somewhat acceptable

4 = Mostly acceptable

5 = Completely acceptable

11. How do you feel about the usage of AI for speaking practice?

1 = Completely unacceptable

2 = Mostly unacceptable

3 = Somewhat acceptable

4 = Mostly acceptable

5 = Completely acceptable

12. How do you feel about the usage of AI for creating practice questions?

1 = Completely unacceptable

2 = Mostly unacceptable

3 = Somewhat acceptable

4 = Mostly acceptable

5 = Completely acceptable

13. For the ones you chose 1 on, why?

14. For the ones you chose 5 on, why?

15. For the ones you chose 3 on, why?

Addressing Cybersecurity Issues Through Collaborative Digital PBL: A Case Study of University-Government-Industry Collaboration on Romance Scams

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Abstract: This paper presented a qualitative case study of an industry–academia–government collaborative Project–Based Learning (PBL) initiative designed to raise awareness of romance scams in Miyazaki Prefecture, Japan. The study examined how interdisciplinary students from non-computing disciplines, including those with liberal arts backgrounds, contributed to regional cybersecurity awareness through structured collaboration informed by a helix-based framework. This study also situates the initiative within a Quadruple Helix framework of regional collaboration. The project integrated students' critical and contextual thinking with anonymized cybercrime data and technical guidance from an IT company. Students engaged in data interpretation, content development, and dissemination, producing awareness videos for regional audiences. Findings indicated that students applied interpretive capacity—the ability to discern social issues, translate them into context, and communicate them effectively—through interdisciplinary collaboration. The case shows that collaborative PBL enhanced participants' digital skills and regional cybersecurity awareness, while enabling students from non-computing disciplines, including those with liberal arts backgrounds, to act as contributors to solving social issues. Although limited in scale, the study highlighted the role of interdisciplinary education in the era of digital transformation.

1. INTRODUCTION

In recent years, rapid digital transformation has reshaped social, economic, and administrative systems worldwide. Alongside its benefits, digitalization has generated new forms of vulnerability, particularly in regional areas where resources and digital literacy may be unevenly distributed. Cybercrime, online fraud, and information security breaches increasingly affect local communities, underscoring the urgent need for comprehensive digital human resource development. In Japan, national strategies emphasize the cultivation of advanced digital professionals; however, regional disparities in

digital capacity remain a persistent concern. Universities located in regional areas are uniquely positioned to bridge this gap by fostering locally grounded yet globally informed talent.

Promoting digital transformation requires not only conventional approaches to digital human resource development but also an increased emphasis on the role of liberal arts education. In addressing complex social and technological challenges across organizations, regions, and society, technical expertise remains important; however, greater importance lies in the social mobilization of interpretive capacity—grounded in flexible thinking, critical reflection, collaboration, and the integration of knowledge within human-centered contexts. This study examines how such capabilities can be mobilized to address regional cybersecurity challenges.

This study examines a collaborative cybersecurity awareness initiative conducted in Miyazaki Prefecture, Japan. The project brought together police authorities, an IT company, and undergraduate students from non-computing disciplines to analyze regional cybercrime trends and develop public awareness materials. Participation in the project was voluntary and not formally integrated into the university curriculum. The purpose of this paper is to explore how interdisciplinary student participation contributes to regional cybersecurity awareness and institutional collaboration. The collaboration originated from the author's leadership of the Industry-Academia-Government Digital Education Initiative in the Miyazaki region. Together with students participating in the author's digital career support workshops, the author had gradually proposed a series of small-scale collaborative activities to the prefectural police. Through these continued efforts, trust was established among the stakeholders. At the same time, the police faced a growing need for new approaches to raise awareness of cybercrimes such as romance scams and were receptive to the flexible thinking and expressive abilities of non-specialist students. The alignment of trust-based relationships and institutional needs enabled the development of a full-scale collaboration. By documenting this initiative, the study contributes empirical insight into how regional multi-stakeholder collaboration can support cybersecurity awareness and digital resilience. Despite growing attention to cybersecurity education, relatively few studies have examined how students from non-computing disciplines can participate in regional cybersecurity initiatives through collaboration with public institutions and industry. In particular, empirical studies exploring such collaboration in regional contexts remain limited. This study particularly focuses on interpretive capacity as a core competence underlying such interdisciplinary engagement.

2. BACKGROUND AND CHALLENGES

Japan's digital human resource strategy has begun to be updated in response to the era of AI. Public documents have started to emphasize the importance of foundational DX literacy for society at large and have proposed the role of business architects who require human and conceptual skills for addressing digital challenges (METI, 2024a; METI, 2024b; Digital Agency, 2026). However, individuals with flexible thinking and strong initiative - such as students from non-computing disciplines - remain insufficiently recognized as valuable contributors capable of effectively advancing organizational or regional digital initiatives, despite their potential. Regional communities face particular challenges. Limited access to digital education, demographic aging, and resource constraints heighten susceptibility to cybercrime. Moreover, collaboration between educational institutions, industry, and public agencies often remains fragmented. This case study was conducted with the expectation that, in order to mitigate such fragmentation, fostering career awareness among individuals expected to address regional digital challenges, together with the effective implementation of collaborative and practice-based learning through PBL, would function as a means of problem solving.

However, sustaining such industry-led experiential collaborative activities proved challenging. Although both industry and public agencies exhibited strong demand for student collaboration,

recruiting participants was difficult. In this case, student engagement relied primarily on the cooperation of participants from the digital learning sessions and digital career-support workshops organized by the author. While this approach was effective in attracting highly motivated participants, it remained insufficiently developed as an institutional foundation for the stable provision of PBL. Moving forward, it will be essential for industry and public sectors to raise awareness of such initiatives in order to recruit students more effectively. Ideally, continuous student participation would be secured through the allocation of academic credits.

From a theoretical perspective, collaborative initiatives involving universities, industry, government, and society can be interpreted through innovation ecosystem frameworks. The Triple Helix model conceptualizes innovation as interactions among universities, industry, and government (Etzkowitz & Leydesdorff, 2000). Carayannis and Campbell (2009) expanded this framework into the Quadruple Helix model by incorporating civil society as a fourth helix, emphasizing the role of public participation in innovation ecosystems. Recent studies have applied this perspective to digital society issues. For example, Kulikauskienė (2021) proposed a Quadruple Helix framework for addressing digital inclusion, highlighting the collaborative roles of academia, industry, government, and society in solving digital challenges. The present study interprets the Miyazaki initiative as a regional collaborative practice that reflects such a multi-stakeholder framework. In this sense, the initiative provides a small-scale empirical example illustrating how Quadruple Helix interactions can emerge in regional digital resilience initiatives.

3. METHODOLOGY

3.1. Research Design

This study was designed as a qualitative exploratory case study examining the implementation process and initial outcomes of a cybersecurity awareness initiative involving the participation of students from non-computing disciplines (including liberal arts) conducted in Miyazaki Prefecture through collaboration among police authorities, an IT company, and university students. The objective is to analyze how interdisciplinary student participation contributed to regional cybersecurity awareness and institutional collaboration. Given the small-scale and practice-oriented nature of the initiative, the study emphasizes contextual depth rather than statistical generalization. The project included a practice-based collaborative component in which police officials provided statistical data, while the effectiveness of the cybersecurity awareness video produced by the students was evaluated by both university faculty and police representatives from the perspective of public communication. In addition, the study offers an exploratory model of institutional collaboration within industry–academia–government partnerships for addressing regional challenges.

3.2. Participants

Approximately five undergraduate students majoring in non-computing disciplines, including liberal arts fields, participated in the project. Under the guidance of a director from an IT company, the students analyzed regional cybercrime trends, proposed awareness strategies, and produced informational videos.

3.3. Data Collection

The primary data consisted of anonymized internal cybercrime statistical data provided by the Miyazaki Prefectural Police under institutional agreement. The dataset included the number of incidents by crime category over a specified period. No personal data were accessed in the course of this study. Students analyzed statistical trends to extract regional characteristics and risk patterns. Their analytical results were submitted to police representatives, who provided expert review regarding interpretive validity and contextual appropriateness. This activity was implemented as an extended collaboration of a digital career support workshop organized by the author in partnership with the police. All participants joined voluntarily as a continuation of the aforementioned workshop, and although some university faculty members provided support and review, the activity

was not directly associated with formal university courses or curricula at the time. While the participating students did not necessarily possess advanced digital skills, they improved their competencies through guided instruction in the use of spreadsheet software such as Excel, presentation skills, the use of generative AI, information dissemination, and collaborative communication through chat-based tools. The study complied with relevant ethical standards governing research collaboration and data use. Several compliance-related considerations emerged in this study. The use of anonymized cybercrime data provided by the police required careful attention to data handling, privacy protection, and institutional agreements. In this sense, ensuring ethical compliance did not constitute a major barrier but rather functioned as an important learning opportunity. The collaboration enabled students to engage with real-world ethical standards, including data responsibility and communication ethics, thereby enhancing their understanding of compliance in practice.

3.4. Analytical Approach

Analysis was conducted using descriptive and interpretive methods. Crime frequency, financial damage, distribution patterns, category–based tendencies, and temporal changes were organized into comparative categories and time-series trends and examined. From these observations, thematic interpretations regarding regional digital risk and social vulnerability were derived. Basic indicators - including year-on-year increases in financial damage, monthly crime-type frequencies, and patterns of peak occurrence—were used to identify high-risk categories and trends in crime victimization.

3.5. Modelling a Collaborative Framework for Regional Cybersecurity Awareness

The project was implemented through collaboration among a university (students from non-computing disciplines), a regional IT company, and the Miyazaki Prefectural Police, with the broader community positioned as the target of cybersecurity awareness activities. This structure represents a practical configuration of the Quadruple Helix model, encompassing academia, industry, government, and civil society in a regional context. Within this framework, each stakeholder assumed complementary roles, and the integration of data analysis, contextual interpretation, and public communication was achieved.

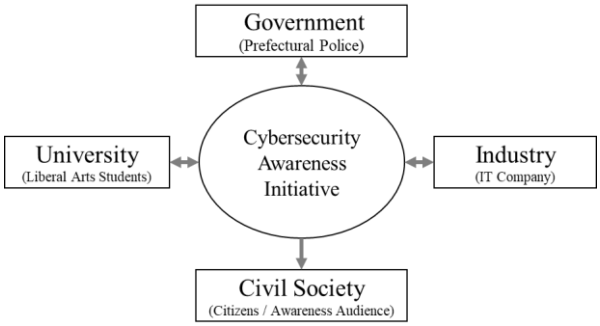

Figure 1 - Collaborative framework illustrating the application of the Quadruple Helix model in the Miyazaki cybersecurity awareness initiative

4. PROJECT DESIGN AND IMPLEMENTATION

The initiative was structured around tripartite collaboration among Miyazaki Prefectural Police, a regional IT company, and university students. Police authorities provided anonymized cybercrime statistics and contextual explanations. The IT company offered technical and strategic guidance. Students conducted analysis and developed awareness materials, including video content tailored to regional audiences. Workshops facilitated iterative discussion, enabling participants to integrate statistical evidence with contextual understanding. This collaborative design emphasized practical engagement and mutual learning. This collaboration was designed by the author as an extension of a workshop-based PBL initiative following a consultation request from the police in June 2025. Prior to the end-of-term examinations, students were provided with an explanation of the project and their willingness to participate, as well as preferred implementation schedules, were confirmed. The activity was conducted outside formal class time and began in earnest after the examinations, continuing into the summer vacation period. The initial draft was completed within approximately one week, followed by a short period of stakeholder review,

and was largely finalized by September. The completed materials were broadcast on a local public display system in November, and in December, the participants received a letter of appreciation from the police and the project was covered by local media.

5. OUTCOMES

The project yielded several observable outcomes. First, students increased their awareness of regional cybercrime patterns and developed a sense of the urgency of cybercrime as a critical issue even in local cities in Japan. Second, they gained experience in interpreting real crime statistics provided under ethical considerations within social contexts and communicating their findings to society based on creative perspectives. Third, the collaboration demonstrated a practical example of communication among regional institutions, private companies, and educational organizations. Fourth, awareness materials were produced and disseminated, contributing to increased public awareness of cybercrime and the development of digital human resources in the region.

Furthermore, participating students gained practical experiences of success through recognition from the police and coverage by local media, which allowed them to perceive that their activities had a tangible impact on society. They also received feedback from friends and family, including praise for their activities and recognition of the importance of cybercrime awareness. Although exploratory in scale, these outcomes indicated that PBL initiatives such as this case could enhance both the development of individuals capable of recognizing and promoting solutions to digital challenges and regional engagement.

6. BENEFITS, LIMITATIONS, AND REPLICABILITY

The initiative demonstrates several advantages. It leverages liberal arts competencies—critical thinking, ethical reflection, and communication—to complement technical cybersecurity efforts. It also fosters institutional trust among academia, industry, and public authorities.

