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RESEARCH PULSE

CONTENTS

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WELCOME TO RESEARCH PULSE

Welcome to the third issue of Research Pulse of 2025. We continue to share the research interests of our academics. Dr Hazik Mohamed continues to share his thoughtful insights on global affairs, this time on the implications of US tariffs on ASEAN and Australia. Dr Murphy Choy shares his on-going research on the impact of generative artificial intelligence on students' programming skills. Finally, we are also happy to share reflections on the use of artificial intelligence by researchers, as well as updates on our recent publications.

We hope our research continues to inspire our readers' research endeavours. Thank you for tuning in to Research Pulse.

Best Wishes,

Dr Adrian Tan
Research Director
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The Implications of Sweeping Tariffs and Projected Global Trade Adjustments for ASEAN and Australia

Contributed by Dr Hazik Mohamed

As of April 8, 2025, Southeast Asia and Australia stand at a pivotal juncture in their economic trajectories. The next few months (April–July 2025) will test their resilience amid global trade reconfiguration, geopolitical tensions, and shifting policy landscapes. Southeast Asia, a dynamic region with a combined GDP of approximately US$3.6 trillion in 2022, and Australia, a resource-rich economy with deep ties to Asia, are both poised for modest growth. However, uncertainties—ranging from U.S. tariff policies to commodity price volatility—could disrupt this stability. This article explores the short-term outlook for trade and economic stability in these regions, drawing on recent analyses and projections.

Southeast Asia: Resilience Amid External Pressures

Southeast Asia's economic outlook for mid-2025 remains cautiously optimistic, with regional real GDP growth projected at 4.7% for 2025, slightly up from 4.6% in 2024 (New Zealand Ministry of Foreign Affairs and Trade [MFAT], 2024). This growth is driven by robust domestic demand, a recovering tourism sector, and surging semiconductor exports, particularly in countries like Singapore, Malaysia, and Vietnam. The Asian Development Bank (ADB) highlights the role of improving global demand for electronics, noting that high-income technology exporters in the region will benefit from a rebound in semiconductor cycles (ADB, 2024). For instance, Vietnam's export-driven economy, with a significant trade surplus with the U.S., is expected to maintain growth around 6%, bolstered by its role in supply chain diversification away from China.

Trade will be a critical factor in the coming months. The Association of Southeast Asian Nations (ASEAN) has seen trade integration remain high, but geopolitical pressures are reconfiguring supply chains. McKinsey & Company (2025) warns of implications from the scaling up of U.S. tariffs that has targeted ASEAN economies with large trade surpluses, such as Vietnam and Thailand. Trump's 10%–20% across-the-board tariffs on U.S. imports, combined with specific measures against goods from China, may flood Southeast Asia with redirected exports from China, risking a backlash against cheap imports (South East Asia Public Policy Institute [SEAPPI], 2025). However, this also presents opportunities: ASEAN's "China Plus One" strategy has attracted multinational firms diversifying from China, with foreign direct investment (FDI) in manufacturing and services showing resilience despite a sluggish 0.3% growth in 2023 (MFAT, 2024).

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Economic stability in Southeast Asia hinges on managing external risks. The International Monetary Fund (IMF) notes that escalating geopolitical tensions, such as those in the South China Sea or the Russia-Ukraine conflict, could disrupt supply chains and amplify commodity price volatility (IMF, 2024). For commodity exporters like Indonesia and Malaysia, stable oil and palm oil prices will support growth, with Indonesia projected to grow at 5.1% in 2025 (ADB, 2024). Yet, a slowdown in China—ASEAN's largest trading partner—poses a threat. Weak demand in China could dampen tourism and commodity exports, with the IMF estimating a 4.4% regional growth rate for Asia in 2025 if external demand falters (IMF, 2024). Central banks, such as Vietnam's State Bank, are prepared to ease rates to stimulate growth if needed, maintaining policy rates at 4.5% as of early 2025 (McKinsey & Company, 2025).

