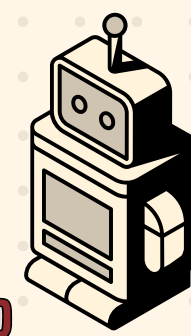




Integrating Artificial Intelligence in Teaching and Learning Geography in Hong Kong Secondary Schools



Introduction

RESEARCH BACKGROUND

- Artificial Intelligence in Education (AIED)
 - AIED has gained global attention since 2016 → offering promise for enhancing educational methodologies
- Geospatial AI (GeoAI)
 - Widely used for professional spatial analysis → holding potential to enhance learning outcomes in general geography education
- Geography curriculum
 - Hong Kong's secondary geography curriculum, revised for junior (2011) and senior (2022, updated from 2007) → lacking alignment with technological advancements

RESEARCH OBJECTIVES

- To investigate geography teachers' and students' knowledge, attitudes, and practices (KAP) regarding AI tool integration in the Hong Kong geography curriculum
- To assess AI tools' effectiveness in enhancing secondary students' geography learning outcomes compared to traditional methods
- To explore opportunities and challenges of the AI tool integration
- To provide recommendations for incorporating AI tools into the design of Hong Kong geography curriculum

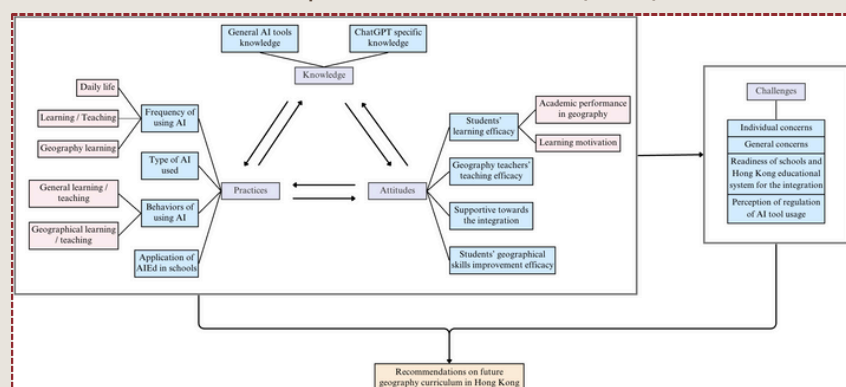
RESEARCH SIGNIFICANCE

- Knowledge
 - Limited AIED research on secondary geography education in Hong Kong.
 - Insufficient progress in evaluating AIED's practical effectiveness beyond theoretical planning
- Practical
 - Explore practical integration of AI tools in geography education via AIED Geography Trial
 - Provide constructive insights and recommendations for HKEDB's future geography curriculum development

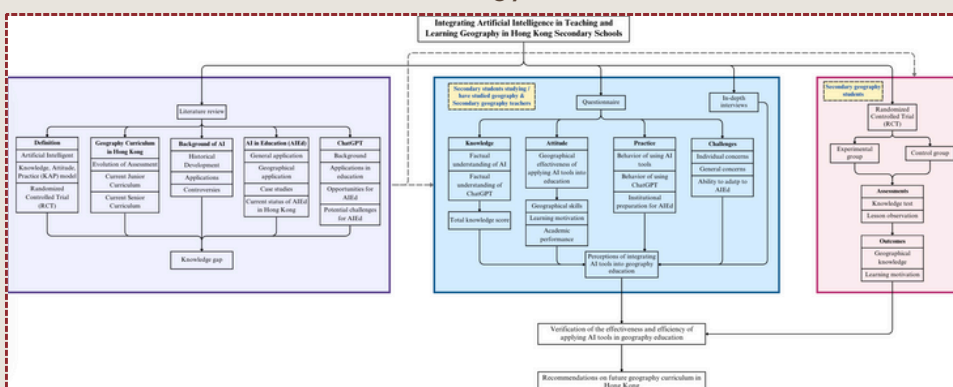
Methodology

FRAMEWORKS

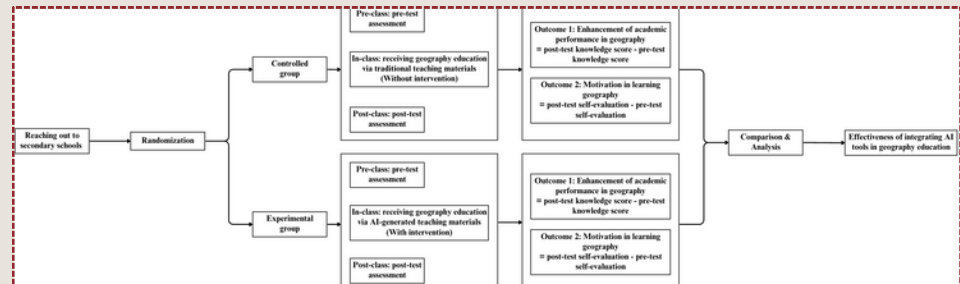
Conceptual framework (KAP)



Methodology framework



Conceptual framework (Randomized Controlled Trial (RCT))



DATA COLLECTION

Primary data

- Questionnaires (Nov 2024 – Mar 2025)
 - Distribution through sending participation letters, online questionnaires, and Hong Kong Geography Day.
 - 28 teachers & 208 students
- In-depth interviews (11 interviewees)
- AIED Geography Trial (RCT) (3–4 Mar 2025)

