Curtin Singapore

AUGUST 2025

RESEARCH PULSE

CONTENTS

1 WELCOME TO RESEARCH PULSE

2 RETHINKING GLOBALISATION: RESILIENCE, REGIONALISM, AND THE NEW ECONOMIC ORDER

3 HARNESSING LLM-BASED OCR FOR GRADING HANDWRITTEN MATHEMATICAL ASSESSMENTS: A RESEARCH IN PROGRESS

4 CURTIN SINGAPORE POSTER PRESENTATION IN THE TOP 10 AT THE 6TH SINGHEALTH NURSING CONFERENCE 2025

5 HEALTH INNOVATION ACCELERATOR WORKSHOP 2025: AN OPPORTUNITY FOR RESEARCH SHARING, NETWORKING, AND COLLABORATION

6 LATEST PUBLICATIONS

research@curtin.edu.sg

ISSN: 2810 9481

WELCOME TO RESEARCH PULSE

We continue to share the research expeditions at Curtin Singapore.

Dr Hazik Mohamed leads with his thought-provoking analysis on the evolution of globalisation, exploring resilience, regionalism, and the emerging economic order. Mr Leo Kee Chye follows with his ongoing research on using Large Language Model-based Optical Character Recognition (LLM-OCR) technology to grade handwritten mathematical assessments.

We highlight the achievement of Ms Joelle Yap, whose poster presentation was ranked among the top 10 at the 6th SingHealth Nursing Conference 2025. Mr Jeffrey Woo reflects on his experience at the Health Innovation Accelerator Workshop 2025, where he presented a collaborative study on nurses' and nursing students' experiences with generative artificial intelligence.

Finally, we also feature the latest publications from our academic community.

Thank you for tuning in to Research Pulse.

Best Wishes,

Dr Adrian Tan
Research Director
Curtin Singapore

ISSN: 2810 9481

Rethinking Globalisation: Resilience, Regionalism, and the New Economic Order

Contributed by Dr Hazik Mohamed

Globalisation, once celebrated as the catalyst for worldwide economic integration and prosperity, is undergoing a profound transformation. The early 21st century witnessed an era of hyper-globalisation, characterised by rapid cross-border flows of goods, services, capital, and information. However, recent events — including the contagion of the 2008 financial crisis, the COVID-19 pandemic, and escalating geopolitical tensions — have exposed vulnerabilities in the global economic system. These challenges have prompted a re-evaluation of globalisation, leading to a renewed focus on resilience, regionalism, and the emergence of a new economic order.

The Evolution of Globalisation

In the late 20th and early 21st centuries, globalisation was driven by technological advancements, the liberalisation of trade policies, and the expansion of multinational corporations. This period saw significant economic growth, poverty reduction, and increased cultural exchange. However, the benefits of globalisation were unevenly distributed, leading to widening income inequalities within and between countries.

The 2008 global financial crisis marked a turning point, revealing the fragility of the interconnected financial system. The crisis underscored the risks of over-reliance on global supply chains and the potential for systemic shocks to propagate rapidly across borders. In response, nations began to reconsider the structure of their economies and the extent of their integration into the global market.

ISSN: 2810 9481

The Rise of Regionalism

As faith in hyper-globalisation waned, regionalism emerged as a compelling alternative. Regionalism refers to the process by which countries within a specific geographic area collaborate to achieve common economic, political, or security objectives. This approach emphasises strengthening regional ties to enhance economic resilience and reduce dependence on distant markets.

The resurgence of regionalism is evident in various parts of the world. For instance, the Association of Southeast Asian Nations (ASEAN) has deepened economic integration among its member states, creating a more cohesive regional economy. Similarly, the African Continental Free Trade Area (AfCFTA), launched in 2021, aims to create a single market for goods and services across 54 African countries, fostering intra-African trade and investment.

In the Americas, the United States–Mexico–Canada Agreement (USMCA), which replaced the North American Free Trade Agreement (NAFTA) in 2020, reflects a renewed commitment to regional economic collaboration. These initiatives signify a shift towards regional blocs that prioritise local supply chains and economic self-sufficiency.

