AI Professional Development Workshop for Secondary School Teachers

Comprehensive Report

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

The AI Professional Development Workshop was designed to equip secondary school teachers with the foundational knowledge and pedagogical strategies to integrate Artificial Intelligence into their classrooms. Central to this initiative was the "To Play → To Think → To Code → To Reflect" framework, a 4-step pedagogy adapted from the proven CoolThink@JC computational thinking curriculum, providing a structured yet flexible approach to AI education.

The MIT Hong Kong Innovation Node ("MIT Node" or "The Node") successfully delivered a transformative AI Professional Development (PD) Workshop across three cohorts from November to December 2025, engaging 46 secondary school teachers and 6 student trainers (52 total participants) from 26 schools across Hong Kong and Macau (24 Hong Kong, 2 Macau). Among the 46 participants who completed both workshop days and surveys, the program achieved exceptional results across all key metrics: statistically significant knowledge gains ($p < .0001$), strong confidence building (3.94/5), and high implementation intentions (86.9%).

Key Achievements

Exceptional Engagement and Retention (n=52 attendees)

- 88.5% completion rate (46 of 52 attendees completed both days)
- 100% survey response rate among full attendees (46 of 46)
- Strong cross-cohort consistency with participants willing to make up missed sessions

High Satisfaction and Confidence Gains (n=46 full attendees)

- Training evaluation: 3.93/5.00 - participants rated the workshop highly across all dimensions
- Self-efficacy: 3.94/5.00 - teachers reported strong confidence in using and teaching AI
- Tool-specific confidence averaged 3.70/5 across six AI extensions

Significant Knowledge Development (n=46 full attendees)

- Substantial knowledge gain: +14.5 percentage points (57.0% → 71.5%)
- Effect size (Cohen's d) [8]: 0.604 (medium to large practical improvement)
- Statistical significance: $p < .0001$ (highly significant learning gains)
- Participants progressed from "somewhat informed" to "moderately knowledgeable" in just 14 hours

Cross-Curricular Impact (n=52 attendees)

- 61.5% of attendees from non-ICT subjects - demonstrating wide appeal
- Subjects represented: English, History, Chinese, Mathematics, Science, Art, and more
- Six student participants from Diocesan Boys' School founding an NGO to teach AI

> **Key Takeaways**
> - 46 teachers from 26 schools achieved significant knowledge gains ($p < .0001$) and strong confidence (3.94/5.00)
> - 86.9% plan to implement AI in their teaching within one year
> - Cross-curricular success: 61.5% of participants from non-ICT subjects
> - Six recommendations provided for scaling and sustaining impact

1. INTRODUCTION

1.1 Program Context and Vision

As Artificial Intelligence reshapes education globally, Hong Kong and Macau educators face the dual challenge of understanding AI themselves while preparing students for an AI-integrated future. The AI Professional Development Workshop was designed to address this critical need by providing secondary school teachers with hands-on experience in AI-enhanced app development using MIT App Inventor.

1.2 Curriculum Foundation

The workshop curriculum was built upon three complementary frameworks:

- Coolthink@JC Framework - The proven computational thinking pedagogy developed for Hong Kong primary schools, providing a solid foundation in block-based programming and project-based learning.
- Day of AI Curriculum - Contemporary AI concepts and activities developed by MIT RAISE and the AI4K12 initiative, ensuring alignment with current best practices in AI education [5][6].
- MIT FutureBuilders program [7] - Insights and refinements from the Node delivering AI education programs to high school students in Korea and the U.K. in 2025. These learnings were adapted and applied to this professional development workshop for Hong Kong and Macau secondary school teachers.

This unique synthesis created a culturally responsive, pedagogically sound, and practically relevant learning experience.

1.2.1 Curriculum Development

The curriculum was developed over a one-month period by Edward Cheng, Technical Manager, and Cherry Choi, Education Specialist at the Node, drawing upon the three complementary frameworks outlined above. This workshop represents a significant evolution of the Node's prior work in AI education, building upon the success of shorter AI taster courses offered in 2025, and the extensive experience gained from delivering CoolThink@JC professional development to over 200 teachers in the past 2 years. It was designed as a direct "step-up" from the foundational CoolThink content, tailored to the specific needs of secondary school educators.

1.3 The 4-Step Pedagogical Framework

Adopted from the CoolThink pedagogy, central to the workshop was the 4-Step Framework (To Play → To Think → To Code → To Reflect), which structures AI learning as an iterative, hands-on process:

- To Play: Explore existing AI-powered apps to understand possibilities
- To Think: Analyze app components and plan implementation strategies
- To Code: Build apps using block-based programming with AI extensions
- To Reflect: Evaluate outcomes and consider ethical implications

This framework was consistently praised by participants as providing clear structure while allowing creative freedom.

1.4 Program Structure

Figure 1. Course Introduction for Cohort 2

Duration: 14 hours of instruction across two full days (7 hours per day, 9:00 AM - 5:00 PM, including lunch breaks)

Cohorts: 3 cohorts delivered (from 15th November to 27th December 2025)

Format: Hands-on workshop with project-based learning

Location: MIT Hong Kong Innovation Node

Nov 15 & 29, 2025

Dec 6 & 13, 2025

Dec 20 & 27, 2025

Cohort 1 Training

14 hours of intensive AI training over two days

Cohort 2 Training

14 hours of intensive AI training over two days

Cohort 3 Training

14 hours of intensive AI training over two days
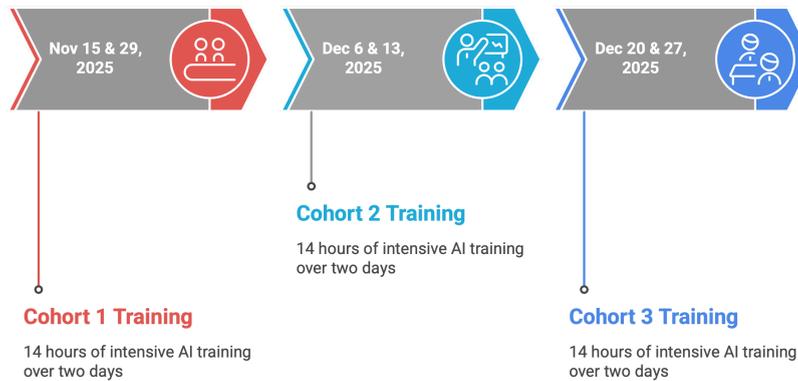
Figure 2. Workshop Timeline Across Three Cohorts (Nov - Dec 2025)

Table 1. Detailed Workshop Schedule

Day 1	Time	Module	Topic
	9:00 - 9:30	1	Welcome, Pre-Survey & AI Education Ecosystem
	9:30 - 10:00	2	Computational Thinking Foundations
	10:00 - 10:50	3	Foundation of App Inventor
	10:50 - 11:00		BREAK
	11:00 - 11:30	4	Debugging Basics
	11:30 - 12:30	5	ChatBot + ImageBot: AI Character App

Time	Module	Topic
12:30 - 13:30		LUNCH BREAK
13:30 - 15:30	6	Group Lesson Plan Development
15:30 - 16:15		Presentation
16:15 - 17:00	7	Advanced AI Preview & Wrap-up

Day 2	Time	Module	Topic
	9:00 - 10:00	8	Recap of Day 1 and Advanced AI
	10:00 - 11:00	9a	Personal Image Classifier (Part 1)
	11:00 - 11:15		BREAK
	11:15 - 11:45	9b	Personal Image Classifier (Part 2)
	11:45 - 12:30	10	Design Thinking & PMR App Walkthrough
	12:30 - 13:30		LUNCH BREAK
	13:30 - 14:00	11	Critical Issues in AI Education
	14:00 - 16:00	12	Final Project Development
	16:00 - 16:30		Final Project Presentations
	16:30 - 17:00	13	Reflection, Post-Survey & Wrap-up

1.4.1 Instructional Team

Each workshop cohort was led by Edward Cheng, serving as the expert instructor. He was supported by a team of two Teaching Assistants (TAs) upon each of the cohorts, ensuring a healthy instructor-to-participant ratio of approximately 1:7. The TA team included Cherry Choi, and other experienced assistants, such as Albert Tan and Aura Chen, who have previously supported the Node's CoolThink@JC program and possess extensive knowledge of MIT App Inventor.