Australia: Balancing Trade Surplus and Global Shocks

Australia's economic stability over the next few months will rely heavily on its strategic trade surplus with the U.S. and its adaptability to global shifts. With a GDP of approximately US$1.7 trillion, Australia has enjoyed decades of growth tied to open trade, with 31% of its economic output linked to trade activity (East Asia Forum, 2025). The United States Studies Centre (USSC) notes that Australia's 10 percent U.S. tariffs was due to its favorable trade balance, shielding key exports like iron ore, coal, and rare earth minerals (USSC, 2025). Discovery Alert (2025) corroborates this, estimating minimal impact on agricultural and resource goods, with Australia's trade surplus acting as a buffer against protectionist measures.

Trade dynamics will shape Australia's near-term outlook. China remains the destination for nearly one-third of Australia's exports, particularly iron ore and metallurgical coal, but a slowing economy in China—projected to grow at 4.5% in 2025—could reduce demand (CSIS, 2025; IMF, 2024). Conversely, Southeast Asia offers diversification opportunities. The Australian Department of Foreign Affairs and Trade (DFAT) emphasizes Southeast Asia's growing economic weight, projecting a compound annual growth rate of 22% in digital financial services revenue by 2025 (DFAT, 2023). Australia's 18 free trade agreements, covering 78% of its two-way trade, will support export growth to ASEAN, with bilateral trade in goods and services expected to rise modestly through July 2025 (East Asia Forum, 2025).

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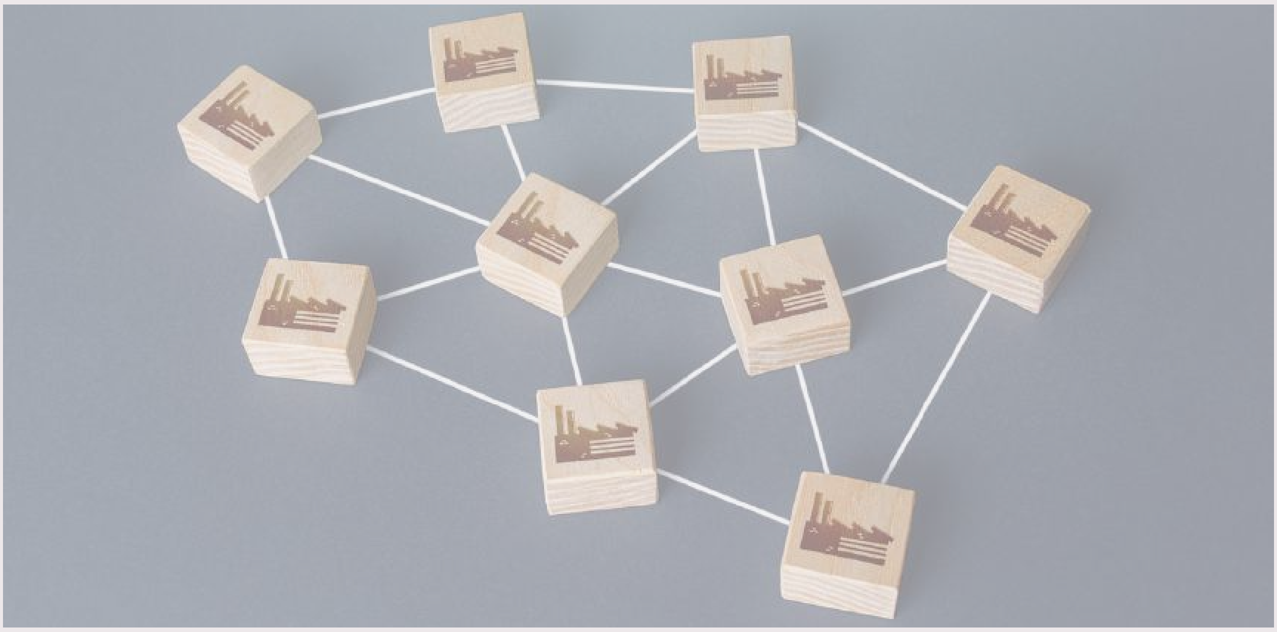
Economic stability faces challenges from global uncertainties. The Centre for Strategic and International Studies (CSIS) highlights Australia's vulnerability to U.S.-China trade tensions, noting that the blanket U.S. tariffs could indirectly raise costs for Australian exporters reliant on integrated supply chains (CSIS, 2025). The East Asia Forum (2025) warns of slower progress toward net-zero emissions and higher U.S. inflation under Trump's policies, potentially weakening growth in China and, by extension, Australian commodity exports. However, domestic policies like the Future Made in Australia Act, passed in late 2024, aim to bolster resilience through investments in clean energy and manufacturing, cushioning external shocks (East Asia Forum, 2025).



