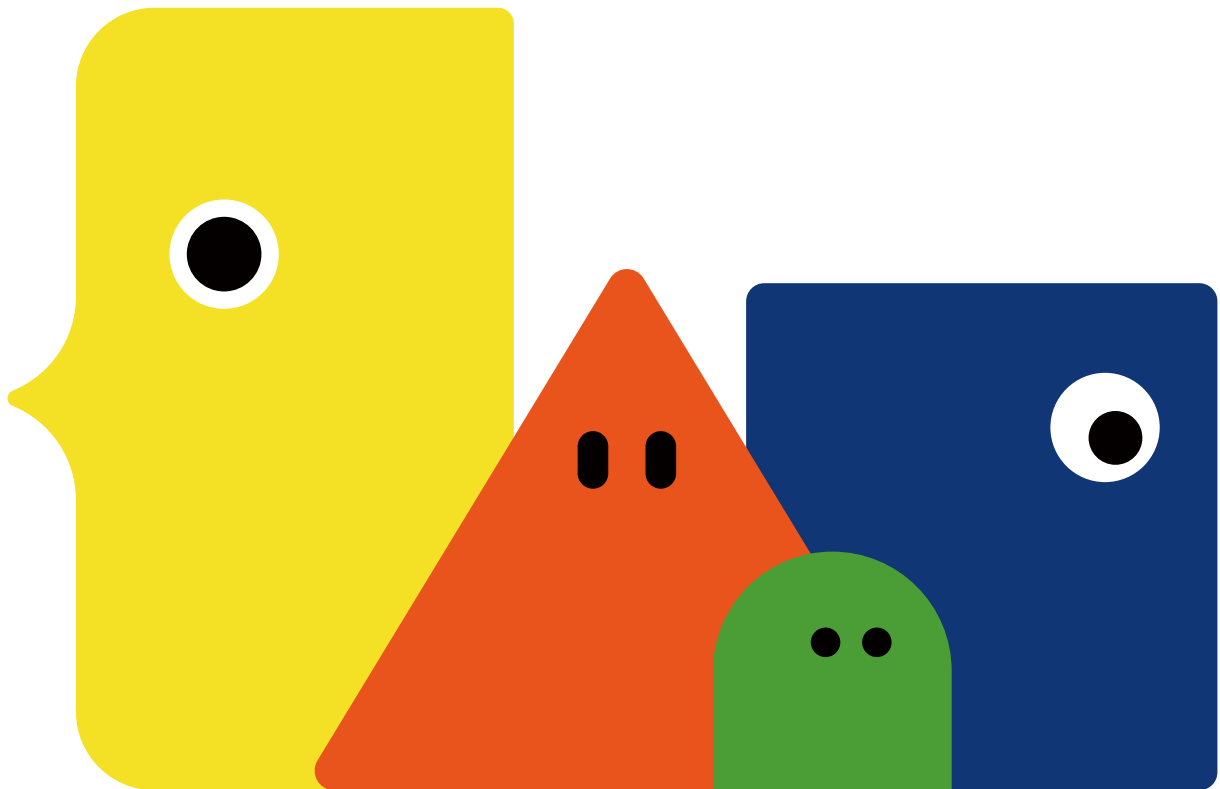


A Case Study on Mainstreaming
**Computational
Thinking
Education**
in School System



Created and Funded By



The Hong Kong Jockey Club Charities Trust

Co-created By



香港教育大學
The Education University
of Hong Kong



Massachusetts
Institute of
Technology



香港城市大學
City University of Hong Kong



Summary



In the dawn of the Age of Artificial Intelligence (AI), a period marked by both instability and opportunity, it is perfectly understandable for present and future workers to harbour deep concerns about their employment prospects. As we hurtle towards a future where automation is predicted to eliminate nearly half of all jobs by 2034, as per research from the University of Oxford, it becomes imperative to prioritise the acquisition of essential skills to navigate this tumultuous era.

To fully harness the potential of artificial intelligence, individuals must also be digitally literate, possess critical and creative thinking skills, and excel in problem-solving developed through computational thinking – a problem-solving technique that can be applied to everyday situations. By using computational thinking skills such as decomposition, pattern recognition, pattern abstraction, and algorithmic thinking, complex issues are deconstructed with potential solutions generated and presented in an understandable manner to both humans and machines.

The CoolThink@JC programme initiated and funded by The Hong Kong Jockey Club Charities Trust (“The Trust”), addresses this critical need. This nine-year, HK\$523 million donation, educational initiative aims to provide computational thinking education to upper primary school students. Its mission is to nurture students' proactive use of technologies for social good from a young age, and offer equitable access and mainstream computational thinking education in the formal curriculum.

CoolThink@JC can be divided into two major phases: the pilot phase, which took place from 2016 to 2020, and the scale-up phase, which started in 2020. In both phases, strong outputs, positive outcomes, global recognition, and sustainable long-term impact were achieved, with the first phase involving 32 schools and the scale-up phase branching out to 477 schools.

During the pilot phase, approximately 20,000 students and 3,000 parents were educated on computational thinking, with 110 teachers receiving professional training. In the full-fledged scaling-up phase, the number of students educated by CoolThink@JC ballooned to over 100,000 students and more than 30,000 parents. The programme extended its outreach to 100% of publicly funded schools and trained more than 2,000 teachers.

The programme's influence on policy development has steadily increased over time. In 2023, the Education Bureau adopted and adapted CoolThink@JC materials and mainstreamed them to all primary schools in Hong Kong.





CoolThink@JC Background



Research indicates that children aged nine and above are typically physically, mentally, and logically prepared to begin learning basic computational thinking concepts and engaging in lightweight, visual-based programming tools to foster digital creativity. In 2016, countries such as the UK and Singapore had already begun transforming their Information and Communications Technology (ICT) or computing subjects by introducing computational thinking, coding education, and computer science into their primary curriculum and school environments. The Trust recognised the necessity of enhancing technology education in schools to bolster the future readiness of the next generation and align it with global technological advancements. They aimed to equip students with computational problem-solving skills and empower them to innovate and create.

Although the promotion of Science, Technology, Engineering, and Mathematics (STEM) Education was initially proposed in the 2015 Policy Address and further endorsed in the 2016 Policy Address, it remained an overlooked area at that time. Promoting computational thinking and coding

education faced significant challenges at the time. Limited resources hindered the attention that primary schools could dedicate to computational thinking education. Moreover, it was difficult to foster a mindset shift among educators and stakeholders, as computational thinking were relatively novel concepts requiring awareness-building efforts to underscore their significance. Overcoming resistance to change and traditional teaching methods required providing educators with sufficient training, resources, and support for integrating computational thinking into the curriculum.

The goal of fostering digital creativity and problem-solving skills among students and cultivating a diverse pool of talents with varied skill sets to enhance Hong Kong's competitiveness aligned with the Trust's objective of strengthening future readiness in the next generation.

The programme's DNA is rooted in the ambition to narrow the digital divide. It strives for all students to acquire basic digital literacy concepts and problem-solving skills for everyday life. CoolThink@JC regards computational thinking as a fundamental aspect of education, believing every student should have equal access to this critical 21st-century skill and modern education in the classroom, irrespective of their socioeconomic status or family background. The initiative also offers additional support to marginalised groups to enhance their basic skills in an increasingly technological society.



Not every student has an equal opportunity to learn modern, basic technology that is essential to lucrative careers, such as in STEM fields. We want to close the wealth gap. And we want to close the digital divide.