Although context-dependent, the model may be adaptable to other regional settings, provided that stakeholders commit to collaborative engagement and data-sharing frameworks. In this case, the initiative originated from trust-building through the accumulation of small-scale collaborative activities led by private-sector digital professionals engaged in cross-sectoral support across academia, industry, and government. This was followed by the clarification of mutual benefits and alignment with institutional needs, which enabled project implementation and knowledge transfer. Once the project gained momentum, the capabilities of public institutions and students exceeded initial expectations. Such regionally embedded leadership can provide role models for the next generation and facilitate skill transfer, suggesting that similar approaches may be applicable in other regional contexts.

However, this study has several limitations. The small number of participants and the single-region case design limit the generalizability of the findings. The study does not include control groups or pre–post comparisons; therefore, causal claims regarding educational effectiveness remain limited. Nevertheless, the research provides meaningful insight into interdisciplinary collaboration under real institutional conditions.

7. FUTURE DIRECTIONS

Ideally, the continuous recruitment of student participants would be institutionally secured by integrating the program into the formal curriculum and granting academic credit, thereby establishing a stable and sustainable cycle of human resource development. At present, participation is fostered primarily through voluntary mechanisms such as regional digital skills workshops and digital–sector career support programs. While this approach cultivates highly motivated participants, it remains underdeveloped as a long–term institutional foundation. Future efforts should expand collaborative partnerships, secure financial and human resources, and align the initiative with broader policy frameworks—such as Japan's Digital Agency policies and METI's digital human resource strategies—to connect regionally developed talent with national digital human

resource strategies.

Furthermore, while this case involved students from non-computing disciplines, increasing participation by students majoring in digital and information security fields would enable more substantive interdisciplinary exchange and contribute to the further development of PBL design. Interaction between non-computing students and digital specialists can generate intellectual stimulation, enhance mutual understanding, and promote the resolution of regional challenges. At the same time, such interaction can raise awareness of roles and career paths that contribute to problem-solving in the AI era, and serve as a model for developing individuals capable of interpreting, collaborating on, and contributing to the resolution of social issues.

8. CONCLUSION

The Miyazaki initiative demonstrates how collaboration among universities, public institutions, private-sector actors, and local communities can contribute to enhancing cybersecurity awareness and strengthening digital resilience at the regional level. The project further clarifies that collaborative education emphasizing critical thinking and interpretive capacity can function as a practical approach to addressing digital risks while strengthening connections between higher education and local society.

This case study aimed to prevent cybercrime through regional collaboration among academia, industry, government, and society, involving students from non-computing disciplines. Such problem-solving initiatives enhance recognition of these students—whose potential as future advanced digital human resources has not been sufficiently acknowledged—and provide them with practical experiences of success. In doing so, the initiative expands the social foundation of advanced digital human resource development beyond a sole reliance on technical expertise. In contrast to conventional digital human resource development models that emphasize technical specialists and system-oriented responses, it highlights human agency—grounded in interpretive capacity, critical thinking, and collaboration—as well as the active participation of diverse stakeholders, including the public. In this respect, the initiative is consistent with METI's concept of the "business architect." Furthermore, expanding participation to include students specializing in digital fields can generate constructive interdisciplinary interaction and support more robust human resource development.

From a theoretical perspective, these findings can be interpreted through the framework of innovation studies. This study adopts the Quadruple Helix model to account for the role of civil society, particularly local communities and students, as active participants in regional cybersecurity awareness and digital resilience, building on the Triple Helix model, which conceptualizes innovation as interactions among universities, industry, and government (Etzkowitz & Leydesdorff), while the Quadruple Helix model further incorporates civil society as a key participant in innovation ecosystems (Carayannis & Campbell, 2009). In this sense, the Miyazaki initiative represents a practical example of the Quadruple Helix in action, where academia, industry, government, and society collaboratively address challenges of the digital era, particularly in the areas of cybersecurity awareness and digital inclusion. Although exploratory in scale, this case suggests that liberal arts–based collaborative education can function as a practical mechanism for activating Quadruple Helix relationships in regional digital governance.

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Beyond Control and Enthusiasm: A Ten-Phase Model for Pedagogical AI Integration in Academic Writing

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Abstract: The rapid adoption of generative AI among students and faculty has confronted universities with a pedagogical challenge that neither prohibitionist control strategies nor uncritical enthusiasm adequately address. The present paper puts forward the argument that a deliberate, process-oriented framework is required; one that renders the use of AI visible, discussable and educationally meaningful. The present study draws on the cognitive process tradition of Flower and Hayes (1981) and Bereiter and Scardamalia's (1987) distinction between knowledge-telling and knowledge-transforming writing. In this paper, a foundational conceptual distinction is introduced between AI-supported authorship and AI-displaced authorship. On this basis, a ten-phase model of academic writing is proposed. This model functions as a transparency scaffold rather than a prescriptive sequence, thereby making the recursive subprocesses of academic writing explicit. This enables students to reflect on their use of AI within each phase. Seven competence dimensions—including process awareness, AI-related information literacy, evaluative judgment, didactic prompt design, transparency and documentation, ethical and legal awareness, and cooperative AI use—translate the model's logic into teachable and assessable criteria.

1. INTRODUCTION

Over the past two years, generative AI systems such as ChatGPT have become an integral part of student and academic work. Data from the AI Monitor 2025, a nationwide study of German universities (HFD, 2025), illustrates the speed and breadth of this adoption: 91% of students and 68% of faculty report using tools such as ChatGPT, DeepL Write, or Grammarly. This empirical study concludes that students in Germany primarily use generative AI for exam preparation (76%), text production (64%), and information retrieval and research (59%). Faculty members use it primarily to create teaching materials, assignments, and for providing feedback. These figures present universities with a decision that goes deeper than the question of rules or detection mechanisms: How should we respond to a tool that deeply impacts core academic practices—namely, scholarly writing? Two approaches have dominated the discourse so far, and both fall short. On the one hand, there is mistrust and control: the call for reliable "AI detectors," for stricter examination formats, for institutional bans. This impulse is humanly understandable, but factually

problematic. Current research and legal opinions demonstrate that existing detectors are technically unreliable, legally fragile, and epistemically opaque: They produce a significant number of false positives and false negatives, cannot cite verifiable sources in the sense that plagiarism software does, and generally lag behind the latest model generations (Baresel et al., 2025). Even more serious is that an overemphasis on the control function distracts universities from one of their core tasks: fostering critical thinking. On the other hand, there is an uncritical enthusiasm that views generative AI primarily as a productivity tool—and in doing so risks undermining central educational goals: independent thinking, argumentation skills, and the understanding of academic work as a process.

This article takes a different approach. Instead of relying on control or euphoria, we ask: How can we identify the points in an academic writing process where AI can be usefully integrated—and where fundamental debates about authorship, intellectual property, original contribution, and the acquisition of academic competence are absolutely essential? This approach builds on the tradition of critical thinking. It views integration not as a capitulation to a tool, but as a prerequisite for students to make informed, reflective, and responsible decisions when dealing with AI (Weimann-Sandig, 2023). Such an integrative stance requires structured guidance—not despite, but precisely because of the openness and ambivalence that generative AI introduces into academic writing processes.

The strongest objection to the framework proposed here could, of course, be the one that assumes that intensive independent reading and autonomous writing may simply produce better learning outcomes than any form of AI-assisted composition, and the pedagogical energy invested in managing AI integration might be better spent defending and cultivating those practices. This objection deserves to be taken seriously. There is robust evidence that cognitive struggle produces deeper and more durable learning than assisted performance (Shanley, 2026; Klein, 2023). The present framework does not dispute this. It proceeds, however, from a different empirical starting point: the question is no longer whether students *should* encounter AI in academic writing contexts, but how they already do, and under what conditions that encounter can be pedagogically structured rather than left unmanaged.

2. ACADEMIC WRITING MODELS: CURRENT STATE OF RESEARCH

A seminal shift in the field of writing research was initiated by the cognitive process model of Flower and Hayes (1981). Previous literature on academic writing (e.g., Britton, 1977) has typically suggested a predominantly linear progression from literature review to drafting to final revision, thus emphasizing the text as a product. Conversely, Flower and Hayes (1981) conceptualize writing as a goal-directed and recursive process, wherein planning, formulating, and revising interact continuously throughout the composing process. In this view, writers set and adjust goals, monitor the emerging text, and develop ideas through the act of writing itself. This means that composing functions not only as communication but also as discovery and conceptual clarification. Later work (Hayes, 2012) have highlighted the role of goal setting, working memory, and the social-material environment in the regulation of these recursive cycles. The distinction between process and product needs to be clarified, as this is often erroneously interpreted as a dichotomy. This is not the case. The written product is precisely the sedimented form of the process: it bears the traces – visible or invisible – of the planning decisions, the discarded formulations, the revised arguments, and the knowledge transformations that produced it. From a process perspective, the product is not rejected but examined – as evidence of the decisions and reasoning that shaped it. This distinction matters particularly with AI-tools. When assessment focuses exclusively on the submitted text, the question of how that text came to be—which cognitive operations were performed by the student, and which were delegated to a tool—remains systematically invisible. Conversely, a process-oriented lens enables educators and students to formulate more precise inquiries, focusing not on the AI-generated output, but rather

on the specific components of the writing process that the AI either supported, reshaped or displaced. This reinterpretation builds on Bereiter and Scardamalia (1987), who drew a distinction between knowledge-telling and knowledge-transforming writing. In knowledge-telling, the writer retrieves and transcribes existing content; in knowledge-transforming, the writer restructures both content and rhetorical goals through the act of composing. Academic writing, as conceived by higher education, exemplifies knowledge transformation (Bereiter & Scardamalia 1987). It demands that the writer formulate research questions, construct and evaluate arguments, integrate and critically assess sources, and revise reasoning under uncertainty. These are not merely incidental features of academic work but precisely the operations that generative AI is capable of performing, simulating, or substituting. This distinction forms the foundation for differentiating between two qualitatively distinct modes of AI involvement in academic writing. We use two terms throughout this paper: "AI-supported authorship" and "AI-displaced authorship". In the context of AI-supported authorship, generative AI functions as a heuristic aid within a writer's own recursive goal-directed activity (Buck, 2026). This activity may involve asking to suggest counterarguments, seeking help with alternative phrasing, or generally receiving support during the revision process. However, the writer retains executive control over planning, conceptual decisions, and evaluative monitoring (Brommer et al., 2023; Limburg et al., 2023). In contrast, in AI-displaced authorship, the substantive knowledge-transforming operations are outsourced: The use of artificial intelligence in academic research entails the formulation of research questions, the structuring of arguments, and the production of draft text. The student then adopts this draft with only superficial changes (Buck, 2026). The transformative act of writing was not carried out by the learner, but by the tool, and was subsequently merely validated. A process model, however, illustrates the cognitive work expected of students, including goal-setting, planning, and structuring; the translation of ideas into text; and the evaluation and revision of the argument. From this perspective, academic writing is not merely a means of assessing performance, but a central arena where knowledge is organized, questioned, and expanded. This is precisely why generative AI raises not only questions of integrity but also pedagogical questions: If the tool can perform the knowledge-transforming processes that academic writing is actually intended to foster, what purpose does academic writing at universities still serve (Shanley, 2026; Brommer et al., 2023)? A process-oriented perspective facilitates the design of learning and assessment formats that make cognitive work visible and open to discussion (Boud & Dawson, 2023). In the context of writing instruction, these can include, for example, intermediate products such as exploratory notes, outlines, or partial drafts. When generative AI is incorporated, documentation of the process is required regarding the use of AI in the various writing phases. To achieve this, however, students must first be encouraged to break down the academic work process into individual steps. Something that, as shown in the next chapter, is not self-evident for all students.

3. TOWARDS AN INCLUSIVE AI-WRITING MODEL

This paper is founded on the cognitive process tradition and assumes that a stronger orientation towards process models of writing enables students and instructors to integrate generative AI more deliberately and more responsibly (Buck, 2026; Brommer et al., 2023). In the model proposed by Flower and Hayes (1981), the process of writing is not conceived as a linear chain of steps, but rather as a recursive system of interacting processes. These processes, which include planning, drafting, and reviewing (and consequently evaluating and revising), are coordinated through a form of executive control, often described as monitoring. Furthermore, the process of writing is continuously shaped by the task environment, such as the assignment, audience, genre, and constraints, as well as the writer's long-term memory, which encompasses domain knowledge, discourse conventions, and strategies. Later developments (Hayes, 2012) further highlight the role of goal setting, attention and the social-material

environment in regulating these cycles. This theoretical lens matters for the AI debate because generative AI tools can intervene in *each* of these subprocesses: they can support planning (e.g., generating options), translation (e.g., producing draft language), and reviewing (e.g., suggesting revisions). The pedagogical question is therefore not whether AI can produce text, but which cognitive steps the writer delegates to the tool – and why. This distinction matters epistemologically: students who outsource certain writing steps out of genuine curiosity or acquired competence engage with AI differently than those who delegate because they lack the underlying tools. In the latter case, it becomes important to further distinguish whether a foundational understanding is missing or whether the student simply lacks practice. AI use that substitutes for underdeveloped competences risks foreclosing the very learning process that academic writing is meant to support (Bereiter & Scardamalia, 1987). The goal, then, is not to prohibit delegation, but to make it legible – to help students recognize which steps they are handing off, and to reflect on what that reveals about their own epistemic position. This is precisely the approach we are taking in the BediRa higher education development project. The empirical and developmental grounding of this paper draws on the BediRa project (*Building Reflexive Professionalism and Relationships in Remote Teaching*), a higher education development initiative located at the University of Applied Sciences for Social Work, Education and Nursing (EHS Dresden, Germany). The project was initiated in response to the experiences of emergency remote teaching during the COVID-19 pandemic, which revealed both the structural limitations of existing digital teaching practices and the largely untapped potential of involving students as co-constructors of learning environments (Weimann-Sandig, 2022). BediRa encompasses three interconnected formats: a student-led ThinkTank that organizes cross-curricular online test labs in a weekly 60-minute format, in which students and faculty jointly explore digital tools and reflect critically on their affordances and risks; a course on Digital Literacy and Academic Writing, in which generative AI has been systematically integrated as an object of critical inquiry; and a service portal on digital teaching and learning, offering didactic teaching-learning scenarios. BediRa operates on the principle that neither students nor teachers hold exclusive expertise in navigating digital transformation: knowledge is understood as co-constructed, and students are positioned as partners rather than recipients (Cook-Sather, Bovill, & Felten, 2014; Weimann-Sandig, 2023). The project thus provides both a practical testing ground and a conceptual reference point for the didactic proposals developed in this paper. In the BediRa test labs, research involving generative AI has consistently been a major focus. Over the course of four semesters, approximately 200 students explored which stages of the research process can be supported by generative AI and why critical thinking strategies help shape interactions with generative AI in line with the human-in-the-loop approach (von Garrel, 2026).

