香港教育大學
The Education University of Hong Kong

Department of Early Childhood Education
幼兒教育學系

Towards Early Childhood Education for the Future: Advances in Technology and Pedagogy

面向未來的幼兒教育：科技和教學的新展望

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Digital Technology Integration in the classroom

數字科技融合課堂實踐

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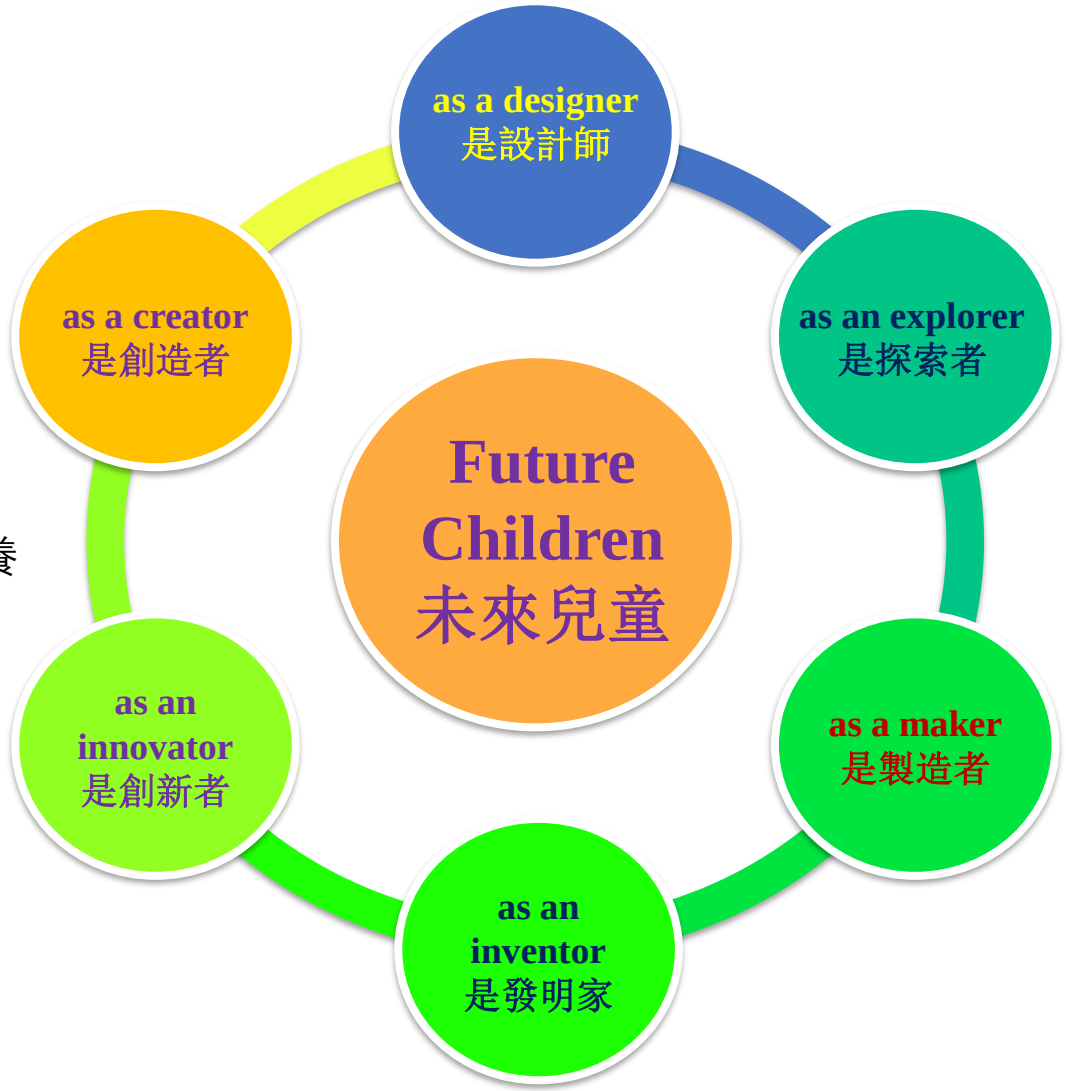
胡馨允

Future learners 未來學習者

- The potential of children 兒童的潛力
- Learning motivation 學習動機
- 21st century learning needs: 二十一世紀學習需求



7C Skills技能


Critical thinking and problem solving 批判性思維和解決問題


Communications, information, and media literacy 溝通、信息和媒體素養


Collaboration, teamwork, and leadership 合作能力、團隊精神和領導力


Creativity and innovation 創造力和創新力


Computing and ICT literacy 電腦和ICT素養


Career and learning self-reliance 工作與學習獨立自主精神


Cross-cultural understanding 跨文化理解

Trilling. B et al., (2010, p 176)

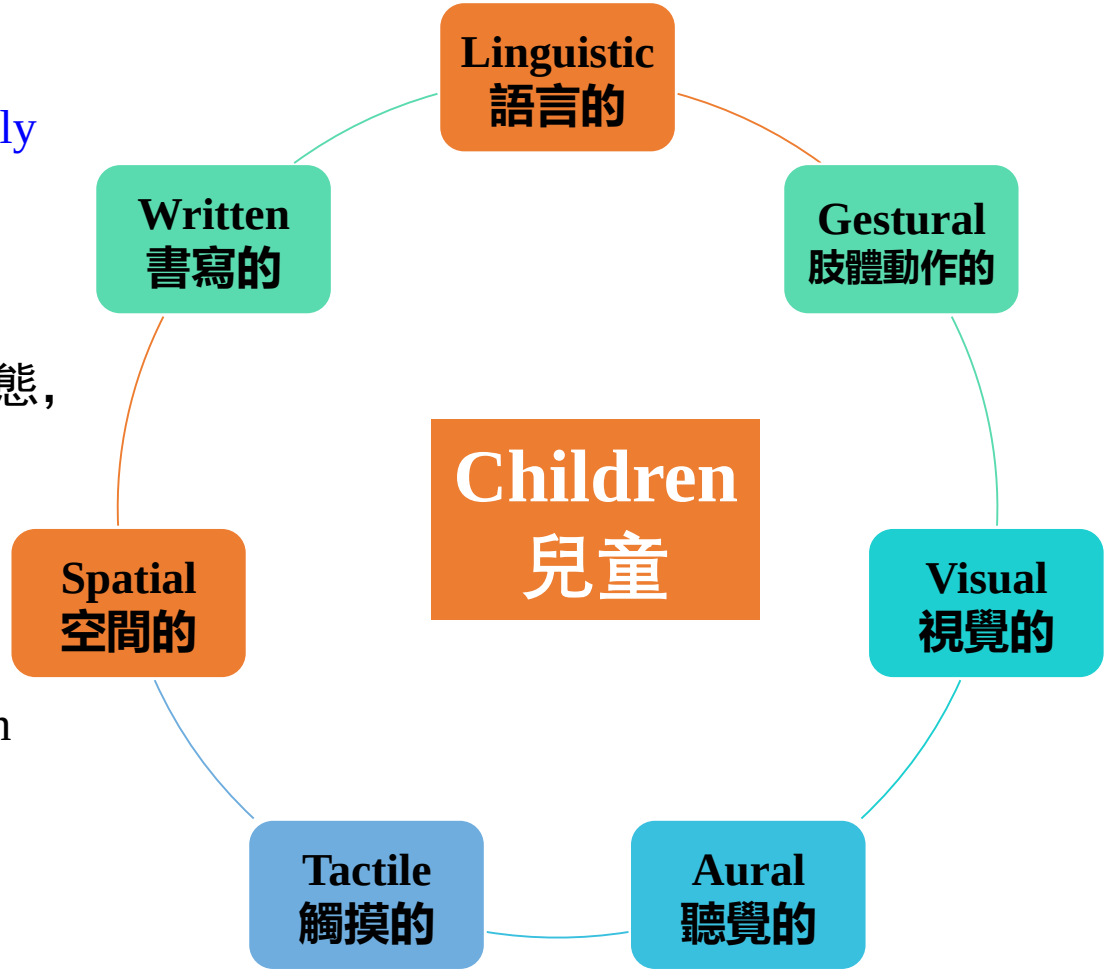
Multimodal Learning 多元模態學習

- Neuroscience research shows that learning ability can be significantly improved by making full use of visual and linguistic of multimodal learning
- 神經科學研究表明，充分利用多模態學習的視覺模態和語言模態，可以顯著提高學習能力

(Fadel, 2008, p. 12).

