Coding for Community Project: Building a diversified coding community in Hong Kong secondary education

「編」、「社」人生計劃：建構多樣化的香港中學編程教育及學習社群

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Date of Submission: May 6, 2022

Summary of the Impact

- The findings from a three-year longitudinal project (2016 – 2019) in Hong Kong revealed the importance of collaboration in computational thinking education, and benefits of developing other skills beyond computational thinking as early as in primary schools. Yet, very minimal knowledge is known about how to foster pedagogical practice in secondary schools for computational thinking education beyond the classroom walls.
- ***Coding for Community (C4C)* Project** was launched in 2019 during COVID-19, as a research-based knowledge exchange programme, to develop a **community-based design of computational learning**, that emphasizes the **learning in classroom**, **building a culture of collaborative knowledge building** among students, and **enhancing collaboration with mentors** to **serve the community** and **build better psychosocial wellbeing**.

Underpinning Research

- **Project title:** The impact of coding education in Hong Kong primary schools: a longitudinal study
- **Nature of project:** a three-year multi-case longitudinal research
- **Project goal:** to examine the impact of students' computational thinking through coding education in schools, and how students can develop computational thinking across ages and be motivated to serve the needs in our society
- **Grand challenges addressed and highlighted**:
  - the importance of developing **computational thinking and other skills** (cognitive or psychosocial) in the process;
  - the awareness of **developmental aspects** of computational thinking across different ages; and
  - the roles of **collaborative** versus individual problem-solving in the processing of solving computational problems and developing computational thinking.

Underpinning Research

- When conducted?
  - **Pilot study:** Before Jan 2017 [Survey study with 9300+ students]
  - **Main study:** Jan 2017 to Dec 2019 [Theoretical and empirical study with 700+ students]
- Who are involved and their roles:
  - **PI:** Gary WONG (HKU)
  - **Co-Is:**
    - William COPE (U of Illinois at Urbana Champaign)
    - George REESE (U of Illinois at Urbana Champaign)
    - Ivan KALAS (UCL)
    - Chun Kit CHUI (HKU, Dept of Computer Science)
    - Cher Ping LIM (EdUHK)
    - Tak Lam WONG (EdUHK)
    - Hin Leung CHUI (EdUHK)

Underpinning Research

(contextual information about this research)

We have discovered the interrelationship between computational thinking and other skills, developing through ages and collaboration.

INTERACTIVE LEARNING ENVIRONMENTS
2020, VOL. 28, NO. 4, 438–450
https://doi.org/10.1080/10494820.2018.1534245

Routledge
Taylor & Francis Group

Check for updates

Exploring children's perceptions of developing twenty-first century skills through computational thinking and programming

Gary Ka-Wai Wong and Ho-Yin Cheung

Faculty of Education, The University of Hong Kong, Pokfulam, Hong Kong, People's Republic of China

Received: 12 November 2020 | Accepted: 9 August 2021
DOI: 10.1111/bjet.13157

REVIEW

British Journal of Educational Technology BERA

Collaborative versus individual problem solving in computational thinking through programming: A meta-analysis

Xiaoyan Lai | Gary Ka-wai Wong

Unit of Human Communication, Development and Information Sciences, Faculty of Education, The University of Hong Kong, Hong Kong, China

Abstract
Computational thinking (CT), which is a cognitive skill

Received: 7 February 2021 | Revised: 28 June 2021 | Accepted: 11 July 2021
DOI: 10.1111/jcal.12591

ARTICLE

Journal of Computer Assisted Learning WILEY

Exploring age and gender differences of computational thinkers in primary school: A developmental perspective