This article argues that both outright bans and uncritical enthusiasm for such tools are inadequate responses to generative AI in academic writing. Three interrelated arguments support a deliberate, pedagogical integration. First, a sociocultural perspective on learning (Vygotsky, 1978) shows that the construction of knowledge is inextricably linked to the cultural tools and symbolic environments in which learners operate. If, as current data on media use consistently confirms (Gonser, 2024; HFD, 2025), students' lived environments are strongly shaped by digital and AI-supported environments, then excluding these tools from higher education does not result in a neutral learning environment; rather, it creates an artificial environment that is disconnected from the lived environment in which students currently find themselves. Second, a critical engagement with any technology requires a well-founded and reflective experience with it, and ideally, this experience should be guided. Universities must therefore increasingly see themselves as spaces for gaining experience in working with generative AI (Cox, 2024). Banning or ignoring generative AI in academic writing instruction means that students will develop their practices informally, influenced

by peer networks and commercial platforms rather than by academically grounded judgment. Integrating AI into university curricula also means that we must familiarize ourselves with students' biographical backgrounds. At many universities, the number of first-generation college students has risen sharply—a trend that must be actively promoted as part of efforts to reduce educational inequalities. However, this also means that a large number of students are not automatically familiar with academic standards through family socialization (Lea & Street, 1998). It is precisely these students who, out of a sense of perceived inadequacy, tend to trust the expertise of AI more than their own. Third, prohibitionist strategies reinforce tendencies toward avoidance and defensive regulation, as has already been documented among university instructors in German studies (Weßels, Bils & Budde, 2025; Budde, 2024). This leads to a lack of engagement on the part of instructors with the pedagogical integration of AI into teaching and, consequently, to a role dilemma (Budde, 2024). If students believe that generative AI would have provided them with a more insightful answer than the instructor, how does this affect the relationship and trust between instructors and learners, especially when instructors themselves refuse to engage in such a discourse?

To summarize the argument developed so far: this paper proposes the integration of generative AI into academic writing instruction as a component of critical thinking education – not as a concession to technological inevitability, but as a response to the epistemic realities of students' lived environments. We proceed from the assumption that the capacity to engage reflectively with AI tools is itself an essential academic competence. The didactic goal of the learning formats we propose is therefore not rule compliance, but informed judgment: students should, by the end of such a learning unit, be able to assess for themselves where AI involvement supports their writing process and where it risks displacing the very cognitive work that academic writing is meant to develop. Achieving this requires institutional spaces in which such reflection can take place – spaces that universities, as sites of formation rather than mere credentialing, are uniquely positioned to provide. It also requires, however, a prior and honest inquiry into what students already know about academic writing, how they have engaged with it so far, and where their uncertainties lie. This is precisely the starting point of the BediRa test labs.

4. THE IDEA: A 10-PHASE MODEL OF SCIENTIFIC WORK

The following observation is not merely anecdotal: In BediRa test laboratory sessions on academic writing with AI, 200 first-semester bachelor students who had already completed a mandatory academic writing module were asked to map their own writing process. Over 70% described their process in three stages or fewer—a finding that is striking given that even introductory models in German writing pedagogy operate with at least five steps (Girgensohn & Sennewald, 2012, p. 102). The implication is not that students had forgotten their instruction; it is that the instruction had not produced a workable, differentiated process model that students could carry forward and apply independently. In contexts where generative AI is available, this gap becomes structurally consequential: a student with an underdeveloped process conception has no framework within which to locate AI use, evaluate its appropriateness, or recognize what cognitive work is being displaced. This objection must be taken seriously: if generative AI consistently performs the cognitive operations that academic writing is meant to develop, then integrating it without pedagogical structure does indeed risk foreclosing the formation of core competences. We also provide a platform for them to state that they do not consider the use of AI in academic work to be desirable at all, and to explain why. Consequently, the aim here is not to make AI a requirement, but rather to establish conditions for its use—or even to support the conscious decision to do without it.

In line with the co-constructive learning approach, students developed, discussed, and revised the steps of the academic research process over several phases. In the end, it became clear that, particularly for the integration of generative AI, a granular

process model appears practical for students because it helps them break down both work steps and thought processes, thereby enabling them to reflect on them more deeply. This resulted in a **10-phase model**, which is examined in more detail below. We therefore propose this ten-phase model as an inclusive scaffold that translates the abstract recursion of Flower and Hayes (1981) into units that can be taught, discussed, and reflected upon. This should not be misread as a return to linearity. The ten phases are a didactic decomposition, not a sequence: each phase corresponds to a cluster of goals and subprocesses – planning, translation, reviewing – and can be revisited at any point in the writing process. The value of this decomposition is, first, one of inclusivity. Making the phases explicit reduces reliance on the tacit knowledge about how academic writing 'is done' that students from non-academic backgrounds often cannot draw upon. Second, a phase-sensitive scaffold makes it possible to define AI use as guided inquiry rather than product generation, because prompts can be tied to the specific epistemic goals of each phase – challenging assumptions during framing, testing argument coherence during revision. Third, and not least, explicit phases make AI use both documentable and assessable: the relevant question shifts from whether AI was used to how it functioned within a specific phase and in relation to the learning aims associated with it. It is also necessary to provide a terminological clarification prior to the presentation of the phases. Phases 5 (micro-planning and paragraph-level design) and 6 (drafting and initial text production) may appear to be inseparable from a cognitive perspective, and in one sense they are: research in cognitive process (Flower & Hayes, 1981; Hayes, 2012) consistently shows that planning and translating are recursively intertwined rather than sequentially ordered – writers plan as they draft, and drafting reshapes their plans. The distinction drawn here is therefore not a claim about cognitive sequence, it is a didactic one. Students who have previously been exposed to the implicit conventions of academic writing, whether through family socialisation, intensive prior schooling, or extensive academic reading, often exhibit a high degree of automaticity in many micro-structural decisions. These decisions encompass aspects such as the initiation of a paragraph, the indication of an argumentative transition, and the management of the claim-evidence-commentary structure. For students who have not had this access, these decisions remain opaque and effortful precisely because they have never been made explicit (Lea & Street, 1998). The rendering of these elements as a discrete phase does not imply that competent writers treat micro-planning as a separate step. Rather, it is a pedagogical strategy that facilitates the transition from structural planning to the production of a legible and discussable text. This strategy is beneficial for individuals who may not be aware of the expectations at this stage. This design choice is directly consistent with the inclusive rationale previously stated: the ten phases function as a transparency scaffold. The value of these resources lies not in prescribing a particular writing sequence, but in providing a shared vocabulary that students and instructors can use to locate, discuss, and critically evaluate where generative AI was involved—and to what effect.

Ten phases (overview)

We operationalize the recursive writing process as ten phases. The phases are not a prescribed sequence; writers may move back and forth between them as their goals, evidence base, and drafts evolve. The phases are: (1) topic exploration and task clarification, (2) exploratory reading and literature orientation, (3) research question and conceptual framing, (4) planning and macro-structuring the argument, (5) micro-planning and paragraph-level design, (6) drafting and initial text production, (7) revising and evaluating, (8) source integration, citation, and documentation, (9) surface editing and finalisation, and (10) metacognitive reflection on the process. Across all phases, a cross-cutting principle applies: AI outputs are treated as proposals requiring verification, justification, and alignment with disciplinary norms. Students document (minimally) what they used AI for, why in that phase, and how they verified—or decided against—suggestions. **Table 1** summarizes phases 1-9:

Table 1 - Nine phases of Academic Writing with AI-specific writing support. Source: own illustration.

Phase	Process-model link (Flower & Hayes, 1981; Hayes, 2012)	Epistemic purpose (what students should learn/do)	Legitimate AI role (as heuristic aid)
1. Topic exploration & task clarification	Task environment analysis; initial goal setting (planning)	Make constraints explicit (genre, audience, scope, assessment criteria)	Clarifier: generate interpretations of the task; surface hidden assumptions; suggest feasible scopes
2. Exploratory reading & literature orientation	Long-term memory building; planning (knowledge gathering)	Map a field, identify debates, concepts, and search directions (without claiming completeness)	Mapper (verification-heavy): propose keywords, clusters, contrasts based on provided sources/abstracts
3. Research question & conceptual framing	Planning; goal refinement; monitoring (fit of question and evidence base)	Move from topic to investigable question; define terms; select perspective	Socratic framer: critique scope/ambiguity; propose alternative lenses; ask counter-questions
4. Macro-structuring the argument	Planning; goal hierarchy; rhetorical problem solving	Design overall architecture; align sections to the research question	Structure challenger: propose alternative outlines with explicit rationale; identify "burden of proof" points
5. Micro-planning (paragraph-level design)	Planning ↔ translating interface; local goal setting	Turn macro structure into paragraph moves (claims, warrants, evidence placement)	Warrant tester: ask what evidence is needed; stress-test inferences; generate topic-sentence options
6. Drafting & initial text production	Translating; continuous monitoring	Produce a workable draft while preserving authorship of claims and reasoning	Expression support: improve clarity/register; offer alternative phrasing **without** replacing reasoning
7. Revising & evaluating (global/local)	Reviewing; evaluation; revision cycles; monitoring	Test coherence, alignment, and argument strength; revise substantively	Reviewer simulator: generate objections; identify drift/inconsistencies; suggest revision strategies
8. Source integration, citation & documentation	Task environment (integrity norms); reviewing for attribution	Integrate sources with clear function; ensure correct citation; document AI use where required	Source-bound assistant: help with citation formatting and attribution language; never invent sources
9. Surface editing & finalisation	Reviewing at surface level; task constraints	Ensure correctness, consistency, and formatting compliance	Consistency checker: grammar/style, terminology consistency, readability/accessibility checks

Phase 10 (metacognitive reflection) is intentionally excluded from AI support. Reflection serves to consolidate self-regulation and transfer by requiring students to articulate what they learned, where they struggled, and how they will adapt their strategies next time. For this reason, it should be completed independently and assessed as the student's own account of their writing process.

A first empirical indication of the model's pedagogical utility comes from the BediRa writing course itself, where 20 students applied the ten-phase model to an actual term paper and subsequently reflected on the experience. The results, while preliminary, are instructive. More than half of the participants reported that prior to the course, they had engaged with generative AI in a predominantly production-oriented mode – submitting direct instructions such as *"Create a research question for my paper on topic X in module Y"* and adopting the output with minimal revision. Following their engagement with the ten-phase model, several of these students described a qualitative shift in how they formulated their prompts. Rather than requesting a finished product, they began using AI to clarify their own epistemic situation – asking, for instance, what a viable research question might look like for a specific module with a particular thematic focus, and then evaluating the response against their own developing understanding of the subject matter. In essence, what changed was not the tool, but the students' orientation toward it: from output retrieval to process inquiry. At the same time, four of the twenty participants responded to the model with a degree of skepticism that deserves to be taken seriously rather than dismissed. For these students, the ten-phase framework did not feel like a scaffold but like an additional burden: it made visible how much reflexive work a properly conducted writing process actually involves – and how little time the structural conditions of their degree programme allow for it. This is not a weakness of the model, but a systemic observation it enables. If students can now articulate that the problem is not their willingness to reflect but the temporal and institutional conditions under which they write, then the model has already done part of its critical work. The discomfort it produced in these cases is not a failure of the didactic intervention; it is, arguably, one of its more important effects

5. DIMENSIONS OF COMPETENCE FOR USING GENERATIVE AI IN ACADEMIC WRITING

Based on these initial findings, as part of the BediRa project, we have been working with the students to repeatedly discuss and develop the competencies needed to consistently implement such an inclusive 10-phase model—both as learners and as teachers—since our approach is based on co-constructive knowledge acquisition. These competences can be aligned with specific phases of the writing process. The seven competence dimensions outlined below are not intended as a taxonomy for summative grading. The objective is to facilitate discussion and, when deemed pertinent, evaluation of these procedures. For each dimension, we give at least one example

from practice, drawn from the BediRa project.

