Using Artificial Intelligence and Internet of Things (AIoT) in the School Curriculum to Enhance Students' Academic Performance

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Introduction

- Enhancing Academic Performance through AIoT Education
- Exploring the Impact of AI and IoT in School Curricula

AI + IoT → AIoT

Introduction

- Integration of Artificial Intelligence (AI) and the Internet of Things (IoT)  AIoT
- Leading expert in the application of AI in education proposed a framework for understanding the complexity of human intelligence by identifying the comparative limitation of AI when analysed using the same framework, and offers clear-sighted recommendations for how educators can draw on what AI does best to nurture and expand our human capabilities (Luckin, 2017).

Introduction

- To fully utilize AI's technological innovation for educational purposes, ethical considerations must be taken into account (Micheni et al, 2024).
- The effectiveness of AI-driven educational tools and assess their implications for students, educators, and institutions had been analysed (Degni, 2024).

Introduction

- Transformation of education through technology
- Integration of AI and IoT (AIoT)
- Focus on academic performance enhancement

What is AIoT?

- Definition of AIoT
- Interconnected network for data collection and analysis
- Applications in personalized learning and classroom management

Scope of AIoT Education Curriculum

Key components of the curriculum:

- AIoT concepts
- Basic electronics
- Practical applications (e.g. robotics)

- Robotic arm kit with following components:
- - Metal arm assembly with base
- - Robot claw
- - 4 servo motors
- - Enhanced Arduino microcontroller platform with a serial bus architecture
- - Detached RGB camera
- - LCD colour monitor
- - Microphone and speaker
- - Transformer
- - Joy-stick components
- - Miscellaneous objects for robot arm manipulation
- - Circuit board to support Python programming

Curriculum Timeline

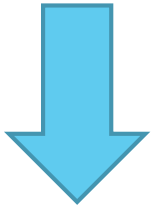
Three stages of learning:

- Theoretical concepts
- Text-based programming (Arduino)
- Design and application of solutions

Curriculum Planning

S1 Adobe Illustrator for graphics design, MS Access for basic database concepts

S2 Adobe Photoshop for photo editing, Video Studio X7 for video editing, PowToon for animation editing



S3 Lightbot, Hour of Code (Flappy Bird, Minecraft, Code with Anna and Elsa), and MIT App Inventor 2.0 for block programming, Code Combat, Tynker, and CodeHS for text-based programming (Python)

All S3 students

Regular STEAM education curriculum

16 students

Enhancement class

Secondary School
Category

Champion

Tilt Angle Detection of Vertical Objects
文理書院(九龍)

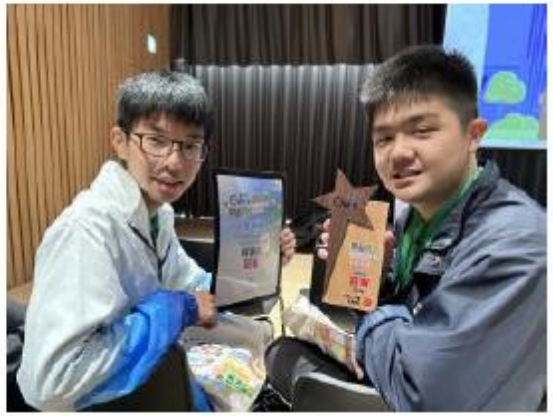
First Runner-up

Food Waste Reduction Specialist
拔萃女書院

Second Runner-up

太陽能綠化帶生長範圍探測裝置
嵐溪第一中學

Judges Commendation



Judges Commendation Awards

政府物聯路路通
香港資優教育學苑

智能回收垃圾箱
明愛聖若瑟中學

Water Level Sensing
文理書院(九龍)

Consolation Prizes

安行手環
港澳信義會慕德中學

與「桶」不同 - 人工智慧垃圾桶
保良局姚連生中學

環境空氣=市民健康(SMART 空氣檢測提示系統)

Figure 4

GWIN 2024 Smart City E&M IoT Application Challenge, Secondary School Category, Champion

Figure 5

GWIN 2024 Smart City E&M IoT Application Challenge, Secondary School Category, Judges Commendation Award