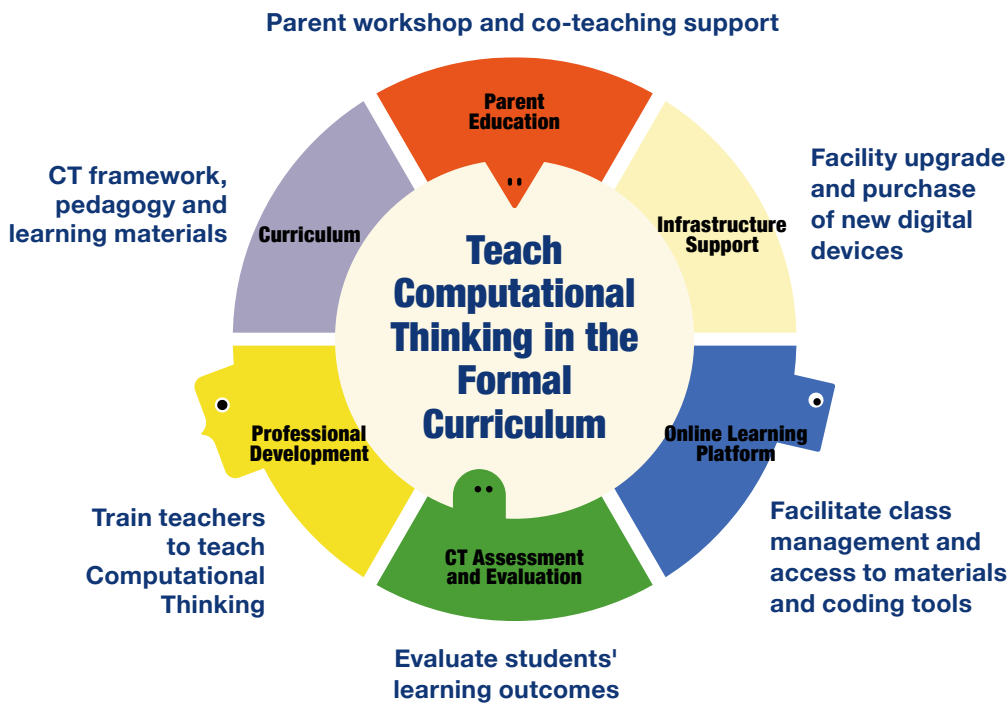
Ms. Marjorie Yang

Chairperson of CoolThink@JC's Advisory Committee





CoolThink@JC's Holistic, Integrated and Inclusive Model



As a testament to its collaborative nature, the CoolThink@JC programme is created and funded by The Hong Kong Jockey Club Charities Trust and co-created by The Education University of Hong Kong (EdUHK), Massachusetts Institute of Technology (MIT), and City University of Hong Kong (CityU). This three-year, age-aligned curriculum for upper primary students aged 9 to 12 is a key element, if not the backbone, of the programme. It covers more than 14 class hours of computational thinking education in each academic year, culminating in a final project that integrates the year's learning with practical applications.

As an integrated and comprehensive programme that involves different stakeholders, it emphasises different aspects that contribute to its ultimate goal: **"To nurture students' proactive use of technologies for social good from a young age, and offer equitable access and mainstream computational thinking education in the formal curriculum."** Although a primary focus is on the development of computational thinking in students to assist them in becoming more future-ready, the programme offers full-fledged support in terms of professional

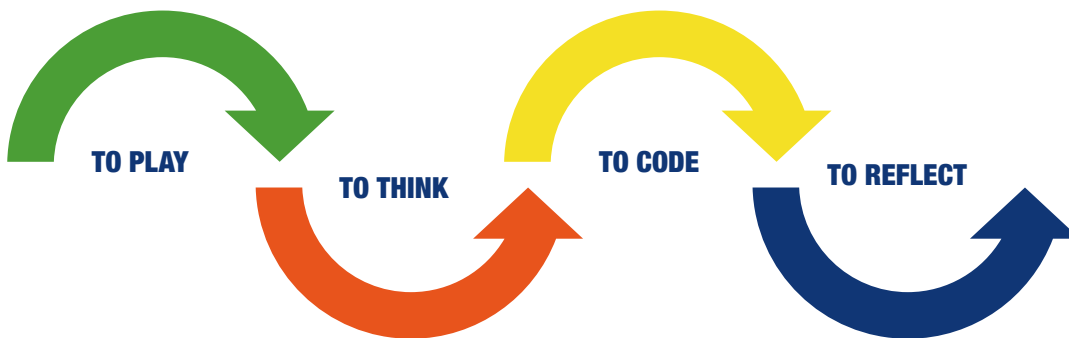
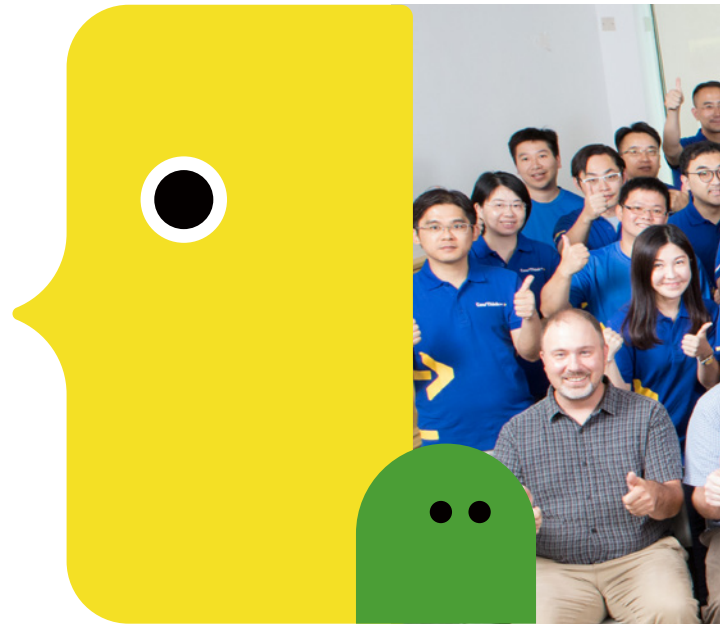
development and infrastructure to attain this goal and ultimately raise public awareness of the importance of computational thinking.

CoolThink@JC offers a comprehensive curriculum grounded in rigorous research, fostering computational thinking skills among students. Through a structured learning approach encompassing play, think, code, and reflect steps, students develop problem-solving abilities and creativity through coding activities. The program emphasizes hands-on experiences and AI-incorporated applications to illustrate the relevance of computational thinking in daily life and future careers. Professional development opportunities are provided to teachers, enhancing their skills in computational thinking and coding education. Parent education workshops and community events raise awareness and facilitate effective communication between parents and children regarding computational thinking. CoolThink@JC also fosters a supportive teacher community through regular events and conferences. Additionally, the program actively engages the public through city-wide campaigns and media features to promote awareness of computational thinking education.

CoolThink@JC's Holistic, Integrated and Inclusive Model

Curriculum

CoolThink@JC provides a three-level, age-aligned curriculum for upper primary students (age 9-12) covering more than 14 hours of learning in each academic year, developed by MIT and EdUHK. It has built its foundation on rigorous research, such as the pilot phase impact study and the implementation study during the scaling phase. A typical CoolThink@JC lesson features four learning and practising steps: to play, to think, to code, and to reflect, and is primarily designed to empower thinkers and active creators of technology.



Students first try out the applications and then uncover the steps of decomposing the tasks of building the applications into subtasks and testing out the partially built applications stepwise through coding in an incremental manner. Students will reflect on what they have learned from these learning processes in terms of computational thinking concepts, practices, and perspectives. These lessons focus on hands-on experiences which help them understand the widespread use of programmable robotics, Internet of Things (“IoT”) and Artificial Intelligence (“AI”) in their daily lives and future workplaces.