The **first competency is process awareness**, which can be defined as an understanding of academic writing as a multi-stage epistemic and communicative process, rather than as a one-time product to be produced. Students with a high degree of process awareness can distinguish between phases such as topic selection, planning, drafting, revision, and final editing, and articulate the various cognitive and epistemic functions of these phases (Flower & Hayes, 1981; Kieft et al., 2006). In the BediRa writing course, we presented students with a term paper written by AI to help them practice this skill and had them switch roles. They then acted as first and second reviewers to evaluate this paper, meaning they had to work in pairs to examine how the process of topic selection, the logic of the argumentation, and the development of the theoretical framework might have taken place, and how plausible this seemed to them. A student demonstrating low process awareness might describe their writing process in two or three undifferentiated steps and use AI to generate a complete draft. A student demonstrating high process awareness can articulate which specific cognitive goals were at stake in a given phase, explain what they delegated to AI within that phase, and reconstruct the reasoning behind those decisions in Phase 10 reflection. Instructors can assess this aspect by asking students to submit a brief reflection on their work process along with their final paper. In research papers, critical reflection on the research process is an essential component for demonstrating the validity of the research; this approach could be adopted for academic writing as well. The relevant indicator is not the maturity of the report, but its level of detail: For example, a student who can distinguish between a planning decision and a revision decision demonstrates a qualitatively different level of process awareness than someone who views their work as a mere writing and editing process.

The **second dimension concerns AI-related information literacy**, that is, the ability to critically evaluate AI-generated information and sources. Students must understand the potential pitfalls of generative models, including their tendency to invent facts and sources, reproduce biases, and make claims that appear convincing at first glance but are unsubstantiated (Kasneci et al., 2023). The production of so-called fake news or fake facts is a central part of our students' everyday lives. They are inundated with such a flood of information that they often find it difficult to distinguish between reality and pseudo-realities, as recent studies show. In the context of academic work, the BediRa test labs showed that nearly 100% of students trust the scientific facts presented to them by generative AI because they lack the necessary background knowledge to question these facts. In this regard, the focus of skill development here was primarily on demonstrating verification techniques and alternative research methods. Competence in this dimension manifests along a discernible continuum. At a nascent level, students accept AI-generated claims without scrutiny, treating confident prose style as a proxy for factual reliability and making no attempt to verify citations or trace claims to primary sources. At an intermediate level, students demonstrate awareness that AI outputs can be unreliable and apply selective verification – checking sources when they appear implausible or unfamiliar, but still relying on surface plausibility as a first filter. At an advanced level, students treat AI-generated information as a starting point requiring systematic verification by default: they cross-reference claims against primary literature, flag unverifiable assertions in their writing, and can articulate specific mechanisms – such as token-prediction dynamics or training data biases – that explain why a given output may be misleading. This progression from passive reception to active, structurally informed scrutiny is precisely what the model aims to support through its verification-focused phases. Instructors may ask students to document at least one instance in which they verified or rejected an AI-generated claim, including the verification method used. The ability to provide a specific reason—for example, that a cited work does not exist or that the claim misrepresents the source.

As Tai et al. (2018) explain, a **third dimension**

consists of an evaluative assessment specifically applied to AI-generated outputs. Students must assess the suitability of AI-generated texts for academic purposes, evaluating their accuracy, conceptual appropriateness, the appropriate length for the assignment, and compliance with disciplinary conventions. This encompasses not only superficial criteria (e.g., grammar, coherence) but also substantive academic standards, including the quality of argumentation, the use of evidence, and the text's contribution to scholarly debates. In the process of drafting and revising, evaluative judgment is of crucial importance, as students might be tempted to uncritically adopt AI-generated phrasing. Without this competence, the use of AI in education carries the risk of improving the superficial quality of written work while simultaneously undermining students' ability to construct and evaluate arguments independently. In the BediRa project, AI platforms such as POE were used here, which allow for the comparison of different AI agents, so that students can also gain a sense of the different stages of development of generative AI. In addition, AI-generated texts were examined for weaknesses in their argumentation using the Socratic dialogue method (Stavemann, 2008). This dimension is assessable through targeted revision tasks: students are asked to evaluate an AI-generated paragraph against the disciplinary conventions of their field and to justify any changes they make. The relevant indicator is the quality of the justification – whether the student can articulate why a formulation is argumentatively weak or disciplinarily inappropriate, rather than merely substituting their own preferred phrasing

It is also important to consider a **fourth dimension** in policy debates, which is often overlooked. This is the **didactic prompt design**. In contrast to the utilisation of prompts for the primary purpose of saving time or outsourcing cognitive effort, it is imperative for both students and teachers to cultivate the capacity to design prompts that facilitate profound learning. This can be achieved by, for instance, eliciting counter-arguments, alternative theoretical perspectives, or critical questions (Brommer et al., 2023). The ability to competently and promptly design is comprised of the following competencies: In order to formulate effective prompts, it is necessary to consider the phase of the writing process to which they are to be attached. For example, in the context of a discussion section, it is important to suggest possible structures for this section, rather than simply writing it for the reader. In addition, the model should be invited to surface assumptions, limitations, or missing perspectives. Finally, it is important to use AI interaction as a form of scaffolded dialogue that supports conceptual development, rather than replacing it. This dimension is of particular relevance during phases of planning, argument development, and metacognitive reflection, where prompts can be designed to stimulate higher-order thinking. Instructors can ask students to include two or three representative prompts in their AI log, together with a brief reflection on the intent behind each. The performance indicator is whether the prompt is designed to elicit a response that supports the student's own thinking – for instance, by requesting counterarguments or surfacing assumptions – or whether it requests a finished output. The distinction between these two prompt types is itself a teachable and discussable criterion.

The fifth dimension is that of **transparency and documentation of AI use**. This encompasses the capacity to disclose and justify the use of generative AI in the production of an academic text, in accordance with institutional policies and emerging publishing standards (Flanagin et al., 2023). Competence in this area is defined by the following criteria: All students were required to keep records of the phases or stages of the writing process in which AI support was used. In addition, they were tasked with marking where AI had influenced the content and where technical support (e.g., in the form of a grammar check) was provided. Finally, they were asked to create their own AI log for this purpose, the form and scope of which were entirely up to them; the only requirement was that the use of AI had to be traceable from the students' perspective. This is the most directly assessable dimension: the AI log is the artefact. Instructors can evaluate it on three

minimal criteria – whether the phase of use is indicated, whether content-level and technical-level AI involvement are distinguished, and whether the student reflects briefly on the decision to use or not use AI at a given point. Completeness is less important than traceability.

The **sixth dimension concerns ethical and legal awareness** regarding the use of generative artificial intelligence in academia. It is essential that students develop a comprehensive understanding of the normative frameworks governing good academic practice, authorship, and the prohibition of deception (Díaz & Nussbaum, 2024). In practice, this means knowledge of institutional regulations, issues of copyright and data protection, as well as the ability to recognize when AI-assisted practices cross the line into plagiarism or contractual fraud. In the BediRa project, we followed the international debates on AI authorship and jointly analyzed the EU AI Act. In particular, the question of what personal data can be fed into generative AI was highly relevant to the students. To this end, the students trained their own AI agents (which is possible on the POE platform) using fictional personal data, while also utilizing local AI models and discussing the training outputs. Assessment here is best embedded in a short reflective question at the end of Phase 10: students are asked to identify one decision point in their writing process where the boundary between AI support and AI displacement was genuinely unclear to them, and to explain how they navigated it. This produces evidence of normative reasoning in context, rather than abstract knowledge of regulations.

Depending on the institutional and disciplinary context, a **seventh**, more advanced **dimension** can be added: the **cooperative and dialogic use of AI**. In this paradigm, the focus is on using generative tools as a third voice in the context of collaborative writing and peer feedback. To illustrate this, consider the use of AI to generate alternative formulations, suggest revision strategies, or model questions from reviewers. These questions were then critically discussed by the group. Competence in this dimension encompasses the coordination of human and AI contributions within groups, the negotiation of differences of opinion between peers and AI suggestions, and the preservation of human authorship and responsibility in multi-author contexts. In collaborative writing settings, instructors can ask groups to document how AI suggestions were discussed and either integrated or rejected, and who took responsibility for the final formulation. The relevant indicator is whether the group can articulate a shared rationale for their decisions, rather than simply noting that AI was consulted.

Over the next few semesters, the task will be to assess whether these competencies need to be supplemented or even rethought in light of the ongoing development of generative AI. It should also be noted that our students primarily come from social sciences and humanities programs. Other disciplines have different competency requirements, and this should not be overlooked. However, as a basic framework, these seven competencies have proven to be extremely robust for both the students and the instructors in our project.

6. CONCLUSION

This paper has argued that the question generative AI poses to universities is not primarily one of detection or permission, but one of pedagogy. Neither prohibitionist control strategies nor uncritical adoption constitute adequate responses to a technology that has become structurally embedded in students' epistemic environments. What is required instead is a deliberate, process-oriented framework that renders AI use visible, discussable, and educationally meaningful. The argument developed across these sections is founded upon three interlocking principles. Firstly, the cognitive process tradition – particularly the recursive model of Flower and Hayes (1981) and its subsequent elaborations – provides a theoretically grounded basis for distinguishing between AI-supported authorship and AI-displaced authorship. This distinction is not merely terminological; it determines whether AI use constitutes a pedagogical resource or a pedagogical risk. Secondly, the ten-phase model proposed here functions as a transparency scaffold rather than a

prescriptive sequence. The value of this work lies in its ability to explicate the competencies that are often implicit in the writing process. This explicitness is particularly beneficial for students from non-academic backgrounds, who may lack the familial or social exposure to academic conventions. By associating the implementation of AI with particular epistemic objectives within clearly defined phases, the model shifts the evaluative focus from the mere use of AI to the manner and rationale behind its engagement at a specific juncture. This reorientation gives rise to significant repercussions in the design of assessments. Thirdly, the seven competence dimensions outlined in this paper translate the model's logic into teachable and, where appropriate, assessable criteria. When considered as a whole, these elements portray an academic learner who not only utilizes AI effectively but also engages with it thoughtfully. This involves verifying the outputs of AI, designing prompts that provide support rather than replacing thought processes, transparent documentation of AI involvement, and comprehension of the normative and legal frameworks within which academic AI use is situated. The ten-phase model is not designed for students who have already achieved the competence profile it describes; it is designed for students who are in the process of developing it. The seven competencies do not constitute prerequisites for engaging with the model – they constitute its pedagogical horizon. The model intervenes at the moment of formation, not after it. Framing the competence dimensions as the goal of the intervention, rather than its entry condition, is therefore not a limitation of the approach but its defining rationale.

The preliminary empirical results from the BediRa writing course – while limited in scope – offer an early indication that this approach can produce the intended reorientation. The shift documented in students' prompting behaviour, from direct output requests to epistemic inquiry, reflects precisely the movement from product-oriented to process-oriented engagement that the model is designed to encourage. Concurrently, the scepticism articulated by a minority of participants – their perception that the model illuminates a workload that existing institutional frameworks are unable to accommodate – should not be addressed by diminishing the model's scope. Instead, it should be regarded as a catalyst for introspection regarding the structure of academic writing. When students find it challenging to engage reflexively with their writing process, the constraints are often not due to motivation or capacity, but rather due to limitations in time, the design of the curriculum, and the conditions under which term papers are assigned and assessed. A process-oriented approach to academic writing with AI ultimately gives rise to questions that extend beyond the scope of any individual course. Looking ahead, several lines of inquiry remain open and will require further investigation. The model has thus far been developed and tested within a single institutional context, with students drawn primarily from social sciences and human services programmes. Its transferability to STEM disciplines, to more research-intensive university types, or to contexts with markedly different academic writing conventions has yet to be established empirically. The competence dimensions proposed here must similarly be understood as a working framework rather than a finished taxonomy: they will need to be tested against a broader range of disciplinary practices, learning outcomes, and assessment formats. Most pressingly, the rapid and ongoing development of generative AI models introduces a moving-target problem that any didactic framework must honestly acknowledge. What constitutes a meaningful epistemic contribution from a student writer, and what can be considered routine AI support, is a boundary that will shift as the capabilities of these systems expand. This makes it all the more important that the frameworks we develop now are not built around the limitations of current tools, but around the enduring goals of academic education: the capacity to formulate questions, construct arguments, evaluate evidence, and take intellectual responsibility for one's claims.

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Designing a Lexical Framework for an EAP Program at an American EMI University in Japan

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Abstract: This study outlines the design and implementation of a lexical framework for the English for Academic Purposes (EAP) program at Lakeland University Japan (LUJ), an American English Medium Instruction (EMI) institution. The project was developed in response to a persistent gap between students' in-class performance and both standardized test outcomes and undergraduate matriculation. A needs analysis showed the value of a systematic approach to vocabulary learning that could be aligned with the existing course learning outcomes (CLOs) and the academic goals. As a consequence, five vocabulary workbooks were created, with a total of 2,400 words drawn from the New General Service List (NGSL) and the New Academic Word List (NAWL). The workbooks promote revision and verbal elaboration which also reinforce grammar structures appropriate to each level for each workbook (CEFR A1-C1). The materials were further enhanced through inclusive language updates, self-check sections, Quizlet sets, and short assessments. Future research will likely examine the framework's impact on learner autonomy, teachers' instructional practices, and the potential extension into domain-specific vocabulary areas in order to further enhance student success in an EMI setting.