Comparative Dynamics and Interdependencies

Southeast Asia and Australia share deep economic ties, with mutual interests in trade diversification and supply chain resilience. Australia's resource exports complement Southeast Asia's manufacturing base, while ASEAN's digital and industrial growth offers Australian businesses new markets. McKinsey & Company (2025) suggests that Australia could leverage Southeast Asia's developing economies—akin to Japan's "flying geese" model—by building manufacturing bases in the region, enhancing bilateral trade. For instance, Vietnam's role as a trade hub could offset Australia's reliance on China, while Australia's rare earth minerals support Southeast Asia's tech industries (USSC, 2025).

Geopolitical risks bind their fates. Both regions face pressure from U.S. trade policies and China's economic trajectory. A McKinsey analysis notes that ASEAN economies like Vietnam and Australia could see currency pressures (e.g. a weakening dong or Australian dollar) if tit-for-tat tariffs escalate, reflecting terms-of-trade shocks (McKinsey & Company, 2025). Yet, their strategic responses differ: Southeast Asia leans on regional integration via ASEAN, while Australia balances interventionist policies with open trade advocacy (East Asia Forum, 2025).

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Outlook and Risks (April-July 2025)

For Southeast Asia, the next few months promise steady growth—around 4.7%—if trade tensions remain manageable and commodity prices hold (MFAT, 2024). A best-case scenario sees semiconductor and tourism gains offsetting slowdowns in China, with FDI inflows rising as firms diversify supply chains. However, a worst-case scenario involves U.S. tariffs triggering trade disruptions, pushing growth below 4% and destabilizing export-reliant economies like Singapore and Vietnam (SEAPPI, 2025). Australia, meanwhile, is likely to maintain stability, with growth around 2%–2.5%, supported by its trade surplus and domestic investments (USSC, 2025). Risks include a sharp downturn in China or commodity price volatility, potentially shaving growth to 1.5% (CSIS, 2025).

In conclusion, Southeast Asia and Australia are set for modest economic stability through July 2025, buoyed by trade resilience and strategic adaptability. Yet, their fortunes hinge on navigating U.S. policy shifts, demand in China, and geopolitical volatility. Proactive diversification and regional cooperation will be key to weathering these uncertainties.

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Meta-Analytic Study on the Impact of Generative Artificial Intelligence on Students' Programming Skills

Contributed by Dr Murphy Choy

1. Introduction

1.1 Research Background

In an era of digital transformation, programming skills have emerged as a foundational competency for students, shaping their academic trajectories and career readiness (Li et al., 2023). Generative AI tools, such as ChatGPT and GitHub Copilot, have revolutionized programming education by offering code generation, real-time debugging, and personalized feedback, lowering entry barriers and enhancing learning efficiency (Wang & Chen, 2024). Yet, debates persist regarding their impact: proponents highlight accelerated skill acquisition, while critics warn of over-reliance leading to diminished logical reasoning and independent problem-solving (Johnson, 2022).

Empirical research on generative AI in programming education has produced inconsistent results, attributed to variations in methodology, sample demographics, and outcome measures. This divergence complicates evidence-based instructional decisions. To address this gap, this meta-analysis synthesizes existing research to quantify the overall effect of generative AI on programming skills, explore moderating factors (e.g., educational stage, tool type), and identify implications for practice.

1.2 Core Concepts

• *Generative Artificial Intelligence:*
Systems leveraging deep learning to generate code, explain programming logic, and optimize code structure from natural language inputs (e.g., ChatGPT for multi-language code snippets, GitHub Copilot for context-aware code completion).