Professional Development

CoolThink@JC provides participating schools and teachers with a comprehensive, 48 hours of professional development programme. In-service and pre-service teachers are trained in concepts about computational thinking, IoT and AI. In particular, teachers from other disciplines can acquire teaching strategies and methods used in coding education that have allowed them to optimize their teaching

skills to their fullest potential. In addition, in-class teaching support by trained teaching assistants is provided to schools when they first adopt the programme. More than 14 hours are provided to schools and different grades to ease pressure on teachers.



Parent Education

School-based and community-based parent awareness events are integral to the programme. Through the workshops, parents can acquire computational thinking skills underpinning digital technology, learn more about its benefits, and establish effective communication with their children. To promote the benefits of computational thinking to parents, CoolThink@JC collaborates with CityU, to run more than 400 parent workshops and seminars with an outreach to over 30,000 parents.



CoolThink@JC's Holistic, Integrated and Inclusive Model



Teacher Community

Another essential element is the establishment of a teacher community to provide mutual support. CoolThink@JC InnoCommunity, created by CoolThink@JC, is supported by over 50 frontline teachers. Through this means, teacher identity is developed, and an organic teacher community network is incubated. Quarterly teacher community-building events are organized to share best practices across the development regarding people, schools, and sectors. CoolThink@JC also organises local and overseas conferences, allowing teachers to share their teaching experiences and unique CoolThink@JC stories. Through these ways, teachers can also contribute to promoting computational thinking education locally and globally.





Public Awareness Building

An instrumental part of the programme is how CoolThink@JC reaches out to the general public to raise awareness about computational thinking education on a broader scale. It organises city-wide events such as annual Student Competition, Commendation Ceremony and parent-child Coding Fair. CoolThink@JC participates publicity

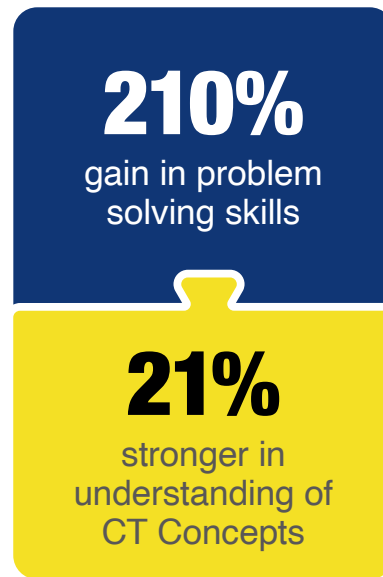
campaigns such as the InnoCarnival and the Hong Kong Book Fair. More than 200,000 public views on CoolFun Times YouTube videos have been registered, while more than 550,000 readers were engaged via 12 CoolThink@JC stories featured in the South China Morning Post. CoolThink@JC is also featured in more than 50 media reports every year.



CoolThink@JC's Holistic, Integrated and Inclusive Model

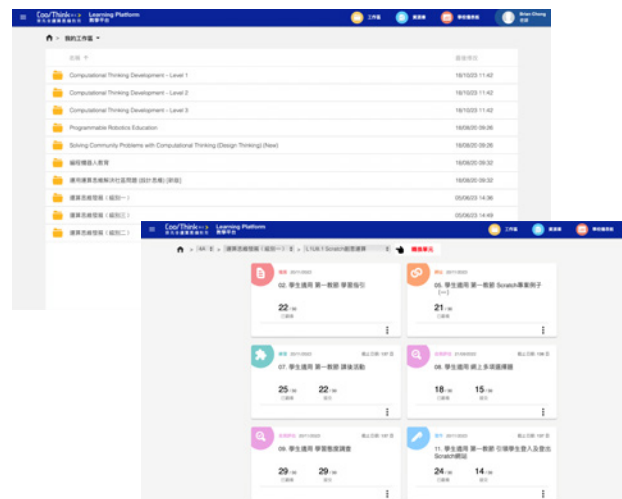
Assessment and Evaluation

CoolThink@JC has engaged SRI, as an independent evaluator, to conduct student outcomes study in pilot phase and implementation study in scale up phase. SRI developed assessment instruments and conducted a rigorous 3-year evaluation of the pilot project between 2016 and 2019 and the progress made by its students. SRI then continued another four years of implementation study on the success factors when CoolThink@JC scaled out to more than 200 schools in Hong Kong. Evaluation reports have been publicly published in SRI website.



Online Learning Platform

CoolThink@JC ensures access to Scratch and MIT App Inventor, which serve as the primary platforms utilised for instructing CoolThink@JC students in coding. Scratch is a “free programming language and online community where you can create your own interactive stories, games, and animations” while the MIT App Inventor is an “intuitive, visual programming environment that allows everyone to build fully functional apps.”



The CoolThink@JC Learning Platform serves as a comprehensive web portal facilitating teaching, resource management, data collection, and reporting. The platform fosters a Community of Practice, enabling teachers, students, and parents to exchange comments, share practices, and disseminate knowledge. Students utilize the platform's classroom environment to access teaching materials,

engage in coding exercises, and undergo CT assessments. Furthermore, it seamlessly integrates with App Inventor through Single Sign-On (SSO), streamlining processes like project template creation and submission. The platform has over 1.8 million of user access and more than 7.7 million of material download since 2016.



School Infrastructure Support

At the school level, CoolThink@JC provides incentives in the form of hardware and infrastructure enhancements, including renovations to computer rooms - named CoolThink@JC Studio - and upgrades to digital devices, aimed at facilitating the seamless integration of the programme. These incentives are designed to support schools in creating an environment conducive to effective implementation and utilization of computational thinking education resources.





CoolThink@JC's Impact on Students



> **100,000**
unique students served



Students are inspired and empowered by what they need to think critically and act digitally. They are enabled to acquire modern digital skills and empowered to become creators of technology through a systematic, comprehensive, research-backed, and localized computational education curriculum. Upper primary school students receive more than 14 hours of class hours focusing on acquiring computational thinking skills and have equitable access and meaningful ICT lesson times to ensure digital inclusiveness and narrow the digital divide.

The three-year independent evaluation report of the pilot project revealed that CoolThink@JC students exhibited a 21% higher grasp of computational thinking concepts compared to non-CoolThink@JC students. On average, pilot students demonstrated 210% greater proficiency in computational thinking practices than students in comparison schools, displaying the programme's positive impact.



The CoolThink@JC Implementation Study Midline Report reported that students feel joyful and more self-directed in learning digital skills and innovation, mentioning they are happy with unstructured play, games, and opportunities to be creative. In particular, 89% of teachers overall agreed or strongly agreed that the project equips students with basic programming capabilities, and 86% of teachers overall agreed or strongly agreed that it gives students opportunities to be creative in class. Some CoolThink@JC

students even mention that the programme has changed their lives and the trajectory of their careers.

Regardless of whether or not students choose to work in the technology industry, CoolThink@JC prepares them to be active and informed contributors to the increasingly technological society. CoolThink@JC students become more empowered to create, and be more confident to face challenges.





CoolThink@JC's Impact on Students

“Growing up, I never thought of thinking computationally or coding in general. However, something crucial happened that made me the person I am now. When I was in second grade, the school introduced CoolThink@JC into Computer Science and it completely changed the trajectory of my life,

At first, I thought that it was probably irrelevant to me, but after the teachers explained what CoolThink@JC was, I started to develop an interest in computer scripting and computers. Every time I am free, I would study, learn, and test new experiments while coding. CoolThink really affected my interest in technology and computer scripting. I am learning and discovering new types of coding because of them.”

Sit Ho Yuen Howard

from S.K.H. Ka Fuk Wing Chun Primary School



“At home, my parents have always been very supportive of my learning about innovation and technology because this knowledge will be very useful to me in the future. Once, when my mom was planting potted plants and I thought I could make an automatic waterer to help her solve the problem of forgetting to water the plants, she said happily that I’m great and she can’t believe I’ve learned so much from the course so I felt very happy.

In my future goals, I have also found a direction for my life. I want to use this knowledge to help more people, and use technology and some innovative and interesting programmes to help people around me.”