- Using various ways to present materials can also encourage children develop another more flexible learning method
- 運用多元化的方式呈現材料還能夠鼓勵學生發展另一種更靈活的學習方法

(Hazari, 2004).

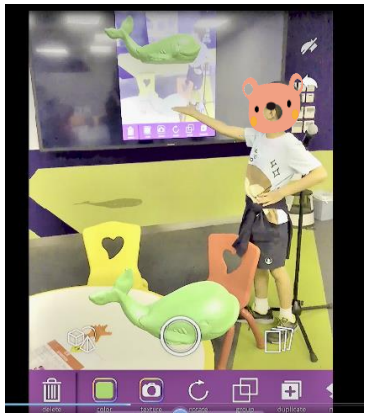


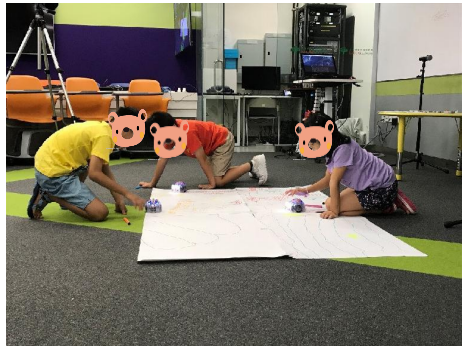
(Hu & Yelland, 2019)

Classroom Practices 課堂實踐

- Theme: My Ocean Park
- Age group: 6-8 years

- 主題：我的海洋公園
- 年齡：6-8歲





1) Explore
探索

2) Design
設計

3) Create
創作

Three Stages
三個學習階段

Stage 1: Explore （階段 1： 探索）

Toolkits
工具箱

Tool 工具		Type 類型	Apply 應用
Computer & Internet 電腦&互聯網		Smart device 智能設備	To search information on the web 在網站上查詢信息
Tablet & Internet 平板電腦 & 互聯網		Smart device 智能設備	To search information on the web 在網上查詢信息
Recordable Talking Interactive Wall 錄音互動墻		Smart toy 智慧玩具	To recognize the Chinese characters 識別漢字
Chatter Block 錄音盒子		Smart toy 智慧玩具	To create information on the six sides with sound and pictures 用聲音和圖片創建六個面的信息

Activity: Ocean World Discovery)
課堂活動：海洋世界探索

Information searching 信息查詢

- Teacher facilitated children to use a **computer or tablet** to find information about the learning theme “Ocean” on the **internet**
- 教師引導學生使用**電腦或平板電腦**在**網上**查找有關“海洋”的學習主題的信息

Tool 工具	Multimodal 多元模態							Engagement 學習參與		
								Cognition 認知	Behavior 行為	Emotion 情感
Computer & Internet 電腦&互聯網	√	√	√	√				√	√	√

Activity: Ocean World Discovery)
課堂活動：海洋世界探索

Record and Play 記錄和遊戲

- Teacher and children play the **Chatter Block** together for learning how to read the ocean animals' name in Chinese that they wrote on the cards
- 教師和學生一起玩**Chatter Block（錄音盒子），**學習如何用中文認讀他們寫在卡片上的海洋動物的名字

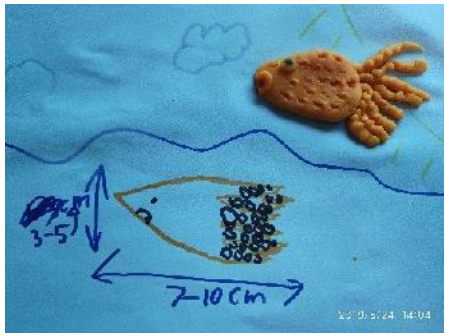
Tool 工具	Multimodal 多元模態							Engagement學習參與		
								Cognition 認知	Behavior 行為	Emotion 情感
Chatter Block 錄音盒子	√	√	√	√	√			√	√	√

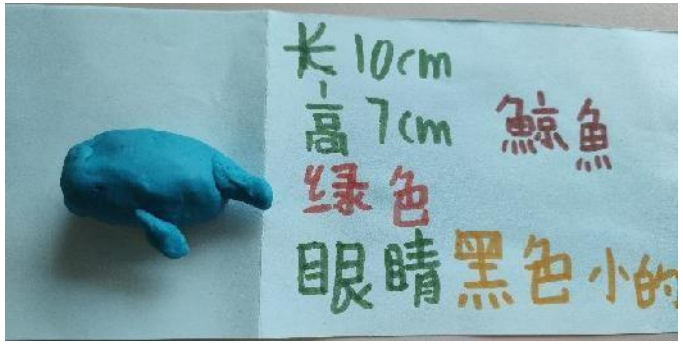
*Stage 1: Children's Exploration Outcomes

*階段1： 學生探索成果

Children drew their favorite ocean animals in 2D format at the beginning
- Pictures

學生最初以2D形式繪製了他們最喜歡的海洋動物
- 圖片





Re-created ocean animals in 3D format after the first stage
- Create new concepts
- New words
- New way of learning

學生隨後以 3D 形式重新創建海洋動物
- 創造新概念
- 新文字
- 新學習方法

Stage 2: Design (階段2： 設計)

Toolkit
工具箱

Tool 工具		Type類型	Apply 應用
Google earth Google 地球		Web software & App 網絡軟件& 應用程式	To relate real-life experience through the digital map 通過電子地圖連接真實生活經驗
VR 虛擬實境		Wearable device 可穿戴設備	To extend children's real-life experience beyond the classroom 將學生的真實生活體驗擴展到課堂之外
Digital book 電子書		App 應用程式	- To facilitate children's **language learning** on oral and speaking skills - To enhance children's **conceptual skills** and **technological skills** - 促進學生在口語和講話方面的語言學習 - 提高學生的概念化技能和科技技能 (Thang et al., 2014; Kallinikou & Nicolaidou, 2019)
3D Bear		App of AR technology AR技術應用程式	To enhance children's learning through extend visual function 通過擴展虛擬現實功能來提高學生的學習能力

Activity: My Ocean Park Designing
課堂活動：我的海洋公園設計

Relate real-life experience through Digital map and VR
通過電子地圖和VR連接真實生活經驗

- **VR** visual travel in the classroom
- 在教室中的VR虛擬旅行

"I am flying to the Ocean Park."
"我要飛去海洋公園啦。"

Digital map: visualize the terrain promoting their skills in reading maps
電子地圖：可視化地形提高用戶閱讀地圖的技能
(Carbonell Carrera et al., 2017).