Resilience in the Global Economy

The concept of resilience has gained prominence as countries seek to mitigate the risks associated with global interdependence. Economic resilience refers to the capacity of an economy to absorb shocks, adapt to changing conditions, and recover swiftly from disruptions.

The COVID-19 pandemic highlighted the vulnerabilities of global supply chains, as lockdowns and travel restrictions led to significant disruptions in the production and distribution of goods. Essential items — including medical supplies and semiconductors — faced shortages, prompting countries to reassess their reliance on complex international supply networks.

In response, businesses and governments are adopting strategies to enhance resilience. These include diversifying supply sources, increasing stockpiles of critical goods, and reshoring manufacturing activities. The emphasis is on creating more robust and flexible supply chains that can withstand future shocks.

ISSN: 2810 9481

The New Economic Order

The interplay between globalisation, regionalism, and resilience is giving rise to a new economic order characterised by multipolarity and decentralised economic power. This emerging order reflects a departure from the unipolar dominance of the United States and acknowledges the rising influence of other economies, particularly in Asia.

China's Belt and Road Initiative (BRI), launched in 2013, exemplifies this shift. The BRI seeks to enhance global trade and investment through extensive infrastructure projects connecting Asia, Europe, and Africa. By fostering regional connectivity, China aims to bolster its economic ties and expand its influence across multiple continents.

Moreover, the concept of a "Tri-Polar World" has gained traction, highlighting regional competition among the Americas, Asia, and Europe in areas such as artificial intelligence, green technology, and security. This perspective suggests that regional integration and competition are reshaping the global economic landscape, leading to a more complex and interconnected world (Pelosky, 2025).

Challenges and Opportunities

While the move towards regionalism and resilience offers potential benefits, it also presents challenges. There is a risk that increased regionalism could lead to protectionism, trade barriers, and fragmentation of the global economy. Such outcomes could undermine the efficiency gains achieved through globalisation and limit the potential for economic growth.

Additionally, the transition to a new economic order requires careful management of geopolitical tensions. The rivalry between the United States and China, for example, has significant implications for global trade, technology development, and security. Navigating this complex relationship is crucial to maintaining global stability and fostering cooperative economic relations (Financial Times, 2024).

On the other hand, the focus on resilience and regionalism presents opportunities for countries to develop more sustainable and inclusive economic models. By strengthening regional supply chains, investing in local industries, and enhancing economic self-sufficiency, nations can reduce their vulnerability to external shocks and promote balanced development.

ISSN: 2810 9481

Policy Implications

Policymakers must carefully balance the benefits of regional integration with the need to maintain an open and inclusive global economy. This involves:

i. Promoting Inclusive Regionalism: Ensuring that regional trade agreements are designed to be open and compatible with the broader multilateral trading system. This approach can prevent the formation of exclusive blocs and promote global economic cohesion.

ii. Enhancing Supply Chain Resilience: Encouraging businesses to adopt strategies that increase flexibility and reduce dependence on single sources of supply. Governments can support these efforts through policies that facilitate diversification and innovation.

iii. Managing Geopolitical Tensions: Engaging in diplomatic efforts to mitigate conflicts and promote cooperation among major powers. This includes participating in international forums and supporting institutions that facilitate dialogue and dispute resolution.

iv. Investing in Sustainable Development: Prioritising investments in infrastructure, education, and technology that support long-term economic resilience and environmental sustainability. Such investments can enhance a country's capacity to adapt to changing global conditions.

ISSN: 2810 9481

Conclusion

The rethinking of globalisation reflects a broader recognition of the need to build a more resilient and balanced global economic system. While the era of hyper-globalisation brought significant benefits, it also exposed vulnerabilities that have prompted a shift towards regionalism and the establishment of a new economic order.

By embracing regional collaboration, enhancing economic resilience, and navigating the complexities of a multipolar world, countries can position themselves to thrive in this evolving landscape. The challenge lies in managing this transition in a way that preserves the gains of globalisation while addressing its shortcomings, ultimately leading to a more sustainable and inclusive global economy.