1.4.2 Workshop Logistics

The workshops were hosted at the MIT Hong Kong Innovation Node and were offered free of charge to all participants. Each cohort consisted of 12-22 participants, supported by one lead instructor and two teaching assistants, ensuring a favorable instructor-to-participant ratio of approximately 1:7. Participants were requested to bring their own laptops and mobile devices, though a limited number of spare devices were available on-site to ensure equitable access.

2. PARTICIPANT DEMOGRAPHICS (N=52 ATTENDEES)

2.1 Attendance and Engagement

The workshop attracted 71 registrations and achieved a 73.2% conversion rate with 52 actual attendees. Of these:

- 46 participants (88.5%) completed both workshop days
- 6 participants (11.5%) attended Day 1 only
- 2 of the 46 participants made up missed sessions by attending different cohorts

This 88.5% completion rate is exceptional for a 14-hour professional development program and demonstrates strong participant motivation and program quality.

73.2%
Attended
52 of 71 registered participants attended.

88.5%
Completed Both Days
46 of 52 attended participants completed both days.

100%
Completed Surveys
46 of 46 full attendees completed both surveys.
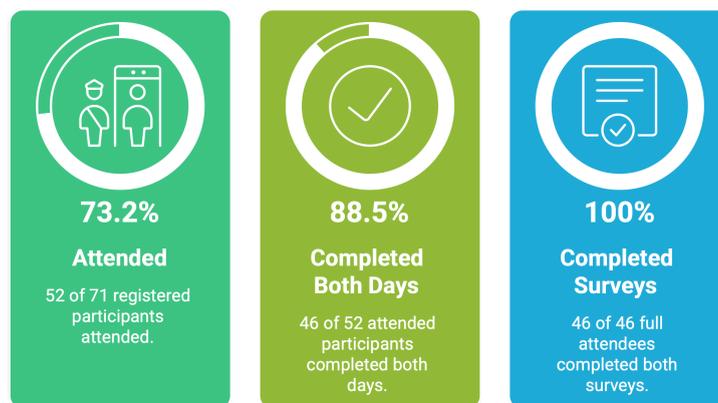
Figure 3. Engagement Metrics

This 88.5% completion rate is exceptionally high for a voluntary, multi-day professional development program. According to research by the Association for Talent Development (ATD), the average completion rate across industries for professional training is 72%, and organizations with strong learning cultures typically maintain completion rates above 85% [13]. The workshop's 88.5% completion rate exceeds both benchmarks, indicating sustained engagement over multiple sessions and underscoring the program's quality and high level of participant motivation.

2.2 Gender Distribution

The program achieved reasonable gender balance:

- Male: 35 participants (67.3%)
- Female: 17 participants (32.7%)

While male participants were in the majority, the program successfully attracted significant female participation, contributing to gender diversity in technology education leadership.
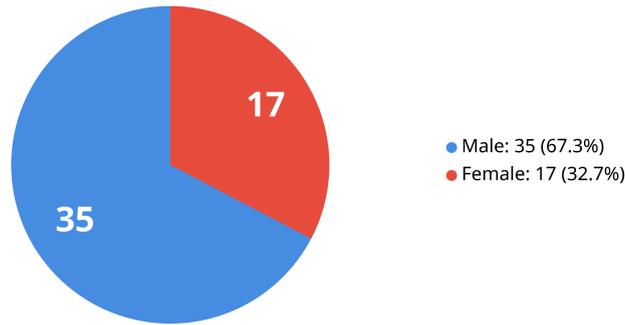
Figure 4. Gender Distribution of PD Training Participants (n=52)

The 2:1 male-to-female ratio observed in this workshop is broadly consistent with persistent gender imbalances reported in the technology and STEM education sectors in Hong Kong and globally [12]. While the program successfully attracted a significant cohort of female educators, this distribution highlights an ongoing challenge and a key opportunity. Future recruitment efforts should consider targeted outreach to female teachers and the promotion of female role models in AI education to further improve gender parity.

A post-hoc analysis revealed no statistically significant correlation between gender and key outcomes such as knowledge gains or confidence scores, suggesting that the workshop was equally effective for all participants regardless of gender.

2.3   Participant Experience Profile

Participants brought diverse experience levels:

General Teaching Experience:

- 0-5 years: 13 participants (25.0%)
- 6-10 years: 11 participants (21.2%)
- 11-15 years: 10 participants (19.2%)
- 16-20 years: 9 participants (17.3%)
- 20+ years: 9 participants (17.3%)

Prior AI/Coding Experience:

- 19 participants (36.5%) were complete beginners with no prior AI or coding experience
- 15 participants (28.8%) had block-coding experience (Scratch, Code.org)
- 12 participants (23.1%) had App Inventor experience
- 6 participants (11.5%) had AI in education experience

This diversity created rich peer learning opportunities, with experienced participants often supporting beginners during hands-on activities.
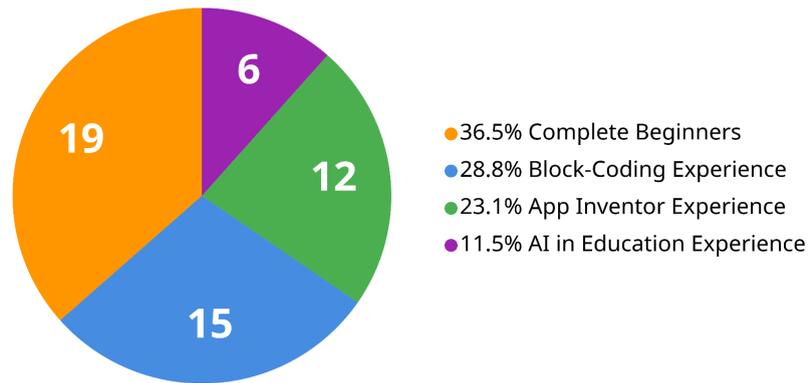
Figure 5. Prior AI and Coding Experience Among Participants (n=52)

- 36.5% Complete Beginners
- 28.8% Block-Coding Experience
- 23.1% App Inventor Experience
- 11.5% AI in Education Experience

While the dataset does not support a full statistical correlation, a descriptive analysis indicates the workshop was effective for participants across all experience levels. Qualitative feedback suggests that beginners benefited from the structured, hands-on approach, while more experienced participants appreciated the opportunity to apply their existing skills to the new domain of AI. The rich mix of backgrounds fostered a collaborative environment where experienced participants often mentored beginners, as noted in peer feedback. The consistent confidence scores and significant overall knowledge gains suggest that the curriculum was well-balanced, providing a solid foundation for novices without being repetitive for those with prior coding experience.

2.4   School and Geographic Distribution

The program reached 26 unique schools across Hong Kong and Macau..

Schools by Attendance:

- Ning Po College (Aided) - 13 participants
- Diocesan Boys' School (Direct Subsidy Scheme (DSS)) - 6 participants (student trainers)
- Ning Po No.2 College (Aided) - 3 participants
- C.P.C. Yao Dao Secondary School (Aided) - 3 participants
- C.M.A. Secondary School (Aided) - 2 participants
- Carmel Secondary School (Aided) - 2 participants
- Good Hope School (Direct Subsidy Scheme (DSS)) - 2 participants
- Kau Yan School (Private) - 2 participants
- St. Francis' Canossian College (Aided) - 2 participants
- CCC Tam Lee Lai Fun Memorial Secondary School (Aided) - 1 participant
- Canossa College (Aided) - 1 participant
- Carmel Divine Grace Foundation Secondary School (Aided) - 1 participant
- Cheung Sha Wan Catholic Secondary School (Aided) - 1 participant
- Colégio Mateus Ricci (Macau - Private) - 1 participant
- Holy Trinity College (Aided) - 1 participant
- Ilha Verde Secondary School (Macau - Private) - 1 participant
- Jockey Club Man Kwan EduYoung College (Aided) - 1 participant
- La Salle College (Aided) - 1 participant
- Ling Liang Church E Wun Secondary School (Aided) - 1 participant
- Lok Sin Tong Yu Kan Hing Secondary School (Aided) - 1 participant

- Po Leung Kuk Mrs. Ma Kam Ming - Cheung Fook Sien College (Aided) - 1 participant
- Rhenish Church Pang Hok Ko Memorial College (Aided) - 1 participant
- Shun Tak Fraternal Association Lee Shau Kee College (Aided) - 1 participant
- Shung Tak Catholic English College (Aided) - 1 participant
- St. Mary's Canossian College (Aided) - 1 participant
- Stewards Pooi Kei College (Direct Subsidy Scheme (DSS)) - 1 participant