Figure 6

Smart Logistics (Bay Area Hong Kong Centre, Consultative Committee on Guangdong-Hong Kong Co-operation (Guangzhou Nansha)), Hong Kong Division, Secondary School Group, Bronze Award

Figure 7

Science Talent Cup (Secondary Division) - STEM Education Challenge 2024, Merit Awards

Figure 8

HKUSPACE Certificate for module (cloud computing elements), 1 Merit, 4 Distinction

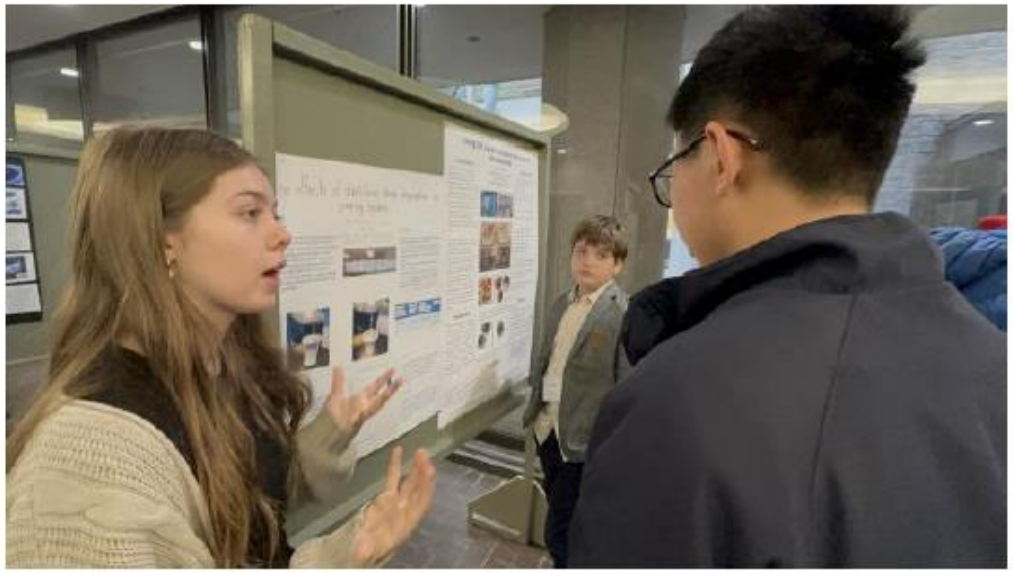
Figure 9

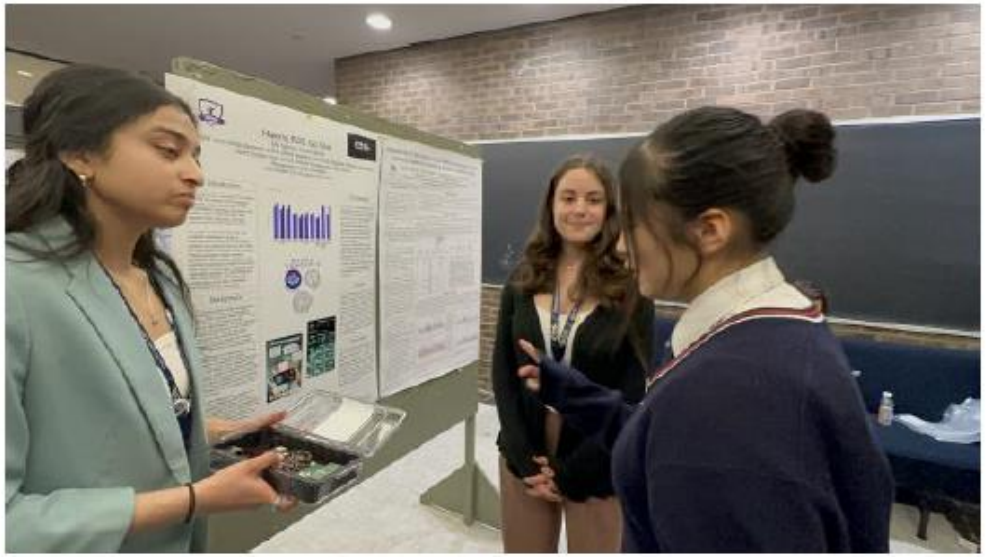
"0 Bullying" Hong Kong Electric Painting Competition, Youth Category, 2rd Runner-up