Secondary data

- Literature review
- Governmental publication

METHODS OF ANALYSIS

- Independent Samples T-test: KAP comparison between teachers and students & RCT comparison between groups
- Paired Samples T-test: RCT comparison within groups (pre- and post-test comparison)
- Qualitative analysis: post-RCT assessment analysis

KAP COMPARISON BETWEEN TEACHERS AND STUDENTS

Dimension	Overall mean (S.D.)		Mean Difference (%)	95% CI for the Difference	Degrees of freedom	t-value	P-value (Two-tailed)	Significance
	Teachers (n=28)	Students (n=208)						
Knowledge	7.86/10 (1.18)	6.89/10 (1.65)	0.97/10 (9.7%)	(0.33, 1.60)	234	2.990	0.003 (P<0.01)	Yes
	4.07/6 (0.68)	4.31/6 (0.81)	-0.24/6 (-13.5%)	(-0.56, 0.07)	234	-1.514	0.131	No
Practice	1.28/2 (0.16)	1.51/2 (0.28)	-0.23/6 (-14.0%)	(-0.33, -0.13)	237	-4.481	P<0.001	Yes
Challenge	3.58/6 (1.02)	2.89/6 (1.00)	-0.69/6 (-11.5%)	(-0.30, 1.09)	234	3.448	P<0.001	Yes

- Knowledge: $t(234)=2.990$, $p<0.01$ = Significant difference (Teachers have greater AI knowledge)
- Attitude: $t(234)=-1.514$, $p=0.131$ (>0.05) = Non-significant difference in attitude (Both positive)
- Practice: $t(234)=-4.481$, $p<0.001$ = Significant difference in practice (Students use AI tools more diversely)
- Challenges: $t(234)=3.448$, $p<0.001$ = Significant difference in perceptions/challenges (Teachers cautious, students ready for AIED)

Findings

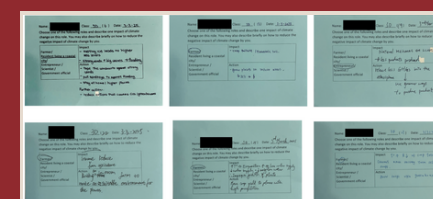
AIED GEOGRAPHY TRIAL RESULTS

Dimension	(Experimental group) (n=29)		Change in Difference (%)	95% CI for the change	Degrees of freedom	t-value	P-value (Two-tailed)	Significance
	Pre-test Overall mean (%)	Post-test Standard Deviation (%)						
Knowledge	4.97/10 (49.7%)	2.03 (68.3%)	1.69 (18.6%)	(-2.65, -1.07)	28	-4.815	P<0.001	Yes
Knowledge Interpretation	4.11/6 (68.5%)	0.83 (72.3%)	0.23/6 (3.8%)	(-0.48, 0.01)	28	-1.957	0.06	No
Learning Interest	4.45/6 (74.2%)	0.64 (74.3%)	0.03/6 (0.5%)	(-0.29, 0.22)	28	-0.275	0.79	No
Learning Experience	4.76/6 (79.3%)	0.66 (80.5%)	0.07/6 (1.2%)	(-0.35, 0.22)	28	-0.497	0.62	No

- Geographical knowledge: AIED_group showed significant improvement ($p<0.001$) & greater consistency (SD reduced by 0.34) while the control group performed non-significant improvement
- Knowledge interpretation, learning interest, learning experience: non-significant improvements ($p > 0.05$)

QUALITATIVE ANALYSIS OF POST-TRIAL ASSESSMENT

- AIED group showed longer, more detailed, and reasoned responses compared to the control group (with causal connections)
- Supports AIED's potential to enhance qualitative expression in geography education



← Responses from the AIED group

Responses from the control group →



Implications

1. SIMILARITIES AND DIFFERENCES

- Teachers: Higher knowledge driven by training and experience, cautious attitude, and limited practice due to professional and generational barriers
- Students: Moderate knowledge from limited exposure, optimistic attitude, and diverse practice due to digital fluency

2. EFFECTIVENESS OF AIED COMPARED TO THE TRADITIONAL METHOD

- Academic performance boosted by AIED's personalized feedback, engagement, and multi-sensory elements
- Learning interest/experience varies due to diverse student preferences, AI skepticism, and lesson design

3. OPPORTUNITIES AND CHALLENGES

- Opportunities: Enhanced academic performance, support for diverse learning modalities, reduced teacher workload, advanced study facilitation, and improved revision processes
- Challenges: Data privacy concerns, accuracy of AI content, teachers' AI literacy concerns, teachers' adaptability, students' preference for traditional methods, institutional preparedness

Recommendations

1. TAILORING AI TOOLS TO HONG KONG CURRICULUM

- AI-generated assessments lack accuracy & misalign with HKDSE marking schemes → Training AI with localized curriculum resources and HKDSE frameworks

2. ENHANCING TEACHER TRAINING & SUPPORT

- Limited geography-specific AIED resources and professional development → Implementing comprehensive and regular workshops on practical AI applications in geography

3. FOSTERING STUDENT AI LITERACY

- Misutilization of AI by students may harm academic integrity → Implementing targeted literacy training to position AI as a learning assistant

4. ESTABLISHING ETHICAL REGULATIONS

- Lack of clear policies on AI use in assessments threatens educational ethics → Developing Hong Kong-specific policies prohibiting direct AI-generated submissions