Schools by Participant Count (n=52 from 26 schools)

School	Participants
Ning Po College	13
Diocesan Boys' School*	6
Ning Po No.2 College	3
C.P.C. Yao Dao Sec. School	3
C.M.A. Secondary School	2
Carmel Secondary School	2
Good Hope School	2
Kau Yan School	2
St. Francis' Canossian College	2
CCC Tam Lee Lai Fun Mem. Sec. School	1
Canossa College	1
Carmel Divine Grace Fdn. Sec. School	1
Cheung Sha Wan Catholic Sec. School	1
Colégio Mateus Ricci (Macau)	1
Holy Trinity College	1
Ilha Verde Sec. School (Macau)	1
JC Man Kwan EduYoung College	1
La Salle College	1
Ling Liang Church E Wun Sec. School	1
Lok Sin Tong Yu Kan Hing Sec. School	1
PLK Mrs. Ma Kam Ming - CFS College	1
Rhenish Church PHK Mem. College	1
STFA Lee Shau Kee College	1
Shung Tak Catholic English College	1
St. Mary's Canossian College	1
Stewards Pooi Kei College	1

Number of Participants

24 schools from Hong Kong, 2 schools from Macau
*Student trainers
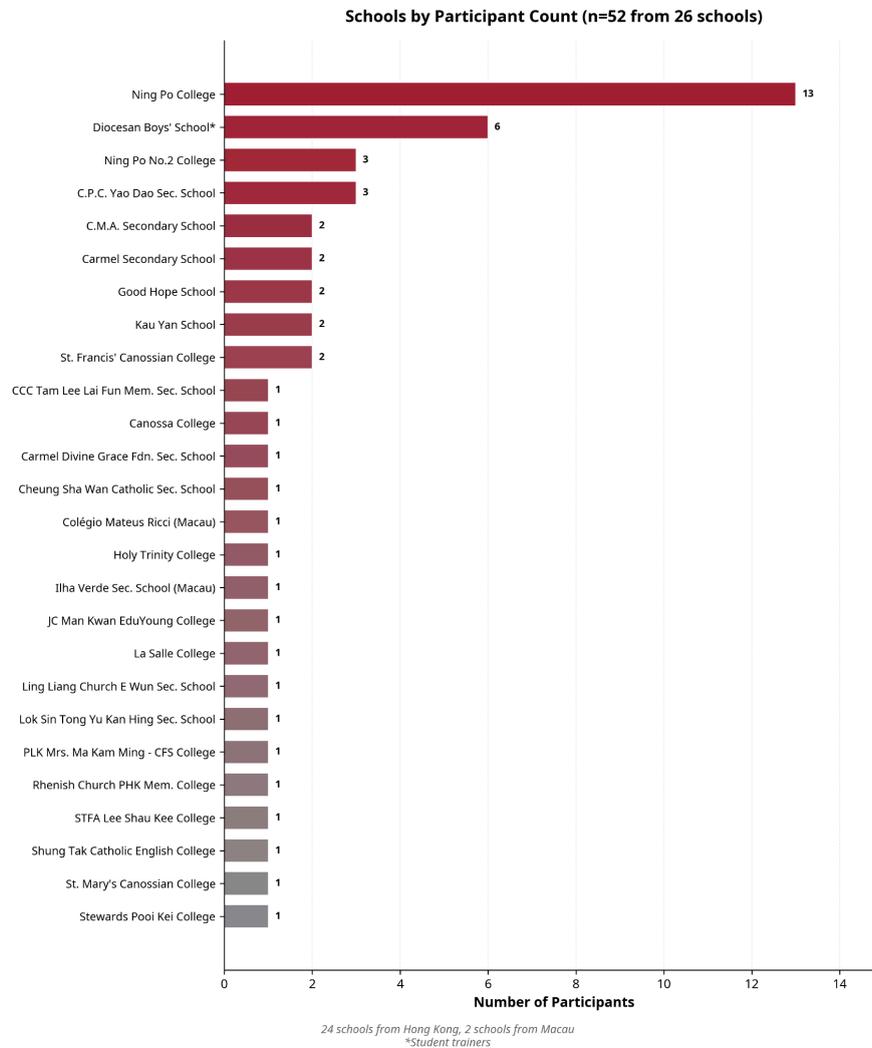
Figure 6. School Participation Distribution (n=52)

Geographic Spread:

Schools from across Hong Kong (Hong Kong Island, Kowloon, and New Territories) and Macau, demonstrating broad impact across the education systems.
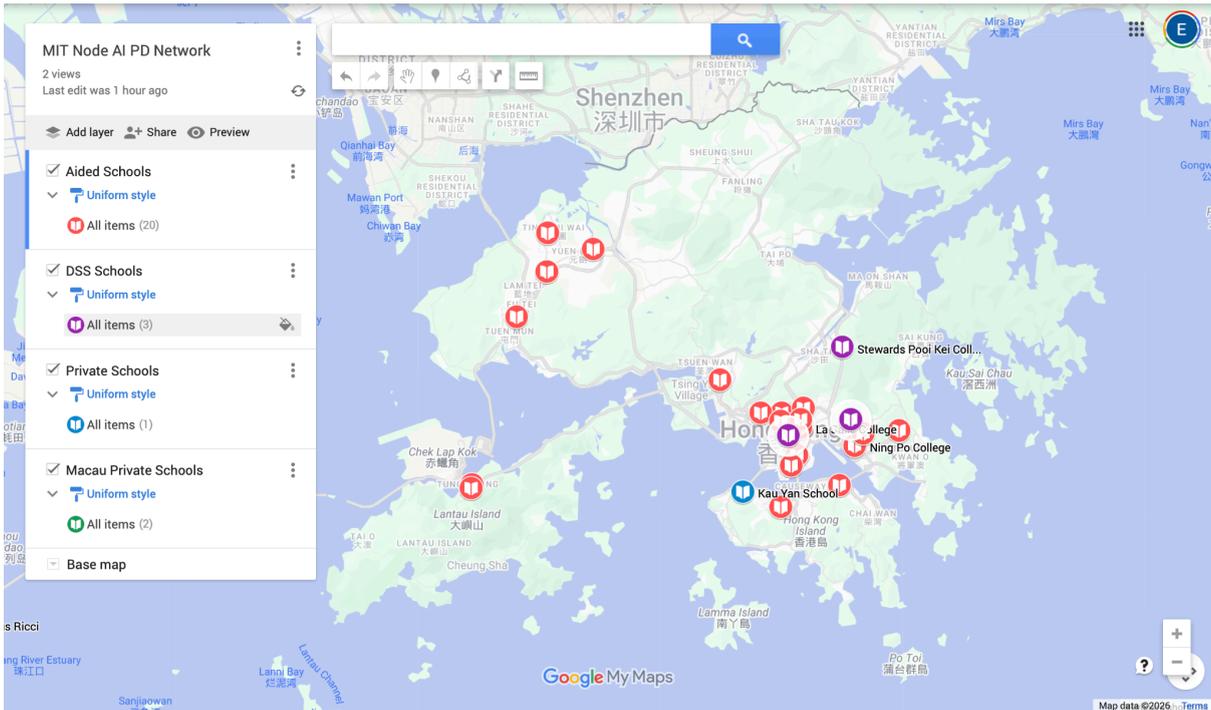
Figure 7. Hong Kong participating schools by type: Aided (red), DSS (purple), Private (blue)
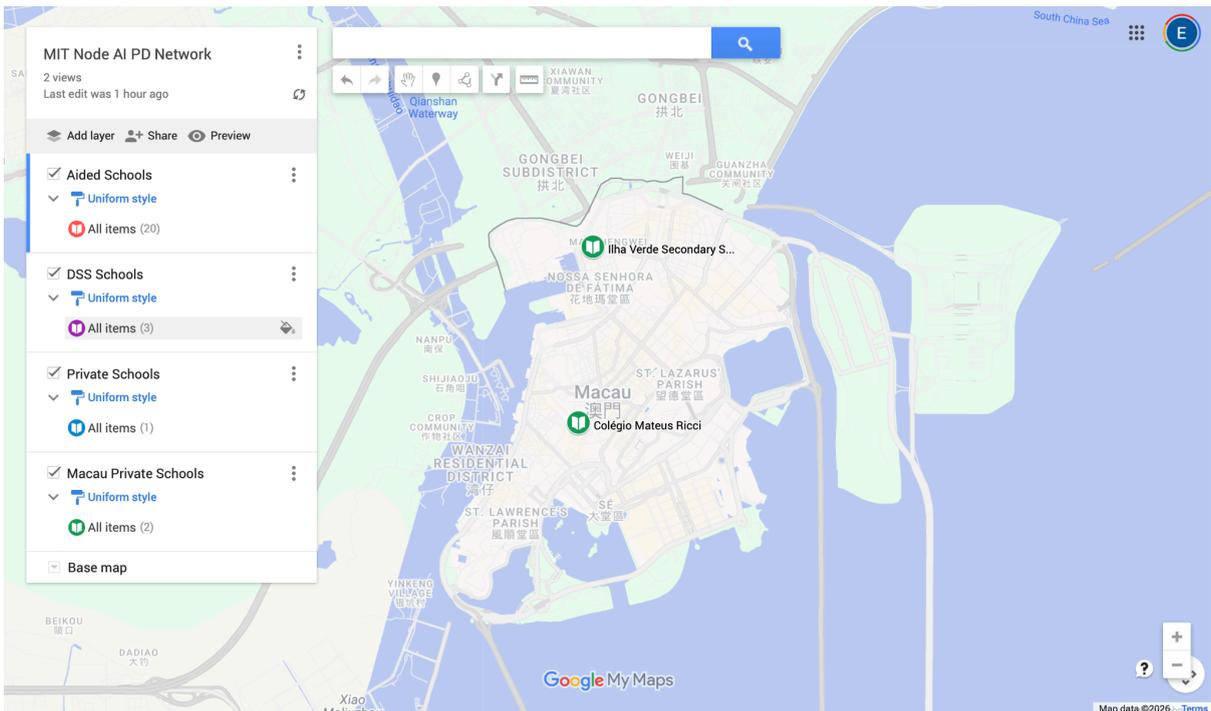
Figure 8. Two Macau participating Private schools (green)