1. INTRODUCTION

The English for Academic Purposes (EAP) program at Lakeland University Japan (LUJ) prepares students for an English-taught language degree program offered in Japan in the context of English Medium Instruction (EMI) education. The LUJ EAP program consists of five levels covering CEFR A1 to B2. By the end of the entire LUJ EAP program, students are expected to discuss, read, and write at a level ready for undergraduate level classes. A standardized English test score is also required for direct entry to the undergraduate program.

The drive to create a language framework in the EAP program came from a number of factors such as a poor alignment with the undergraduate program's needs and the qualifying score for entrance to the undergraduate program from the

EAP program being significantly raised by the university in 2018. However, no resources were made available to aid or facilitate the raising of English proficiency on a programmatic level. This left students without the scores needed to start the undergraduate classes and a faculty struggling to simultaneously improve students' English proficiency scores and academic skills. Furthermore, during the Covid-19 pandemic, all classes were moved online between 2020 and 2022 decreasing the communicative opportunities for students to reuse and reencounter language. The TOEFL ITP test was also limited to certain students during the pandemic to minimize close-contact situations and the test was then made optional for students once in-person classes resumed. Despite the need for social distancing, LUJ continued to administer the test in person for Level 4 and Level 5 students, as around that time, remote teaching and remote proctoring were limited options that were starting to emerge (Patael et al., 2022).

As a result, a disconnect began to develop between positive in-class student performance and a lack of standardized test achievements. This, then affected progression along the institutionally established curriculum and international standards as shown by TOEFL ITP results outlined in Figure 1.

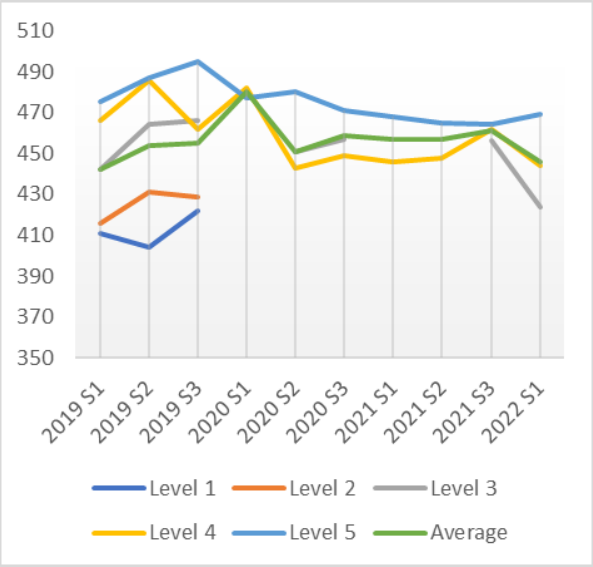

Figure 1 - Average LUJ EAP program test scores from 2019-2022.

Institutionally, the drop in the scores between 2019 and 2022 can be explained by the COVID-19 pandemic, as education had to be delivered online or with minimal contact to prevent contagion. Furthermore, transition from traditional to remote methods was abrupt and required accommodating operational aspects that were not necessarily part of any school's purview, such as how conducive to education a student's home environment was (see Grah & Penger, 2021).

Furthermore, the continued institutional limitations on funding for research and professional development resulting from the pandemic left the faculty in a position where they could either do nothing and continue trying to solve the problem on an ad-hoc basis or attempt to improve the linguistic competency of the students and measure the impact.

The organic response to the difficulties mentioned was the creation of vocabulary workbooks that utilized already existing materials, such as word lists and test preparation materials. Although this approach could be described as a reactive measure, there can be arguably two contrasting views at the classroom level: teaching for the test, which may result in washback (Spratt, 2005), or ownership over the curriculum to drive change and reflect on the future of the program (see Kiely, 2006). The team consciously chose the latter. Washback risks, however, were not completely ignored, and attempts were made to control them by the testing methods employed.

Nonetheless, as mentioned previously, while the TOEFL ITP had historically been used at LUJ as a CEFR B2 benchmark for entrance into the undergraduate program, the EAP program had never established nor used a specific lexical framework equivalent to a B2 level according to the CEFR standards. Instead, the focus was predominantly on the academic skills of listening comprehension, reading comprehension, note-taking skills, essay writing, and presentations, which had historically responded to policy interpretation changes.

The above-mentioned reaction, while new in research, constitutes an approach to policy that views documents as living artifacts which depend on participants' conceptualization of their contents to exist. This means that frameworks do not exist

in a void but inside a system that provides input and receives it cyclically. Researchers define this as the policy transaction approach (Ansell et al., 2025).

As such, our approach followed a simplified method which sought to understand the context as simply and efficiently as possible to construct the meaning of the policy requirements from our perspective. The process was informed by a simplified needs analysis drawing Long's (2005) work, followed by improvements that allowed the inclusion of ipsative and formative milestones that would further feed into the curriculum and its in-class articulation while observing milestones. The entire process in turn, constituted a virtuous cycle based on contextually meaningful interventions already identified in the literature (see Malecka et al., 2022), and a demonstration of how policies are not dead artifacts but instruments intended to generate a reaction.

In other words, the program reacted cyclically to its needs. In particular, we conducted statistical analyses to understand student behavior and proceeded to identify areas of concern that would feed the curriculum and its articulation. Given the internal-review nature the initiative originally had, it is not possible to show any of the data or calculations due to binding regulations, such as the United States Federal Educational Rights and Privacy Act. Thus, after interdepartmental discussions, the EAP department identified the following issues as aspects deserving further attention:

- Skills

Students attained good academic skills in the EAP program but would often struggle in the first semester classes in the undergraduate program even after they achieved a required standardized test score. This is due to the change of focus from learning English to using English instrumentally, as has been noted by scholars in similar contexts (see Brooks et al., 2025), thus making it contextually adequate.

- Reading

In both the EAP and undergraduate programs, students had problems understanding lexically dense material in a short time-frame, mainly due to terminology mismatch and variation, which has been identified in the literature as well (Brown et al., 2021).

- Resources

Some students kept vocabulary notebooks of their own but some did not. In addition, teachers independently utilized a number of different lexical resources in classes at various stages of the program, while appropriate from a curricular execution standpoint due its context responsiveness, this caused divergence. Furthermore, the EAP textbooks, like the curriculum, focused on skills rather than explicit language, thus providing little chance for re-encountering and reusing lexical items. All these initiatives sought to promote metacognition, as well as the identification of strategies that may improve overall performance of the student (Bandura, 1997), which may have an impact on learning (Halmo et al., 2024).

Consequently, while many students had solid academic skills and were able to progress through the EAP program, there was a lack of coherent English vocabulary learning from one level to the next.

2. CURRICULUM DEVELOPMENT

Curriculum modification, even at a minimal level, places the discussion within the realm of organizational theory due to both motivations and the effects changes may have over participants. For instance, Supriani et al. (2022) argue that one of the key ingredients is the drive to improve overall program quality while Fuad et al. (2022) believe that bureaucratic elements should be considered as driving factors – bureaucracy may well mean the intricacies of the curriculum itself or its execution. Regardless, our intention was to solve an issue systematically, namely through formative assessment activities that ultimately allowed compliance with summative overarching standards.

Along these lines, the team considered that the best practice is to address missing parts in lexical knowledge rather than assume a complete lack of understanding, partly because assessment practices

may not necessarily contribute to the learning process (Hattie & Timperley, 2007, p. 82). In addition, developing knowledge through strategies such as reviewing and previewing using the L1 due to the potential benefits for output quality in the L2 (Aubrey & Philpott, 2025) is also recommended. However, these strategies may also have drawbacks, such as fossilized mistakes that learners may never correct (Hamad Al-khresheh, 2015). However, these may serve as evidence for planning more effective output (Cárdenas, 2018) or situations in which learners freeze due to perceived lack of conceptual understanding (see Halmo et al., 2024).

We also understand that vocabulary learning requires repetition via tools that facilitate the learning and instructional process, all of which have an under-researched impact, as it happens with textbooks (Nordlund, 2015). Furthermore, our process departs from the assumption that there exists a strong connection between vocabulary knowledge and reading comprehension (Laufer, 1997), that connects textual understanding and lexical unit command density. We also understand that some reading operations, such as scanning may be less dependent on lexical comprehension and more on chunking and identification, as demonstrated by Naranjo et al. (2021) for A1-A2-level students.

Even though higher education reading often requires careful reading as part of basic skills (Bergman, 2024), it has been noted that a reader will not be able to read effectively unless the reader knows a certain percentage of the running words in a text (Liu & Nation, 1985). At the same time, the reading process itself may also promote lexical gains (Wei & Hu, 2025) or not necessarily require full comprehension to carry out certain operations.

This justifies the need for materials that actively support and promote students' reading by presenting adequate material and fostering natural processes that crystallize knowledge and understanding such as repeated encounters (Dougherty et al, 2010; Nation, 2017).

Due to the nature of our approach and institutional pressure to maintain and/or enhance student progression to the undergraduate program, we decided to contextualize the lexical acquisition process and develop a curricular proposal within our limitations.

3. LEXICAL ACQUISITION

In order to develop our curricular proposal, we decided to operationalize lexical knowledge according to Dale's (1965) proposal, which argues that lexical knowledge manifests in stages:

Stage 1: Never having seen the term before
Stage 2: Knowing there is such a word, but not knowing what it means
Stage 3: Having context-bound and vague knowledge of the word's meaning
Stage 4: Knowing the word well and remembering it

Although it may be argued that Dale's work relies on culturally responsive learning approaches such as rote memorization or verticalized education, and it has been noted that being able to harness culturally familiar educational arrangements can lead to improved attainment in an unfamiliar educational setting (Gu et al., 2010).

Another aspect that can lead to a greater likelihood of learning is verbal elaboration such as agreement, disagreement, comparing, contrasting, discussing, and personalizing (Nation, 2017). Indeed, Coomber et al (1986) showed that the retention of knowledge is heavily dependent in the depth of elaboration during the initial contact with and further practice of new material and that retention and review are closely connected.

Unfortunately, as Kilickaya and Krajka (2010) note, the teaching of vocabulary often presents items in an activity without the opportunity to prepare learners through activation and it does not always allow for the regular revision of the previously encountered items. This is the problem that we faced at a curricular and resource level. However, we considered that repetition is expected by some learners due to educational system tradition (Yamanaka & Suzuki, 2020).

Therefore, it was decided that a lexical framework be built that could sit alongside and work with the academic skills framework that easily allowed for

constant revision and verbal elaboration.

4. LEXICAL SELECTION AND FRAMEWORK IMPLEMENTATION

The lexical items were selected from the vocabulary list of an English test preparation textbook and wordlists provided by the EAP program textbooks, which corresponded to materials developed by established publishers and industry standards. Then, the lexical items were cross-referenced with the New General Service List (NGSL) and the New Academic Word List (NAWL) creating a total of 2400 words with 480 words at each level. These were then split into 30 units each containing 16 words in each unit enabling the units to be completed within a semester. CEFR-compliant wordlists were not included due to resource access. The levels created are as follows:

- Level 1: 480 target words from the NGSL 1st 1000 and 2nd 1000 words.
- Level 2: 480 target words from the NGSL 2nd 1000 words.
- Level 3: 480 target words from the NGSL List 2nd 1000 and 3rd 1000 words.
- Level 4: 480 target words from the NGSL 3rd 1000 words and the NAWL.
- Level 5: 480 target words from the NAWL.

Worksheets were then created with activities that allowed for review and elaboration while also providing space for learners to write definitions in their L1 if desired. This meant that the word list followed a standardized and globally recognized system that many skills textbooks follow (CEFR, NGSL, NAWL) while allowing for activities and testing that could be easily utilized across different EAP classes at all levels of the program, thus allowing scalability and constant formative appraisal. All activities aimed to promote improvement via a cycle focused on teacher's improvement of their praxis and students' polishing of their study techniques. The activities basically implied an application of Kiely's (2006) calls for reflection upon the future goals of the curriculum within the context of the department – here, the program as a whole. Testing, then, targets academic achievement improvement via the identification of individual-specific weaknesses that can translate into strategies (see Miao et al., 2025) and may eventually promote self-efficacy (Bandura, 1997).

The first activity in the worksheet required learners to match target words with synonyms and definitions from a short sentence that used the words in context (see Figure 2). The rationale is knowledge activation via identification, which the literature already defines as desirable (Pearson et al., 2012).

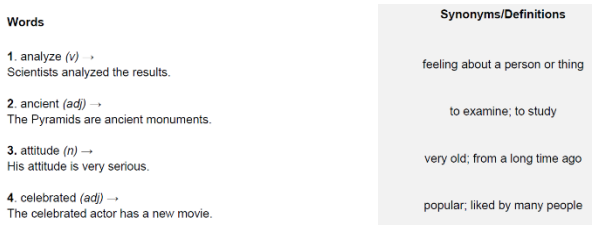

Figure 2 - The English Vocabulary Workbook Level 3 (Learoyd, 2024).