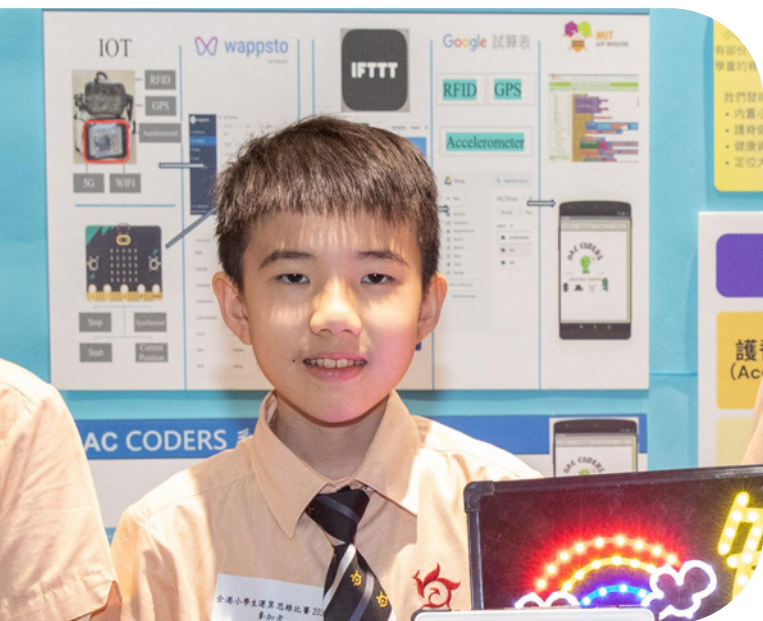
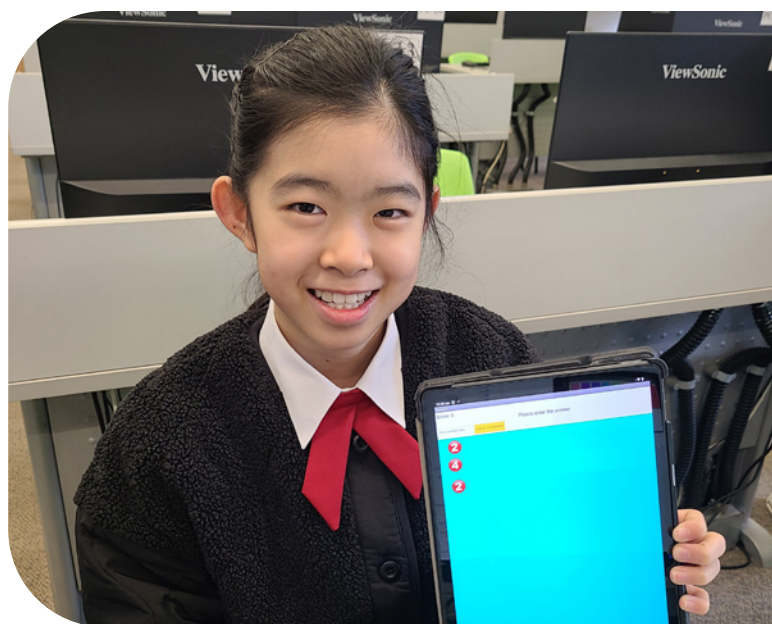
Tsoi Yuet Ying

from Conservative Baptist Lui Ming Choi Primary School

“Previously, my family had reservations about learning about computers. However, when I started learning CoolThink@JC and sharing my learnings with them, they became open to the idea and embraced the knowledge. This experience has not only expanded our Computational Thinking skills but also strengthened our bond as a family.”

Yung Tsz Kei, Valerie

South Yuen Long Government Primary School



“Learning Computational Thinking has equipped me with the ability to make logical deductions, which have proven invaluable in my schoolwork. When I encountered challenging Maths problems which delved into unfamiliar territories, thanks to my Computational Thinking skills, I was able to think logically, creatively and find innovative solutions.”

Oa Yang Yee Ching

Pui Kiu College



CoolThink@JC's Impact on Teachers

> 1,500
teachers trained

> 90%
teachers expressed
confident in teaching



CoolThink@JC's holistic approach to teacher empowerment has revolutionised classroom dynamics and sparked a broader educational movement. The programme empowers teachers with innovative strategies, pedagogical approaches, and comprehensive support systems. It imparts student-centred methodologies, reflecting a fundamental change in the approach to education as teachers evolve from traditional instructors to facilitators guiding students towards independent thinking and problem-solving. More than 2,000 teachers have been trained with more than 48 hours of computational thinking education. Over 90% of teachers expressing confidence in teaching computational thinking in classroom. This confidence stems from CoolThink@JC's emphasis on providing teachers with the necessary tools, training, and support to integrate computational thinking concepts into their teaching practices effectively. Teachers acquire the knowledge and skills to

deliver quality teaching through professional development sessions.

Moreover, CoolThink@JC has established teacher-driven support networks, such as the InnoCommunity, which serve as platforms for teachers to exchange ideas, collaborate, and empower one another. By building a supportive ecosystem, CoolThink@JC ensures teachers can access ongoing professional development opportunities and a network of peers who can offer guidance and support.

The programme's impact extends beyond individual classrooms, as CoolThink@JC has inspired a broader movement towards computational thinking education advocacy. More than 50 CoolThink Fellows and Mentors, incubated as ambassadors, actively promote the importance of computational thinking education within their communities and beyond, and are crucial in driving awareness and advocacy efforts.

Additionally, CoolThink@JC has empowered teachers to infuse computational thinking concepts across disciplines. Owing to the programme's innovative pedagogical approach and comprehensive training, even non-ICT teachers are capable of teaching computational thinking lessons. This integration enriches students' learning experiences and highlights the relevance of computational thinking across diverse fields and contexts.

Testimonials from teachers further underscore the transformative impact of CoolThink@JC on teacher empowerment. One beneficiary is Visual Art teacher Ho Ka Man from Po Leung Kuk Dr. Jimmy Wong Chi-Ho (Tin Sum Valley) Primary

School, who initially lacked coding experience and has transformed remarkably through CoolThink@JC courses.

Mr Andy Li, Principal of Ling To Catholic Primary School also elaborates that Furthermore, CoolThink@JC's accessible, comprehensive, and ready-to-use teaching resources offload the burden on teachers, enabling them to focus on delivering quality instruction and facilitating meaningful learning experiences for their students. Additionally, the programme offers in-class co-teaching support by well-trained teaching assistants, easing the pressure on first-time CT teachers and ensuring a supportive learning environment for all students.



A spark in the education sector was followed by the Jockey Club's foresight in launching the (CoolThink@JC) project.

An idea from the sector was taken to the next level to produce a very successful project. Without it, Hong Kong's own talents would not be as competitive as they can be.

MR ANDY LI

Principal of Ling To Catholic Primary School



Through interaction with other teacher fellows, I acquired a great deal of experience and finally gained confidence. This experience also made me rethink my role as a teacher and revamped my teaching mindset. I changed from an instructor-like presence to becoming a facilitator who would try to find ways to solve problems together with students.

MS. HO KA MAN

Po Leung Kuk Dr. Jimmy Wong Chi-Ho (Tin Sum Valley) Primary School



CoolThink@JC's Impact on Parents



CoolThink@JC's parent workshops foster parental involvement and contribution to the computational thinking education landscape. By providing hands-on experiential workshops for parents and children, CoolThink@JC creates a platform for parents to engage actively with their children's learning journey. The impact of these workshops is significant, with at least two workshops held in each school annually, serving 60-120 parents per year. The workshops have received overwhelmingly positive feedback from parents, with 95% expressing satisfaction, proving their effectiveness in engaging and empowering parents in the computational thinking landscape.