References

Financial Times. (2024, September 15). Can globalization survive the US-China rift? Retrieved from https://www.ft.com/content/611a48d5-8c1a-40de-a062-f1286499c3f3

Pelosky, J. (2025, January 9). Forget American exceptionalism, it's a tri-polar world. Reuters. Retrieved from https://www.reuters.com/markets/us/forget-american-exceptionalism-its-tri-polar-world-pelosky-2025-01-09/

ISSN: 2810 9481

Harnessing LLM-based OCR for Grading Handwritten Mathematical Assessments: A Research in Progress

Contributed by Mr Leo Kee Chye

Introduction

As the influence of artificial intelligence continues to reshape educational practices, a key challenge emerges: how to efficiently and accurately evaluate student work in a way that balances automation with fairness. In response to the rise of AI-assisted digital assessments, universities worldwide are increasingly reverting to handwritten exams to safeguard academic integrity. This development, however, reintroduces the long-standing burdens of manual grading—especially for computation-heavy disciplines like mathematics.

To address this, my current research (working together with Dr Wei Hu, Curtin Perth) explores a transformative solution: using Large Language Model-based Optical Character Recognition (LLM-OCR) systems to automate the grading of students' handwritten mathematical solutions. My objective is to assess whether advanced OCR tools like Mistral OCR, OlmOCR, and Mathpix, when integrated with LLMs, can not only match but potentially exceed the performance of human graders.

Research Objective

The core aim of this study is twofold:

1. Comparative Performance Evaluation: To benchmark the grading performance of LLM-OCR systems against conventional OCR and human graders. This includes accuracy in recognizing and interpreting complex handwritten mathematics—formulas, equations, stepwise reasoning—as well as alignment with human feedback standards.

2. Feasibility for Educational Use: To determine whether these systems can serve as scalable, reliable grading tools in university settings where handwritten computation remains essential.

This research is motivated by the growing body of evidence that advanced OCRs, particularly when combined with LLMs, show promise in automating grading while preserving contextual understanding and accuracy.

ISSN: 2810 9481

Context: The Return to Handwritten Assessments

The proliferation of generative AI tools has significantly impacted how students approach take-home exams and coursework. To mitigate the risk of AI-assisted cheating, many institutions are reinstating invigilated, handwritten assessments. While effective in upholding academic standards, this shift reintroduces time-consuming manual grading workflows—particularly for STEM educators.

In this environment, there is a strong need for grading tools that combine OCR, math parsing, and AI feedback mechanisms—tools capable of reading, understanding, and scoring student work with high reliability and efficiency.

Solution Proposal: LLM-Based OCR Grading

To facilitate this, my research investigates how modern LLM-OCR systems compare with both conventional OCR technologies and human graders. Among the OCR systems under consideration:

Model	Math Support	Handwriting Accuracy	LaTeX Output	Strengths
Mistral OCR	Strong	Good for printed/mixed	Yes	Fast, layout-aware, supports LaTeX/JSON
OlmOCR	Very Strong	90%+ on handwriting	Markdown	Open-source, privacy-focused, customisable
Mathpix	Excellent	Mixed	Yes	Best-in-class math OCR for equations & layout

While conventional OCR systems struggle with non-linear math notation and handwritten input, these advanced OCRs excel through deep learning, layout preservation, and integration with language models.

ISSN: 2810 9481

Prototype Development

I have developed a working application prototype that integrates LLM-based OCR to parse and evaluate handwritten mathematical solutions. A demonstration of this app can be viewed via the following YouTube clip *https://youtu.be/z93RORmhOSY*.

This app utilises a backend pipeline combining advanced OCR (e.g., Mistral OCR or OlmOCR) with a grading logic informed by GPT-based models. The system extracts equations, reconstructs solution steps, and generates both a score and feedback for each student response.

Next Steps: Hypothesis Testing

Once the application reaches full functionality, the next phase of the research will involve empirical evaluation through hypothesis testing. Specifically, I aim to test:

1. Grading Accuracy Hypothesis

H_0: There is no significant difference in grading accuracy between LLM-OCR and human graders.

H_1: LLM-OCR achieves significantly higher or comparable grading accuracy to human graders.

2. Feedback Preference Hypothesis

H_0: Students show no preference between feedback from human graders and LLM-OCR.

