The development of Intelligent Robot-Aided Teaching from the perspective of an instructional designer

從課件編寫者的角度，看智能機械人輔助教學的發展

INTELLIGENT ROBOTS FOR SEN CHILDREN LEARNING

Robot4SEN Project Team (TWGHs Kwan Fong Kai Chi School)

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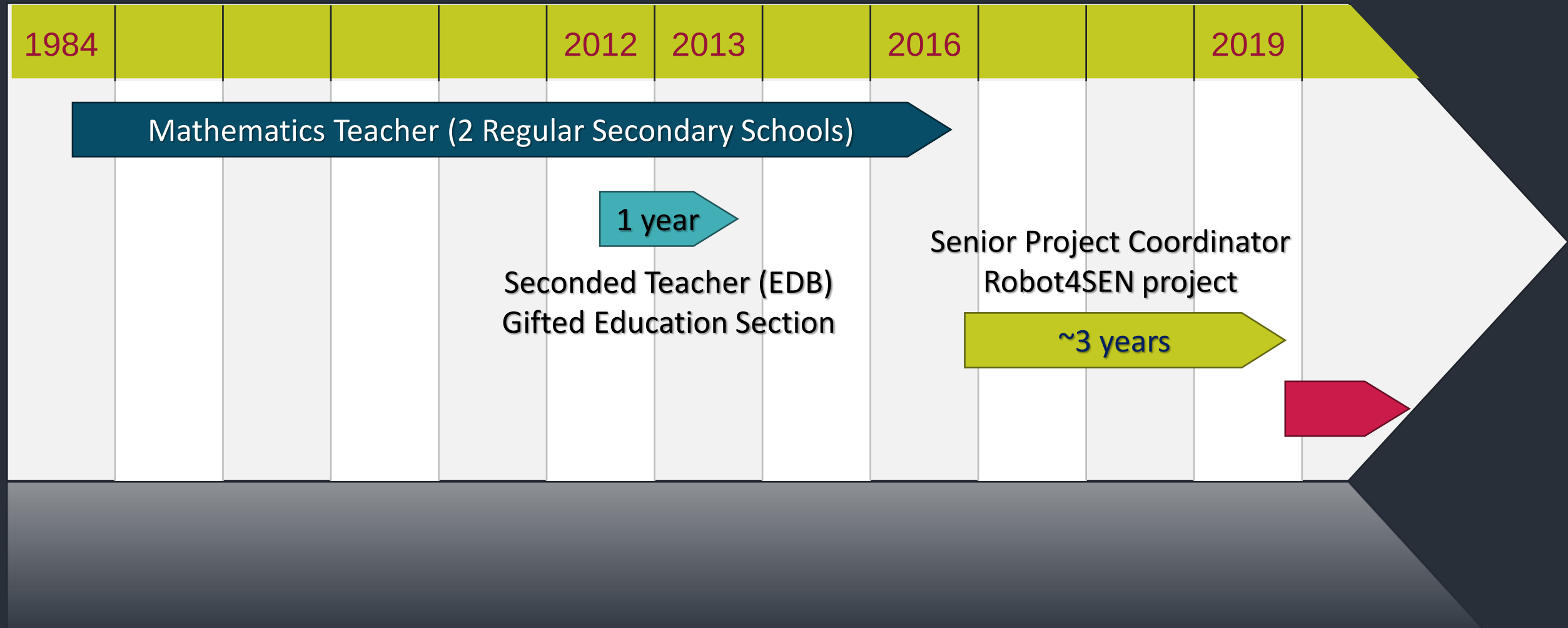
12 Dec 2019