Through these workshops, parents gain insight into their children's educational experiences and develop a deeper understanding of the importance of computational thinking education. This understanding is crucial, as parents' proactive support is vital when schools introduce new learning initiatives. By physically experiencing their children's learning processes, parents become advocates for computational thinking education, advocating for its integration into school curricula and

supporting its implementation at home. Parent workshops empower parents to actively engage in their children's educational journey and foster a collaborative partnership between parents, educators, and the wider community.





Moreover, CoolThink@JC goes beyond individual workshops to organize city-wide large-scale events, such as student competitions and parent-child coding fairs. These events provide students with opportunities to showcase their creations and enable parents to witness the creativity and innovation fostered through computational thinking education.

The impact of parent involvement in computational thinking education extends beyond individual workshops and events. Through their engagement, parents contribute to a supportive ecosystem that nurtures students' interest and enthusiasm for computational thinking. Additionally, parents play a crucial role in advocating for computational thinking education at the community and policy levels. Through their involvement, parents contribute to the growth and development of the computational thinking education landscape, shaping a future where students are equipped with the essential skills and competencies needed to thrive in the digital age.



CoolThink@JC's Sustainable Impact

Ecosystem Change

The integration of various components within CoolThink@JC forms a dynamic ecosystem that drives transformation in educational methodologies and societal perspectives. The programme has made significant impacts across various stakeholders in the education ecosystem.

CoolThink@JC engaged School Sponsoring Bodies to create a positive influence in the adoption and implementation. Participating schools were recognised and co-created a supporting learning circle among their internal network. School Leaders benefit from enhanced awareness and understanding of computational thinking education, tailored workshops, tangible incentives like hardware upgrades, and opportunities for public engagement, elevating their leadership in digital education. CoolThink@JC closely engaged two biggest Teacher Associations in the school sector - The Hong Kong Association for Computer Education (HKACE), and Association of I.T. Leaders in Education (AiTLE) - for promotion and dissemination. Teacher Community Networks such as CoolThink@JC InnoCommunity were established to develop teacher identity and for the purpose of teacher training. Teachers are empowered through extensive professional development, support networks, and recognition, fostering motivation and growth opportunities. The capacity of pre-service and in-service teachers was developed with multiple Teacher Training Partners, including The Education University of Hong Kong, The University of Hong Kong, MIT Hong Kong Innovation Node. Collaborating with District Parents & Teacher



Associations allows city-wide parent engagement through workshops and seminars, enhancing their understanding and support for CoolThink@JC over time. Business and Technology Companies such as Microsoft, Google, and other EdTech companies have been engaged to support student learning experiences and new learning contents. CoolThink@JC collaborated with Non-Profit Organisations to arrange parent and student workshops in deprived locations further deepen additional supports to high-need families. Long term partnership with the Government, especially the Education Bureau (EDB), ensures alignment with policies and drives adoption across schools. Close collaboration with the Innovation, Technology and Industry Bureau (ITIB), Office of the Government Chief Information Officer (OGCIO) and HK Education City provides additional resources support to school sectors.

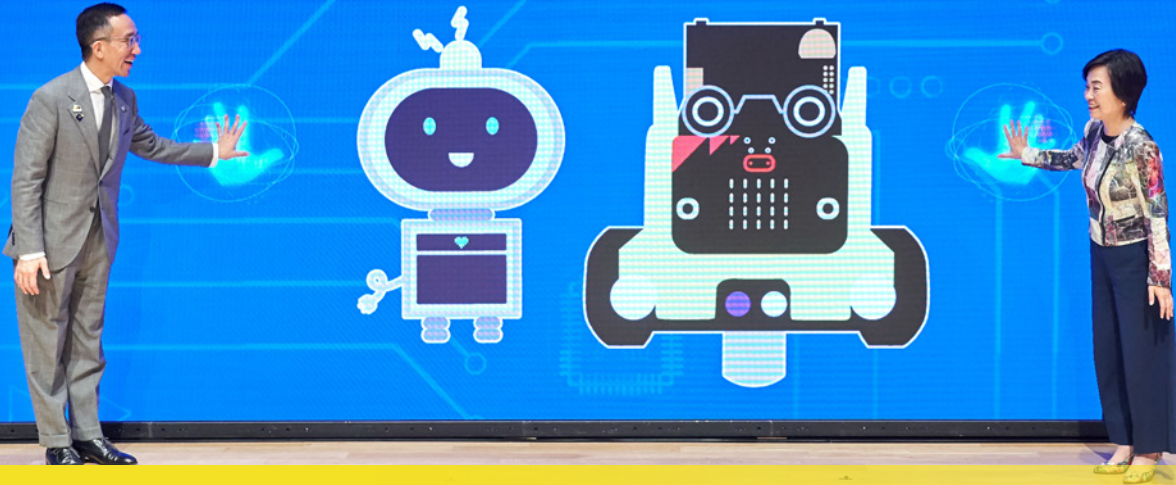
Together, these stakeholders synergise to drive substantial and enduring educational reform. CoolThink@JC has developed a comprehensive ecosystem involving multiple stakeholders that have worked together to eventually reach the critical mass of adoption and mainstreaming of computational thinking education in school system.



Government Regularisation

運算思維及人工智能教育 – 主流化暨嘉許典禮

Computational Thinking & AI Education – Mainstreaming and Commendation Ceremony



An ecosystem of change and sustainability has been instilled by CoolThink@JC, a major result of such are the changes in government policy towards computational thinking education in Hong Kong.

In 2017, the draft for the "Computational Thinking – Coding Education: Supplement to the Primary Curriculum" was published in November 2017 by the Education Bureau (EDB). This marked a pivotal step towards recognising the importance of computational thinking and coding skills in the curriculum, which was finalised in 2020, and solidified the commitment of the government to embrace innovative approaches to education.

In 2019, CoolThink@JC established a collaboration with EDB in teacher professional development. It aims to equip teachers with the necessary skills and knowledge to integrate CT and coding education effectively into their teaching practices. In 2022, the Chief Executive's Policy Address underscored the

importance of STEAM education, emphasising the implementation of enriched coding education for upper primary students. This highlighted the government's recognition of the critical role that computational thinking and coding skills play in preparing students for the future.

The culmination of these efforts came in 2023 with the EDB's decision to adopt CoolThink@JC materials and mainstream them into all primary schools across Hong Kong. This move ensured the widespread availability and sustainability of computational thinking and coding education, firmly embedding it within the educational framework of the region.

CoolThink@JC has played a pivotal role in influencing government policy, driving long-term changes that benefit educators and students, and positioning Hong Kong as a leader in innovative education practices.



CoolThink@JC's Global Impact

Recognition and Award

CoolThink@JC has garnered widespread acclaim on the global stage, solidifying its reputation as a pioneering force in computational thinking education. The programme's achievements are underscored by prestigious accolades, including two awards from the QS Reimagine Education Awards 2021: a Silver Award in Engineering & IT and a Bronze Award in Presence Learning and Teaching. Additionally, the curriculum received the ISTE Seal of Alignment standard from the International Society for Technology Education in 2021. CoolThink@JC's commitment to excellence in education has been certified by Education Alliance Finland in 2021, achieving outstanding performance in "Pedagogical Approach" and "Learning Engagement" in the evaluation process. The programme was also selected

as an impactful innovation in the HundrEd.org Global Collection for both 2023 and 2024. Through its dedication to quality, innovation, and collaboration, CoolThink@JC has emerged as a leading force in computational thinking education, driving positive change and making a lasting impact on learners and teachers locally and globally.

CoolThink@JC has attained new heights and spread its impact to an increasing number of people. The success of the programme is certainly no fluke and can be analysed and replicated by institutions seeking to develop a computational thinking programme with impact locally and globally.