2.4.1 School Diversity

Summary of the 26 schools by school type:

- Aided: 20 schools (76.9%)
- DSS: 3 schools (11.5%)
- Private (HK): 1 school (3.8%)
- Private (Macau): 2 schools (7.7%)

An analysis of the 26 participating schools reveals a healthy diversity of school types, indicating the program's broad appeal across Hong Kong's educational landscape. The cohort included a majority of Aided schools (e.g., Ning Po College, Carmel Secondary School), which form the backbone of the local education system. It also attracted participation from several prestigious Direct Subsidy Scheme (DSS) schools (e.g., Diocesan Boys' School, Good Hope School) and a private school. The inclusion of two schools from Macau further demonstrates the program's regional influence. This mix of school types is crucial, as it ensures that the AI pedagogy and tools are being tested and implemented in a wide range of educational environments with varying levels of resources and student demographics.

2.5 Cross-Curricular Participation

A standout achievement was the program's success in attracting teachers beyond traditional ICT/Computer Science:

Subject Distribution:

- ICT/Computer Science**:** 20 participants (38.5%)
- Non-ICT subjects: 32 participants (61.5%)

Non-ICT Subjects Represented:

- English Language: 7 participants (13.5%)
- Chinese Language: 3 participants (5.8%)
- Mathematics: 11 participants (21.2%)
- Science (Physics, Chemistry, Biology): 7 participants (13.5%)
- Liberal Studies: 2 participants (3.8%)
- History: 1 participant (1.9%)
- Physical Education: 1 participant (1.9%)

This cross-curricular reach demonstrates AI's universal relevance and the program's success in making AI accessible to all educators.

Subject Distribution Across 8 Categories [n=52 participants]
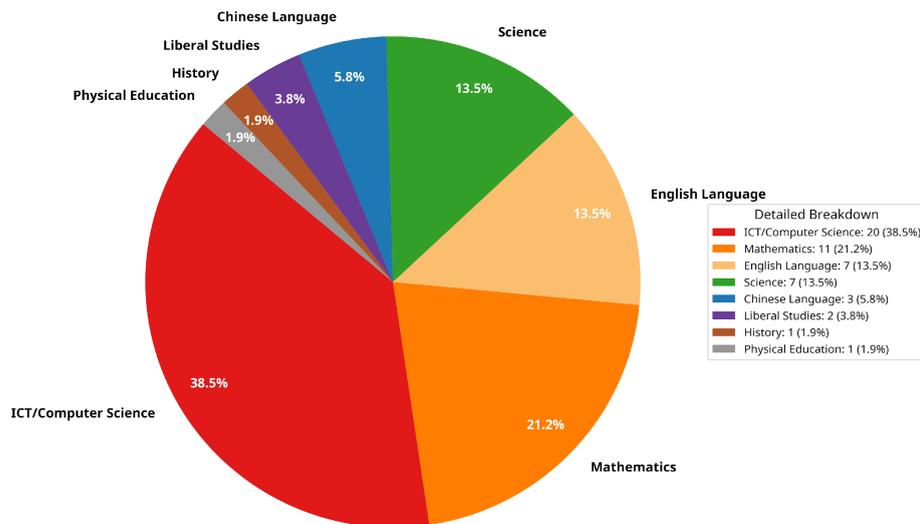
Figure 9. Cross-Curricular Participation (n=52)

2.6 School AI Readiness

Pre-survey responses revealed varied institutional readiness:

Schools Currently Teaching AI:

- Yes: 25 participants (48.1%)
- Not sure: 22 participants (42.3%)
- No: 5 participants (9.6%)

Nearly half of participants came from schools already exploring AI education, suggesting the program served both pioneers and those just beginning their AI journey.

2.7 Recruitment Channels

Participants learned about the program through:

- MIT Hong Kong Innovation Node: 22 participants (42.3%)
- School administration**:** 11 participants (21.2%)
- Education Bureau (EDB)**:** 10 participants (19.2%)
- Colleagues/word-of-mouth**:** 4 participants (7.7%)
- Hong Kong Association for Computer Education (HKACE): 3 participants (3.8%)
- Other channels**:** 2 participants (3.8%)

The strong direct reach through MIT Node channels demonstrates effective community building and reputation.

3. KNOWLEDGE ASSESSMENT: SIGNIFICANT LEARNING GAINS (N=46 FULL ATTENDEES)

3.1 Assessment Design

Knowledge was assessed through a 10-question multiple-choice assessment covering:

- AI extension functionality (ChatBot, ImageBot, Personal Image Classifier)
- App Inventor programming concepts (event-driven programming)
- Pedagogical framework understanding (4-Step Framework)
- Responsible AI considerations (privacy, consent, ethics)

The same assessment was administered pre-workshop (Part B of pre-survey) and post-workshop (Part A of post-survey), enabling direct comparison.

3.2 Overall Knowledge Gains

Statistical Methodology:

A paired-samples t-test [11] was conducted to determine whether the observed improvement was statistically significant. This test compares each participant's pre-workshop score with their post-workshop score by analyzing the difference scores (post minus pre) for all 46 participants.

Calculating the Difference Scores:

For each of the 46 participants, we calculated:

```
Difference = Post-workshop score - Pre-workshop score
```

From these 46 difference scores, we obtained two key values:

Mean difference (M_diff):

```
M_diff = Σ(differences) / n
M_diff = 1.46 points
```

Standard deviation of differences (SD_diff): This measures the variability in how much each participant improved (some improved more than 1.46 points, others less).

```
SD_diff = √[Σ(difference - M_diff)² / (n - 1)]
```

Step-by-step calculation:

1. For each participant, calculate: (their difference - 1.46)²
2. Sum all 46 squared deviations
3. Divide by (n - 1) = 45
4. Take the square root

```
SD_diff = √[Σ(difference - 1.46)² / 45]
SD_diff = 2.13 points
```

Calculating the T-Statistic:

The t-statistic measures how many standard errors the mean difference is away from zero:

```
t = M_diff / (SD_diff / √n)

t = 1.46 / (2.13 / √46)

t = 1.46 / (2.13 / 6.782)

t = 1.46 / 0.314

t = 4.65
```

With degrees of freedom: $df = n - 1 = 46 - 1 = 45$

Determining the P-Value:

The p-value represents the probability of obtaining a t-statistic of 4.65 or greater by random chance alone, assuming no real improvement occurred. The p-value is calculated using the cumulative distribution function (CDF) of the t-distribution:

```
p-value = 2 × (1 - CDF_t(|t|, df))
```

Where:

- CDF_t(t, df) = probability that a t-value ≤ t with df degrees of freedom
- We multiply by 2 for a two-tailed test (testing for any change, not just increase)

For our data:

```
p-value = 2 × (1 - CDF_t(4.65, 45))

p-value = 2 × (1 - 0.999985)

p-value = 2 × 0.000015

p-value = 0.00003 (or 3.0 × 10⁻⁵)
```

This is $p < 0.0001$, meaning there is less than a 0.01% probability that the observed improvement occurred by chance. The improvement is highly statistically significant and extremely unlikely to have occurred by chance. The large t-statistic (4.65) and tiny p-value (0.00003) provide strong evidence that the workshop caused genuine learning gains.