Sharing of Experience as an instructional designer

Background Information

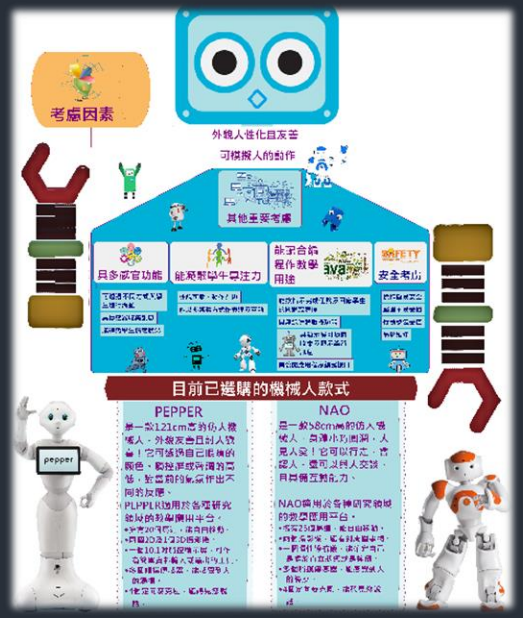


Sharing of Experience as an instructional designer

Major Duties

1. Design Teaching & Learning Exemplars 
2. Program Robots for Use in the Teaching & Learning Exemplars 
3. Provide Training for School Teachers (Learning Circle) 
4. Research into Smarter Use of Robots 

Essential Features of Robots for Design Consideration

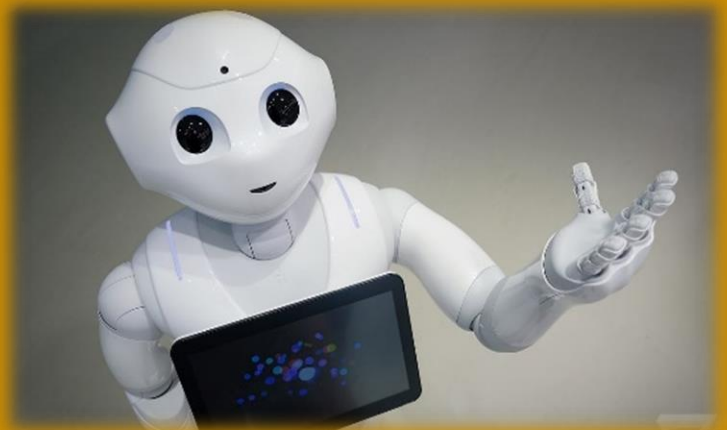


編寫教材套時盡量考慮運用以上機械人的特色：

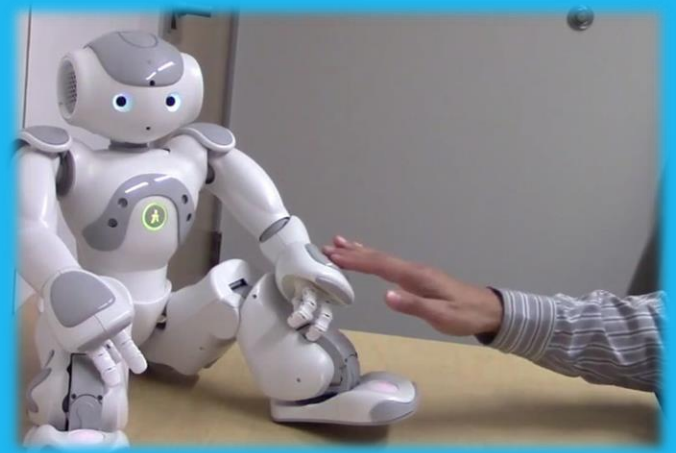
- 利用傳感器（sensors）作互動安排；
- 可用多媒體方式作表達及回應學生所作的選擇；
- 利用顯示屏加強學與教的效能 (只限Pepper)；
- 最理想是可將現有的教材套機械人的功能相結合。