The second activity included the words in chunks in mis-ordered sentences that the learner then wrote into the correct order to create a grammatically accurate sentence using the target word, which has been long established (see Purpura, 2004, for details). The completed sentences would allow for verbal elaboration in discussion prompts, writing prompts, sentence modification, paraphrasing, or speech topics (see Figure 3).

Figure 3 - Example from The English Vocabulary Workbook Level 3 (Learoyd, 2024).

In addition, the sentences utilized grammatical structures from the different levels allowing for the review of and exposure to grammatical forms if desired. Level 1 used grammatical forms from CEFR A1 to A2, Level 2 from CEFR A1 to B1, Level 3 from CEFR A1 to B2 and Level 4 and 5 from CEFR A1 to C1.

After using these activities in classes, it was determined that edits and corrections were necessary. Due to institutional rules and policy limitations, it is not possible to discuss at length what exactly motivated the updates, but most of the identified areas responded to how students reacted to the materials. A cursory summary is as follows:

First, the content of sentences that were designed for verbal elaboration contained references to Japan, Tokyo, and LUJ, but not all LUJ students are from Japan or have spent a long time in Tokyo. These references were subsequently amended to "my country", "my city", "my school" or "my university". Second, there were personal references such as "father", "mother", "brother", and "sister" in the exercises for verbal elaboration, but not all students have these relations, so were altered to "family member" and "friend". These changes allowed all students to elaborate using the target vocabulary and matched the diversity of students in LUJ's EAP program. The edited and corrected worksheets were then made into workbooks for each level including answer sections and alphabetized tables containing parts of speech which enabled students to self-check their answers and engage in further study of the vocabulary as needed.

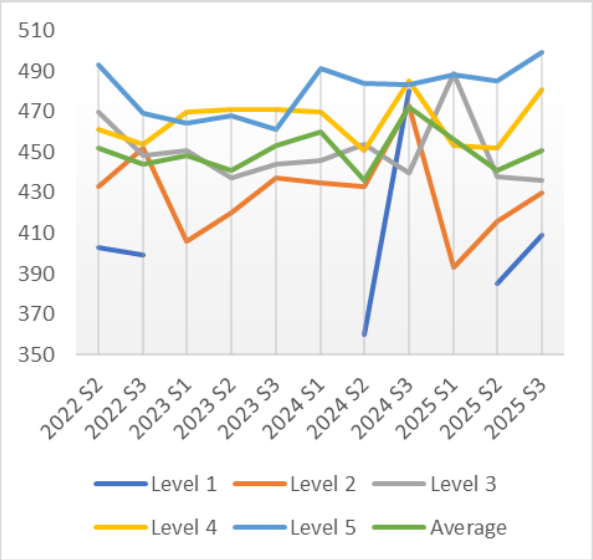

Figure 4 - Average LUJ EAP program test scores from 2022-2025.

Finally, Quizlet packs were created to encourage further review and engagement outside the textbook and classroom while quizzes and short tests were designed and given in classes to motivate the completion of the exercises, show progress, and contribute to overall assessment of students. The current materials are under constant review for further improvements. Finally, as of 2025, the in-person TOEFL ITP test again became mandatory for all LUJ EAP students every semester, as it was pre-2020. This policy adjustment will enable us to systematically measure the impact of the changes described above and any other additions or modifications to the EAP program. Initial observations seem positive (see Figure 4), as overall scores have been increasing since the first term of 2025 (2025 S1).

5. CONCLUSIONS

The EAP program at LUJ now has five vocabulary workbooks with target words from the NGSL and NAWL that overlap with program textbooks and standardized test word lists while utilizing CEFR A1 to C1 grammatical forms in activities that facilitate frequent review and verbal elaboration. The next steps are to gain feedback from the students, track the overall scores of the students in standardized English tests, and assess the extent to which the lexical framework has altered the EAP program's approaches to teaching and assessing vocabulary. Once more evaluations have been completed, there are possibilities to produce lexical frameworks in other areas of EMI education. These include phrasal verbs, idioms, the remainder of NAWL word list for use in the undergraduate program, and English for Specific Purposes (mathematics, computer science, environmental science, business, etc.) for students who want to pursue more specific areas of academia both at LUJ and beyond.

6. FURTHER RESEARCH AND IMPLICATIONS

Other research could explore from a clinical evaluation perspective the effectiveness of our proposal by conducting a longitudinal study that validates the current curricular approach. Additionally, since most of the actions described in this paper correspond to organic reactions to environmental cues or threats, such as the COVID-

19 pandemic, the team is aware of any limitations with regards to the generalizability of any conclusions. Additionally, the aggregated nature of the data used to demonstrate our points, given the difficulty of permission processing, limits the scalability of our results. Therefore, any future initiatives should focus on conducting an evaluation of the program and its changes from a specific underpinning approach, be it the policy transaction approach or any other.

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English Communication Classes with Generative AI “ChatGPT”

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Abstract: This paper reports on a classroom practice integrating generative artificial intelligence (ChatGPT) into a Japanese senior high school English Communication course. The practice was implemented in four second-year classes (approximately 40 students per class; total N ≈ 160) using LANDMARK II (Keirinkan), Lesson 10 “AI and Our Future,” together with supplementary writing materials including a CNN Workbook (Asahi Press) and GTEC STEP UP NOTE Writing Work (Benesse Corporation).

Students first composed opinion-based texts independently and then used ChatGPT strictly as a rewriting assistant. External assessment data indicate that the average GTEC writing score increased from 150.8 to 182.6 (+31.8 points; +21.1%). While causation cannot be attributed solely to this intervention, the results suggest that structured AI-assisted revision may have contributed to measurable improvements in writing performance. The findings demonstrate that, under careful teacher guidance, generative AI can function as pedagogical scaffolding that enhances linguistic expression while preserving students’ cognitive ownership. The study also discusses ethical considerations surrounding AI use in education and proposes practical guidelines for responsible classroom implementation.

1. INTRODUCTION

The rapid development of generative artificial intelligence has significantly influenced educational discourse worldwide. Tools such as ChatGPT can generate coherent written responses, summarize information, and assist with revision processes. In language education, these capabilities have the potential to support writing development by providing immediate linguistic feedback and modeling natural language usage.

However, the integration of AI technologies into educational settings also raises substantial pedagogical and ethical questions. Some educators worry that students may become overly dependent on automated systems, potentially weakening their own ability to construct ideas and communicate independently. Others argue that AI, when used carefully, can function as a form of scaffolding that supports students’ development rather than replacing their thinking.

In Japanese senior high school English classes, students frequently demonstrate thoughtful understanding of discussion topics but struggle to express their ideas clearly in written English. Their writing often contains simple sentence structures, limited vocabulary, and weak logical connections. This gap between cognitive understanding and linguistic expression provided the motivation for the present classroom practice.

The central research question of this study is

therefore: How can teachers integrate generative AI into writing instruction in a way that supports linguistic development while preserving students' ownership of ideas?

2. TEACHING CONTEXT

The classroom practice described in this study was conducted in four second-year English Communication classes at a Japanese senior high school. Each class consisted of approximately 40 students, resulting in a total of about 160 participating learners. The students were typically 16 and 17 years old and had completed several years of English education under the national curriculum established by the Ministry of Education, Culture, Sports, Science and Technology (MEXT, 2018), which has been fully implemented since 2022.

The primary textbook used in the course was LANDMARK II (Keirinkan), specifically Lesson 10 titled "AI and Our Future." This lesson introduces students to contemporary debates surrounding artificial intelligence and encourages them to consider the societal impact of emerging technologies. The thematic focus on AI provided a natural context for introducing generative AI tools as part of classroom activities.

To extend writing practice beyond the textbook, two supplementary resources were incorporated: the CNN Workbook (Asahi Press), which presents current global topics, and GTEC STEP UP NOTE Writing Work (Benesse Corporation), which focuses on structured writing practice aligned with external proficiency assessments.

While students generally understand the content and are able to form opinions, many struggle to express their ideas clearly in English. Common difficulties include limited vocabulary, repetitive sentence patterns, and insufficient use of logical connectors. As a result, students often feel that their English ability does not reflect their actual thinking.

3. DESCRIPTION OF TASKS AND STUDENT EXAMPLES

The writing tasks used in this practice required students to express their opinions on global social issues and cultural topics. These tasks were intentionally open-ended, allowing students to develop individual perspectives rather than reproducing predetermined answers. The CNN Workbook tasks used in this practice covered topics such as:

- the mandatory wearing of hijabs for women in Iran;
- appropriate dress when attending international ceremonies as a representative of Japan;
- opinions about school uniforms in Japanese high schools.

There were no single correct answers, and students were expected to organize their ideas logically within a limited word count.

Table 1 - Opinion on School Uniforms

Version	Text
Original	I think uniforms are good. Students don't have to choose clothes. Everyone is same.
Revised (AI-assisted)	I think school uniforms are beneficial because students do not need to spend time choosing clothes every day. In addition, wearing the same uniform can reduce visible differences among students.

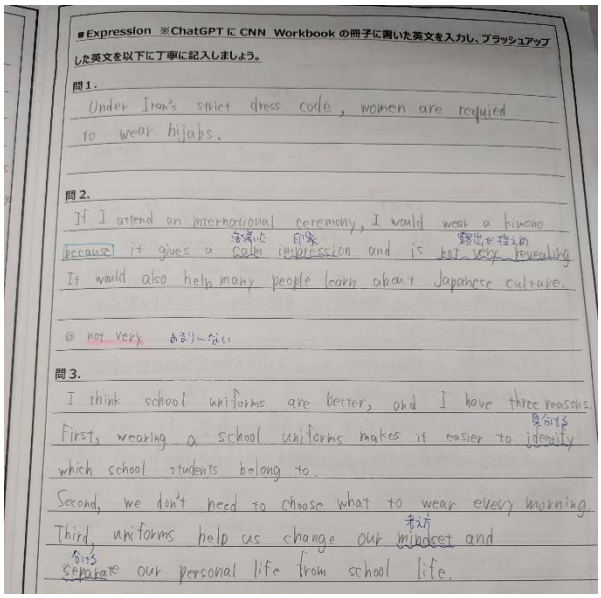
Table 2 - Cultural Perspective Example

Version	Text
Original	If I go to other country ceremony, I will respect their culture. Because I represent Japan.
Revised (AI-assisted)	If I attend an official ceremony in another country, I would respect the local culture and customs.

As shown in Tables 1 and 2, analysis of students' original writing showed that most students had relevant ideas and opinions, but their English expressions were often simple and underdeveloped. This gap between thought and expression became the focus of instructional intervention.

4. CLASSROOM PRACTICE: AI-ASSISTED REVISION

Students were explicitly instructed that ChatGPT should not generate ideas for them, but rather help them improve how their ideas were expressed.


■Expression ※ChatGPT に CNN Workbook の冊子に書いた英文を入力し、ブラッシュアップした英文を以下に丁寧に記入しましょう。

問1.
Under Iran's strict dress code, women are required to wear hijabs.

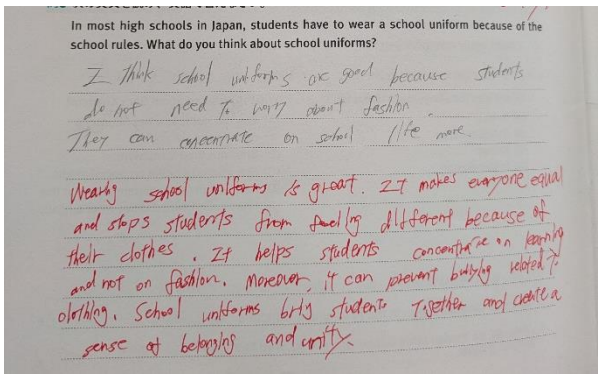
問2.
If I attend an international ceremony, I would wear a kimono because it gives a calm impression and is not very revealing. It would also help many people learn about Japanese culture.

@ not very あまり～ない

問3.
I think school uniforms are better, and I have three reasons. First, wearing a school uniforms makes it easier to identify which school students belong to. Second, we don't need to choose what to wear every morning. Third, uniforms help us change our mindset and separate our personal life from school life.

Figure 1 - Student notebook with sample answers before using AI

Students first completed writing tasks independently in order to ensure that the ideas expressed were their own. After completing their drafts, they entered their sentences into ChatGPT and requested revisions that preserved the original meaning while improving clarity and naturalness.


In most high schools in Japan, students have to wear a school uniform because of the school rules. What do you think about school uniforms?

I think school uniforms are good because students do not need to worry about fashion. They can concentrate on school life more.

Wearing school uniforms is great. It makes everyone equal and stops students from feeling different because of their clothes. It helps students concentrate on learning and not on fashion. Moreover, it can prevent bullying related to clothing. School uniforms bring students together and create a sense of belonging and unity.

Figure 2 - Simple student answers compared to sentences improved after using AI

Students then compared the original and revised versions in small groups, discussing differences in vocabulary, sentence structure, and logical flow. Finally, they rewrote their responses by selecting the elements they considered most useful.