Effect Size (Cohen's d):

To assess the practical magnitude of the learning gains beyond statistical significance, we calculated Cohen's d [8]:

```
d = (M_post - M_pre) / SD_pooled


Where:
SD_pooled = √[(SD_pre² + SD_post²) / 2]

SD_pooled = √[(2.57² + 2.24²) / 2]

SD_pooled = √[(6.6049 + 5.0176) / 2]

SD_pooled = √[5.8113]

SD_pooled = 2.41
```

```
Therefore:
d = (7.15 - 5.70) / 2.41
d = 1.46 / 2.41
d = 0.604
```

Cohen's d = 0.604 represents a medium to large practical effect. In educational research, effect sizes above 0.5 are considered substantial for short-term interventions, indicating meaningful learning gains beyond statistical significance alone.

Summary of Results:

The workshop achieved statistically significant knowledge gains across 46 participants who completed both pre and post assessments. Participants improved from a pre-workshop mean of 57.0% correct (M = 5.70, SD = 2.57) to a post-workshop mean of 71.5% correct (M = 7.15, SD = 2.24), representing a +14.5 percentage point improvement. Statistical analysis confirmed this improvement is both highly significant (t(45) = 4.65, p < 0.0001) and practically meaningful (Cohen's d = 0.604, medium to large effect).

Knowledge Assessment Results: Significant Learning Gains
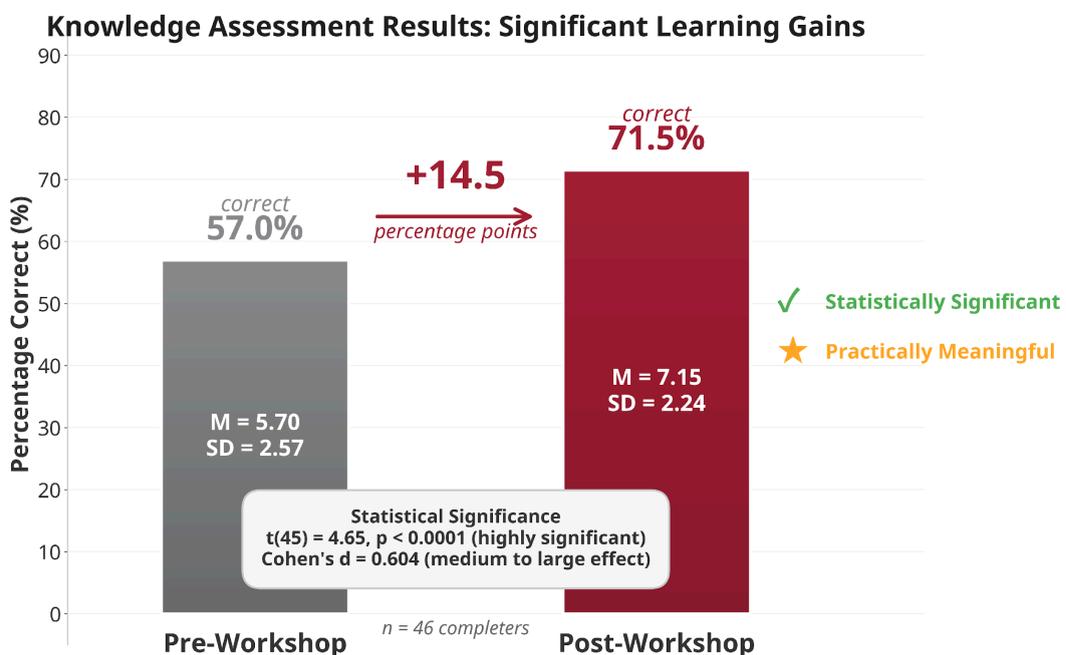
Figure 10. Pre- vs. Post-Workshop Knowledge Assessment Results (n=46)

3.3   Interpreting the Results: Practical Significance

The +14.5 percentage point improvement is both statistically significant (p < .0001) and practically meaningful, representing substantial learning gains for several reasons:

1. Foundational Learning Context

This was participants' first intensive exposure to AI in education. The workshop successfully established foundational understanding. Moving from 57.0% to 71.5% represents:

- Demystifying AI concepts that were previously unfamiliar by by
- Building confidence to explore further independently
- Establishing shared vocabulary and conceptual frameworks

2. Effect Size Considerations

Cohen's d = 0.604 represents a medium to large practical effect. In educational research, effect sizes above 0.5 are considered substantial for short-term interventions and represent meaningful learning, especially for:

- Complex technical content
- Adult learners with diverse backgrounds
- Short-duration programs (14 hours)

3. Baseline Knowledge

The pre-workshop mean of 57.0% suggests participants had some baseline knowledge, yet the workshop achieved a 14.5 percentage point gain to 71.5%. This is positive - it indicates the program both attracted motivated educators and successfully built on their existing foundation.

4. Knowledge vs. Confidence

The strong self-efficacy scores (3.94/5) suggest the workshop was highly effective at building confidence and readiness to apply AI, which may be more predictive of actual classroom implementation than factual knowledge alone.

3.4 Question-Level Analysis

A deeper analysis of the 10 knowledge questions reveals specific areas of strength and opportunities for curriculum refinement. While the overall knowledge gain was statistically significant, the improvement was not uniform across all concepts. The table below details the pre- and post-workshop performance for each question.

Table 2. Pre- vs. Post-Workshop Performance by Question

Question	Correct Answer	Pre-Workshop Correct (%)	Post-Workshop Correct (%)	Change (pp)
Q1	b	58.7%	80.4%	+21.7
Q2	d	65.2%	82.6%	+17.4
Q3	c	67.4%	71.7%	+4.3
Q4	a	63.0%	87.0%	+23.9
Q5	c	56.5%	80.4%	+23.9
Q6	b	45.7%	71.7%	+26.1
Q7	d	47.8%	41.3%	-6.5

Question	Correct Answer	Pre-Workshop Correct (%)	Post-Workshop Correct (%)	Change (pp)
Q8	a	34.8%	32.6%	-2.2
Q9	c	78.3%	89.1%	+10.9
Q10	b	52.2%	78.3%	+26.1