• *Programming Skills:*
Encompass code accuracy, algorithm design, debugging efficiency, and code normativity, measured via task completion rates, error rates, and logical complexity (Anderson et al., 2021).

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2. Methods

2.1 Literature Retrieval and Selection

We searched CNKI, Web of Science, ERIC, and CSSCI for studies published between 2018 and 2025 using keywords: “generative artificial intelligence,” “programming education,” and “programming skills.” Inclusion criteria: (1) empirical designs (experimental, quasi-experimental, survey); (2) student samples (primary, secondary, higher education); (3) quantitative outcomes (e.g., code accuracy, Cohen’s d). Excluded: theoretical papers, non-educational applications, and studies with incomplete data. After screening, 56 studies (32 international, 24 domestic) were included.

2.2 Data Extraction and Quality Assessment

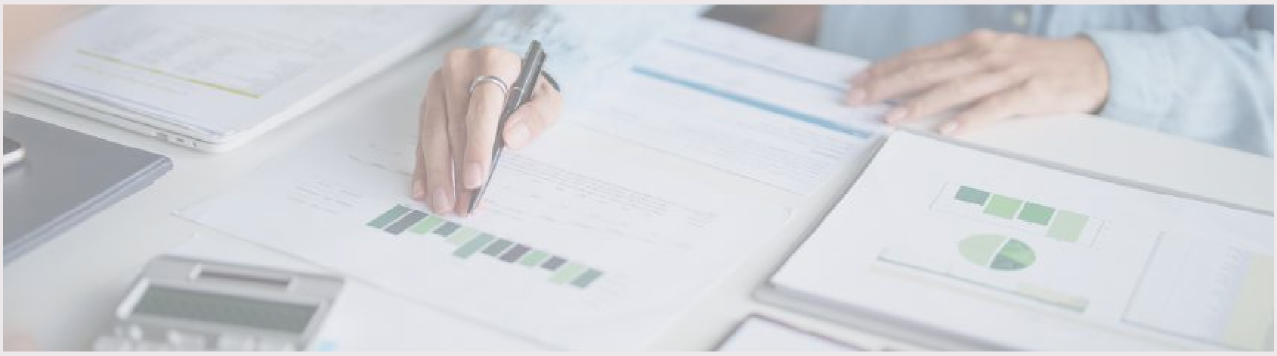
Key variables included study characteristics (publication year, sample size, educational stage), intervention details (tool type, usage frequency), and outcomes (skill scores, effect sizes). Study quality was evaluated using the Cochrane Risk of Bias Tool, excluding 8 low-quality studies due to selection bias or insufficient data.

2.3 Statistical Analysis

• ***Effect Size Synthesis:***
Random effects models combined effect sizes to account for inter-study heterogeneity, calculating weighted averages for Cohen’s *d* and 95% confidence intervals (CIs).

• ***Heterogeneity and Subgroup Analysis:***
I^2 statistics identified significant heterogeneity ($I^2 > 50\%$), prompting subgroup analyses by educational stage (K12 vs. higher education), tool type (general-purpose vs. specialized), and usage frequency (≤5 vs. >5 hours/week).

• ***Bias Detection:***
Funnel plots and Egger’s test ($p > 0.05$) confirmed no significant publication bias, and sensitivity analyses demonstrated robust results after excluding influential studies.



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3. Results

3.1 Overall Impact of Generative AI

Generative AI yielded a significant positive effect on programming skills, indicating that users outperformed controls. Sub-dimensions showed varying effects: code generation and algorithm comprehension were most enhanced, while debugging skills showed moderate gains, likely due to AI's limited capacity to replace hands-on debugging expertise.