VR：creating engaging learning environments
VR：創建參與性學習環境
(Bailey & Bailenson, 2017).

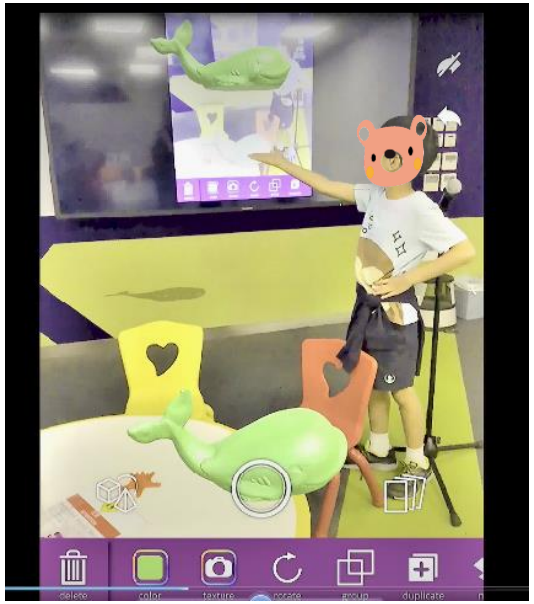
Tool 工具	Multimodal 多元模態							Engagement 學習參與		
								Cognition 認知	Behavior 行為	Emotion 情緒
Google Earth Google 地球	√	√	√	√		√	√	√	√	√
VR	√	√		√	√	√	√	√	√	√

Activity: My Ocean Park Designing
課堂活動：我的海洋公園設計

Strengthen real-life experience by playing with the visual ocean animals

通過與虛擬海洋動物遊戲來增強現實生活體驗

- Children used AR (3D Bear-app) to design a visual Ocean Park
- 學生使用AR（3D Bear-app）設計虛擬海洋公園



"The shark is same size as me!

鯊魚和我一樣大！"

Tool 工具	Multimodal 多元模態							Engagement學習參與		
								Cognition 認知	Behavior 行為	Emotion 情感
AR 增強現實	√	√	√	√	√		√	√	√	√

Activity: My Ocean Park Designing
課堂活動：我的海洋公園設計

Create stories about my ocean friends' life

創造關於我的海洋朋友生活的故事

- ✓ Fun 有趣味
- ✓ Engage參與性

- Children used **Book Creator** (App) to record stories according to their artworks
- 學生根據他們的繪畫作品使用Book Creator（App）錄製故事

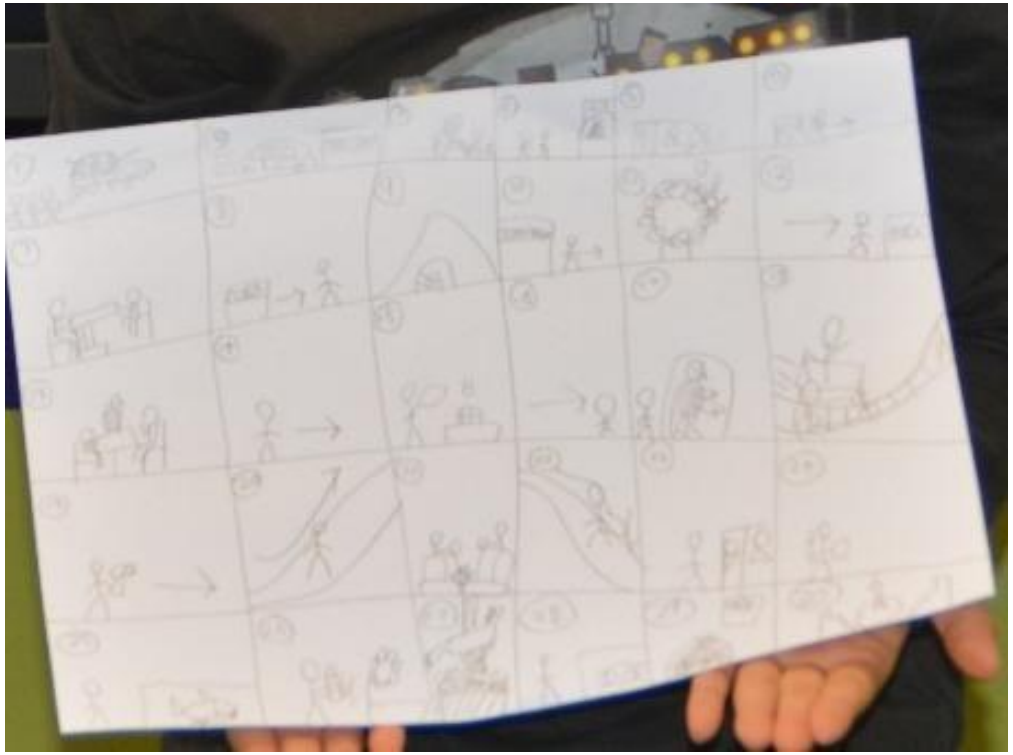
播放影片

Tool 工具	Multimodal 多元模態							Engagement 學習參與		
								Cognition 認知	Behavior 行為	Emotion 情感
Book Creator 電子書	√	√	√	√			√	√	√	√

*Stage 2: Children's Designing Outcomes
*階段2: 學生設計成果

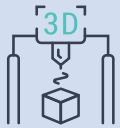
Children designed their storyline about the visual traveling

學生設計了關於虛擬旅行的故事情節



Stage 3: Create (階段3：創作)

Toolkit
工具箱

Tool 工具		Type 類型	Apply應用
SeeSaw	Seesaw The Learning Journal	App 應用程式	To record and share children's thoughts 記錄和分享學生的想法
Bee-Bot®		Programmed toy 編程玩具	To promote children's abilities of spatial and mathematical domains 促進學生空間和數學領域的能力
3D Printing		Additive manufacturing 增材製造	To promote children's creativity and enhance the ability to solve real-life problems through the manufacture of real objects 通過製作實物，促進學生的創造力，增強解決現實生活問題的能力
Stop Motion		App 應用程式	To create children's short animation 創作學生動畫短片

Activity: Travel In My Ocean Park
課堂活動：在我的海洋公園中旅行

Cooperative create and play the map

合作創建地圖，共同遊戲

Children played a travelling game by using Bee-Bot® (programmed toy) on the Ocean Park map they created together

學生在他們共同創建的海洋公園地圖上使用 Bee-Bot®（編程玩具）玩旅行遊戲

Tool 工具	Multimodal 多元模態							Engagement 學習參與		
								Cognition 認知	Behavior 行為	Emotion 情感
Bee-Bot® 編程玩具	√	√	√	√	√	√	√	√	√	√