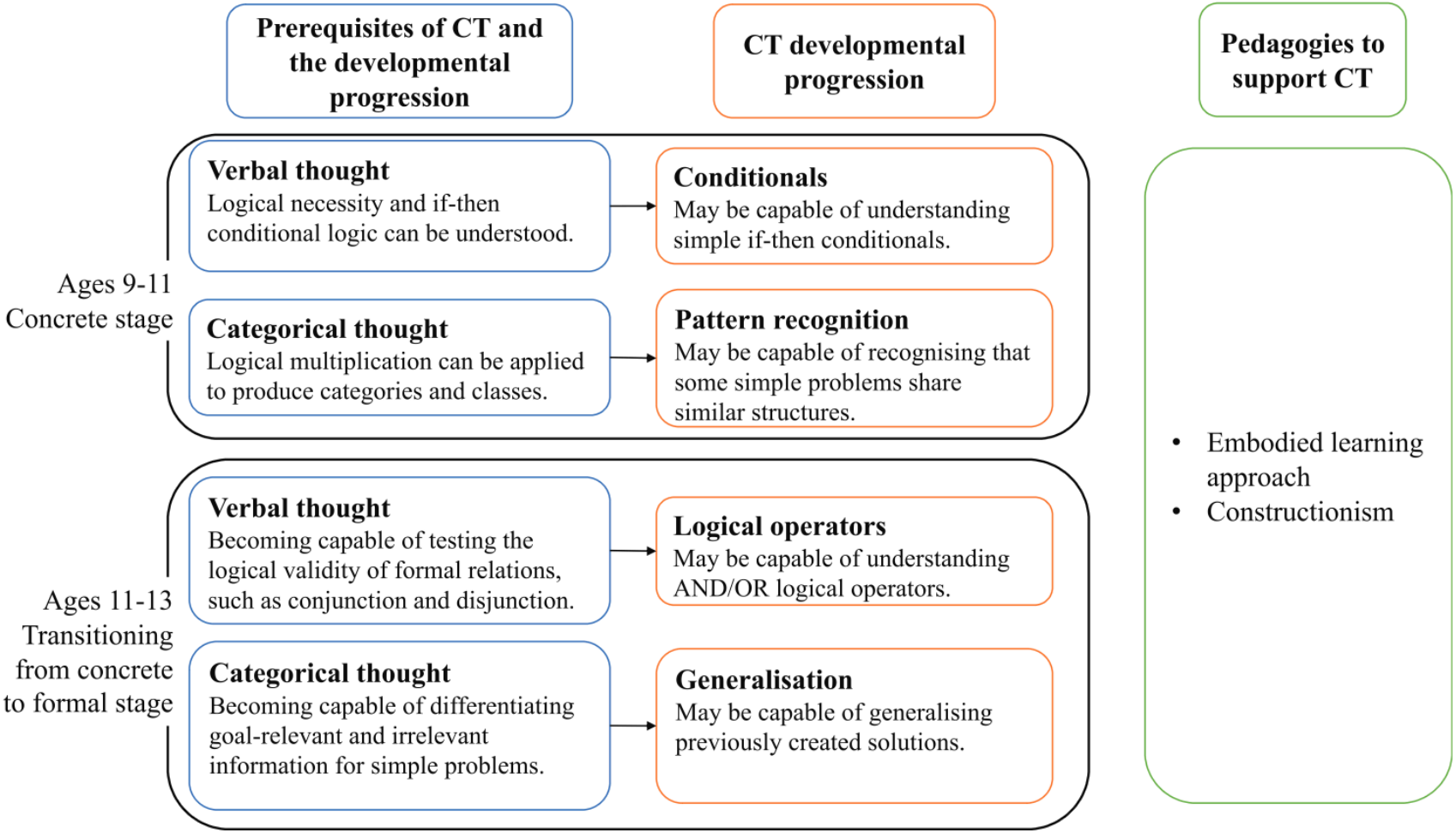
Shan Jiang | Gary K. W. Wong

Faculty of Education, The University of Hong Kong, Pok Fu Lam, Hong Kong

Abstract

Underpinning Research

(Innovativeness of knowledge arising from your research)



Computational thinking is developed through different ages.