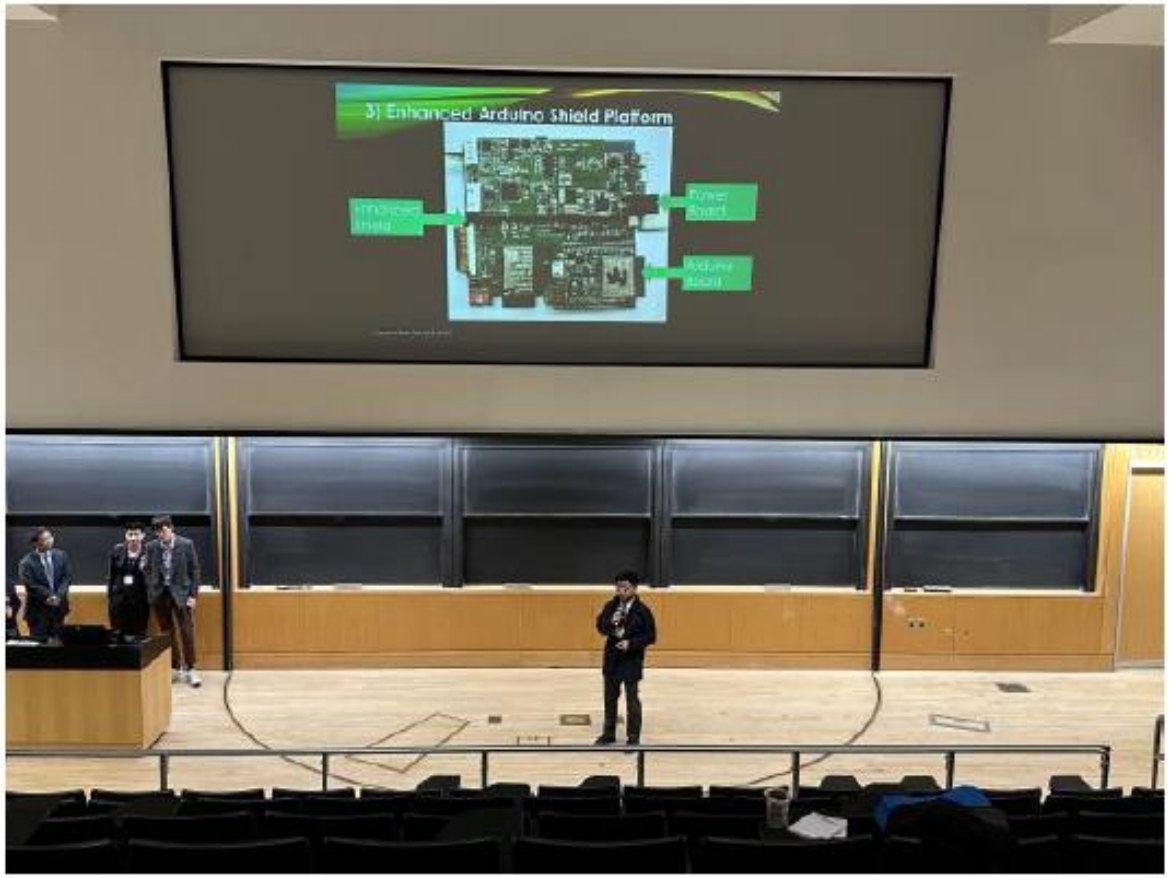
Figure 10

"XR Travel across Major Fields of National Security" Design Competition (Hong Kong Subsidized Secondary Schools Council), Second Prize: trophy, certificates and $500 book coupons