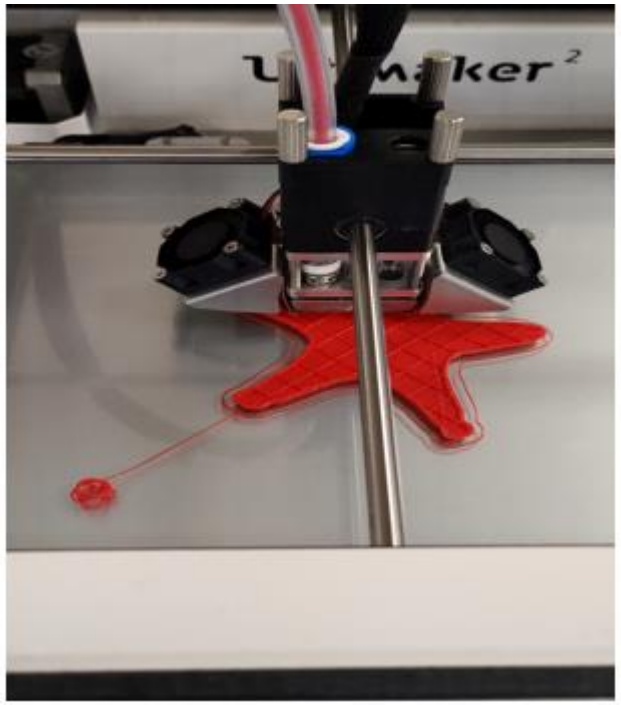
Activity: Travel In My Ocean Park
課堂活動：在我的海洋公園中旅行

播放影片

Make my favorite ocean animals for the map game

為地圖遊戲製作我最喜歡的海洋動物

- The teacher facilitated children to use a 3D printer to create and make ocean characters for the map game
- 教師指導學生們使用3D列印機為地圖遊戲製作海洋角色



Tool 工具	Multimodal 多元模態							Engagement 學習參與		
								Cognition 認知	Behavior 行為	Emotion 情感
3D printer 3D列印機	√	√	√	√	√		√	√	√	√

Activity: Travel In My Ocean Park
課堂活動：在我的海洋公園中旅行

Creative writing

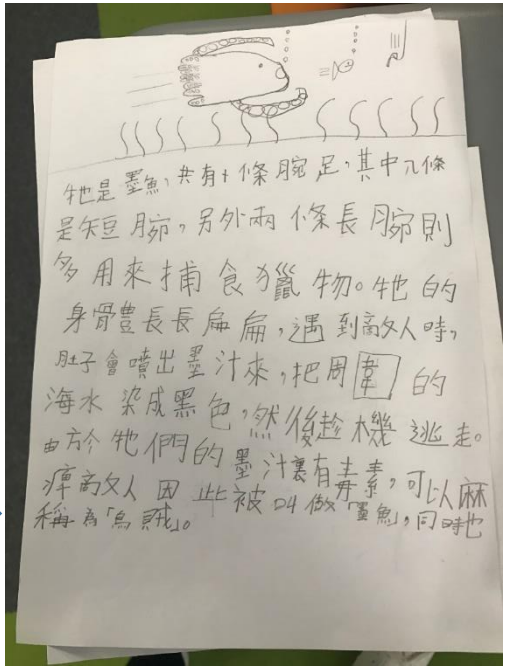
創造性書寫

- Teacher used Stop Motion (App) to support children to **create animations**
- 教師用定格動畫（App）支持學生**創作動畫**

Design
設計

Create
創作

Share
分享



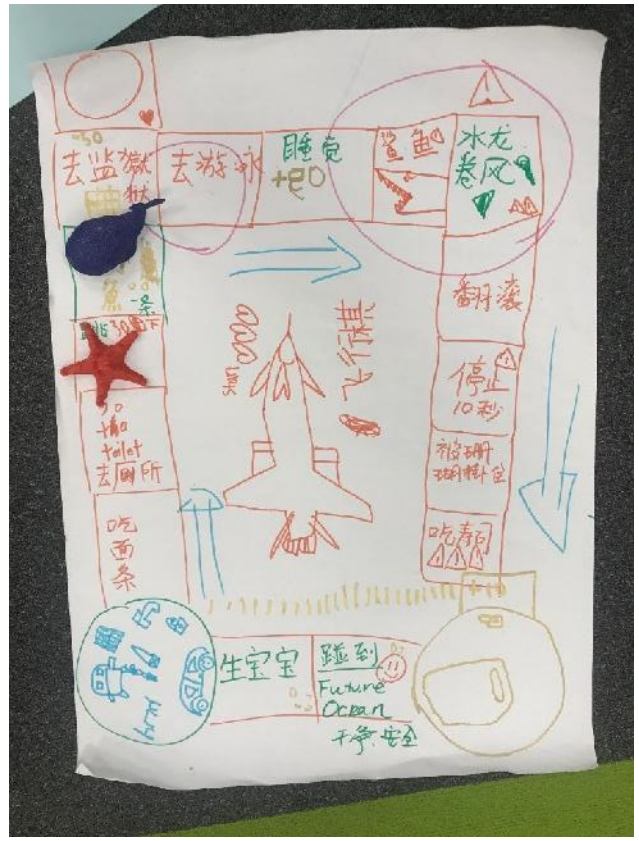
Tool 工具	Multimodal 多元模態							Engagement 學習參與		
								Cognition 認知	Behavior 行為	Emotion 情感
Stop Motion 定格動畫App	√	√	√	√	√		√	√	√	√

*Stage 3: Children's Creating Outcomes
*階段 3：學生的創作成果

Children' map creation progress: Design and think
學生地圖創作過程：設計與思考

Designed simple signs
符號設計

Built **connection among the signs** and created Ocean Park maps
在符號之間建立聯繫並創建海洋公園地圖



Created an **interactive and playful** map games
互動趣味的地圖遊戲創設

Theories and Academic Studies

理論與研究

Dr. YANG Weipeng

楊偉鵬

Study 1 – Using an Inquiry-Based Science and Engineering (IBSE) Curriculum to Promote Science Knowledge, Problem-solving Skills and Approaches to Learning in Preschool Children
研究一：使用基於探究的科學與工程（**IBSE**）課程來促進學齡前兒童的科學知識、問題解決技能和學習品質

Background 研究背景

- Science achievement gaps begin in the early years and persist until at least the eighth grade (Morgan et al., 2016)
- Early childhood teachers are usually found underprepared for teaching science (Greenfield et al., 2009; Gerde et al., 2018)
- Preschoolers' science learning experiences are minimal and less supported (Brenneman et al., 2009; Nayfeld et al., 2011; Saçkes, 2014)
- Limited engineering-related learning materials (Bagiati et al., 2010) and teachers' minimal background in engineering pedagogy (Bustamante et al., 2018)

- 科學成就的差距始於早期，並且一直持續到至少八年級 (Morgan et al., 2016)
- 許多幼兒教師對科學教學的準備不足 (Greenfield et al., 2009; Gerde et al., 2018)
- 學齡前兒童的科學學習機會很少，得到的支持較少 (Brenneman et al., 2009; Nayfeld et al., 2011; Saçkes, 2014)
- 與工程相關的學習材料有限 (Bagiati et al., 2010) 教師在工程教學方面接受過極少的訓練 (Bustamante et al., 2018)

Intervention: The IBSE Curriculum
干預方案：IBSE課程

Teacher Training 教師培訓

Teachers were trained in a 3-hour PD session to learn: (1) EDP and the cycle of young children's scientific inquiry; (2) 5Es instructional model and teachers' questioning skills; (3) core ideas about objects' motion (e.g., force and motion, speed and direction).

對教師進行了3小時的PD培訓，學習：
1）EDP和幼兒科學探究的過程；
2）5Es的教學模式和教師的提問技巧；
3）有關物體運動的核心思想（例如，力和運動、速度和方向）。

Classroom Setting 班級設置

Many types of large pipes, big blocks and accessories were provided in the classroom to encourage children's inquiry on "movement" (i.e., How to make it move?).