With this approach, teachers could ensure that ChatGPT was introduced as a rewriting and polishing tool, not as a source of answer. Also, it is important to note that the teacher played a central role in guiding this activity. The teacher explained appropriate and ethical use of AI, emphasized critical evaluation of AI output, and encouraged students to notice differences between their original sentences and the revised versions. Students were reminded that they did not need to accept all AI suggestions and should make final decisions themselves.

5. EDUCATIONAL OUTCOMES

Several positive outcomes were observed through this instructional approach. Students became more aware of how English sentences can be structured logically and gained exposure to a wider range of vocabulary and connectors. Many also reported increased confidence in their writing, as they could see concrete examples of improved expression.

To evaluate these outcomes, the Global Test of English Communication (GTEC), a standardized English proficiency test developed and administered by Benesse Corporation and widely used in Japanese high schools, was used as a reference. In this study, the GTEC Advanced type (maximum total score: 1280) was utilized. The test assesses students' skills in reading, listening, writing, and speaking, with a particular focus on communicative competence.

At the author's current high school, students take the GTEC test five times over the course of three years. The present analysis is based on the results of four administrations conducted from the first to the second year. The test was administered as part of the regular assessment schedule in June and December.

Results showed a clear improvement in students' writing performance. The average writing score increased from 150.8 to 182.6, representing a gain of 31.8 points (approximately 21.1%). These scores are reported on a standardized scale used by GTEC to indicate levels of communicative ability.

However, these improvements cannot be attributed solely to this instructional activity, as students were

engaged in multiple learning experiences. Nevertheless, the quantitative gains, together with increased confidence and qualitative feedback, suggest that the approach contributed positively to students' development.

Furthermore, teachers observed a shift in instructional focus from error correction to meaning-based communication, with students beginning to view writing as a process of refining ideas rather than simply avoiding mistakes.

6. ETHICAL CONSIDERATIONS IN AI-ASSISTED LEARNING

The integration of AI technologies into educational environments requires careful attention to ethical considerations. UNESCO (2021) emphasizes the importance of transparency, accountability, and human oversight in AI-supported systems.

In this classroom practice, AI use was restricted to the revision stage in order to maintain students' ownership of ideas. Students were explicitly instructed that ChatGPT should not be used to generate entire answers. Instead, it functioned as a tool for improving linguistic clarity.

In other words, using ChatGPT after students had attempted to write independently allowed AI to function as a scaffold rather than a substitute for learning. Under appropriate teacher supervision, generative AI supported reflection, comparison, and revision, all key elements of language development.

7. DISCUSSION

The findings of this study suggest that generative AI can function as a form of scaffolding in writing instruction. Rather than replacing students' thinking, AI-assisted revision can help learners bridge the gap between their ideas and their ability to express those ideas in English.

The key factor appears to be instructional design. When AI tools are used without guidance, they may encourage passive learning. However, when integrated into structured learning activities that emphasize reflection and comparison, they can promote deeper metalinguistic awareness.

8. FINAL CONSIDERATIONS

This study represents a single classroom case study and therefore cannot be generalized without caution. Future research should examine similar practices across multiple schools and educational contexts.

This study demonstrates that generative AI can be integrated into English writing instruction in a way that supports students' linguistic development while preserving their ownership of ideas. It offers a practical and meaningful way to maximize students' expressive potential in English classes

With careful instructional design and ethical guidance, AI tools such as ChatGPT may serve as valuable partners in language education rather than a threat to it.

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Self-Audit Your Skills Like a Ninja: An Approach to Stimulate Critical Use of Digital Tools

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Abstract: Student motivation often plateaus at upper intermediate level. Digital tools which are available easily online, allow students to get feedback on various quantitative aspects of their performance and set achievable, quantifiable goals. This article describes how a class of upper intermediate and advanced ESL students exploited various apps or sites to measure aspects of their performance such as reading level, reading speed, vocabulary size, spoken fluency and pronunciation. They were required to keep handwritten logs of what they discovered about their performance and submit handwritten reflections on the activity. It is suggested that this activity may help to raise students' awareness, of both their own level, and how various language-learning sites and apps are designed. This can be termed a "ninja approach" to online learning, in which the learner decides what they want to find out, selects the app and grabs the output with a screenshot, as far as possible avoiding tracking or logging in. The sites range from the newest AI-assisted speech coach to simple data-base-driven vocabulary size measures. In the context of increasing AI-mediated control over various aspects of language learning, this combined analogue/digital, student-centered approach seeks to hand agency back to students.

1. INTRODUCTION

Students often become demotivated because they cannot see whether they are improving (Richards, 2008). A sense of mastery is necessary for motivation (Williams and Burden, 1997). External tests do not always help because in the short term, the test algorithm relies on inferencing which may not capture how each individual is progressing. Therefore, asking students to log quantifiable aspects of their performance can be interesting and motivating for them. Tasks which harness this include timed writing, timed reading and vocabulary size tests. Starting to notice quantifiable aspects of their performance gives some control back to students, and is often novel and fun. How long can they speak for without a break? How many words can they say in one minute? And so on. Recently the power of technology to measure and track all aspects of language competence has increased greatly, meaning that students can access a range of tools for gathering quantitative data about their own output with accuracy and ease. In this article I would like to explore a "ninja approach" to the use of these powerful tools. The characteristics of this approach are that the learner sets their own goal, finds out what they want to know with minimal surrendering of their data such as email and credit card number, and keeps their own audit trail

through analogue (pencil and paper) notes and screenshots. It is possible that an app might help us more if we decide to make an account. However, my experience of teaching with apps for vocabulary, extensive reading or grammar practice, reveals that the apps have a certain addictive quality, which I think may lead to cognitive offloading (Gerlich, 2025). Students keep their heads down and focus on the app for long periods of time. There is plenty of research to show that apps work well for language learning, but very little that focuses on the possible negative impact if decisions about what to learn next become restricted to the choices in the app.

If we want to encourage critical thinking, it is important to ask "What did this app do for you?" and "How much were you able to get without logging in?" "Is this app the best one for this purpose?" and even "Were you able to break it?" instead of fostering compliance with an app. In this way we can promote learner agency and those moments of "friction" which promote learning (Hawkinson, 2025, p. 183). Hawkinson opines that "agency requires intentional friction" and the interpolation of decision-making points. (ibid, p.79). Hawkinson writes that human agency is preserved by a certain amount of necessary friction. "The friction must be productive, challenging students in ways that develop capabilities rather than merely creating obstacles." (Hawkinson, p. 183).

By designing a task to be completed "ninja style", we are getting students accustomed to some useful practices such as evaluating various tools, training them to navigate fluently between analogue and digital modes, and raising awareness that digital tools should be at their service rather than the other way round.

2. THEORETICAL BACKGROUND

In spite of the widespread excitement around advances in AI in relation to language education, some ELT professionals see a significant risk to critical thinking, autonomous learning and academic literacy (Baldrich, Perez-Garcia, Santamarina-Sanco, 2025). Olsson (2026) goes further in stating that a certain amount of slow and painstaking work or "drudgery" is actually a necessary part of developing academic literacy. Thus, there is a well-developed rationale for creating tasks which encourage students to keep offline notes and to use digital tools selectively for particular purposes, with critical awareness.

Hawkinson (2025) describes several approaches to the issue of AI use, from "passive consumption" in which the users surrender their thinking capabilities to AI, to "human-in-the-loop" in which humans maintain a higher degree of control over when and how AI is used. Here is Hawkinson's definition of human-in-the-loop:

> Human in the loop maintains high human agency while AI capabilities remain relatively basic. Students and teachers actively direct AI tools that respond to prompts but do not plan independently. This scenario requires conscious institutional effort to preserve agency even as it forgoes some benefits of more advanced systems. (Hawkinson, p.100)

In the "human-in-the-loop" scenario, inefficiency is seen as necessary part of the learning process.

AI tools do tend to recommend themselves. In their current iterations AI will rarely say "The best thing you can do is go off line now." This appears to undercut student self-efficacy and autonomy. As studies by Zimmerman and others show, self-efficacy requires students to be able to estimate their own capability and to think of their own next actions in their learning sequence. (Zimmerman, 1995, p.204).

3. THE SELF-AUDIT EXPERIMENT

3.1. Participants in this study

The participants in my advanced communicative English class in Spring 2025 had CEFR levels ranging from B1 to C1. Over half came from what Kachru (1992) would term "second circle" countries where they had done a significant amount of their secondary school education in English. They were in the third semester at a small university in Japan, studying for a BA in liberal arts in English. The communicative English class used the textbook World Link 4. The textbook was

somewhat easy for them. The course requirements included the completion of some assignments on the proprietary learning management system, which students were able to ace easily and, in some cases, were a little bored with. Those from English speaking countries in particular were complacent about their level because it was much higher than that of the Japanese students with whom they interact during EMI classes.

In connection with the approach advocated here, it is relevant to note that digital tracking had been a topic of discussion in the class already, thanks to a unit in the textbook, World Link 4 (Hughes, 2021). Data privacy is discussed in Unit 4 "The Second Self", which includes questions about social media image and a reading about "How to disappear." Students were very interested in the issue.

3.2. The Flow of the Class

The module on "skills self-audit" was integrated over four weeks of the class. Table 1 below gives an overview of the components of the activity.

Table 1 - Classroom Activities Week-by-week

Week	Activity
1	Teacher introduces the self-audit activity.
2	Self-audit of spoken fluency (Yoodli)
3	Follow up to self-audit of spoken fluency: analogue record-keeping
4	Self-audit of reading speed (Ace reader, Spreeder) Vocabulary size tests (Lex tutor, Vocabulary Size test)
5	Follow up to self-audit; reflection, discussion, goal setting. Upload work to moodle.
6	Teacher feedback on self-audit task.

Near the start of their third semester, students were asked to watch a TED talk by computer programmer Varun Puri, designer of an AI speaking coach app called Yoodli. Puri made the app to help himself because he was not a confident speaker. After having students watch the video at home, I showed students my own result from speaking Yoodli. After having a good laugh at the fact that Yoodli analytics under "conciseness" noted that I spoke 41% more than necessary, I showed students how to find and try an evaluation for free under the presentation tab. (There is also an interactive sales interview with an AI interlocutor, which some students tried.)

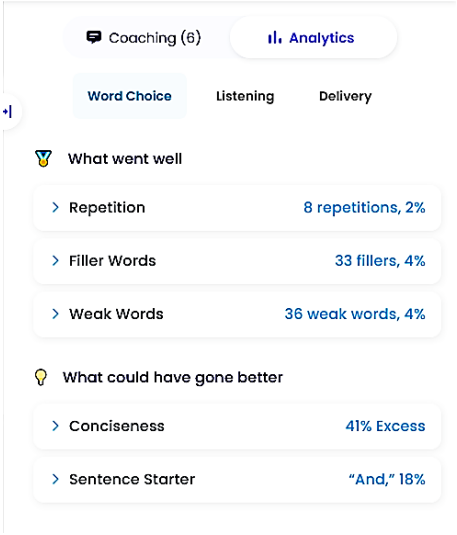

Figure 1 - AI Speaking Coach Feedback (Ellen's speech)

The feedback is extraordinarily detailed, relevant and human-like. I asked students to try out the app and to save screenshots and fill in some notes of what they discovered, on a paper worksheet which I handed out. The format of the worksheet was very open-ended rather than following the categories in Yoodli, because I wanted students to choose for themselves what they found noteworthy from the Yoodli feedback. Yoodli requires a log-in but it is possible to have five sessions for free. It can offer feedback on the basis of only 30 seconds of speaking. I encouraged them to play with it and see what they could learn, saving the output as a screenshot and pasting it into MS word which could be uploaded to the class moodle to share at least a portion of the output with me. At the end of the class, I gave out a paper pro-forma, telling them to keep notes about what they did and what they thought of it. I explained that this assignment had several parts and would be graded not on the level they attained but on completing the assignment and keeping a record carefully.

In the next class I showed students the online reading site Spreeder, which allows you to paste some reading material into a text window and then deliver it in small chunks at a particular speed. Usually if you start at about 60 words per minute, students can read it but you can ask them what speed they want, and increase until they cannot read aloud any more but can still follow cognitively. There are many things they can learn from this: most people do not realize that in L1 they read faster than they speak, and in the case of these students many read faster than they thought. They also gained awareness of the trade-off between speed and depth of understanding. However spreeder is less satisfying to use alone because the user has to input text to put into the window, meaning that it is not completely unseen text. So we looked at another reading test site, Ace reader, which allows the user to find a speed independently, selecting from 13 levels and also selecting the theme and choice of stories. As before, students had some time to play with the site in class and were asked to follow up at home. This time many students tried to do the test during class and scored rather low due to the distraction of the others around them. A few people tried again at home and improved their speed. The take-away was that their reading speed would vary depending on the level of interest they are feeling, the difficulty of the text among other factors.