Essential Features of Robots Used in designing Teaching & Learning Exemplars

Multimedia Presentation

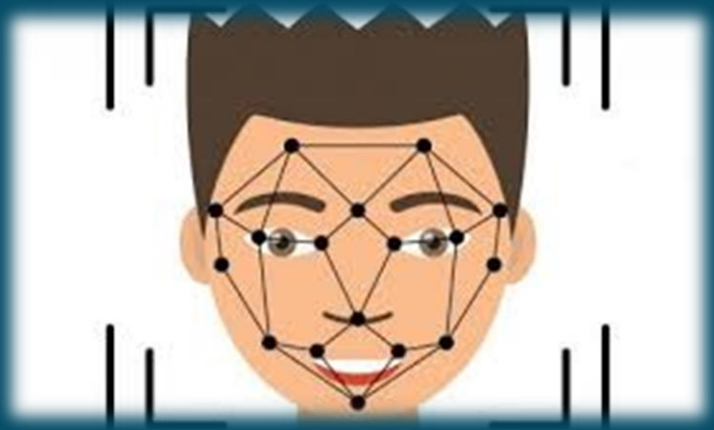


Speak in different Languages



Sensor Response

Listen (Speech Recognition)

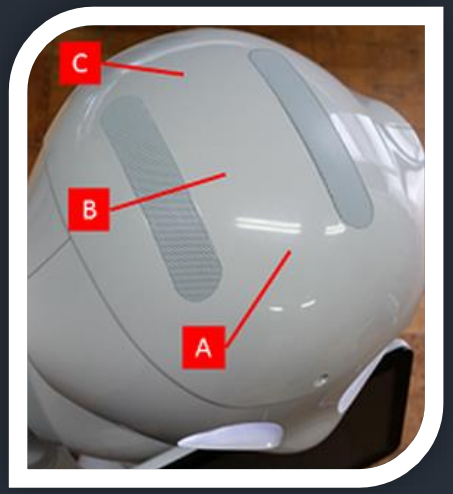


Face Recognition (Tracking)

Animation & Movement

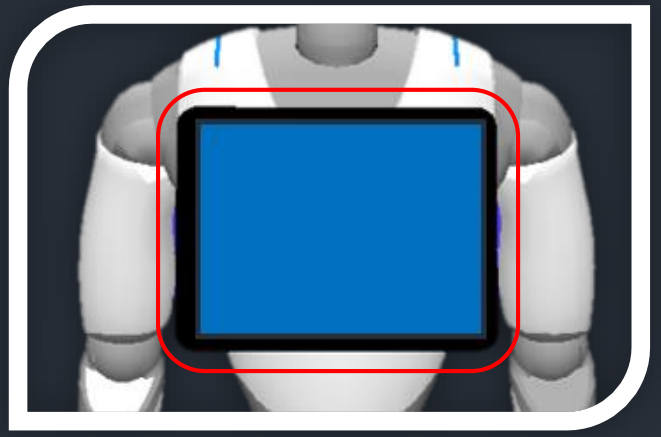
Touch Sensors / Switches

Tactile Head



Front [A], Centre [B], Back [C]