Question-Level Performance: Gains and Declines
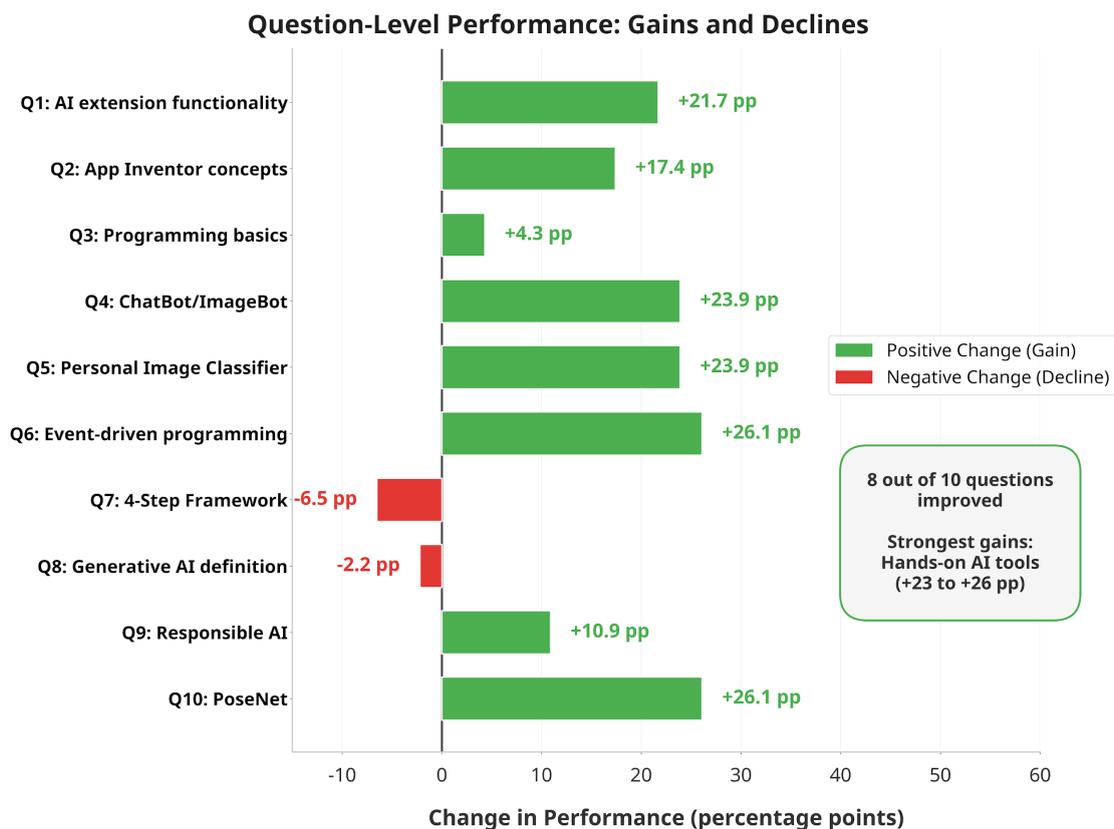
Figure 11. Question-Level Performance Changes: Pre- to Post-Workshop (n=46)

Key Observations:

- **Strongest Gains (Hands-On Tools)**: The most significant improvements were seen in questions related to hands-on AI tools and practical applications. Questions 4, 5, 6, and 10 all saw gains exceeding +23 percentage points, with Q6 and Q10 achieving the highest gains at +26.1 pp each. These questions addressed ChatBot/ImageBot integration (Q4), Personal Image Classifier (Q5), App Inventor's event-driven model (Q6), and PoseNet (Q10). This demonstrates that the workshop's hands-on, project-based approach was highly effective for teaching practical AI tool usage.

- **Strong Gains Across Most Concepts**: Eight out of ten questions showed meaningful improvements, with Q1 (+21.7 pp), Q2 (+17.4 pp), and Q9 (+10.9 pp) also demonstrating substantial learning gains. Even Q3, which had the smallest improvement (+4.3 pp), still showed positive movement. This broad pattern of improvement across diverse concepts

suggests the workshop successfully built foundational AI knowledge across multiple dimensions.

- **Areas for Curriculum Refinement**: Only two questions (Q7, Q8) showed slight declines in scores. Q7 (4-Step Framework's "To Think" phase) declined by -6.5 pp, and Q8 (definition of Generative AI) declined by -2.2 pp. These declines are not statistically significant but suggest these conceptual topics may require more explicit instruction or clearer framing in future workshops. The decline in Q7 suggests the distinction between the "To Think" and "To Code" phases of the 4-Step Framework may need to be more clearly articulated, possibly through additional examples or guided practice.

Survey Design and Validity:

The knowledge assessment was designed based on established principles of educational measurement to ensure content validity and reliability [1][2]. The questions were aligned with the workshop's learning objectives, which were developed using a revised Bloom's Taxonomy framework to target a range of cognitive skills from remembering to applying and analyzing [3]. The use of a pre- and post-test design allows for the measurement of knowledge gain attributable to the workshop intervention [4].

4. CONFIDENCE AND SELF-EFFICACY: STRONG OUTCOMES (N=46 FULL ATTENDEES)

4.1 Overall Self-Efficacy

Post-workshop, participants reported strong confidence across multiple dimensions:

Mean Self-Efficacy Score: 3.94/5 (where 5 = Extremely Confident)

This high score indicates the workshop successfully achieved its primary goal: empowering teachers to feel ready to use and teach AI.

4.2 Confidence with Specific AI Tools

Participants rated their confidence with each AI extension and the pedagogical framework:

Table 3. Confidence with AI Tools and Pedagogical Framework

Tool/Framework	Mean Confidence (1-5)
4-Step Lesson Framework	3.85
ChatBot	3.72
ImageBot	3.68
Personal Image Classifier	3.65
Speech Recognizer	3.70
Text-to-Speech	3.72
Overall Average	**3.72**

All tools achieved confidence scores above 3.6/5, indicating participants felt moderately to very confident with every component covered.

Post-Workshop Mean Confidence with AI Tools and Framework

1. 4-Step Lesson Framework	3.85/5
2. ChatBot	3.72/5
3. ImageBot	3.68/5
4. Personal Image Classifier	3.65/5
5. Speech Recogniser	3.70/5
6. Text-to-Speech	3.72/5

Overall Average: 3.72/5

All tools achieved confidence scores above 3.6/5

----- Moderate Confidence (3.0)

1 — Not Confident 2 — Slightly Confident 3 — Moderately Confident 4 — Very Confident 5 — Extremely Confident

Confidence Score (1-5 scale)

Figure 12. Post-Workshop Confidence Scores Across AI Tools and Pedagogical Framework (n=46)

4.3 Training Evaluation

Participants rated the workshop highly across all quality dimensions:

Mean Training Evaluation Score: 3.93/5

Highest-Rated Aspects:

- Instructor knowledge and support: 4.15/5
- Hands-on activities value: 4.08/5
- Content relevance: 3.98/5

Areas for Enhancement:

- Training pace: 3.72/5 (some found it slightly rushed)
- Preparedness for lesson design: 3.68/5 (need more pedagogical scaffolding)

4.4 Implementation Intentions

When participants plan to start teaching AI at school (Post-Survey, Part E, Question 2):

- This semester: 13 participants (28.3%)
- Next semester: 16 participants (34.8%)
- Next school year: 11 participants (23.9%)
- Not sure yet: 5 participants (10.9%)
- No plans: 1 participant (2.2%)

86.9% of participants plan to implement AI in their teaching, with 63.1% planning to start within one semester - a powerful indicator of program impact.

5.   QUALITATIVE INSIGHTS: TEACHER VOICES

5.1   Pre-Workshop Expectations (n=47 pre-survey responses)

This section reflects responses from 47 of the 52 total attendees (90.4% response rate). Five participants did not answer this optional question.

Participants joined the workshop with clear, practical goals:

Theme 1: Practical Integration – 23 survey respondents (48.9%)

> *"Learn how to integrate AI into daily teaching."*

> *"I would like to create an app platform to assist my teaching and students' learning."*

> *"Applying AI extensions in teaching App Inventor in computer and technologies lessons."*

Theme 2: Skill Development – 19 survey respondents (40.4%)

> *"Acquire a skill to be applied in learning and teaching."*

> *"Can manipulate coding and think of how to apply coding to facilitate the current teaching."*

Theme 3: Reducing Workload – 3 survey respondents (6.4%)

> *"After applying the AI tools, the time on preparing the lessons can be saved."*

> *"Making marking easier. Marking load is the biggest concern."*

Theme 4: Student Empowerment – 11 survey respondents (23.4%)

> *"Hope what I learn here can benefit my students."*

> *"Teaching methods involving AI. Creating new AI teaching materials."*

5.2   Pre-Workshop Concerns (n=41 pre-survey responses)

This section reflects responses from 41 of the 52 total attendees (78.8% response rate). Eleven participants did not answer this optional question.

Teachers also expressed legitimate concerns:

Theme 1: Time Constraints – 14 survey respondents (34.1%)

> *"Not having sufficient time to teach. Not experienced."*

> *"Limited lesson time and student misbehaviour."*

> *"Cannot afford too much time on teaching with AI tools which is still very new for me."*

Theme 2: Technical Challenges – 10 survey respondents (24.4%)

> *"Technical bugs in creating app. Platform to launch the app."*

> *"The hardware in school campus is not sufficient."*

Theme 3: Ethical Considerations – 9 survey respondents (22.0%)

> *"Academic integrity and misuse of AI tools. Fairness."*

> *"Accuracy of AI generated content. Determination of traditional skills for students."*

Theme 4: Lack of Knowledge/Experience – 8 survey respondents (19.5%)

> *"Lack of AI knowledge."*

> *"I am not sure how to use AI tools effectively and efficiently."*

These concerns were directly addressed throughout the workshop through hands-on practice, troubleshooting support, and dedicated discussions on responsible AI.