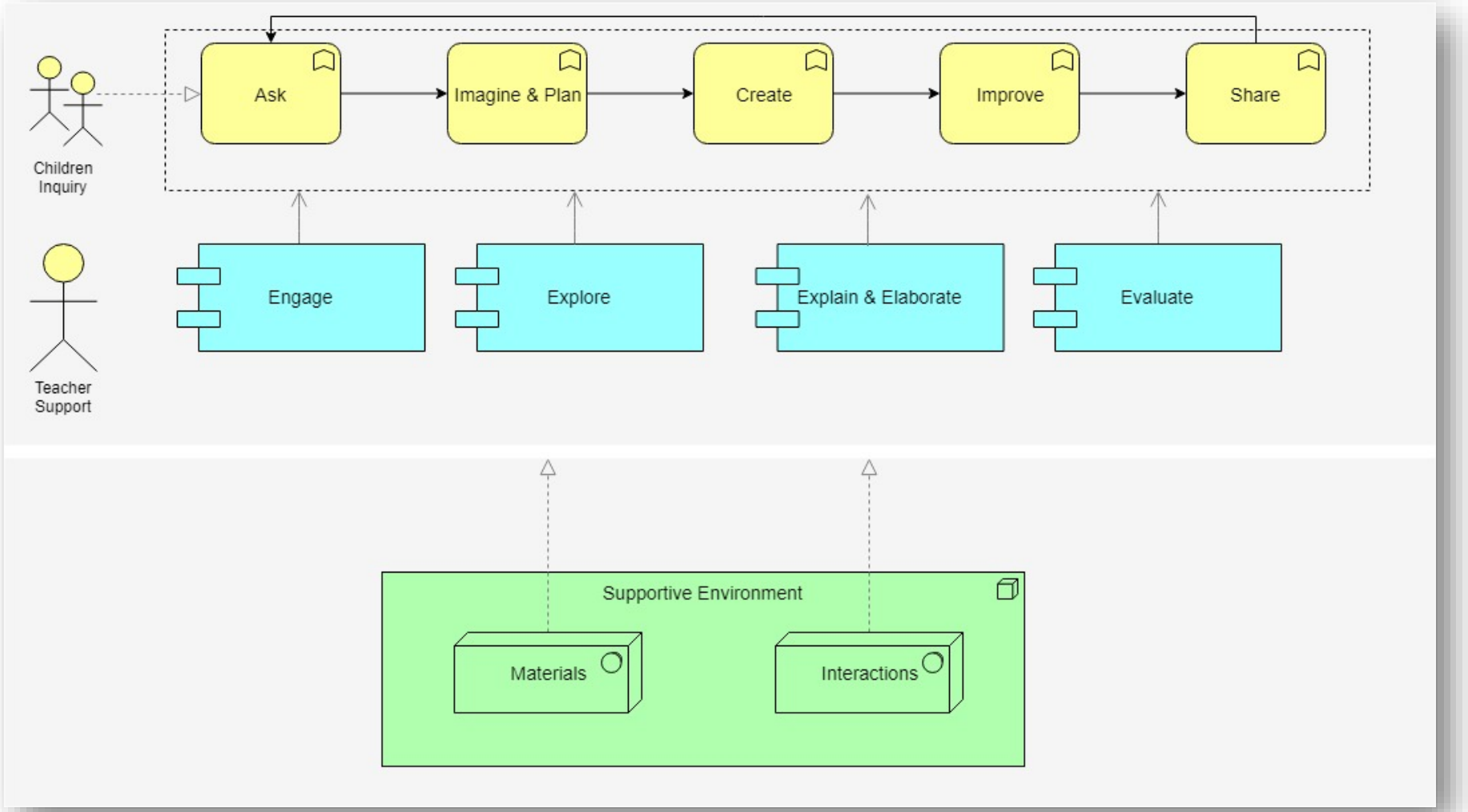
教室中提供了許多類型的大管道、大積木和配件，以鼓勵兒童探究"運動"（即如何使物體動起來？）

Curriculum Delivery 課程實施

First, pictures involving objects' movement on an inclined plane were shown to communicate with children the purpose of moving blocks/balls. Next, the children explored and manipulated the blocks and materials following the EDP and inquiry cycle with teachers' facilitation.

首先，教師展示涉及物體在傾斜平面上運動的圖片，以便與兒童交流移動積木/球的目的。
接下來，在教師的協助下，兒童探索並操作積木和材料。

Curriculum Intervention
課程示意圖



Participants
被試

- Permission was first sought from the principal. Next, the four K1 classes were chosen and all the parents of 122 children (M=61.10 months, SD=3.73) endorsed the participation of their children.

  首先徵求校長的許可，隨後選擇四個小班，122名兒童（M = 61.10個月，SD = 3.73）的所有父母都同意了他們孩子的參與。

Of these children, 61 were girls and 61 were boys.
在這些兒童中，女孩61個，男孩61個。

Of the parents, 2.5% completed high school, 18.4% completed an associate degree program, 55.7% had a bachelor degree, and 23.4% completed master degree or above.
父母中，高中畢業的占2.5％，大專畢業的占18.4％，本科學歷的占55.7％，碩士或以上學歷的占23.4％。

The parents have different vocational status (7.0% were stay-at-home, 4.9% were semi-technical and technical worker, 20.1% were semi-professional and public servant, 55.7% were professional and officer, and 12.3% were high-level professional and administrator).
父母的職業狀況不同（全職為7.0％，半技術和技術工人為4.9％，半職業和公務員為20.1％，專業人員和官員為55.7％，高級別專業人員和管理者為12.3％）。

Regarding the families, 1.6%, 58.2% and 40.2% had low, medium and high household incomes, respectively, based on local levels.
在家庭方面，按地方水準家庭收入低、中和高的分別為1.6％，58.2％和40.2％。

Measures
測量工具

Demographic Questionnaire
基本資訊問卷

- parental educational attainment
- parental vocational status
- household income
- child's age and gender

- 父母受教育程度
- 父母職業
- 家庭收入
- 兒童年齡與性別

Object Motion Test
物體運動測試

- science knowledge acquisition (SKA)
- engineering problem solution (EPS)

- 科學知識習得
- 工程問題解決

Picture Problem Solving Task
圖片問題解決任務

- children's openness to problems
- approaches to diverse solutions in science

- 兒童對問題的開放程度
- 科學問題解決的途徑

(Fusaro & Smith, 2018)

Preschool Learning Behavior Scale
幼兒學習品質量表

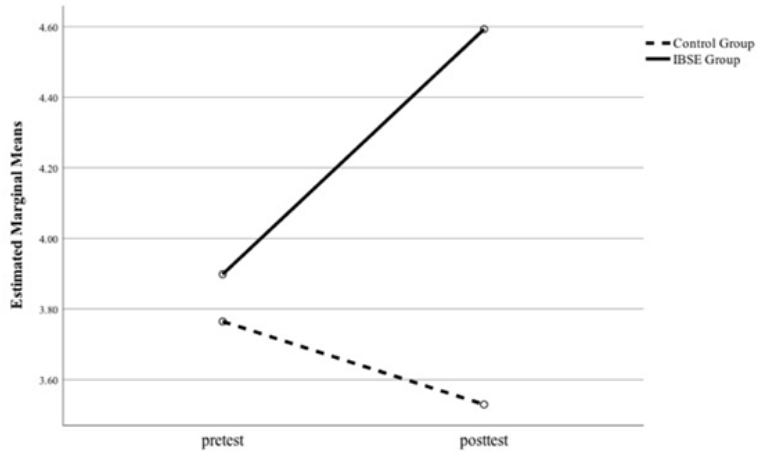
- competence motivation
- learning strategy
- attention/persistence