Tactile L/R Hand

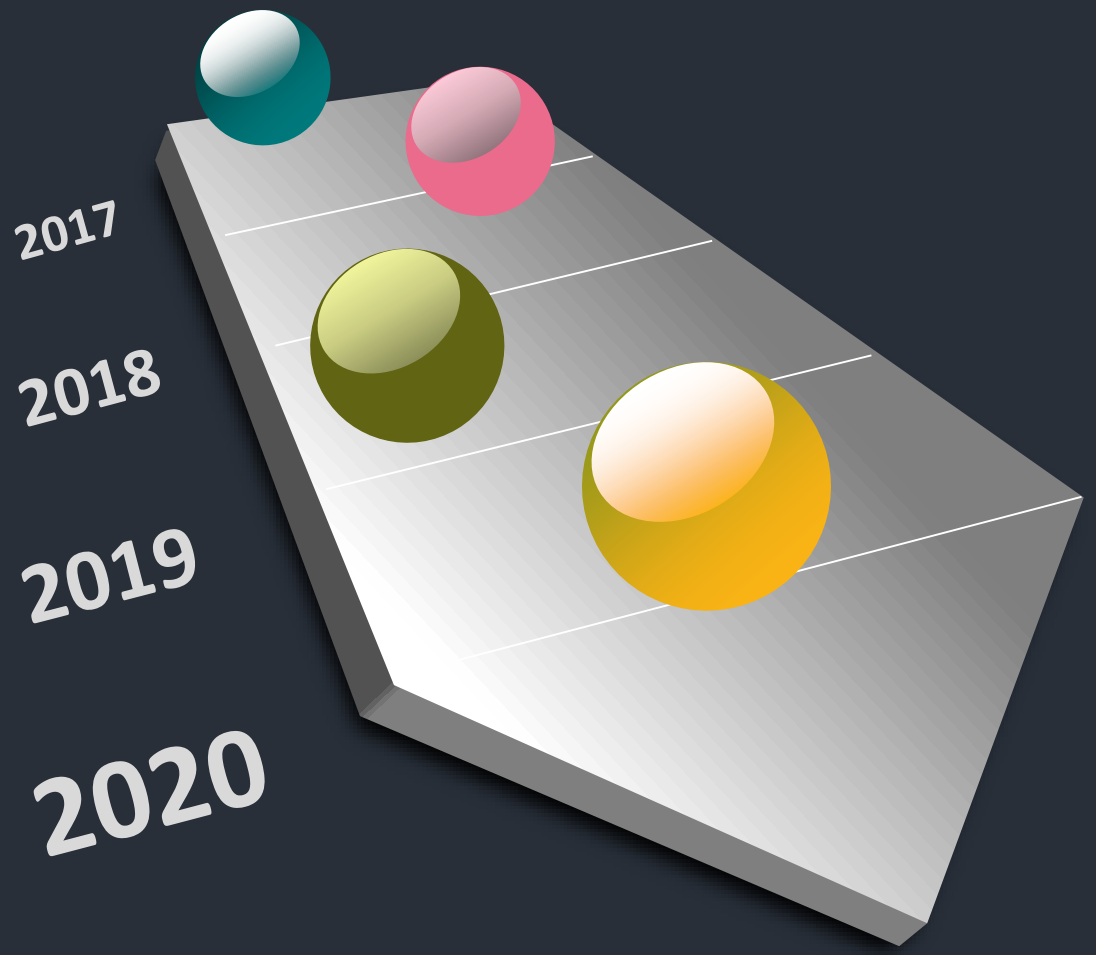


Tablet Touch

L/R Bumpers

Back Bumper

Stages of Change in Exemplars Development



- Exploration Stage
- Production (Learning) Stage
- Further Practice Stage
- Extension Stage

Stages of Change in Exemplars Development

Exploration Stage

In-depth Understanding of the properties of Different Types of Robots
R: Senior Project Coordinators

- Recognise the strengths and limitations of using robots in teaching and learning
- Consultation and reference from VTC(PEAK)
- Initial Draft of Teaching Plan for Trial Test and Reference

Questionnaire to collect Teachers' Comments and Proposals from Schools of Different SEN Categories
R: MiID:12, MoID:9, SID:9, VI:1, HI:1

- Recognise the difficulties encountered by School Teachers in teaching particular areas
  R: Senior Project Coordinators
- Propose teaching units to be developed and the application skills required by the students
  R: Teachers of Participated Schools
- Initial Design of Lessons assisted by Robots (assumed NAO or PEPPER) to solve the above teaching difficulties
  R: Senior Project Coordinators

Exploration Stage

東華三院群芳啟智學校
匯豐銀行150週年慈善計劃 – 特殊需要學童智能機械人教育方案
研發建議收集（數學學習領域）
資料統計(2017/03/08)

教學難點：
閣下認為哪一些會在教學過程中，出現一些老師較難處理或學生較難掌握的概念，請在以下適當位置加上「✓」

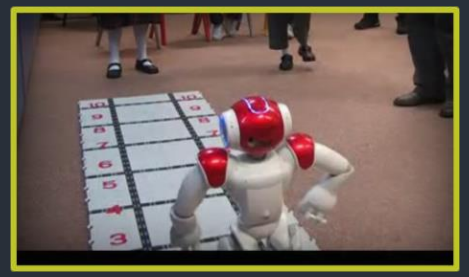
F --代表學前或一般初小程度，即學生能力與第1學習階段相近或以下
B --代表一般高小程度，即學生能力與第2學習階段相近
S --代表高於第2學習階段的能力