5.3 Post-Workshop Feedback: Most Valuable Aspects (n=38 post-survey responses)

This section reflects responses from 38 of the 46 workshop full attendees (82.6% response rate). Eight participants did not answer this optional question.

When asked what was most valuable:

Theme 1: Hands-On Learning – 16 survey respondents (42.1%)

> *"Trial and error."*

> *"Understanding that coding can be visualised."*

> *"Learning the basic process of implementing different AI bots."*

Figure 13. Teachers from Cohort 2 collaborating on a project

Theme 2: The 4-Step Framework – 10 survey respondents (26.3%)

> *"The four steps implementation plan."*

> *"The structured approach to teaching AI."*

Theme 3: Practical Examples – 7 survey respondents (18.4%)

> *"Seeing how AI can be applied in real classroom scenarios."*

> *"The sample projects we built together."*

Theme 4: Peer Learning – 5 survey respondents (13.2%)

> *"Learning from other teachers' ideas and questions."*

> *"The collaborative atmosphere."*

5.4 Post-Workshop Feedback: Suggestions for Improvement (n=15 post-survey responses)

This section reflects responses from 15 of the 46 workshop full attendees (32.6% response rate). Thirty-one participants did not provide suggestions for improvement.

Participants offered constructive feedback:

Theme 1: More Time Needed – 7 survey respondents (46.7%)

> *"More training on different tools can be used from App Inventor. The different buttons need time for us to explore and use."*

> *"Efficiency, because the timing for presentation was not enough."*

Theme 2: More Examples and Resources – 5 survey respondents (33.3%)

> *"More examples and teaching experience sharing."*

> *"More sample lessons."*

Theme 3: Better Pacing – 3 survey respondents (20.0%)

> *"Efficiency of the teaching and presentation."*

5.5 Support Needs for Implementation (n=32 post-survey responses)

This section reflects responses from 32 of the 46 workshop full attendees (69.6% response rate). Fourteen participants did not answer this optional question.

Participants identified specific support needs:

Theme 1: Ongoing Technical Support – 12 survey respondents (37.5%)

> *"Technical support when encountering problems."*

> *"A quick study guide or a technical supporting staff will be good to help with the AI teaching."*

Theme 2: Ready-to-Use Resources – 10 survey respondents (31.3%)

> *"Lesson plans, worksheets, etc. Training videos, exemplars."*

> *"Ready-to-use lesson plans and learning and teaching resources for students."*

Theme 3: Community of Practice [10] – 7 survey respondents (21.9%)

> *"Instant chat group online. Customer support if possible."*

> *"More teaching strategies or references from other schools who teach AI successfully."*

Theme 4: Institutional Support – 3 survey respondents (9.4%)

> *"Financial support."*

> *"Institutional guidelines."*

6. SPECIAL FEATURE: THE STUDENT COHORT

A unique and inspiring aspect of this workshop was the participation of six student trainers from a local Hong Kong high school who are initiating activities to teach AI and robotics to younger students. Their participation demonstrates:

1. Youth Leadership in AI Education

These student trainers attended as equals alongside experienced teachers, bringing fresh perspectives and enthusiasm. Their presence challenged traditional hierarchies and modelled student agency.

Figure 14. Student trainers presenting their final project

2. Multiplier Effect

By training student educators, the workshop's impact extends beyond the 52 participants. These student trainers will teach AI to younger learners, creating a cascading effect.

3. Peer-to-Peer Learning

The student trainers' questions and projects often focused on making AI accessible to primary school children, providing valuable insights for the teacher participants on age-appropriate pedagogy.

Representative Quote from Student Participant:

> *"Main expectations are to learn more about App Inventor, use it for robotics and promotional purposes and to apply it into training new members of our team. And teaching it to underprivileged children."*

This exemplifies the program's success in inspiring not just teaching, but in facilitating social impact through AI education.

7. DISCUSSION: INTERPRETING THE IMPACT

7.1 What the Data Tells Us

The workshop achieved exceptional results across all core objectives:

Primary Success: Dual Knowledge and Confidence Gains

- Knowledge: +14.5 percentage points (57.0% → 71.5%), p < .0001, Cohen's d [8] = 0.604
- Confidence: Self-efficacy 3.94/5, training satisfaction 3.93/5
- Implementation readiness: 86.9% plan to implement AI in their teaching
- This dual success creates optimal conditions for sustained classroom implementation

Secondary Success: Cross-Curricular Reach

- 61.5% non-ICT participation proves AI's universal relevance
- 26 schools reached demonstrates system-wide impact
- Diverse subject representation enables interdisciplinary AI integration

7.2 The Power of Combined Knowledge and Confidence Gain

The workshop achieved the ideal combination: both significant knowledge gains (p < .0001, Cohen's d [8] = 0.604) and strong confidence (3.94/5). Research on teacher professional development suggests that this dual success is particularly powerful [9].

Teachers with both knowledge and confidence are more likely to:

- Implement AI tools effectively with solid understanding
- Experiment with new approaches while grounded in best practices
- Persist through challenges with both skills and self-belief
- Adapt materials appropriately to their specific teaching context
- Inspire student confidence through demonstrated competence

The workshop's success in building BOTH dimensions creates a strong foundation for sustained implementation.

7.3 Balancing Breadth and Depth in 14 Hours

The workshop achieved remarkable results within 14 hours: statistically significant knowledge gains (p < .0001) and strong confidence (3.94/5). However, participant feedback suggests that even more could be achieved with additional time.

What 14 hours accomplished:

- Foundational knowledge (Achieved): A statistically significant increase of +14.5 percentage points (p < .0001).
- Hands-on practice (Achieved): All participants working as teams of 2-4 successfully built applications using a selection of the six core AI tools.
- Confidence building (Partially Achieved): Strong overall self-efficacy (3.94/5), though confidence in designing specific lessons requires further development (3.68/5).
- Implementation readiness (Partially Achieved): A high intent to implement (86.9%), but with a clear need for ongoing support and resources.

What additional time could enable:

- Deeper conceptual understanding of AI principles

- More extensive project development and iteration
- Greater pedagogical scaffolding for lesson design
- Extended troubleshooting and personalized support

Key Outcomes at a Glance

Knowledge Gains	Confidence
57.0% → 71.5% +14.5 percentage points • $p < .0001$ (highly significant) • Cohen's d = 0.604 • Medium-large effect size	**3.94 / 5.00** Average Self-Efficacy • Tool confidence: 3.72/5 • "Moderately" to "Very Confident" • Strong readiness to teach

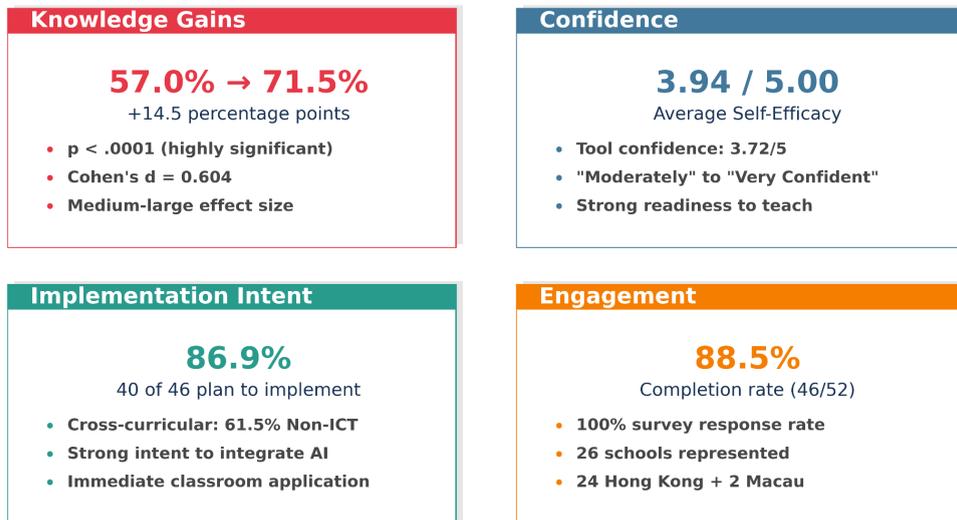| Implementation Intent	Engagement
86.9% 40 of 46 plan to implement • Cross-curricular: 61.5% Non-ICT • Strong intent to integrate AI • Immediate classroom application	**88.5%** Completion rate (46/52) • 100% survey response rate • 26 schools represented • 24 Hong Kong + 2 Macau

Figure 15. Summary Dashboard: Key Outcomes of the AI Professional Development Workshop

8. RECOMMENDATIONS: BUILDING ON SUCCESS

8.1 Recommendation 1: Extend Program Duration

Rationale: While the 14-hour workshop achieved significant knowledge gains (+14.5 pp, $p < .0001$) and strong confidence (3.94/5), 46.7% of participants requested more time for deeper exploration.