- 能力動機
- 學習策略
- 注意力/堅持性

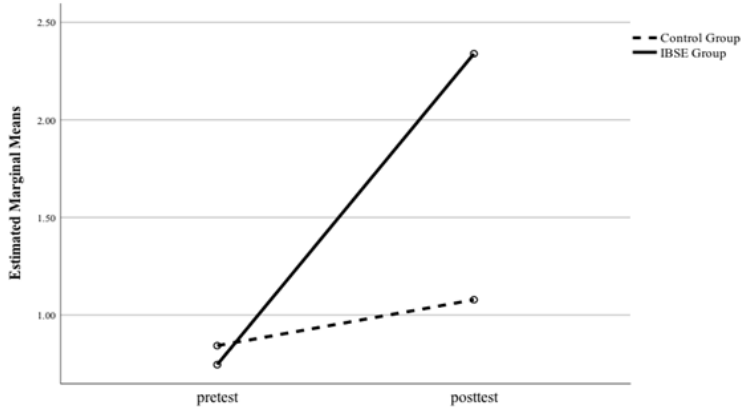
(McDermott, Leigh, & Perry, 2002)

Procedure
程序

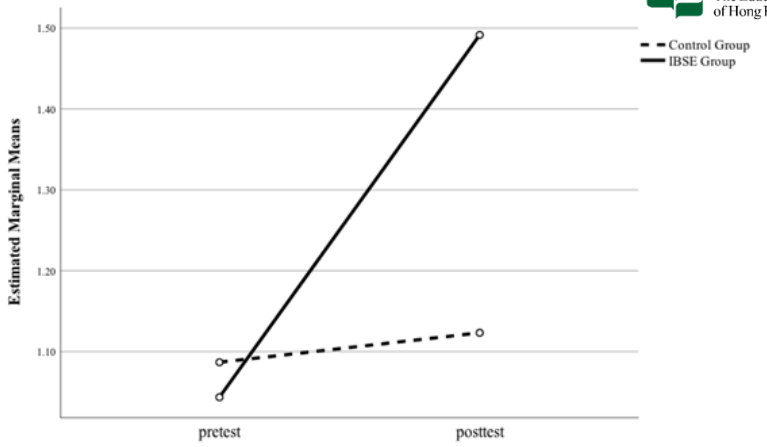
		Control 控制組	Intervention 干預組	Activities 活動
1	Pre-test 前測	✓	✓	• Teacher survey 教師調查 • Parental survey 家長調查 • Child assessment 兒童測查
2	12-week experiment 12周干預	✗	✓	Rating of Implementation fidelity 干預一致性測查 1. Play space and materials 遊戲空間和材料 2. Peer interactions 同伴互動 3. Teacher questioning 教師提問
3	Post-test 後測	✓	✓	• Teacher survey 教師調查 • Child assessment 兒童測查



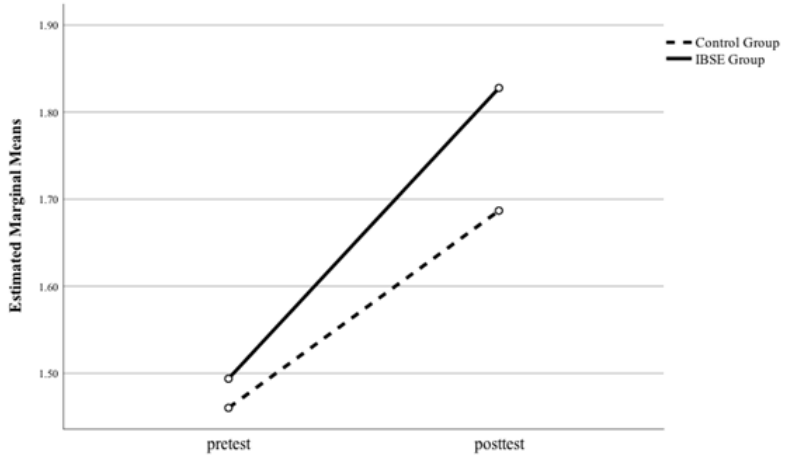
Between-group effect size, computed as the differences (IBSE minus control) between within-group ds was medium to large for OMT-SKA scores (*d*=0.64).
對於OMT-SKA評分，組間效應量由組內ds之間的差異（IBSE減去對照）計算為中到大（d = 0.64）。



It was noted *d*s between IBSE and control groups was very large for OMT-EPS scores (*d*=1.28).
IBSE和對照組之間的OMT-EPS效應量非常大（d = 1.28）。



The between-group effect size (*d*=0.96) was large for PPST scores.
對於PPST評分，組間效應量大（d = 0.96）。



A very small effect size favoring the IBSE group was found for PLBS (*d*=0.05) and a small to medium effect size for CM (*d*=0.27); while small effect sizes favoring the control group was noted LS (*d*=-0.19) and AP (*d*=-0.17).
對於PLBS（d = 0.05），發現對於CM（d = 0.27）很小到中等的效應量。

Table 2

Moderation model of intervention on pre/post OMT-EPS at the moderator of PPST baseline

Variable	*B*	se	*t*	95% CI
constant	0.11	0.11	0.99	[-0.11, 0.33]
PPST_baseline	0.13	0.08	1.73	[-0.02, 0.28]
Group	1.16	0.15	7.55***	**[0.85, 1.46]**
Group* PPST_baseline	0.38	0.15	2.58*	**[0.09, 0.68]**
Child sex	0.18	0.16	1.18	[-0.49, 0.12]
Child age	0.05	0.08	0.68	[-0.21, 0.10]
SES	0.15	0.08	1.90	[-0.31, 0.01]

Notes. N=110. PPST= Picture Problem Solving Test; OMT-EPS= Engineering Problem Solution in object motion test. All the quantitative data was standardized before being put into the model.
$^{*}p < 0.05$; $^{***}p < 0.001$.

- Children's initial competence in the scientific problem solving task moderated the association between the intervention and the improvement in engineering problem-solving skills.
  兒童在解決科學問題中的初始能力（基線水準）調節了課程干預與工程問題解決能力提升之間的聯繫。