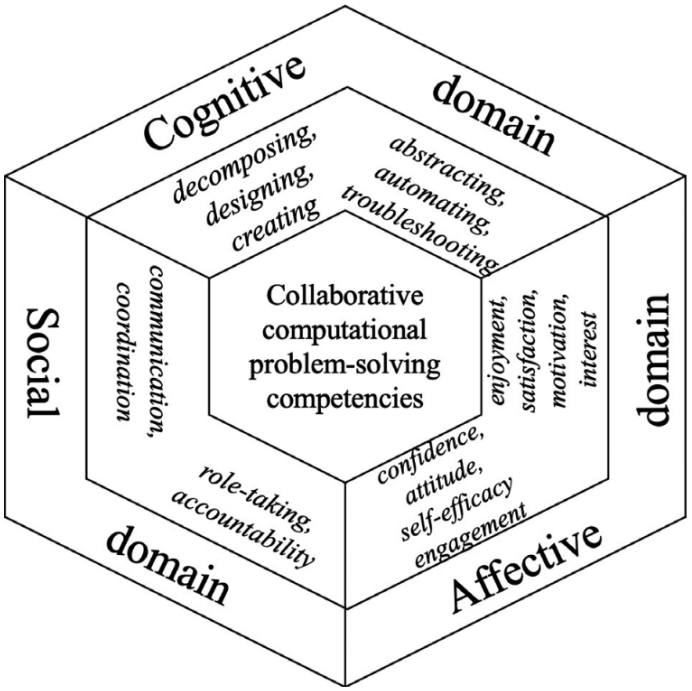
Jiang, S., & Wong, G.(2022). Exploring age and gender differences of computational thinkers in primary school: A developmental perspective. *Journal of Computer Assisted Learning*, *38*(1), 60-75. https://doi.org/10.1111/jcal.12591

Underpinning Research

(Innovativeness of knowledge arising from your research)

Table 1. Conceptual framework of computational thinking.

Dimensions	Descriptions	Examples	Mapped twenty-first Century Skills
Computational concepts	Syntactic, semantic and schematic knowledge commonly used in programming	Variables, loops (e.g. repeat, do … while), conditionals (e.g. if … then … else), operators (e.g. arithmetic and comparison)	• Critical thinking • Problem solving
Computational practices	Strategic knowledge to solve programming problem during the process of thinking and practices	Being incremental and iterative, testing and debugging, reusing and remixing and abstracting and modularising.	• Creativity • Critical thinking • Problem solving
Computational perspectives	Understandings of personal, social and technological relationships around them in connection to programming	Expressing and questioning the technology world through computation (e.g. Create their own digital stories with Scratch)	• Creativity • Critical thinking



- Computational thinking is **a multifaceted skill across different domains** that support the development of other skills.
- Advanced our understanding **constructionism learning theory** and **social-constructivism theory in practices**.

Wong, G., & Cheung, H. Y. (2020). Exploring children's perceptions of developing twenty-first century skills through computational thinking and programming. *Interactive Learning Environments*, *28*(4), 438-450. https://doi.org/10.1080/10494820.2018.1534245

Lai, X., & Wong, G. (2022). Collaborative versus individual problem solving in computational thinking through programming: A meta-analysis. *British Journal of Educational Technology*, *53*(1), 150-170. https://doi.org/10.1111/bjet.13157

Underpinning Research

(Significance of the key insights or findings from the research)

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Global Forum: Futures of Education and Schooling in the Digital, Post–Pandemic Era

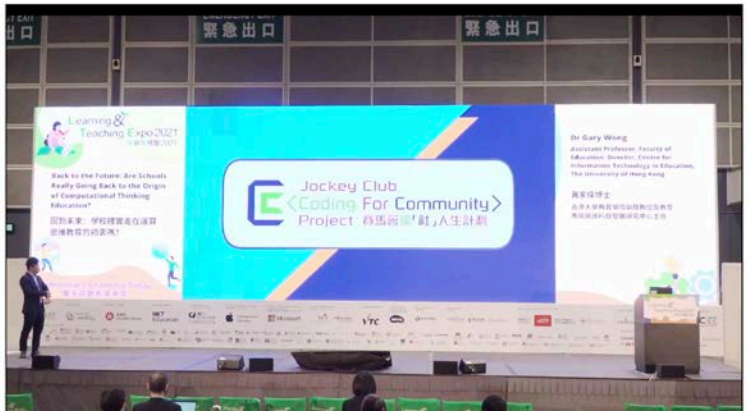
Series: Global Horizon on Education
Author: Professor Cheng Kai Ming, SBS, JP | Mr Mart Laidmets | Professor Fernando M. Reimers | Professor Andreas Schleicher | Mr Wong Siew Hoong | Dr Gary Wong
Last Modified: 30/11/2021