3.2 Moderating Factors

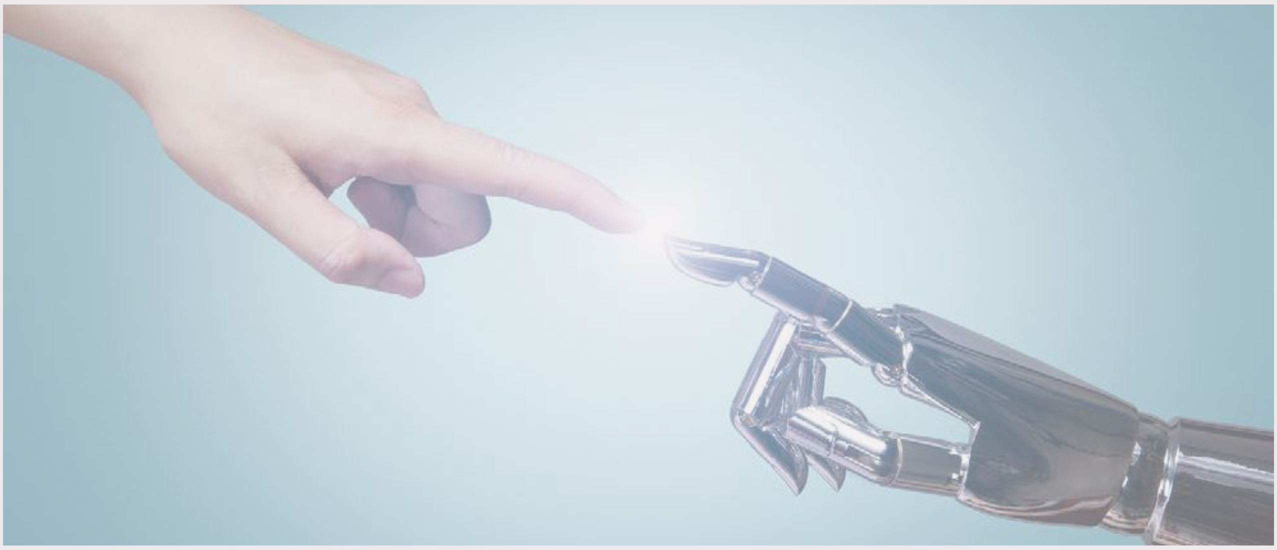
• *Educational Stage:*
Higher education students exhibited stronger effects compared to K12, attributed to alignment with complex tasks (e.g., algorithm implementation, large-scale projects) where AI's code generation and logical analysis add substantial value.

• *Tool Type:*
Specialized tools (e.g., GitHub Copilot) excelled in code generation speed via programming-specific templates, while general models (e.g., ChatGPT) better explained programming logic through natural language clarity.

• *Usage Frequency:*
Moderate-high use (≥5 hours/week) correlated with higher effects than low use, though excessive reliance risked diminishing returns, as over-dependent students showed reduced independent problem-solving.

3.3 Bias and Sensitivity

Funnel plots were symmetric, and Egger's test ruled out publication bias. Sensitivity analyses confirmed stable effect sizes after excluding outliers, underscoring result robustness.



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4. Discussion

4.1 Mechanisms of Skill Enhancement

• *Cognitive Scaffolding:*
AI reduces working memory load via real-time code completion and syntax checks, enabling students to focus on algorithm design rather than mechanical coding (e.g., GitHub Copilot auto-completing Python loops, freeing cognitive resources for logic flow).

• *Personalized Learning:*
Tools adapt to student proficiency, recommending tailored tasks (basic scripts for novices, complex optimizations for advanced learners) and providing step-by-step explanations, fostering incremental skill development.

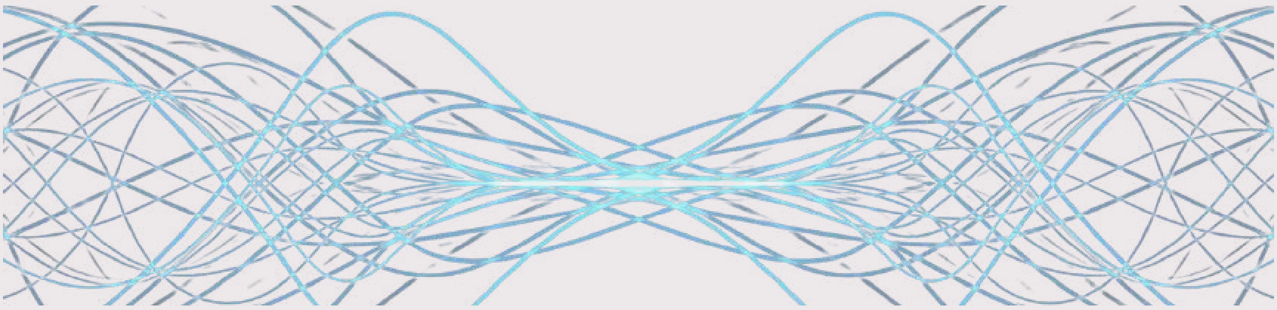
• *Practice Facilitation:*
Low-threshold code generation encourages experimentation, allowing students to iterate on ideas (e.g., prototyping machine learning models) and learn through "generate-test-refine" cycles, building practical experience.