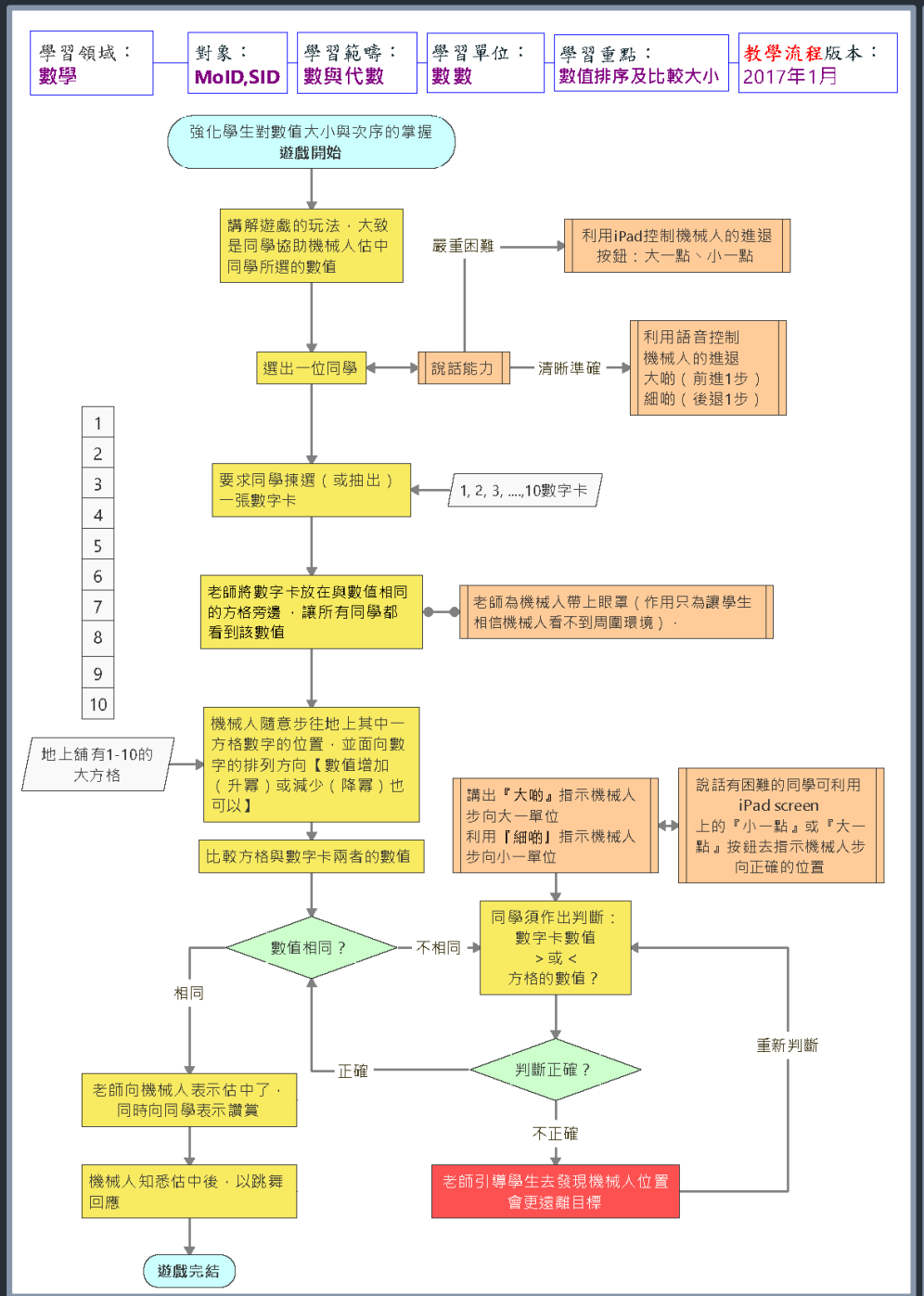
在有教授的單元中，老師認為較難處理或學生較難掌握的學習單位

學習範疇	數與代數					度量、圖形與空間					數據處理				
學習單位	程度	F	B	S	Total	程度	F	B	S	Total	程度	F	B	S	Total
	1. 數數	8	2	2	12	12. 長度和距離	3	1	1	5	26. 象形圖	2	1		3
	2. 數值	7	6	2	15	13. 線和角	2	3	2	7	27. 方塊圖	3	1	1	5
	3. 加法	6	2	3	11	14. 立體圖形	4	3	2	9	28. 棒形圖	3	4	1	8
	4. 減法	7	3	3	13	15. 平面圖形	5	3	2	10	29. 折線圖	3	2	2	7
	5. 乘法	5	7	3	15	16. 貨幣	6	4	3	13	30. 概率	2		1	3
	6. 除法	5	5	4	14	17. 時間	10	3	1	14					
	7. 四則混算	3	3	4	10	18. 重量	7	1	1	9					
	8. 分數	2	3	3	8	19. 容量	8	2	1	11					
	9. 小數	2	2	2	6	20. 周界	3		2	5	問卷回應學校類別				數目
	10. 百分數	2	2	3	7	21. 面積	4	1	3	8	MiID				8
	11. 代數	2	2	2	6	22. 體積	4	2	2	8	MoID				6
						23. 方向	4	3	3	10	SID				4
						24. 坐標	3	1	5	9	VI				1
						25. 速率	2	1		3	Total				19

紅色表示該單元在這程度內屬最多學校老師表示較難處理的頭4位

Exploration Stage





學習領域：數學	對象：MoID,SID	學習範疇：數與代數	學習單位：數數 (Game1)	學習重點：數值排序及比較大小	Robot Scripts 版本：2017年1月

1. 大家好！我介紹吓我自己，我嘅名叫做 NAO。

講解遊戲的玩法，大致是同學協助機械人估中同學所選的數值

2. 我今日同大家玩個遊戲，玩法會由老師同大家詳細講解，但大致係要大家比個數目字我估，由於我唔係好聰明，你哋要幫我架。如果你幫我估中咗，我會跳舞比你睇。

[這個安排是要引起學生的興趣，而且要讓學生明白今次是自己挑選問題比機械人，不是回答機械人的問題，並且希望學生有感覺是幫助機械人完成任務。]