Related Articles

學與教博覽2021 – 回到未來：學校確實走在運算思維教育的初衷嗎？

系列： 學與教博覽2021
作者： 黃家偉博士
最後更新： 29/12/2021

人工智能教育先驅Seymour Aubrey Papert博士提出孩子應利用電子裝置培養運算思維，這個50多年前的倡議如今已在校園裡實現。多年以來，電腦科學家與教師強調孩子學習運算思維的重要性，主張孩子應透過思考運算問題互動和建構數碼製品，啟發其認知能力。時至今日，學習運算過程及運算思維不應只流於學習編程，也不應是精英的專利。教師與其他持分者未來應如何「修正未來」，帶領學生重拾運算思維教育的初衷？未來教育應如何轉變，以切合學生的學習需要？教育工作者又應如何避免未來的運算思維教育走向「精英主義」？



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科技知識增益系列：(1) 研討會暨展覽 – 人工智能

系列： 教育中的人工智能與人工智能教育 | 創新教育科技
作者： 黃家偉博士 | 陳汝堅先生 | 洪偉林先生 | 鄭弼亮先生 | 邱志南先生 | 文可為先生 | 江文其先生
學與教策略： 編程及計算思維
最後更新： 28/07/2021

開展AI教育從何入手？

香港大學教育學院助理教授黃家偉博士亦分享了他對運算思維、STEM教育及AI教育三者的見解。黃博士認為STEM教育和AI教育均旨在培養學生的解難能力，應對未來複雜多變的社會環境。他指出，科技與工程有機會取代科學和數學成為引領世界的主流，學生須利用解難能力，刺激思維，發展更多工具解決生活中的難題，而人工智能與運算思維能力兩者實是相輔相成。

黃博士深信，AI是帶領未來科技潮流的主要方向，他建議本地學校在推行AI教育時，可從三方面入手，包括AI概念、AI應用、AI道德。例如，AI可應用於跨學科，協助學生培養面對綜合社會問題的解難能力，小學生於資訊科技課學會使用AI工具後，常識科教師可在課堂上帶領學生思考不同議題，討論解難方案，再把議題及方案帶回資訊科技課上動手實踐，成為專題研究；數學科的處理數據能力，亦同樣可輔助學生理解及應用AI。

城、資訊科技教育領袖協會
l益系列：(1) 研討會暨展覽 – 人工智

（香港大學教育學院助理教授黃家偉博士展望，未來AI教育發展可更多元化且深入，學界應更積極參與，一起為學生的全方位學習作出貢獻。）

The research reveals a potential of **advancing computational thinking education** to **interdisciplinary** approach, in **higher age groups**, to **impact future technologies** in society, e.g. **AI**, and collaborate with others for **positive psychosocial wellbeing**.

Engagement

(Engagement process)

- Previous research findings were disseminated through various means, such as press media interview, educational events for public seminars and talks, and workshops at EDB between 2016 and 2019.
- Knowing the needs of **developing new curriculum** and **pedagogical practices** based on the findings for secondary schools, the recruitment process of external partners such as local institutes and NGO, and resources began in Jan 2019 to develop a project to engage schools into the evidence-based intervention to inform the future policy of computational thinking education.
- ***Jockey Club Coding for Community Project (C4C Project)*** was developed and funded by the Hong Kong Jockey Club Charities Trust with **HK$11,370,000.00**, in collaborating and exploring a possible extension of **CoolThink@JC** project to secondary schools (one of the largest scale of KE project in promoting coding education in primary schools).
- Based on the pre-mature project, **Project C**, initiated by Youth Global Network (YGN), **C4C Project** extended the legacy of Project C in collaboration with CITE and Department of Applied Social Sciences at PolyU to revamp the current ICT curriculum.
- The **collaboration team** discussed with existing research findings as well as seeking other recommendations from different stakeholders such as **school principals, teachers, educators, and policymakers** to develop the project plan.
- During the discussions, **youth development and engagement** were highlighted as a part of the theme to develop a holistic and equitable computational thinking education in secondary schools.