Reimagine Education Awards 2021



International Society for Technology Education (ISTE) Seal of Alignment



Education Alliance Finland 2021



Selected as an impactful innovation in HundrED.org Global Collection 2023 and 2024



The global recognition of CoolThink@JC is evident through its widespread dissemination of learning materials and teacher training across various countries, including the US, Canada, New Zealand, and Dubai. This international outreach displays the programme's commitment to sharing its innovative approach to computational thinking education on a global scale. CoolThink@JC has extended its reach to international audiences and promoted global collaboration and knowledge exchange in computational thinking education through its localized customised learning materials and teacher training workshops.

The world-class CoolThink@JC programme distinguishes itself from other programmes through its comprehensive approach and unparalleled impact on systemic change. Unlike conventional educational initiatives, CoolThink@JC offers a holistic framework that engages stakeholders on different fronts to advance the agenda of advocating the importance of computational thinking education. What sets CoolThink@JC apart is its commitment to providing quality learning materials and teacher training and fostering a culture of innovation and collaboration.



CoolThink@JC also founded the International Conference on Computational Thinking Education, which is now hosted annually in different regions. The conference serves as a platform for educators, policymakers, and stakeholders worldwide to exchange insights and share best practices on computational thinking education.

Through strategic partnerships and global recognition, CoolThink@JC drives systemic change by influencing educational policies and practices in Hong Kong and sharing its experience globally. The programme ensures that all students have access to high-quality computational thinking education regardless of background or ability. With its unwavering dedication to excellence, CoolThink@JC acts as a guiding light for innovation, shaping the future of education and preparing students to thrive in the digital age.



Inclusive and Equitable Quality Education

CoolThink@JC focuses on basic education and equity, closely aligning with the United Nations' Sustainable Development Goal of "ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all." Through its comprehensive approach, CoolThink@JC addresses various aspects of educational equity and accessibility, contributing significantly to the goal of global educational development.

CoolThink@JC strives to offer quality computational thinking education to all students, regardless of their socioeconomic backgrounds or academic abilities. By providing access to cutting-edge educational resources and curriculum materials, CoolThink@JC ensures that every student has the opportunity to develop essential computational thinking skills, preparing them for success in the digital age.





SRI compared computational thinking education in Hong Kong with other regions such as Guangzhou, Shenzhen, Singapore, and the United Kingdom in a Global Benchmarking Report in 2022. It was found that CoolThink@JC is the only initiative in all jurisdictions that has publicly reported on student computational thinking outcomes through an emphasis on evidence-based evaluation. This commitment to inclusivity and equity is further highlighted by the programme's workshops for parents and professional training for teachers. By empowering parents and educators with the knowledge and skills needed to support students' learning,

CoolThink@JC fosters a collaborative learning environment that values the input and participation of all stakeholders.

CoolThink@JC embodies the principles of inclusive and equitable education by providing quality computational thinking education to all students, empowering parents and teachers, integrating innovative curriculum materials into formal education systems, and addressing systemic inequalities through community outreach efforts. CoolThink@JC is a brilliant case study of Sustainable Development Goal of ensuring inclusive and equitable quality education for the world to reference.

4 QUALITY EDUCATION



SUSTAINABLE DEVELOPMENT GOAL 4:

Ensure inclusive and quality education for all and promote lifelong learning.



Key Takeaways from the CoolThink@JC Model

The CoolThink@JC Programme has attained new heights and spread its impact to an increasing number of people. The success of the programme is certainly no fluke and can be analysed and replicated by institutions seeking to develop a computational thinking programme with impact locally and globally.

CoolThink@JC's core mission is deeply rooted in promoting student empowerment through the “Think-Do-Empower” philosophy, aligning with the Hong Kong Jockey Club's Institute of Philanthropy (IoP), a "Think-Fund-Do" tank dedicated to promoting philanthropic thought leadership at the local, regional, and global levels together with its funding partners.

CoolThink@JC empowers students to analyse challenges, think creatively, and develop innovative solutions. Through hands-on activities and projects, CoolThink@JC encourages students to become makers and creators, enabling them to apply their knowledge and skills in real-world contexts, fostering a sense of agency and ownership over their learning journey. Furthermore, CoolThink@JC aims to improve students' confidence and prepare them for a hopeful future by instilling in them the belief that they have the capability to make a positive impact on the world around them. By embracing the “Think-Do-Empower” philosophy, CoolThink@JC equips students with essential skills for success in the digital age, nurtures their aspirations, and fosters a sense of optimism for the future.

Emerging as a symbol of innovation and inclusiveness, the CoolThink@JC programme has transformed the educational sphere by incorporating computational thinking as a core element of the learning process. The success of the CoolThink@JC programme can be attributed to its unique approach as an integrated educational model, which emphasises synergies among various factors to create an ecosystem driving change. The programme's ongoing engagement with the EDB lays a solid foundation for systemic transformation. By closely collaborating with policymakers, CoolThink@JC ensures that its initiatives accelerate policy change to drive adoption.

CoolThink@JC's articulated course sequence, extensive outreach efforts, and comprehensive professional development programmes collectively contribute to its distinction as a leader in computational thinking education. By prioritising accessibility, community engagement, and pedagogical excellence, CoolThink@JC sets a benchmark for other jurisdictions seeking to implement similar initiatives on a global scale and serves as a blueprint for other regions aspiring to enrich computational thinking education through collaborative partnerships, comprehensive curriculum, and targeted professional development initiatives.

Replicating the success of CoolThink@JC requires a multifaceted approach aligning with the success factors of its model to be further addressed in the annex.

Firstly, policy alignment is crucial. Programmes should align with government policies and educational objectives, engaging policymakers from the outset to ensure support and integration into the formal curriculum.

Secondly, establishing a strategic network of stakeholders is vital. This includes educators, industry leaders, governmental agencies, and educational institutions. Forming an advisory committee with influential members can provide guidance and support throughout the programme's implementation.

Thirdly, the quality of learning materials and infrastructure is paramount. Collaborating with experts to develop robust curriculum frameworks and providing necessary resources, including hardware and infrastructure upgrades, ensures equitable access and enhances effectiveness.

Moreover, securing commitment from school leaders and teachers is essential. Providing professional development opportunities, support networks, and incentives for educators fosters buy-in and ensures successful implementation at the grassroots level.

Furthermore, building teacher capacity through structured training programs and ongoing support is crucial. Offering ready-to-use teaching resources and in-class support helps alleviate the pressure on educators and boosts their confidence in delivering the curriculum effectively.

In addition, fostering an environment where students are active learners is vital. Encouraging creativity, critical thinking, and problem-solving skills through hands-on activities and competitions engages students and enhances their learning experience.

Lastly, parent engagement and support are fundamental. Educating parents about the importance of computational thinking education and involving them in their children's learning journey through workshops and events fosters a supportive ecosystem.

Replicating CoolThink@JC's model requires a comprehensive approach that addresses policy alignment, strategic collaboration, resource provision, educator support, student engagement, and parental involvement. By following these key principles, similar programs can drive the adoption of computational thinking education and shape the educational landscape on a local and global scale.