4.2 Risk and Challenges

• *Superficial Learning:*
Over-reliance leads to "cognitive-offloading," where students priortize tool output over deep understanding. Experimental evidence shows AI-dependent students scored lower on independent problem-solving highlighting the need for balanced tool use.

• *Feedback Limitations:*
General models occasionally misinterpret technical naunces (e.g., conflating class methods with object properties in OOP), leading to incorrect guidance and persistent misconceptions.

• *Ethical Concerns:*
AI-generated code complicates plagiarism detection, while biased training data may propagate algorithmic discrimination (e.g., skewed recommendations toward dominant programming styles), necessitating robust ethical frameworks.



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4.3 Educational Implications

• ***Instructional Design:***
Adopt a hybrid model where AI supports syntax learning (e.g., code completion for grammar drills) but is restricted during algorithm design phases to promote independent thinking, complemented by peer collaboration and teacher-led conceptual deepening.

• ***Skill Priortization:***
Shift focus from code writing to problem decomposition algorithm optimization, and cross-tool collaboration. Introduce courses on "AI-assisted programming strategies" to teach critical evaluation of AI outputs and strategic-tool integration.

• ***Assessment Innovation:***
Incorporate dynamic metrics (e.g., code refactoring without AI, debugging speed) and process data (code modification history, AI interaction logs) to assess deep learning and tool dependency, moving beyond superficial task completion.

5. Conclusions and Future Directions

5.1 Conclusions

Generative AI significantly enhances programming skills, particularly in code generation and algorithm comprehension, with moderated effects by educational stage, tool type, and usage frequency. While offering unprecedented learning support, risks of superficial learning and ethical challenges necessitate intentional pedagogical design