Jockey Club Coding For Community Project 賽馬會編「社」人生計劃

Engagement

(External partners)

Jockey Club Coding For Community Project 賽馬會編「社」人生計劃

Organized by

Centre for Information Technology in Education
The University of Hong Kong

Funded by

香港賽馬會慈善信託基金
The Hong Kong Jockey Club Charities Trust
同心同步同進 RIDING HIGH TOGETHER

Co-organized by

YOUTH GLOBAL NETWORK
青年全球網絡

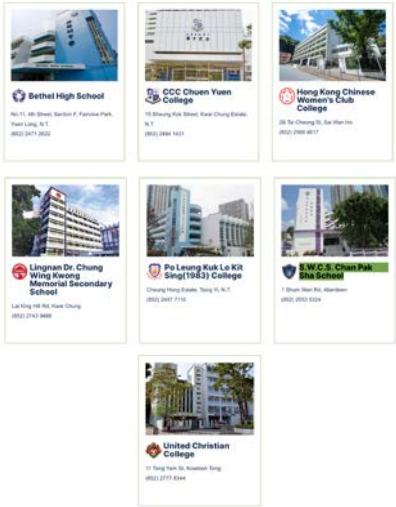
THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

Engagement

(Innovativeness of the engagement approach)

Jockey Club Coding For Community Project 賽馬會編「社」人生計劃

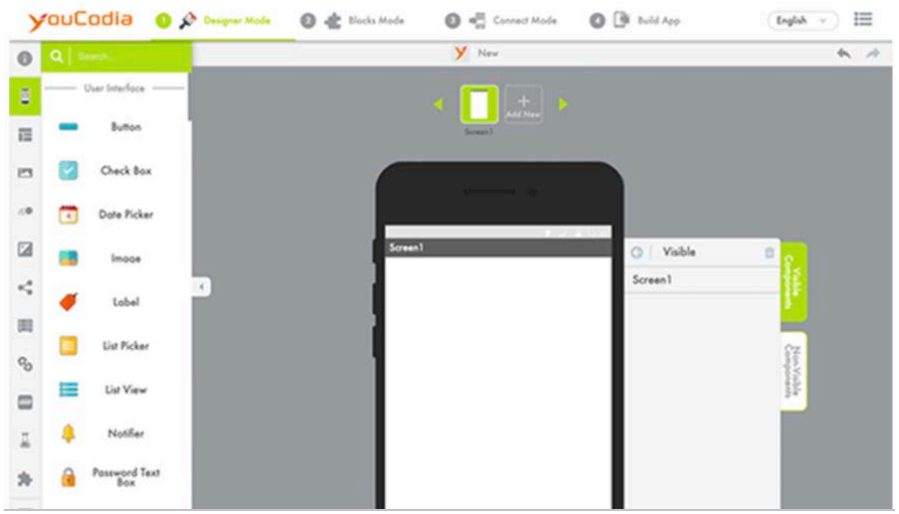
Introduction seminar	School invitation and recruitment	Teacher /Mentor Training	Kick-off Cohort 1 (F.2) (3 schools)	Data Collection and Evaluation	Teacher/Mentor Training	Kick-off Cohort 1 (F.3) and Cohort 2 (F.2) (3+4 schools)	Data Collection and Evaluation	Coding Competition cum Award Ceremony	Kick-off Cohort 2 (F.3) (4 schools)	Data Collection and Evaluation
June 2019	**July**	**Aug**	**Sept – June 2020**		**July**	**Aug**	**Sept – June 2021**		**July**	**Aug and ongoing for Cohort 2 (F.3) until 2022**



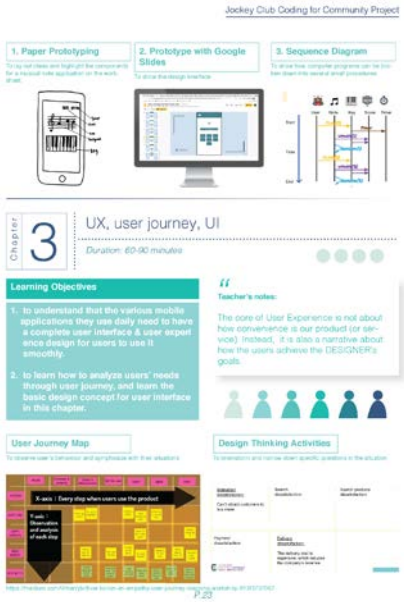
Impacts Achieved (Curriculum)