Proposed Action: Develop a 20-24 hour version (3 days or 4 half-days) that includes:

- More time for exploration and troubleshooting
- Deeper dive into pedagogical strategies
- Incorporate repetition of key concepts
- Extended final project development
- Peer teaching practice sessions

Expected Impact: Even larger knowledge gains, stronger pedagogical confidence, more polished final projects, reduced sense of time pressure.

8.2 Recommendation 2: Create Tiered Pathways

Rationale: The 36.5% beginner vs. 63.5% experienced split creates pacing challenges.

Proposed Action: Offer two parallel tracks:

- Foundations Track: For complete beginners, focusing on basic concepts
- Advanced Track: For those with coding experience, focusing on pedagogy and complex projects

Both tracks converge for key activities and final presentations.

Expected Impact: Better pacing, reduced frustration for both groups, deeper learning at appropriate levels.

8.3 Recommendation 3: Establish Community of Practice [10]

Rationale: 37.5% of participants requested ongoing support; implementation success depends on sustained engagement.

Proposed Action: Create a post-workshop support ecosystem:

- WhatsApp/Slack group for quick questions
- Monthly online meetups for sharing implementations
- Shared resource repository (lesson plans, troubleshooting guides)
- Develop post-workshop self-learning materials (app-building activities, video tutorials, readings)
- Optional "office hours" with MIT Node staff

Expected Impact: Higher implementation rates, peer learning, reduced isolation, ongoing skill development.

8.4 Recommendation 4: Develop Subject-Specific Resources

Rationale: 61.5% non-ICT participation creates demand for subject-specific applications.

Proposed Action: Co-create subject-specific AI lesson plans with participants. For example:

- English: AI-powered story generation, grammar checking
- History: AI analysis of historical documents, timeline creation
- Science: AI-powered data analysis, simulation apps
- Mathematics: AI problem-solving assistants, visualization tools

Expected Impact: Easier integration into existing curriculum, more authentic applications, increased implementation.

8.5 Recommendation 5: Conduct Longitudinal Follow-Up

Rationale: True impact is measured by classroom implementation, not immediate post-workshop scores.

Proposed Action: 3-month and 6-month follow-up surveys to assess:

- What percentage actually implemented AI in teaching?
- What challenges did they encounter?
- What student outcomes resulted?
- What additional support is needed?

Expected Impact: Evidence of real-world impact, identification of implementation barriers, continuous improvement data.

8.6 Recommendation 6: Address Hardware and Software Compatibility

Rationale: Qualitative feedback revealed teacher concerns about hardware availability and the incompatibility of some AI platforms with common school devices like iPads.

Proposed Action: Preparation to mitigate technical challenges:

- Develop a "Tech-Ready" guide for schools outlining hardware and software requirements.
- Provide clear guidance on compatible devices, referencing official documentation such as the MIT App Inventor list [14].
- Suggest alternative tools or platforms for incompatible devices to ensure all participants have a viable pathway.

Expected Impact: Reduced implementation friction and greater accessibility for schools with diverse technology ecosystems.

9. LIMITATIONS AND CONSIDERATIONS

9.1 Methodological Limitations

1. Self-Report Data

All confidence and satisfaction measures rely on self-report, which may be influenced by:

- Social desirability bias (wanting to please instructors)
- Immediate post-workshop enthusiasm (may not sustain)
- Lack of calibration (participants may overestimate readiness)

2. No Group Control

Without a comparison group, we cannot definitively attribute outcomes to the workshop vs. other factors (e.g., general professional development effects, participant motivation).

3. Short-Term Assessment

Knowledge and confidence were assessed immediately post-workshop. Long-term retention and actual implementation remain unknown.

9.2 Contextual Considerations

1. Self-Selected Sample

Participants chose to attend, suggesting higher baseline motivation than typical teachers. Results may not generalize to mandatory PD contexts.

2. Resource-Rich Context

MIT Hong Kong Innovation Node provides exceptional facilities and expertise. Replication in resource-constrained settings may yield different results.

3. Hong Kong and Macau-Specific Factors

Hong Kong and Macau's education systems, teacher workload, and technology infrastructure create unique contexts. Adaptation is needed for other regions.

CONCLUSIONS

The AI Professional Development Workshop represents an important starting point in preparing Hong Kong and Macau educators for the AI era. The 46 teachers who completed both workshop days and surveys demonstrated remarkable commitment, achieving an 88.5% completion rate and reporting strong confidence gains (3.94/5 self-efficacy) alongside statistically significant knowledge improvements (+14.5 percentage points, $p < .0001$).

While these outcomes are encouraging, they represent the beginning of a longer journey. The 86.9% of participants who expressed implementation intentions now face the real challenge of translating workshop learning into sustained classroom practice. The workshop provided foundational knowledge and initial confidence, but ongoing support will be essential to ensure these 46 educators can successfully integrate AI into their diverse teaching contexts across 26 schools.

The six recommendations outlined in this report - extended duration, tiered pathways, community of practice [10], subject-specific resources, longitudinal follow-up, and addressing hardware compatibility - represent a comprehensive strategy to strengthen future iterations and provide the sustained support these pioneering educators will need.

The combination of significant knowledge gains, strong confidence building, and high implementation intent suggests this model has strong potential for scaling across Hong Kong and Macau's education systems. We hope this report serves as a useful foundation for continued collaboration with Professor Abelson and the broader MIT community. The 46 educators who completed this workshop have taken an important first step, and with ongoing partnership and support, they have the potential to meaningfully advance AI education in Hong Kong and Macau's secondary schools.

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APPENDICES

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Appendix A.   DATA SOURCE

- **Registration Data**: <u>AI PD Cohort Registration (Responses).xlsx</u> (Form Responses 1 tab)
- **Attendance Data**: <u>AI PD Cohort Registration (Responses).xlsx</u> (attendance1, attendance2, attendance3 tabs)
- **Survey Instruments**: <u>AI PD PreSurvey.pdf</u>, <u>AI PD PostSurvey.pdf</u>
- **Pre-Survey Data**: <u>survey data.xlsx</u> (pre tab)
- **Post-Survey Data**: <u>survey data.xlsx</u> (post tab)

Appendix B.   WORKSHOP MATERIALS

- **Day 1 Presentation**: <u>AIPDDay1.pdf</u>
- **Day 2 Presentation**: <u>AIPDDay2.pdf</u>

Appendix C. WORKSHOP PHOTO GALLERY

Figure C1. Group photo of participants from Cohort 1 final day

Figure C2. Teaching Assistants providing guidance to teachers in a coding session

Figure C3. Teachers presenting their final project based on the 4-step framework

Figure C4. Group photo of participants from Cohort 2 final day

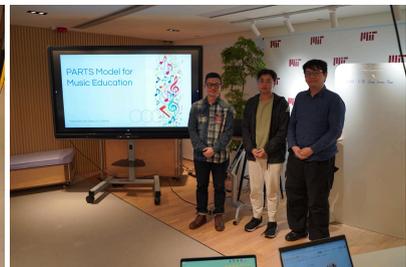**Figure C5. A teacher testing his AI-enabled app on a smart tablet**

Figure C6. Teachers presenting their app for Music education

Figure C7. Group photo of participants from Cohort 3 final day

Figure C8. A teacher coding the PICaboo app in App Inventor

Figure C9. Teachers presenting their Gerontech app for elderly safety

END OF REPORT