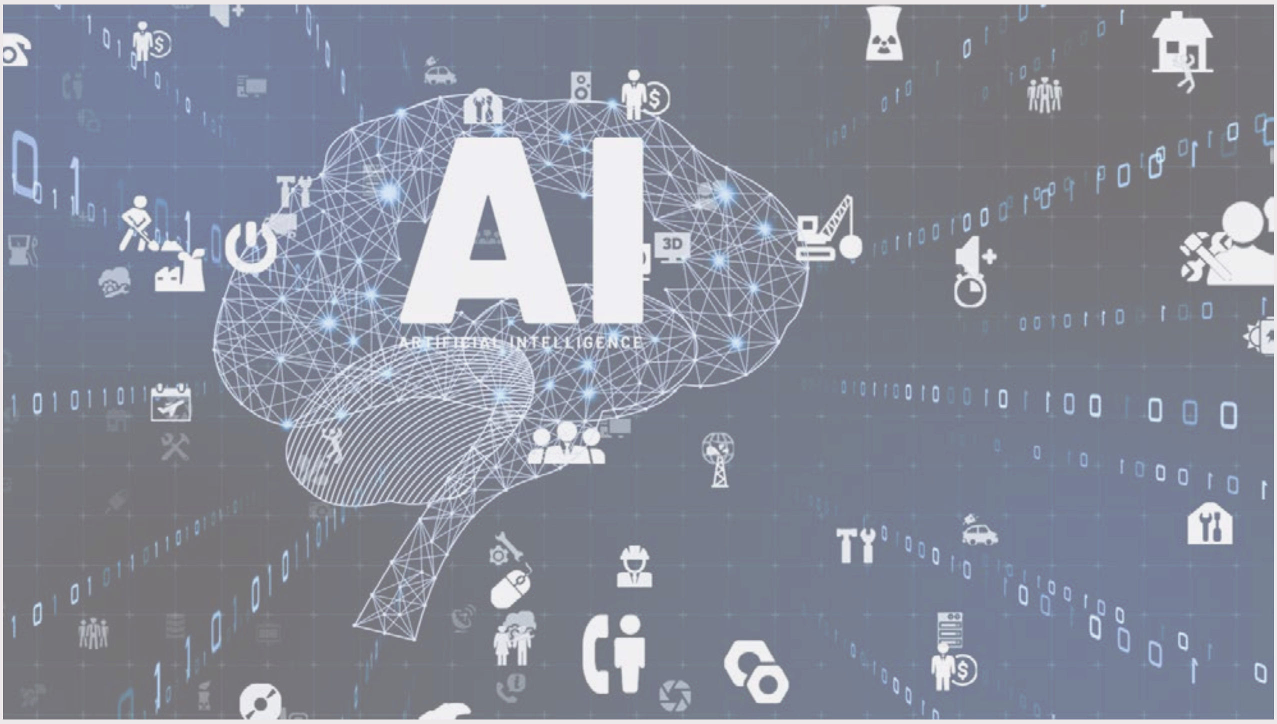
5.2 Limitations and Future Research

Most studies focus on higher education, leaving K12 impacts under-researched. Future work should (1) explore long-term effects on younger learners; (2) assess non-cognitive skills (creativity, collaboration); (3) integrate neuroscientific methods (e.g., fMRI) to study AI's impact on cognitive processing; and (4) develop adaptive frameworks to balance AI assistance with human-guided critical thinking.

Reflections on the Use of AI in Research: To Use or Not to Use?