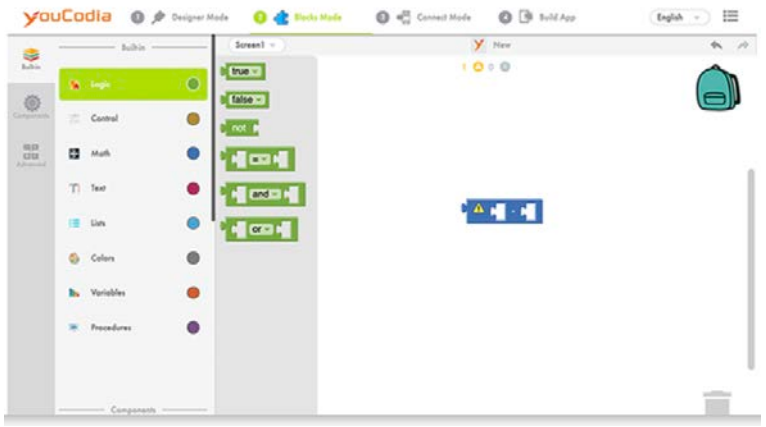
- **Invent** a new community-based pedagogical practice for changing the computational thinking education
- Adopted by **22 secondary schools**, serving more than **4,000 students** (including those that were not funded by the project grant), with nearly **100 teachers** along with **700 trained mentors** supporting the students' computational learning and community projects

Impacts Achieved (Curriculum)



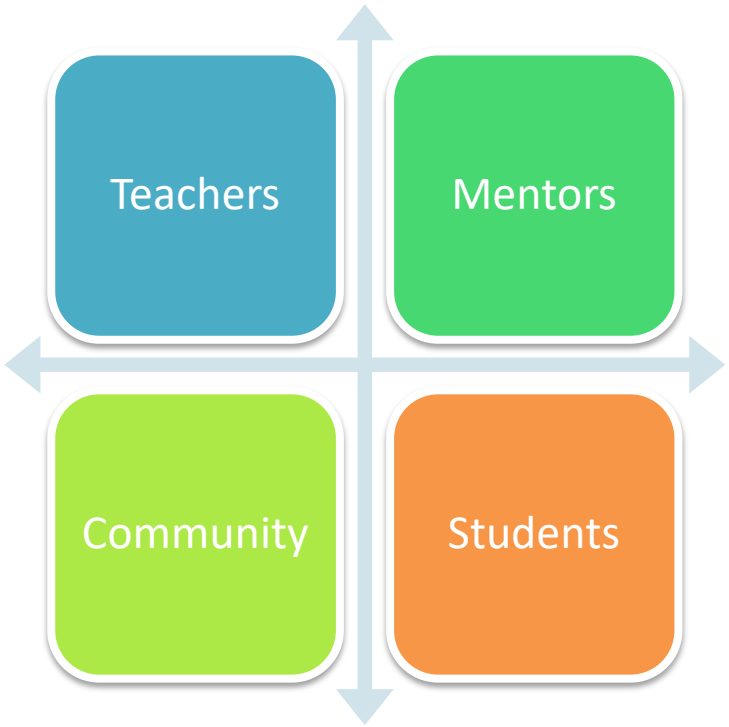
- **Unit 1: Visual Programming Basics**
- **Unit 2: Mobile App Development**
  - Use **unplugged activities**, games and exercises on the computer to learn computational thinking concepts, events, commands, loops, functions, conditionals, variables, etc.
- **Unit 3: Advanced Mobile App Development & Database**
  - Students will learn how to use **youCodia** to build a database for their apps. They will also learn about how to improve user experience for their apps.