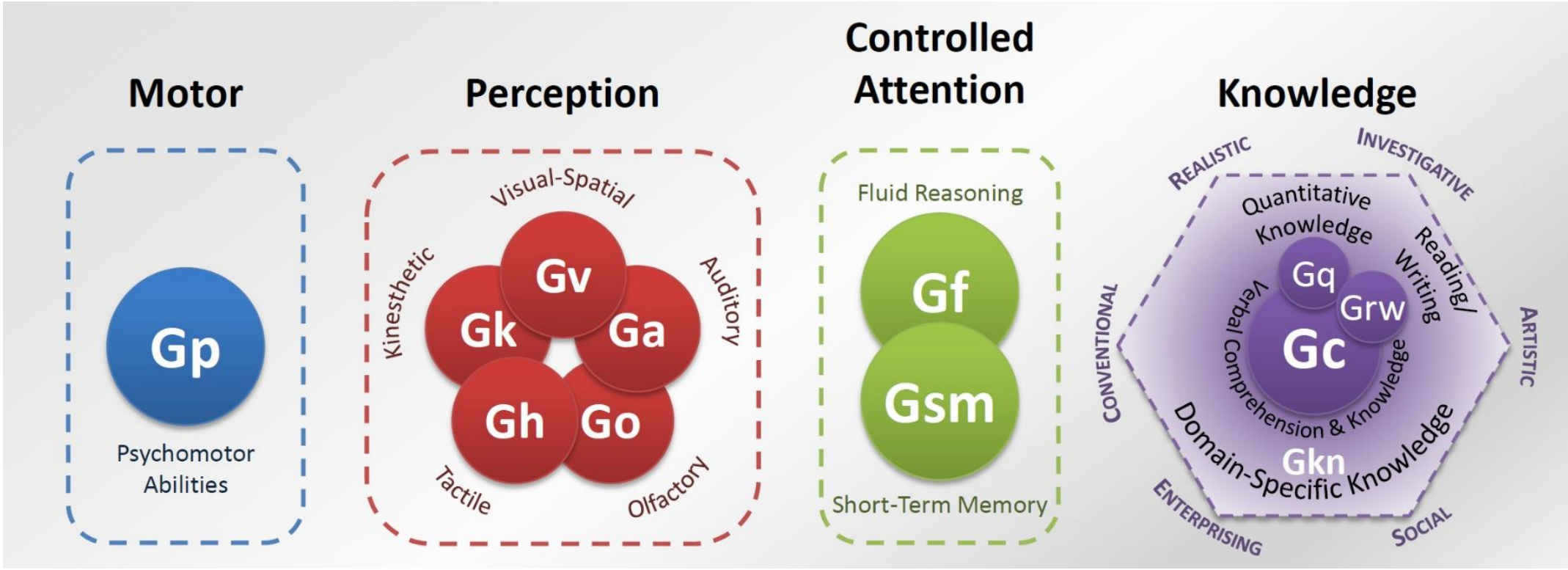
Study 2 – Does computational thinking (CT) predict school readiness?
研究二：計算思維 (CT) 能預測入學準備嗎?

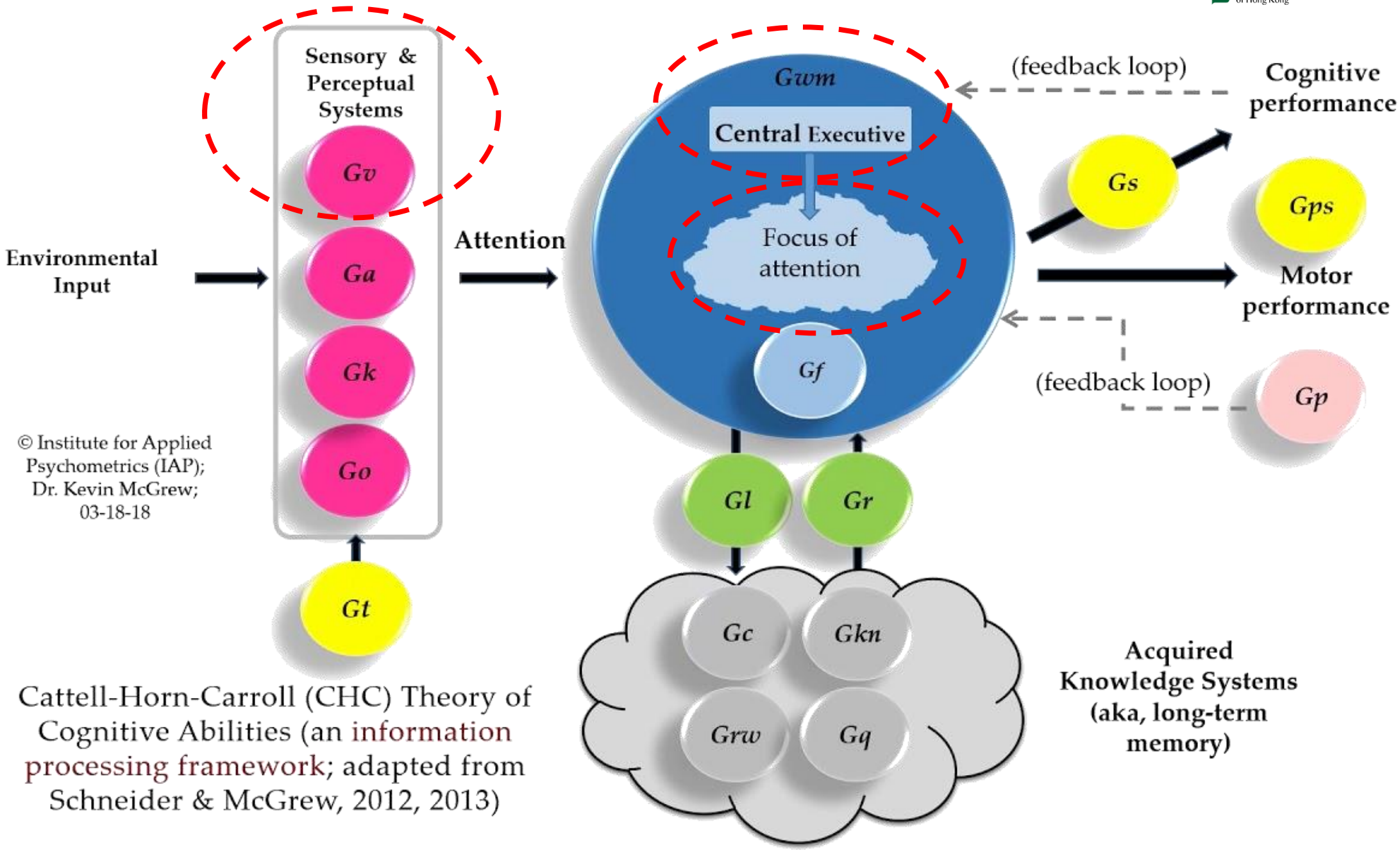
- The sample consisted of 101 Chinese children (n_{girl} = 52 and n_{boy} = 49; M_{age} = 5.25, SD_{age} = 0.73) who were enrolled in a public kindergarten in Beijing, China.
- Parents who signed the consent form were asked to complete a survey that collects information about their education, occupation, family income, and their child's age and gender.
- Six assessors used the *TechCheck* (Relkin et al., 2020) to test children's CT, the Picture Sequencing Task (Kazakoff & Bers, 2014) to test if children can physically manipulate the cards to visualize the sequence of stories, and the direct measure of behavioral regulation – *Head-Toes-Knees-Shoulders* (Ponitz et al., 2008).

- 樣本由 101 名中國兒童組成，他們就讀於中國北京的一所公立幼稚園。
- 簽署同意書的父母被要求完成一項調查，收集有關他們的教育、職業、家庭收入以及孩子的年齡和性別的資訊。
- 六位評估員使用 **TechCheck**（Relkin et al., 2020）來測試兒童的計算思維，使用圖片排序任務（Kazakoff & Bers, 2014）來測試兒童是否可以通過身體操作卡片來視覺化故事的順序，以及行為調節——頭-腳趾-膝-肩（Ponitz et al., 2008）。

The Cattell-Horn-Carroll (CHC) model of intelligence
CHC智慧模型

- The Cattell-Horn-Carroll (CHC) model of intelligence (McGrew, 2009)





Cattell-Horn-Carroll (CHC) Theory of Cognitive Abilities (an information processing framework; adapted from Schneider & McGrew, 2012, 2013)

Findings
研究發現

Descriptive and Correlational Analyses

描述性和相關性分析的結果

Table 1

Mean, Standard Deviation, and Correlation Coefficients among the Variables

Variable	*M*	*SD*	*1*	*2*	*3*	*4*	*5*
1. Computational thinking	7.42	2.89	-	.36**	.54**	.44**	.11
2. Sequencing ability	4.49	2.74		-	.40**	.34**	.02
3. Self-regulation	41.63	13.91			-	.36**	.30**
4. Age	5.25	.73				-	.13
5. Family SES	21.39	4.29					-

Notes. ** Correlation is significant at the 0.01 level (2-tailed); SES = socioeconomic status.