H_1: Students prefer LLM-OCR-generated feedback over human feedback due to clarity, structure, or speed.

Quantitative metrics will include agreement rates, error detection capability, and correlation with instructor-assigned scores. Qualitative metrics will evaluate student satisfaction and usefulness of AI-generated feedback.

ISSN: 2810 9481

Preliminary Literature Evidence

Studies such as those by Caraeni et al. (2024) and Nath et al. (2025) suggest that LLM-integrated OCR systems can achieve up to 94% agreement with human graders on simpler problems. However, their performance degrades on multipart solutions, diagrams, or cursive writing. Resource efficiency also varies—larger models face latency issues unless distilled for classroom-scale deployment.

Conclusion

This research represents a timely investigation into the practical intersection of AI and education. By leveraging LLM-based OCR for grading handwritten math, educators could potentially reduce workload, improve consistency, and provide immediate, structured feedback—all while preserving the integrity of human-centric learning environments.

In an academic world where AI is both a tool and a challenge, this work aims to equip educators with robust, scalable solutions to maintain the rigor and fairness of student assessment.

References

Caraeni, A., Scarlatos, A. and Lan, A., 2024. Evaluating GPT-4 at Grading Handwritten Solutions in Math Exams. *arXiv preprint arXiv:2411.05231.*

Nath, O., Bathina, H., Khan, M.S.U.R. and Khapra, M.M., 2025. Can Vision-Language Models Evaluate Handwritten Math?. *arXiv preprint arXiv:2501.07244.*

ISSN: 2810 9481

Curtin Singapore Poster Presentation in the Top 10 at the 6th SingHealth Nursing Conference 2025

Contributed by Dr Adrian Tan

We are pleased to share that the poster presentation by Ms Joelle Yap at the 6th SingHealth Nursing Conference, held from 3rd to 5th July 2025, was selected as one of the top 10 posters presented at the conference. The poster, entitled *"The Resilience of Nurses Who Respond to Natural Disasters: Findings from an Integrative Literature Review"*, was designed in a newspaper style to captivate the audience with the findings of her integrative literature review, which forms part of her Doctor of Philosophy (PhD) research.

ISSN: 2810 9481

We are delighted for Joelle and her captivating poster, which was both designed and presented at the Singapore General Hospital Campus.

6th SingHealth Nursing Conference 2025
co-organised with **West China Hospital, Sichuan University**

The Resilience of Nurses who Respond to Natural Disasters: Findings from an integrative literature review

Yap, J.L.L.[1], Nichols, P.[1], Tan, A.H.T.[2], Brown, J.A.[1,3,4]

[1]Curtin School of Nursing, Bentley, WA, Australia; [2]Curtin Global, Singapore;
[3]The Western Australian Group for Evidence Informed Health Practice: A JBI Centre of Excellence;
[4]St John of God Midland Public and Private Hospitals

Curtin University

SPECIAL NURSING EDITION

SingHealth Times

FRIDAY JULY 4, 2025

ISSUE NO. 1

"We just keep going..."

cited in Broussard & Myers, 2010, p. 235

Resilience of nurses who respond to natural disasters

Introduction

Nurses who respond to natural disasters face challenges and stress. Studies show that resilience can help nurses overcome adversity. However, more needs to be known about how resilience is experienced by nurses who respond to natural disasters.

Aim

The review aims to identify and synthesise the literature on resilience and disaster nursing, specifically natural disasters.

Figure 1: A collage of the literature and a humanitarian response to the Gujarat Earthquake.

Method

The review used the systematic approach by Whittemore and Knafl (2005). This design is suitable for understanding resilience in disaster nursing as the concepts are complex and have not been examined in depth. The approach also allows for diverse sources of information to aid in understanding the concepts in this context.

Findings

18 articles were included in this integrative review (Fig. 2). It was found that there were differences in the characteristics and experiences of nurses who responded to local disasters compared to those who responded to disasters across international borders.

The nurses experienced being in an environment of extreme devastation and losses. **Four themes** were identified in the literature in this over-arching context of adversity.