3. 請老師先幫我搵一位同學。

再由佢揀一張數字卡，記得唔好比我睇到呀。

揀好就請老師同我講：『ＯＫ』

選出一位同學 ↔ 智

要求同學揀選（或抽出）一張數字卡

4. 再麻煩老師為我帶上眼罩，然後將數字卡放在地吓相同數字的方格，比所有同學都可以睇到。

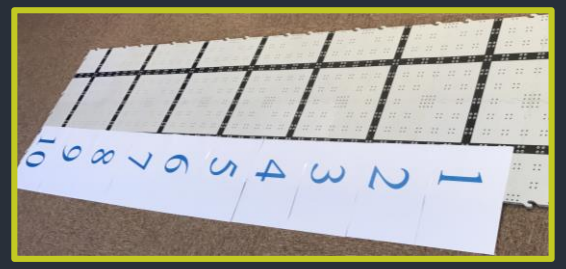
完成後請老師同我講：『ＯＫ』

老師為機械人帶上眼罩（作用只為讓學生相信機械人看不到周圍環境），

5. 好，等我試吓先。如果我真的一行就

Review of this Learning & Teaching Package

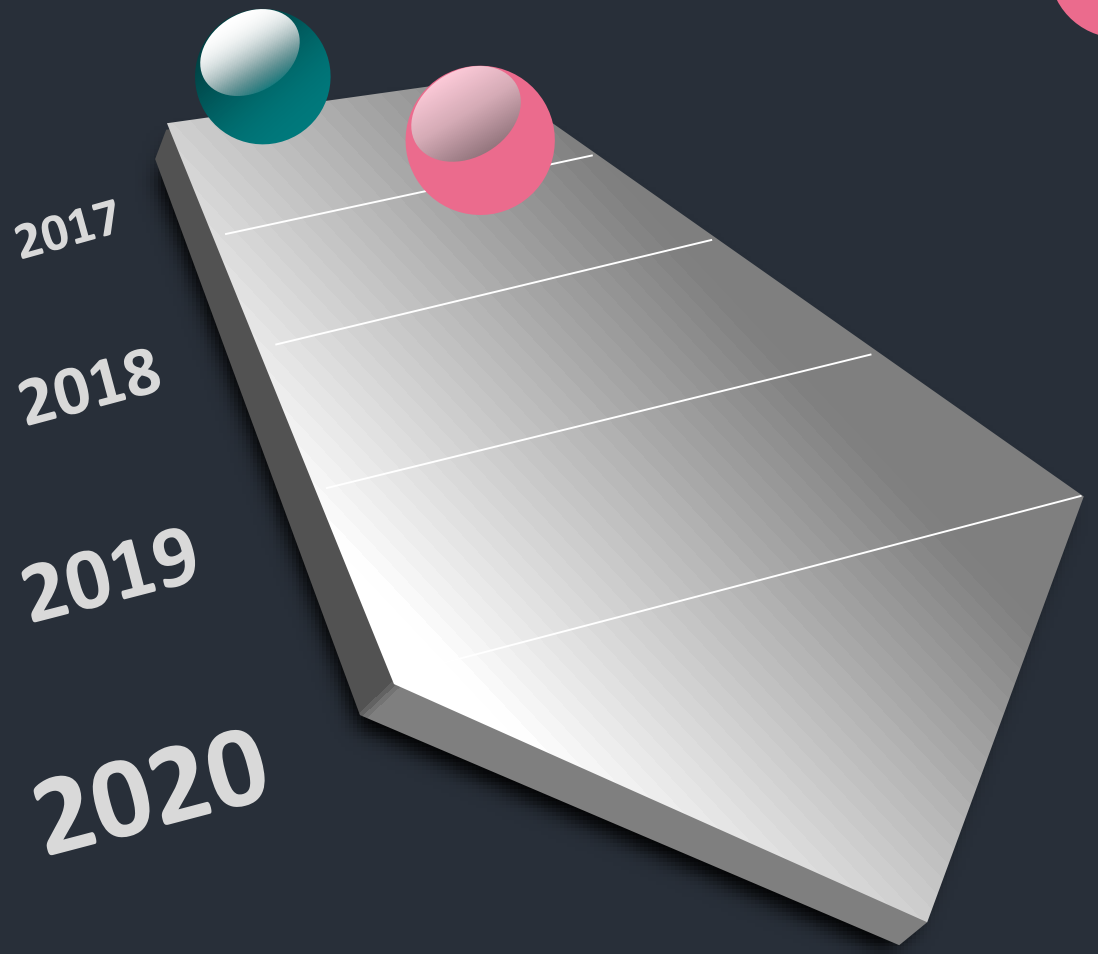
Exploration Stage



- Nao was engaging to students
- Enhanced motivation and interaction
- Several students could learn at the same time
- Role of Nao could not be replaced by a notebook or tablet

- Needed other supports to maintain accurate performance of Nao
- Needed adequate room space
- Response of Nao would be affected by unexpected environment problem
- Difficult to prevent unintentional injuries