Findings
研究發現

Hierarchical Regression Analyses

多層回歸分析的結果

Table 2

Hierarchical Regression Analyses of Demographic Variables and Computational Thinking as Predictors of Sequencing Ability

Variable	β	t	R^2	ΔR^2
Step 1			.113	.113***
Age	.34	3.49***		
Gender	.00	.02		
Family SES	-.03	-.27		
Step 2			.169	.056*
Age	.22	2.07*		
Gender	.03	.34		
Family SES	-.04	-.43		
Computational thinking	.27	2.54*		

Note. *** $p < .001$, ** $p < .01$, * $p < .05$

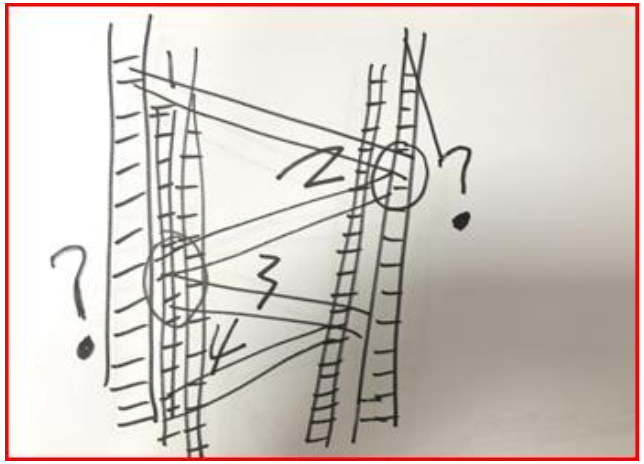
Table 3

Hierarchical Regression Analyses of Demographic Variables and Computational Thinking as Predictors of Self-Regulation

Variable	β	t	R^2	ΔR^2
Step 1			.200	.200***
Age	.33	3.54***		
Gender	.06	.49		
Family SES	.26	2.84**		
Step 2			.376	.176***
Age	.11	1.24		
Gender	.10	1.21		
Family SES	.24	2.90		
Computational thinking	.47	5.20***		

Note. *** $p < .001$, ** $p < .01$, * $p < .05$

Study 1's findings suggest that the IBSE curriculum supported by EDP and scientific inquiry can foster the development of related knowledge, skills, and dispositions among Chinese preschool children.
研究 1 的發現證實，基於工程設計過程（EDP）和科學探究的IBSE課程可以促進中國學齡前兒童相關知識、技能和學習品質的發展。



Study 2's findings show that STEAM learning experiences that are similar to IBSE may promote children's unique intelligences (e.g., CT) that are domain-general and can be predictive of their lifelong learning and career development.
研究 2 的發現表明，類似於 IBSE 的 STEAM 學習體驗可能會促進兒童的獨特智力（例如 CT），這些智力是一般領域的，可以預測他們的終身學習和職業發展。

Future Research Agenda
未來研究議程

- Physical or virtual classrooms providing STEM, coding & AI curricula to support inquiry-based learning, collaborative learning, and personalized learning

  真實或虛擬教室提供STEM、編碼和AI課程以支持探究式學習、協作式學習和個性化學習

- Professional development targeting at effective, scalable practices among teachers

  針對有效、可推廣做法的教師專業發展

香港教育大學
The Education University of Hong Kong

Department of Early Childhood Education
幼兒教育學系

Thank You!
再會！

References:

- Bailey, J. O., & Bailenson, J. N. (2017). Considering virtual reality in children's lives. *Journal of Children and Media, 11*(1), 107–113. doi:10.1080/17482798.2016.1268779
- Barr, R. (2010). Transfer of learning between 2D and 3D sources during infancy: Informing theory and practice. *Developmental Review, 30*(2), 128–154. doi:10.1016/j.dr.2010.03.001
- Couse, L. J., & Chen, D. W. (2010). A tablet computer for young children? Exploring its viability for early childhood education. *Journal of research on technology in education*, *43*(1), 75-96.
- Cross, N. (2001). Designerly ways of knowing: Design discipline versus design science. *Design issues*, *17*(3), 49-55.
- Cross, N. (2011). *Design thinking: Understanding how designers think and work*. Berg.
- Henrie, C. R., Halverson, L. R., & Graham, C. R. (2015). Measuring student engagement in technology-mediated learning: A review. *Computers & Education*, *90*, 36-53.
- Hu, X., & Yelland, N. (accepted on March, 2019). Changing learning ecologies in early childhood teacher education: From technology to STEM learning. *Beijing International Review of Education.*
- Hwang, G. J., Wu, P. H., & Chen, C. C. (2012). An online game approach for improving students' learning performance in web-based problem-solving activities. *Computers & Education*, *59*(4), 1246-1256.
- Kallinikou, E., & Nicolaidou, I. (2019). Digital Storytelling to Enhance Adults' Speaking Skills in Learning Foreign Languages: A Case Study. *Multimodal Technologies and Interaction, 3*(3), 59. doi:10.3390/mti3030059

References:

- Moorhouse, N., tom Dieck, M. C., & Jung, T. (2019). An experiential view to children learning in museums with Augmented Reality. *Museum Management and Curatorship*, *34*(4), 402-418.
- Organisation for Economic Co-operation & Development. (2018). The future of education and skills: Education 2030. Organisation for Economic Co-operation & Development. Retrieved from http://www.oecd.org/education/2030/E2030%20Position%20Paper%20(05.04.2018).pdf
- Plattner, H., Meinel, C., & Leifer, L. (Eds.). (2010). *Design thinking: understand–improve–apply.* Springer Science & Business Media.
- Redecker, C., & Punie, Y. (2013). The Future of Learning 2025: Developing a vision for change. *Future Learning*, *2*(1), 3–17.
- Redecker, C., Ala-Mutka, K., Leis, M., Leendertse, M., Punie, Y., Gijsbers, G., Kirschner, P., Stoyanov, S. and Hoogveld, B. (2011). *The Future of Learning: Preparing for Change.* Luxembourg, Publications Office of the European Union. http://ftp.jrc.es/EURdoc/JRC66836.pdf
- Sun, J. C., & Rueda, R. (2012). Situational interest, computer self-efficacy and self-regulation: their impact on student engagement in distance education. *British Journal of Educational Technology, 43*,191e204. http://dx.doi.org/10.1111/j.1467-8535.2010.01157.x
- Thang, S. M., Sim, L. Y., Mahmud, N., Lin, L. K., Zabidi, N. A., & Ismail, K. (2014). Enhancing 21st Century Learning Skills Via Digital Storytelling: Voices of Malaysian Teachers and Undergraduates. *Procedia - Social and Behavioral Sciences, 118*, 489–494. doi:10.1016/j.sbspro.2014.02.067
- Trilling, B., & Fadel, C. (2010). *21st century skills: Learning for life in our times.* San Francisco: John Wiley & Sons, Inc,.