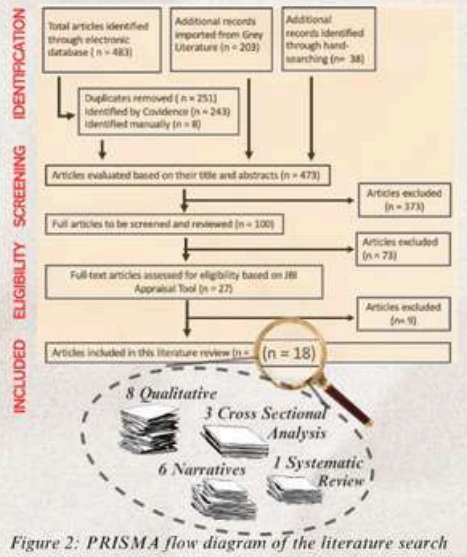
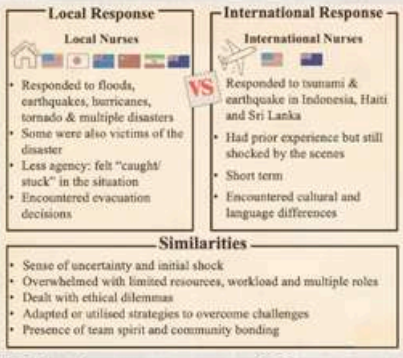


Figure 2: PRISMA flow diagram of the literature search



Four Themes Indentified

The nursing identity remains strong
In disasters, nurses have a strong duty to care. They struggle with maintaining standards and professional dilemmas. They find solutions and adapt to make the situation better.

There are positive experiences amid adversity
Nurses grow from professional and personal challenges. There are moments of joy, hope and growth despite the hardships.

Resilience building is displayed in various ways
Resilience is demonstrated as a challenge to be embraced, as a pivot point, or when a sense of hope develops gradually.

Post-disaster support and pre-disaster preparedness are important
There are long-term impacts on nurses' well-being, including transitioning back. There is a call for nursing education and training in disasters.

HOW THIS REVIEW CONTRIBUTES

Synthesis
Synthesises literature on the experiences of nurses who respond to natural disasters and sheds light on how these nurses build resilience.

Future Directions
The four themes capture directions to inform organisations and nurses to help them in future disaster responses.

Conclusion

The review forms a basis for more stories to be gathered from prospective participants, and more will be explored in the next stage of the first author's PhD.

ACKNOWLEDGEMENT: Ms Annie Hong and Ms Vanessa Varis, University Librarians, Curtin University

Health Innovation Accelerator Workshop 2025: An Opportunity for Research Sharing, Networking, and Collaboration

Contributed by Mr Jeffrey Woo

I am thankful to have had the opportunity to represent Curtin Singapore at the Health Innovation Accelerator Workshop held on 24 June 2025 at the Global Streaming Centre, Bentley Technology Park—an event co-organised by the Faculty of Health Sciences and the Faculty of Science and Engineering. Participating in this workshop was an eye-opening experience that deepened my appreciation for interdisciplinary collaboration and the role of artificial intelligence (AI) in enhancing patient care.

The dynamic exchange among researchers, clinicians, and technology experts illuminated innovative pathways for integrating intelligent systems into clinical practice. The workshop brought together professionals from diverse backgrounds—including researchers, engineers, clinicians, and students—creating a vibrant platform to share evidence-based solutions to real-world health challenges. I was particularly inspired by the discussions on consumer engagement and digital health platforms.

This workshop provided transformative insights into interdisciplinary healthcare innovation and broadened my perspective on the applications of AI in delivering high-quality patient care. The insightful sharing and discussions on digital health and intelligent systems underscored the transformative potential of AI in improving clinical decision-making, streamlining workflow efficiency, and ultimately delivering more responsive and equitable care. It became evident that AI is not just a technological advancement, but a catalyst for reimagining how healthcare is delivered.

ISSN: 2810 9481

During the 5-minute pitch segment, I had the privilege of presenting my latest research study, conducted in collaboration with Dr Adrian Tan, Research Director at Curtin Singapore, entitled: "*Nurses' and nursing students' experiences of the use of generative artificial intelligence: a scoping review.*" This presentation prompted insightful discussions on the ethical, practical, and educational aspects of AI in nursing practice.