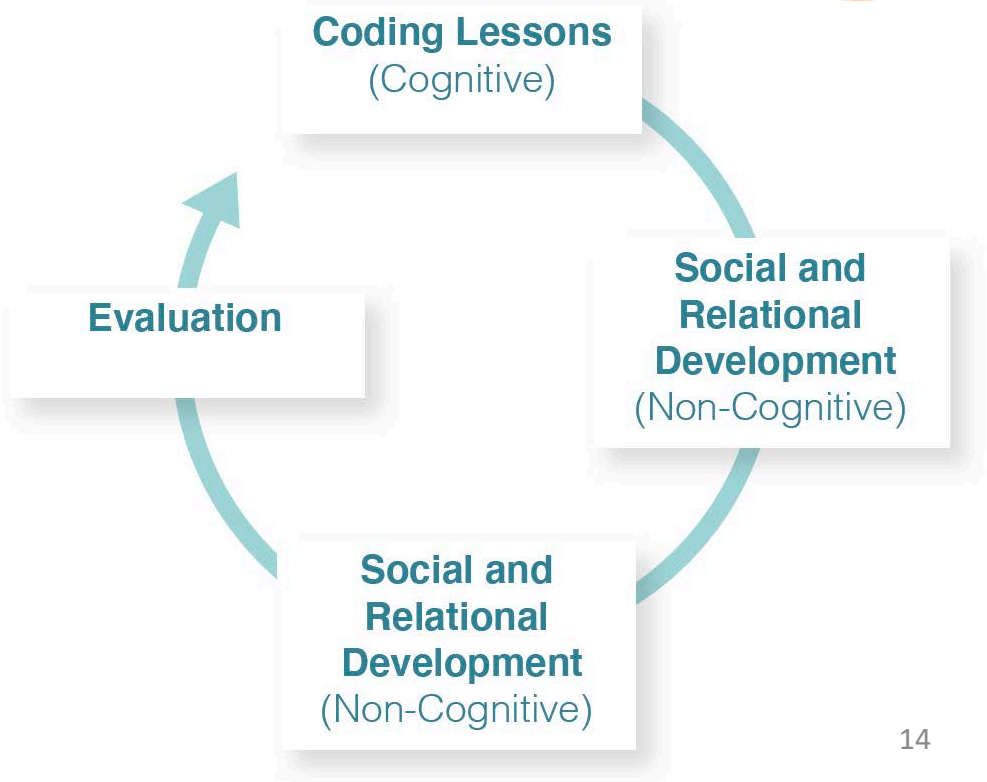




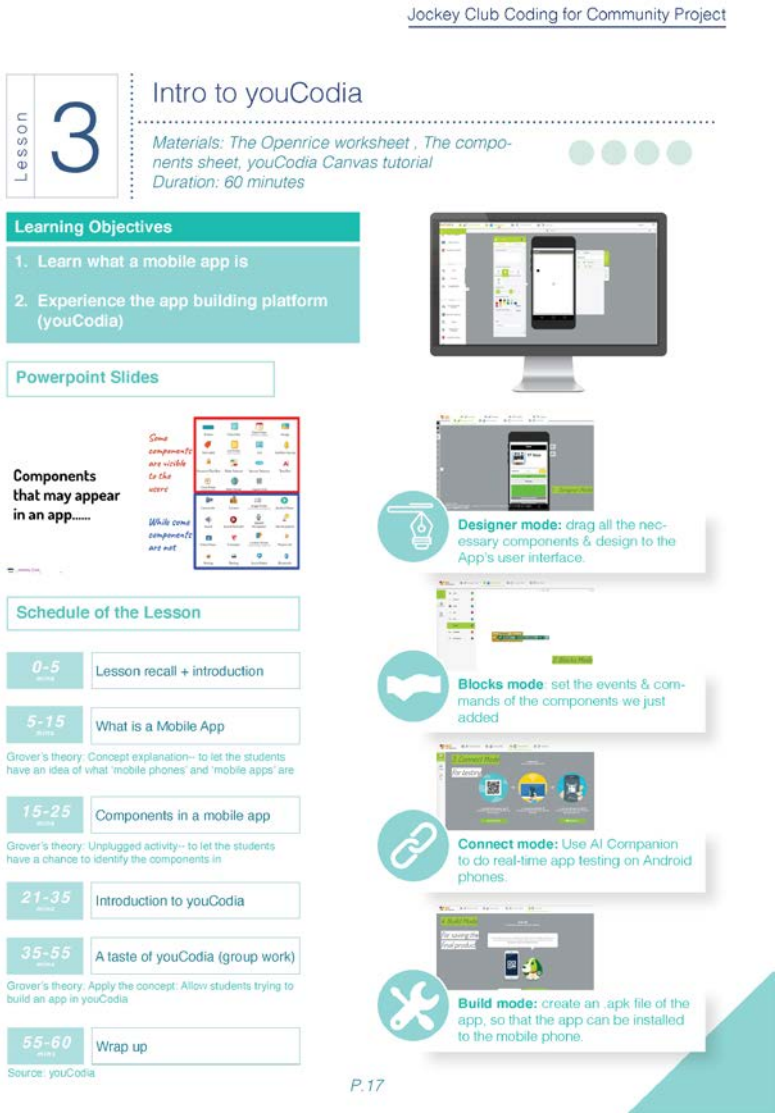
Impacts Achieved (Community-based pedagogical practice)