FDC







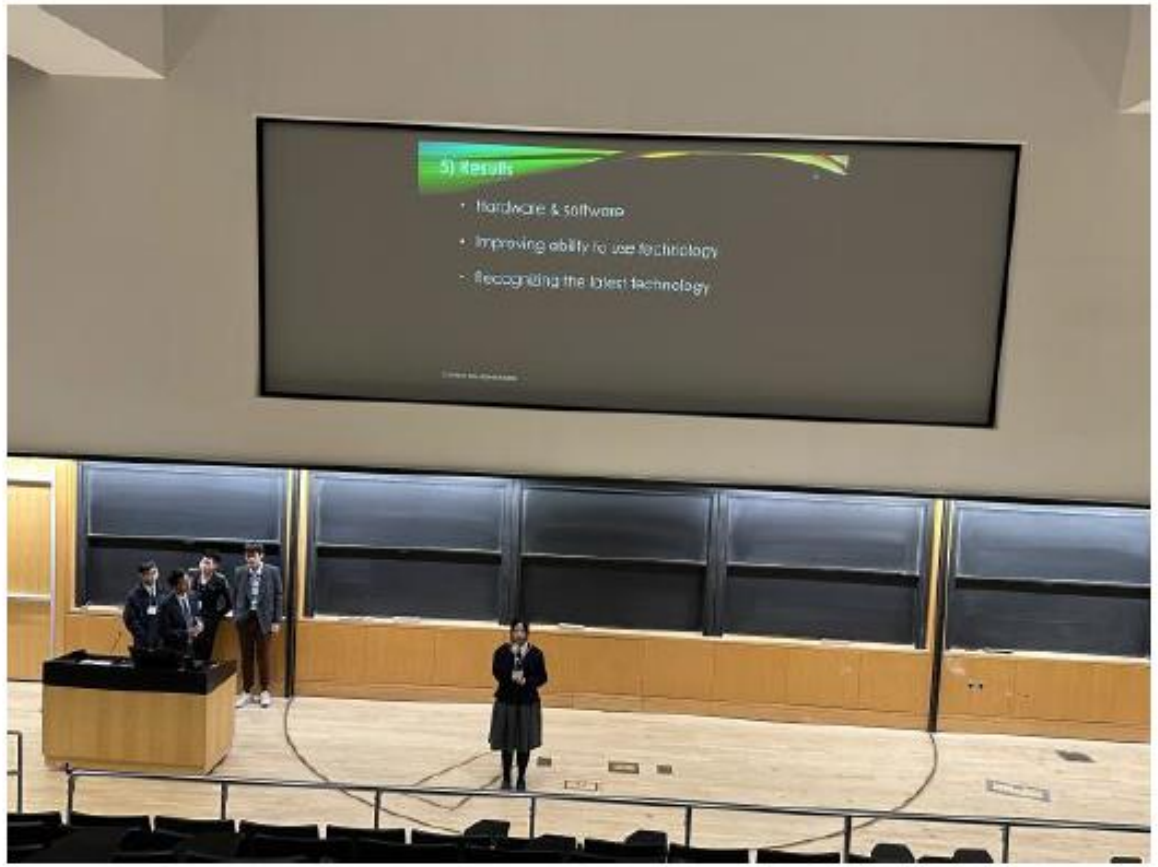


Figure 11

The 14th IEEE Integrated STEM Education Conference at Princeton University

Teacher Training

- Overview of the 3-day training for educators
- Emphasis on practical AIoT components

Teaching Strategies

- Self-directed learning
- Pair programming to support diverse learners
- Cooperative and inquiry-based projects

Participants

- Involvement of 5 teachers and 112 S3 students
- Lesson structure and frequency

Performance Analysis

- Comparison between students with and without AIoT education
- Key results:
- Mean scores: 64.95 vs. 84.68
- Significant correlation (p-value: 1.92084E-05)

Table 1.

Data analysis of academic performance of S3 Computer Literacy marks.

Results of academic performance			
	Students without AIoT education	Students with AIoT education	Difference
Mean	64.95	84.68	19.72
Standard deviation	19.47	13.59	-5.89
Highest	95.00	100.00	5.00
Q3	78.25	94.00	15.75
Q2	71.50	89.00	17.50
Q1	54.00	78.00	24.00
Lowest	0.00	11.00	11.00
Correlation coefficient (r)	0.39		
Sample size (n)	112		
t	4.468477613		
p-value	1.92084E-05		

Limitations

- Limited enrollment in interschool competitions
- Focused sample size

Future Directions

- Research on learner diversity and engagement
- Further studies on curriculum generalization

Conclusion

- AIoT education enhances academic performance
- Importance of continued research in educational integration

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Thank you