The last quantifiable measure we investigated was vocabulary size. The idea of vocabulary size was familiar to them from selecting graded readers on X Reading. I gave a mini lecture about how the computer makes inferences, based on the words that you know, to estimate the words you know which are in the same frequency range. Students may not realize this kind of mechanism underlies much objective testing of language skills. In this class, it seemed that they really liked learning new words. I asked them to choose from two vocabulary size tests, or do both of them if they wanted. Many chose lex tutor. The interface is a classic computer style from 20 years ago. In spite of the old-fashioned interface, the algorithms underlying the test are very sophisticated and are updated regularly. In the initial versions, databases were used to determine word frequency and infer the total number of known words (Cook, 2004).

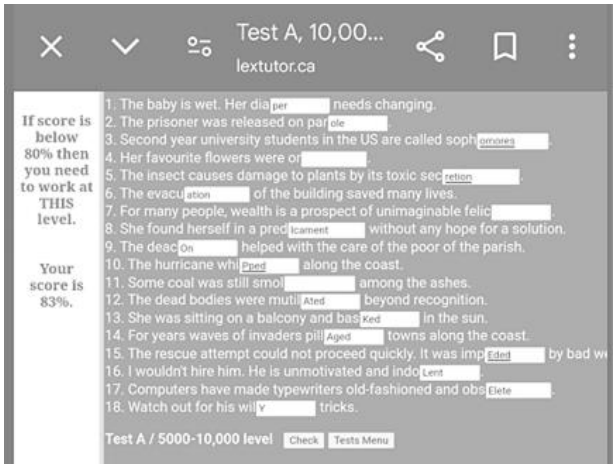

Figure 2 - Lex Tutor Vocabulary Size Test

Going through the process of selecting a test from a particular frequency level, should help students to understand how such tests work, at least I thought so. However when students selected the level of lex tutor, as before, some chose the 2000 word level in spite of my warning that that they must know 6,000-14,000 words just to be able to take the class. Others were highly motivated and tried both lex tutor at the 10,000 word level and the vocabulary size test primarily aimed at native speakers, which is based on recognition and adaptive technology. At larger vocabulary size levels, the accuracy is debatable but given that some students had finished their secondary education in English it was not impossible that the app diagnosed two of them in the expert native speaker range (30,000 words).

3.3. How did students use the self-audit?

In this section we will look at how several students used the self-audit activity. The students were among the more confident members of the class and readily agreed to share their data for the purpose of this publication. Figure 1 shows the proforma which students were given on which to report on their results. It has spaces to record the website used, results, and their own reflection.

They were allowed to upload as many files to the moodle tab as they wanted, and just select the highlights to write about on a paper reporting form as seen in figure 3.

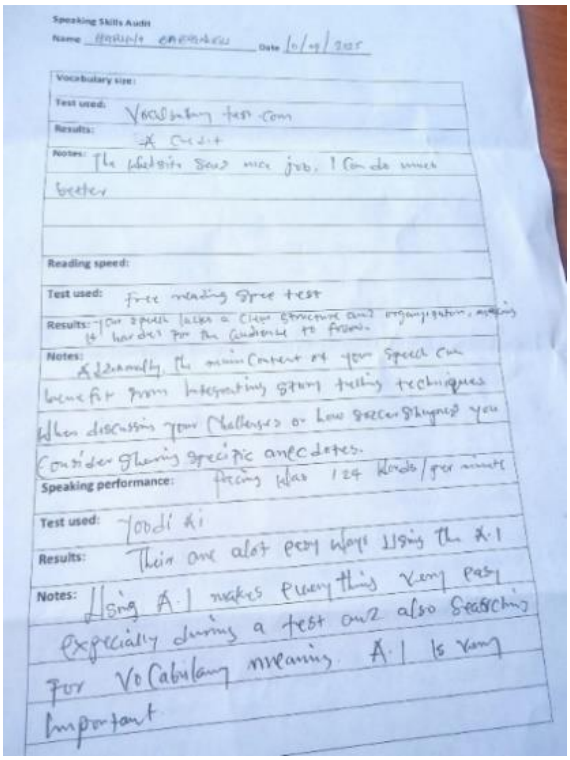

Figure 3 - Worksheet for analogue record-keeping (Student C)

Student A used analogue record keeping only. It was interesting that he tried to use advanced vocabulary in his record. He also seems to have done the reading speed test several times so as to get a higher score. Here are his records.

Skills Audit

Name: Student A
Date: April 10, 2025

Vocabulary size

Test used: Vocabulary Size.com

Results: My vocabulary size is 10,000.

Notes: Activity included plethora of complicated words that I memorized constantly when I faced it.

Reading speed:

Test used: Ace reader

Results: 320 words per minute

Notes:

I increased my speed from 249 to 320 and kept my accuracy. I think it is very beneficial exercise that helps us develop our skills.

Speaking Performance

Test used: Yoodli: 113 words per minute

Notes: I had few words that I repeated several times and started with such as so, like, umm. However, it was beneficial for me by showing not only weak points but also strong for example AI recognized my speech, as well as said my "sentences were well constructed".

Student B lavished great care on the self-audit. He provided three screenshots from Yoodli, one from the vocabulary test and two audio files of his own spoken reflection on the use of the apps. On the worksheet he copied salient parts of the feedback from the app. In his written and spoken reflection he provided evaluative comments about the apps. which I quote in full. The written comment was not extensive but his spoken reflections were thought-provoking. This learner was very experienced as an AI user having worked as a developer before coming to university. His reflection raises some relevant problems with using AI as a speech coach.

> And also, for me, communication is more about how we talk with each other in every day. So, from the eye sight or the body language, that will affect a lot about the daily conversation. So, I still prefer my human partners for my speaking section more than an AI.

His comment on the vocabulary size test also highlighted his feeling that he had not done himself justice. This student was from an EFL background and therefore scored highly on vocabulary tests which were related to the coursebook as opposed to the broader based vocabulary size test. He found it a bit irritating.

> And I found that a lot of words that I know about it, it means when I can, when I saw that word, I know it's that word, I know the meaning, but when we do that kind of test, I just don't figure it out what you're meaning in time. But after I can recognise a lot of words, but yeah, it's just not fit my

> style. That's all.

He included a somewhat defensive comment on the AI's evaluation of his vocabulary:

> Second file
>
> because that's just a quick talk, so I cannot express a lot of my vocabulary. And also, personally, when I do the practise with my friends, they also said my vocabulary skill is quite impressive.

This part seems to flip back to talking about the vocabulary size test

> But I'm not usually use that [kind of word] in a daily life communication. So let's go to the another part is the reading speed and presentation pacing. So in that day, I think I speak kinda calmly.
>
> Okay, so as you can see the result in the picture, they said I should go for faster. But when I talk like in something I haven't prepared, it's quite hard to speak at a fast speed because my brain is not progress the story quick enough. Okay, that is my problem. So yeah, maybe write something down [before speaking?] and no, that is not. Sorry, that's not cool, I guess. (Comment from the audio file of spoken reflection by student B.)

Student C wrote across the worksheet ignoring the spaces for the reading and vocabulary size and focusing on the feedback from Yoodli. He copied out several parts of the salient feedback from Yoodli and uploaded 8 screenshots to show the feedback from Yoodli and other aps. He did not analyze his feedback in detail but writing down the salient point allowed us to communicate about it effectively when chatting later.

Skills Audit

Student C

Speaking Performance

Test used: Yoodli:

Notes: (Copied from Yoodli screen) The main content of your speech can benefit from integrating story-telling techniques. When discussing your challenges or how soccer shaped you, consider telling specific anecdotes.

Reflection: there are a lot of easy ways using the AI.

Student D uploaded a single word document with 10 screen shots pasted into landscape format and a photo of the handwritten reflection. He used more of a note-taking style. By including a screenshot of his speech contents, he communicated his objections to using AI for speaking coaching:

> If you ask me, I'd say no, it's not a good solution for participants practicing speeches. As you can see, I'm very terrible at this. Many people will try to use this but it's always good to have human feedback than AI feedback and that is all for now.

Skills Audit

Name: Student D
Date: April 10, 2025

Vocabulary size

Test used: Vocabulary Tester.com

Results: My vocabulary size is 31,661

Notes: According to the test it is C2.

Reading speed:

Test used: Free Reading Speed Test Ace Reader

Results: 162 words per minute

Notes: The website says I can do better but I don't know about that.

Reflection

The website was easy to use and the options were not too shabby or limited.

Speaking Performance

Test used: Yoodli:

Results: 149 words per minute

Notes: There were a lot of criteria for this test/audit. AI assistant shows that there is much work left to be done.

Student E uploaded 8 screenshots saved into a pdf along with his handwritten comment uploaded as a photo. He showed his agency clearly by connecting the self-audit with his own language learning goals and priorities.

Skills Audit

Student D

Speaking Performance

Test Used: Yoodli

Word choice – not bad

Listening – good

I got some pronunciation corrections from the site and a few tips on how to get better and follow up questions I should expect.

Reading speed 168 words

Free reading test. Com.

Comprehension

75%

I need to increase my speed 33% more. The site has great stories and similar to x reading.

Vocabulary

I got C2 The site is quite easy to use but it does not provide corrections. C2 is a very good level so I am satisfied.

My goal henceforth would be to get 270 to 350 recommended reading speed. Although I want to achieve that by practising on my own pace as I have more important private goals. Reading speed might be ok but understanding comprehension is what helps in passing exams. From April to May I would like to improve in speaking/pronouncing, since the yoodli app made a lot of pronunciation corrections.

Vocabulary is not my priority but I will add a few to the cart.

4. DISCUSSION

Students used the self-audit in their own way and focused on their own goals. Allowing them to choose their own parameters for the levels in the reading test and lex tutor made the assessment less accurate but it gave them more control. The measures were quite different from what I would have expected given my own estimation of the students' performance. However, if we consider this activity as a fact-finding mission in which students see what they can get from various tools, then what is interesting is their level of critical engagement with the various tools. Comments such as "I still prefer my human partners" and "vocabulary is not my priority but I will add a few to cart" showed that students were doing the activity with a high level of awareness of their own needs and goals. In some cases, students copied the feedback from the app, and it was hard to tell whether they had thought much about it. One person even miscopied the speaking feedback into the space intended for reading and vocabulary, and left those blank. This shows the importance of following-up with a teacher or learning advisor in order to get the maximum benefit from a ninja approach. This kind of data seemed to be too personal for sharing through peer coaching, even though students were happy to talk about whether the apps worked or not and help each other in the beginning stages.

Students were surveyed eight months after the course to see what they remembered about the activity. Interestingly, the vocabulary size test and the reading speed test were remembered as well as the more sophisticated app and seemed to be equally popular. One person liked the feeling that they were learning "crazy" advanced words and had taken both vocabulary size tests. Having a feeling of being able to check their level was said to be helpful. Several people said that improving their vocabulary would help them to improve their speaking.

Students were impressed by the speed and human-like nature of the feedback from Yoodli. Most of them were already using Siri or other voice-driven apps but had never experienced evaluation from an app. Yoodli provided a reality check for the most

confident members of the class and also gave positive feedback to those who were less confident. Half mentioned getting feedback on their speaking as useful because it helped to reduce their nerves or helped them to know their level.

Asked "which tools would you use again", they were equally divided between the vocab size, reading and speaking apps. Five out of eight said they used other apps regularly for their independent study. Quizlet, the vocabulary size test and Duolinguo were mentioned and it seemed one person had used Yoodli again too. One mentioned using other apps such as Duolinguo to learn Chinese.

As mentioned above, the students had discussed data tracking in the context of online privacy, in an earlier module. In the follow-up survey I asked students if they were concerned about tracking by apps. On the contrary, one person felt tracking would lead to personalized learning and higher efficiency. In response to a question about tracking within the apps they use for class such as X Reading, two people said they find it useful to check their reading speed and one to check whether they are spending too much time online.

5. CONCLUSION

The self-audit experiment was intended to motivate students by raising their awareness of their strengths and weaknesses and assist them in refocusing their goals. To some extent it seemed to fulfill that purpose. In this activity, students are asked to use various different tools rather on a single integrated one, and to use them with as minimal tracking as possible. This activity highlighted old fashioned, off-line note-taking as a means of keeping our own awareness and control of our progress. It was suggested that students could be encouraged to take an opportunistic attitude to the use of digital tools in order to model criticality rather than compliance. This was a helpful way to build students' awareness of educational measurements which they could do themselves. Language learning systems for online practice need to serve students' goals rather than becoming digital drudgery in which they have to hit some targets set by a teacher. It was encouraging to see that students had their own goals which they could monitor themselves and evaluate independently of exams. It is hoped that the approach showcased here will be helpful to others who are interested in supporting students with goal setting and staying motivated, and with critical thinking in relation to AI use.

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APPENDIX

Links to resources mentioned in this paper

Varun Puri at TED X St George *How AI can help you improve your public speaking.*
https://youtu.be/9CVsdayG2kw

Yoodli Presentation Practice
https://yoodli.ai/use-cases/public-speaking

Free Speed Reading Test by AceReader
https://www.freereadingtest.com/

English Vocabulary Size Test: How many words do I know?
https://www.vocabularytester.com/vocabulary-test

Lex Tutor Vocabulary Levels Test (Productive)
https://www.vocabularytester.com/vocabulary-test

Spreeder App
https://www.spreeder.com/app.html

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