Reflecting on my presentation, I found it rewarding to share evidence on how nurses and nursing students perceive generative AI tools. This is an important and timely study, as the findings underscore the need to co-design AI applications with end-users to ensure relevance, trust, and usability. The feedback received from the workshop was both encouraging and thought-provoking, reaffirming the need for more inclusive and practice-informed research. This paper has been submitted to a journal for publication and is currently under review.

Additionally, I greatly appreciated the opportunity to network with colleagues from across the faculties of Curtin University and various healthcare settings in Western Australia. These connections opened avenues for potential collaborations, joint research initiatives, and future funding opportunities. The workshop left me feeling inspired and more committed to contributing to research that advances AI-enabled healthcare innovations—grounded in real-world clinical needs and co-designed with end users in mind.

The Health Innovation Accelerator Workshop significantly broadened my perspective on the application of artificial intelligence in healthcare, shifting my understanding from isolated, nursing-focused applications to integrated, interdisciplinary solutions that can revolutionise patient care delivery through collaborative innovation.

ISSN: 2810 9481

Latest Publications

By Dr Hazik Mohamed:
"Central Banks and Policy Development for Decarbonization in the G20"
~ Book Chapter in: Irfan Kalayci (Ed.), Central Banking and Monetary Policy in the G20: Paradigms and Challenges, Chapter 6, pp. 149–168. Vernon Press. https://vernonpress.com/book/2122

By Ms Joelle Yap (with PhD supervisors Associate Professor Janie Brown, Dr Pam Nicols, and Dr Adrian Tan):
"The Resilience of Nurses Who Respond to Natural Disasters: Findings from an Integrative Literature Review"
~ Poster presentation at the 6th SingHealth Nursing Conference, 3–5 July 2025.

By Dr Zahirah Zainol, Dr Nik Chong, and Dr Krishna Renganathan (with acknowledged external researchers):
"AI Governance on Young Consumers in Higher Education: A Content Analysis of Policies for Generative AI"
~ Young Consumers, in press.

ISSN: 2810 9481

Latest Publications

By Professor Alex Stojcevski (with acknowledged external collaborators):
"Bidirectional Wireless Charging System for Electric Vehicles: A Review of Power Converters and Control Techniques in V2G Application"
~ IEEE Access, 13: 75242–75260. DOI: 10.1109/ACCESS.2025.3561396

"A Phase-Synchronization Control of Bidirectional Wireless Power Transfer System for G2V and V2G Operation Modes"
~ IEEE Transactions on Transportation Electrification. DOI: 10.1109/TTE.2025.3567490

"Advances in Hosting Capacity Assessment and Enhancement Techniques for Distributed Energy Resources: A Review of Dynamic Operating Envelopes in the Australian Grid"
~ Energies, 18(11). https://doi.org/10.3390/en18112922

"Bayesian Optimization of CNN-M-LSTM for Thermal Comfort Prediction and Load Forecasting in Commercial Buildings"
~ Designs, 9(3). https://doi.org/10.3390/designs9030069

"A New Configurable SC-Based Dual Source Inverter Topology with Improved Reliability"
~ IEEE Transactions on Industry Applications. DOI: 10.1109/TIA.2025.3584035

By Dr Tien Nguyen (with acknowledged researchers):
"Amplified Equity: Towards Personalised Nudge Interventions to Improve Equity Students' Experience and Success Outcomes"
~To be presented at the Science in Australia Gender Equity (SAGE) Conference 2025: Breaking Silos, Working Together for Equity (25–27 August, Sydney).

By Ms Maler Vilee, Dr Tien Nguyen, and Ms Isabella Sreyashi Sengupta:
"The Impacts of Women Entrepreneurship Networks: Insights from a Literature Review and a Case Study of the Singapore Women Entrepreneurs Network (SG-WEN)"
~To be presented at the International Symposium on Action for Women's Rights, Equality, and Empowerment in the Western Indian Ocean (13–15 November 2025, Port Louis, Mauritius).

ISSN: 2810 9481