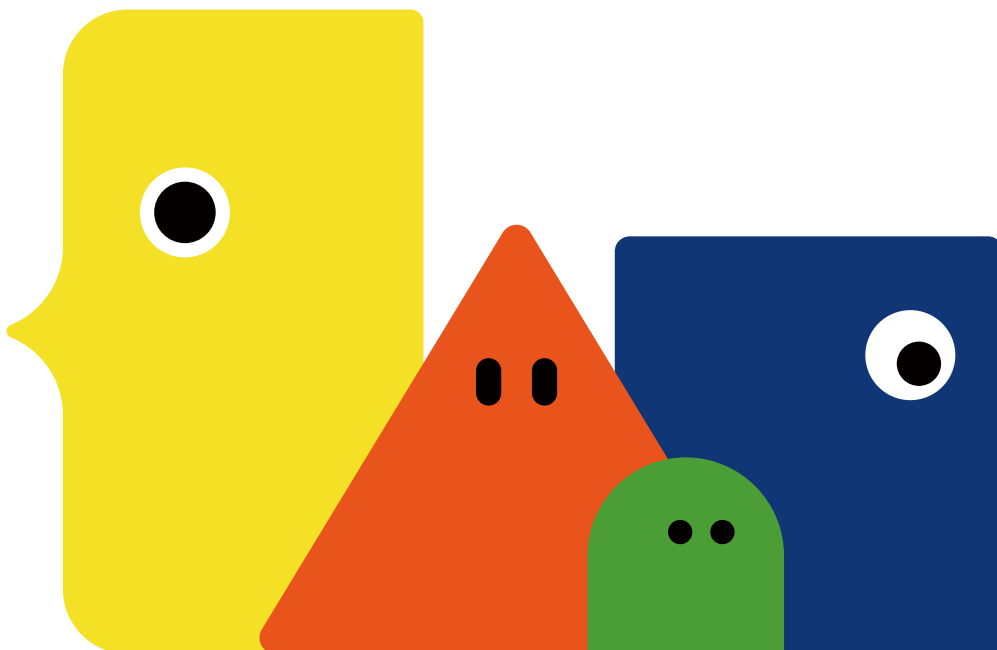


Digital Education for Tomorrow

By recognising the importance of computational thinking as basic education, CoolThink@JC ensures that students are equipped with the essential skills needed to thrive in an increasingly digital world. Moreover, the programme's efforts in narrowing the digital divide promote equity and equal access to opportunities for all students, regardless of their background.

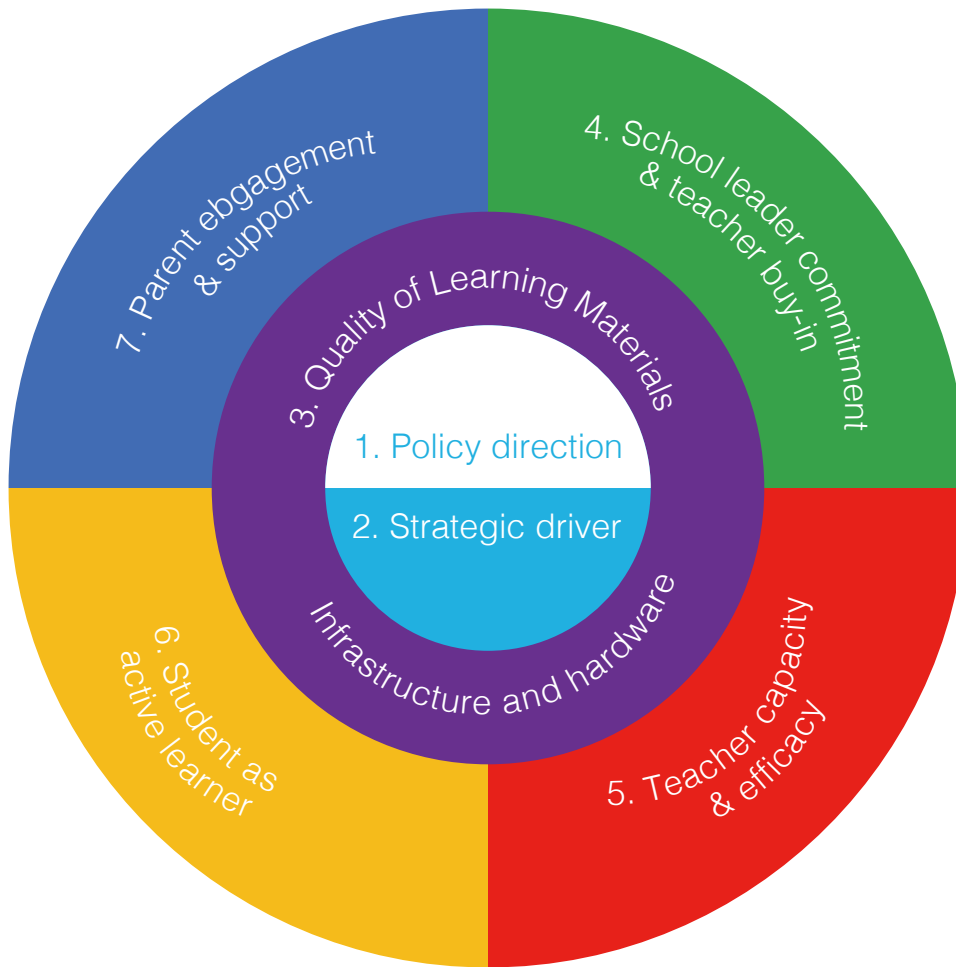
Through its holistic approach, CoolThink@JC not only imparts coding knowledge but also instils problem-solving, critical thinking, and creativity skills – qualities that are indispensable in the AI age through the development of computational thinking. By nurturing these skills from a young age, CoolThink@JC builds a strong foundation for our future talents, preparing them to tackle the challenges and opportunities of tomorrow with confidence and resilience.

As we navigate the complexities of the digital era, the importance of problem-solving, critical thinking, and creativity skills cannot be overstated. In a world where AI technologies are increasingly integrated into various aspects of society, these skills will serve as the cornerstone of success, enabling individuals to adapt, innovate, and thrive in a rapidly evolving landscape. CoolThink@JC not only shapes the minds of today's students but also cultivates the leaders, innovators, and changemakers of tomorrow - empowering them to build a brighter, more sustainable future for generations to come.





Annex A - CoolThink@JC's Pillars for Success



CoolThink@JC's remarkable success in implementation and widespread adoption can be attributed to a synergy of various crucial factors. The alignment with government policy and consistent engagement with educational authorities provided a solid foundation, while strategic collaboration with a diverse network of stakeholders propelled the initiative forward.

Central to its success was the development of high-quality learning materials and the provision of necessary infrastructure and hardware, ensuring equitable access and effectiveness across diverse student populations. The commitment of school leaders and the enthusiastic buy-

in from teachers further catalysed the programme's implementation, supported by comprehensive professional development opportunities and peer networks.

Its emphasis on active student engagement and empowerment fostered a transformative shift in learning paradigms, cultivating digital creators with essential problem-solving skills. Moreover, the active involvement of parents, facilitated through workshops and community events, contributed significantly to the programme's success by fostering a supportive ecosystem around computational thinking education.



Annex A - CoolThink@JC's Pillars for Success

1. Policy Direction

The programme's alignment with government policy and its significant role in accelerating policy change and driving adoption is a major success factor. Ms Michelle Li Mei Sheung, Permanent Secretary for Education, serves as a member of CoolThink@JC's Advisory Committee, so CoolThink@JC has closely engaged the EDB since the programme's inception. School leaders noted that consistency with policy direction and requirements of the subject curriculum was a critical decision element in implementing the new learning programme. CoolThink@JC was able to gain the backing of school leaders for the new curriculum by leveraging policy as in 2023, the EDB adopted CoolThink@JC materials and mainstreamed them to all primary schools in Hong Kong.

2. Strategic Driver

CoolThink@JC is supported by an extensive network that includes organisations across the computational thinking education system. As the initiative's backbone organisation, The Trust, its management, and Central Coordination Team play a crucial role in driving the mission, implementation strategy, and activity execution of the programme, as well as convening local and global partners and experts. CoolThink@JC's Advisory Committee was also established to oversee, direct and steer to ensure that the Programme meets its objectives and delivers the envisaged outcome and benefits. The Advisory Committee comprises Ms Michelle Li Mei Sheung, Permanent Secretary for Education; Ms. Marjorie Yang, Chairperson of Esquel Group; and Ms. Ada Chu, Head of Charities (Talent and Sector Development). Organisations represented in CoolThink@JC's governing structure subcommittees include government agencies such as EDB, Teacher Associations, School Sponsoring Bodies (SSBs), universities, and industry leaders.