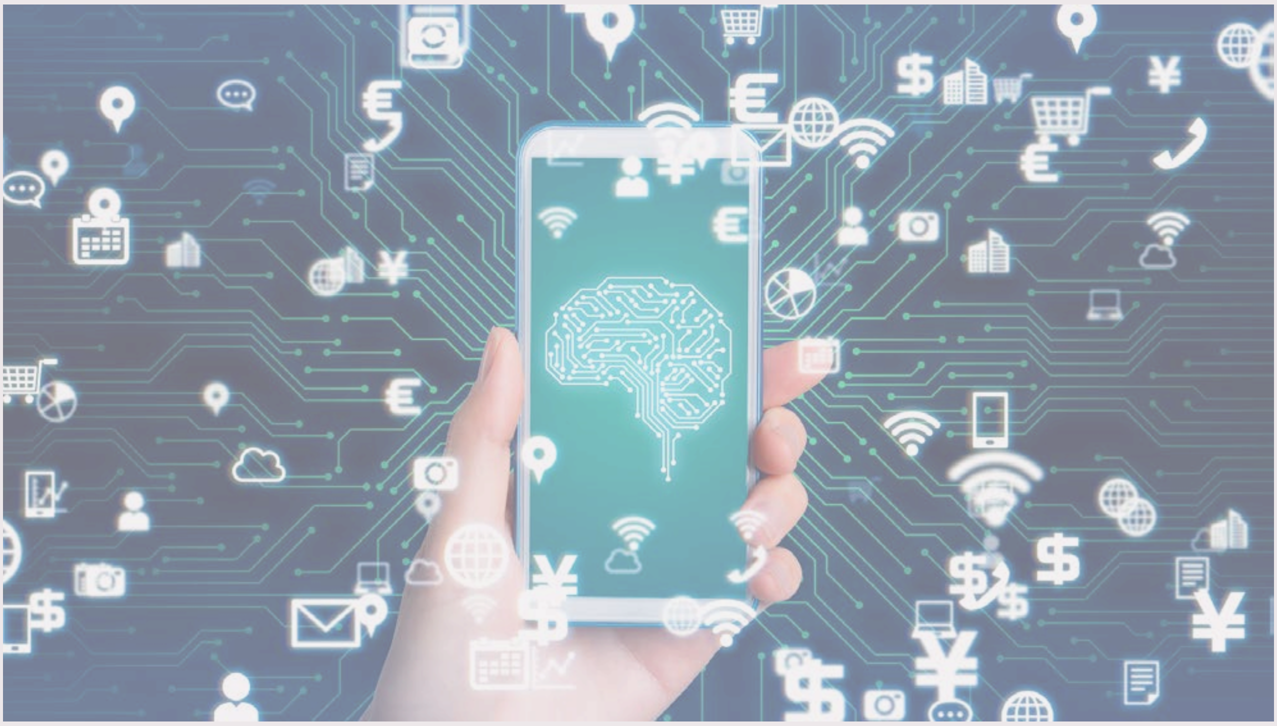
Contributed by Dr Adrian Tan

In this short article, I would like to raise into discussion a seemingly taboo topic in research—the use of AI by researchers for their work. OR should it even be a taboo topic at all? Afterall, AI, and especially GenAI, is an emerging technology that has spilled into use at an increasing rate into most aspects of our lives and work, including in academia. The use of AI in academic and research work remains a contentious issue, but it certainly is not worth shying away from opportunity to attend a short webinar session entitled "AI in Qualitative Research" which was conducted by Dr Claire Moran who has been running Thematic Analysis training for Queensland University of Technology. From this webinar, I would like to share what I have learnt and my reflections on the use of AI in research.



It is basic to truly understand what AI is and is not for research. AI is a research productivity tool that can be used to aid research. However, because the technology is developed to mimic human intelligence by relying on statistical patterns to predict what is most likely based on available data, AI does not understand, think, feel and interpret meaning as humans do. That said, AI is most likely suitable for quantitative research as it involves object analysis and interpretation of quantitative data. AI increasingly can perform good statistical analysis and interpretations. Several AI tools are available that can take the role of data analyst to help the researcher perform data extraction, data manipulation and data visualization, for example: Julius AI.

But what about AI for qualitative research? To answer this question, we would need to get back to the basics to know what qualitative research is fundamentally about. Several AI tools are available for qualitative research, for example tools for transcription (Otter, Whisper, etc), literature mapping (ResearchRabbit, Elicit), summarisation and coding (ChatGPT, Claude, etc), and even writing support (Wordtune, Grammerly). Qualitative research is concerned with development of meaning, experience and interpretation and not about measure and prediction meant for its quantitative research cousin. As the research style is rooted in subjectivity, context and complexity of a phenomenon, the researcher is not neutral as interpretation is dependent on the researcher who is shaped by personality, values and reflexivity. Hence the researcher is central to the qualitative research process. This creates a tension with the use of AI since AI operates from a logic of statistical pattern recognition. AI assumes knowledge is in the data, whereas qualitative research seeks knowledge as being constructed and shaped by context and perspective.



Therefore, it is proposed that AI be used for qualitative research only for obtaining suggestions, and not as a means to obtain a solution or conclusion. There is a need to reflect and interpret the suggestions made by AI. It is also useful to remember that qualitative research is always inherently human interpretation, a function which lies with the researcher and not the technology. Therefore AI cannot replace human interpretation which might be about reading in between the lines or even deciphering nuances. Most importantly, the use of AI should not be at all cost, but also be subject to ethical clarity and clearance where required.

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Latest Publications

By Mr Jeffrey Woo:
“Healthcare workers’ perceptions of patient safety culture in emergency departments: A scoping review”
~ British Management Journal Open, *in press*

By Dr Adrian Tan and Mr Leo Kee Chye:
“Safety of LLM-based AI Chatbots for Young Consumers in Purchase Decisions”
~ Young Consumers, *in press*

By Dr Zahirah Zainol (and external researchers):
“Unlocking LinkedIn Adoption for Higher Education Students: Findings from PLS-SEM and NCA”
~ Young Consumers, *in press*

By Dr Adrian Tan and Dr Tien Nguyen:
“Mandating Flexible Work Arrangements without Legislation: A Discourse on the Case of Singapore”
~ To be presented at the Asia Academy of Management Special Conference in Bangkok, Thailand in June 2025.

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