- Funding **supported 7 schools** since September 2019, benefiting nearly **over 2,000 students**, entirely during the unprecedented COVID-19 epidemic.
- Around **36 teachers** were involved in the delivery of **31 compulsory lessons with 17 elective lessons** (nearly **60 contact hours per student**) in **physical or remote classroom**, with **nearly 300 mentors** participating in **over 150 hours of meeting with the students in community**.

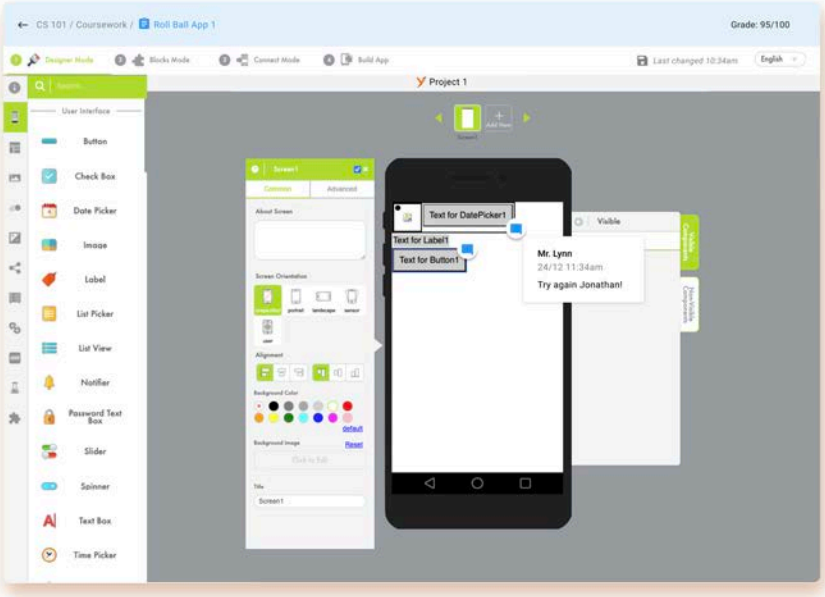




Impacts Achieved (youCodia)



The extension work of ***youCodia*** has been funded for further development (July 2020 – June 2023) with nearly **HK$4 million** by **Innovation and Technology Fund**.



Impacts Achieved (Talks and Events)

- Engaged students **physically** and **remotely** during COVID-19
- Involved **teachers** and **mentors** to help students explore the **community issues** and build apps to address those issues.
- Enhance students' **psychosocial wellbeing**

Impacts Achieved (Documentary Video)

A set of **professional documentary videos** were produced to promote the community-based pedagogical practices for computational thinking education:

1. Project Introduction [6:06]
2. Documentary Video on Teachers [1:48]
3. Documentary Video on Students [1:40]
4. Documentary Video on Mentors [1:35]
5. Highlight of Coding Competition [7:28]

Dissemination plan: Post to various social media such as Facebook, Instagram, Twitter, LinkIn and YouTube to further populate the impacts of the project.

Impacts Achieved (Knowledge Exchange Activities)

- Pioneered various impactful activities for setting future policy
  - Serving on the **Curriculum Development Council (Technology Education)** to revamp the existing technology education curriculum framework
  - **Trained near 200 teachers** who have received more than **500 hours of professional development** to empower their pedagogical competences

Impacts Achieved (Knowledge Exchange Activities)

- Co-founded a mentorship scheme and **trained those 300 mentors** to collaborate with students' coding projects.
- Supported students with **more than 150 hours** in mentoring meetings of **collaborative knowledge building**.

Impacts Achieved (Psychosocial Wellbeing)

- Students had a **positive psychosocial growth** (i.e., coding attitude, self-efficacy, grit, sense of community, sense of belonging, intrinsic motivation of learning) throughout this project
- The difference of the growth between **the underprivileged students** (e.g. from low-income family) and other students **was less divided**.
- Those students who were supported by **mentoring had significant higher growth** in their psychosocial development.