3. Quality of Learning Materials, Infrastructure and Hardware

CoolThink@JC produced world-class learning materials to provide equitable access to resources suitable for students with diverse abilities. The award-winning computational thinking framework, pedagogy, and curriculum were developed in collaboration with world-class computational thinking and coding experts from MIT, EdUHK, and CityU. The learning materials have been trialled, tested, reviewed, and revised to ensure their adaptability, practicality, and effectiveness. The programme also provides the materials with accessibility for easy adoption and adaptation by global and local educators and organisations. CoolThink@JC has received multiple awards including two at the 2021 QS Reimagine Education Awards, known as the "Oscar" in the education sector. At the same time, CoolThink@JC provides resources for updating computer rooms, electronics, and e-learning platforms to schools.

4. School Leader Commitment and Teacher Buy-in

Another factor of success is being able to secure principals and teachers as the change agents of schools. The CoolThink@JC Implementation Study Midline Report released by SRI Education in 2023 found that 100% of principals from CoolThink network schools valued computational thinking education and believe that computational skills such as logical thinking, problem-solving, and creativity are essential, showing the critical role of the school leader when adopting change. CoolThink@JC asks school leaders to assign a minimum of three teachers to at least 24 hours of on-site professional development during school hours in addition to committing to 14 hours of formal instruction. In-school learning circles are also encouraged for peer support.

5. Teacher Capacity and Efficacy

Support networks and structured professional development are the essences of this success factor. To facilitate exchange and empower new teaching methods and to ensure teaching quality is upheld, CoolThink@JC has built teacher-driven support networks and provided teachers with at least 24 hours and up to 48 hours of training in the scale-up phase of the programme. In the pilot phase, two 39-hour teacher development courses were provided for network school teachers taking part in the programme: one on "Introduction to Teaching Computational Thinking with Blocks Programming," primarily taught by MIT, and another on "Coding Pedagogy and Computational Thinking Development," primarily taught by EdUHK. The programme offers accessible, comprehensive, ready-for-use teaching resources to offload teachers. In-class support by teaching assistants recruited and trained by City University of Hong Kong is also provided to ease pressure on first-time computational thinking teachers. The CoolThink@JC Implementation Study Midline Report shows that there was a statistically significant increase in teachers' confidence in teaching CT after they underwent at least 24 hours of professional training and a year of support, including in-class co-teaching support and in-school support by CoolThink resource schools.

6. Students as Active Learners

The programme stimulated a paradigm shift from passive to active learning and cultivated students as digital creators. The aim of the programme's design was to inspire digital creativity, critical thinking, and problem-solving skills through learning soft skills and computational action-driven activities. The findings in the CoolThink@JC Implementation Study Midline show that CoolThink@JC teachers agree the programme improved students differently. 86% of teachers agreed or strongly agreed that it allowed students to be creative in class, while 73% agreed or strongly agreed that the classes helped students

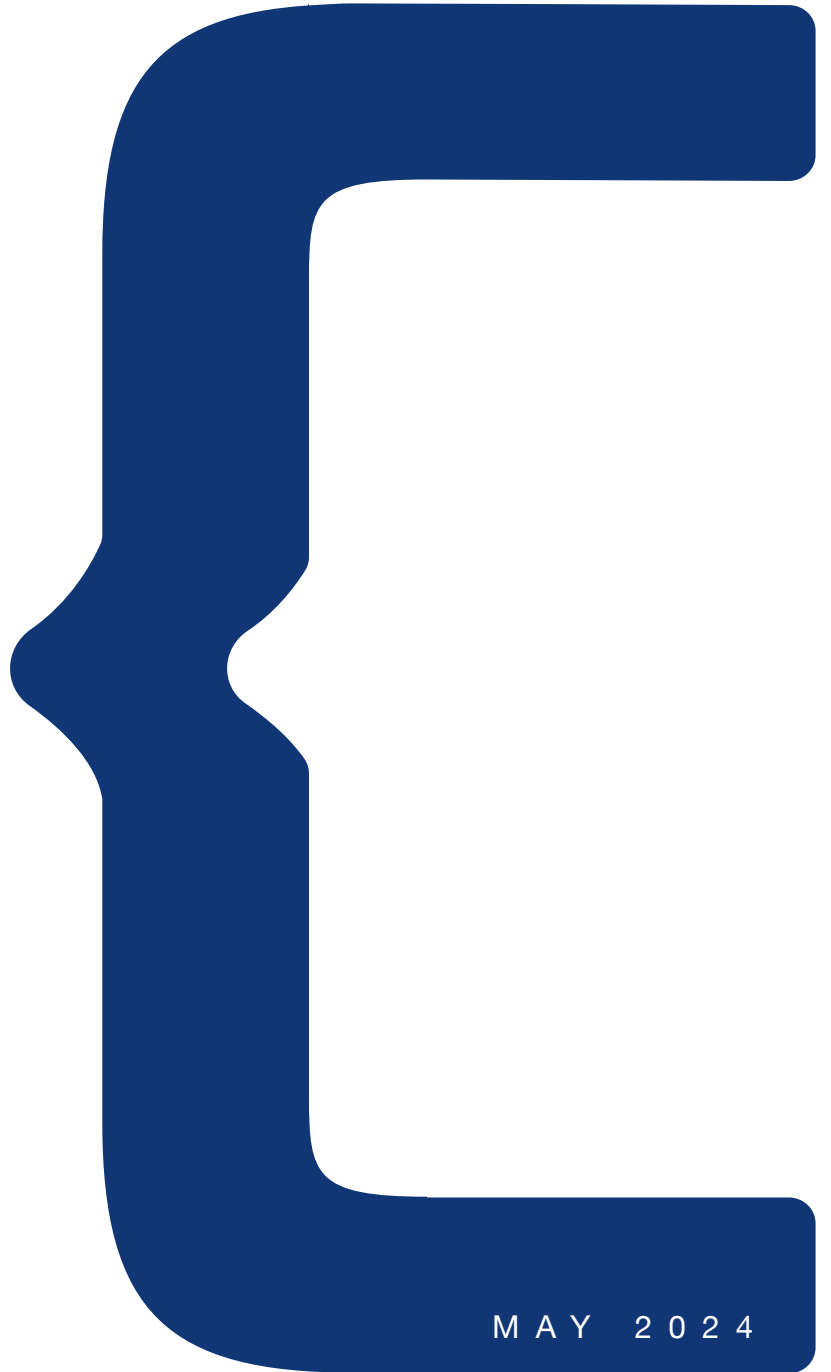
solve open-ended problems CoolThink@JC empowers students by offering platforms such as annual competitions, awards, a coding fair, and commendations to capture their attention and interest while acknowledging their learning accomplishments.

7. Parent Engagement and Support

The engagement of parents and their support for CoolThink@JC has also played a role in the programme's success. It is imperative for parents to understand the importance of computational thinking education to leverage their support. Parent-child workshops allow parents to experience their children's learning journey. Large-scale events such as the CoolThink@JC Competition and parent-child coding fairs are held for students to showcase their creations to parents and the community.

Implementation and critical mass of adoption are recurring themes in measuring the programme's success. Evident in the comprehensive design of this programme, which engages a wide range of stakeholders, is the aim to "offer equitable access and mainstream computational thinking education in formal curriculum."

As a driver of computational thinking education, CoolThink@JC creates a sustainable impact on a macro-level through the facilitation of adoption and shaping of the computational thinking education ecosystem locally and globally.



Cool/Think @JC >
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