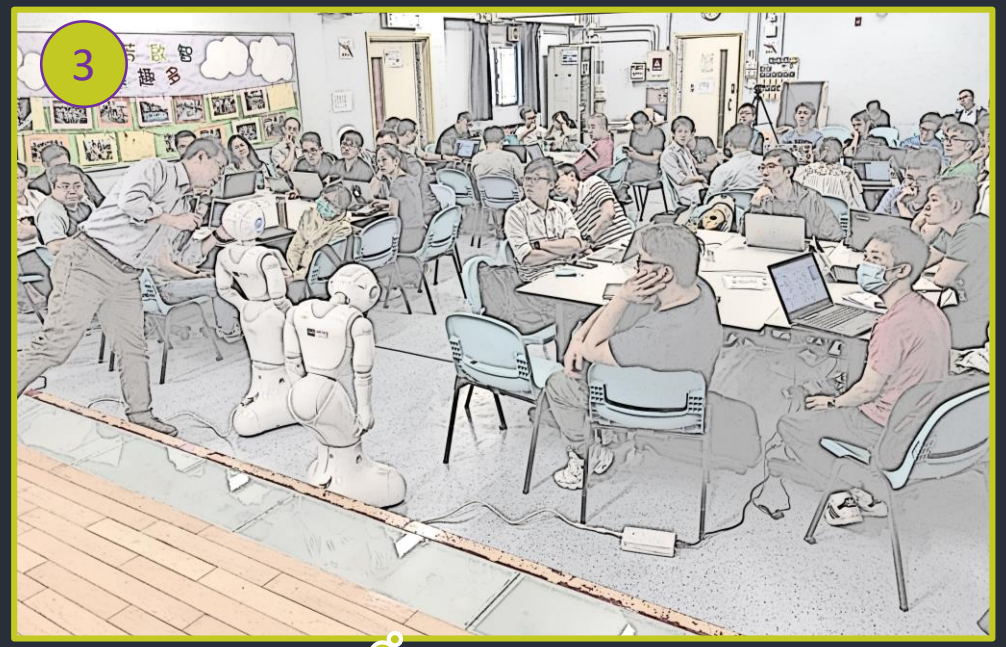
Stages of Change in Exemplars Development



Production (Learning) Stage

- Utilised more features of robots to enhance learning effects
- Started compiling the whole learning package by myself
- Provided training for teachers
- Understood more from dealing with questions raised by teachers in the Learning Circle

3



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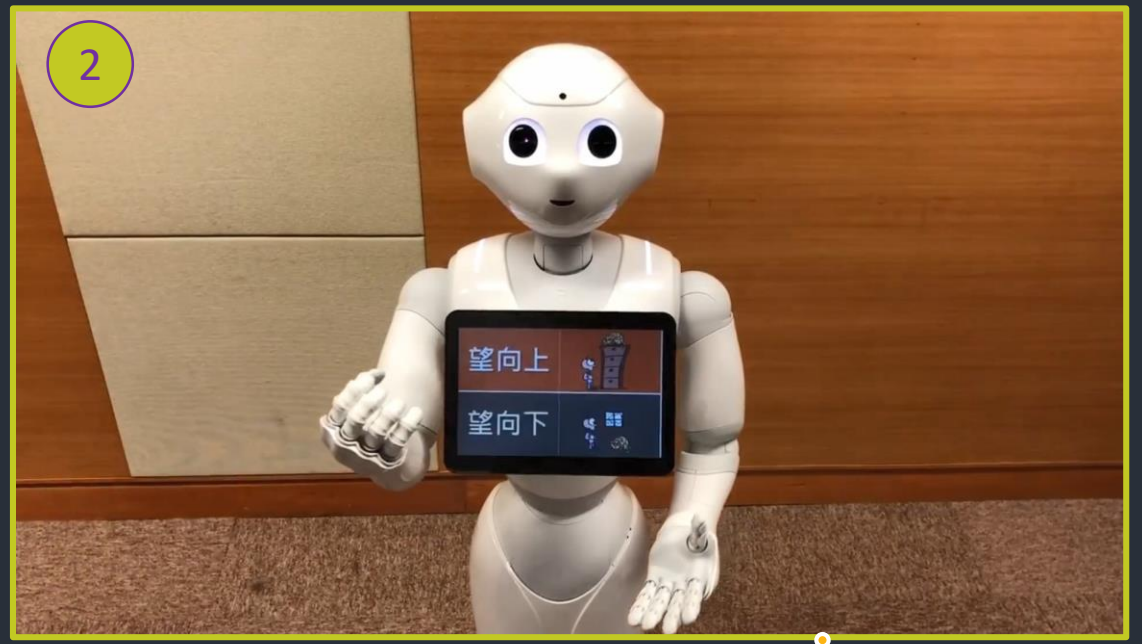
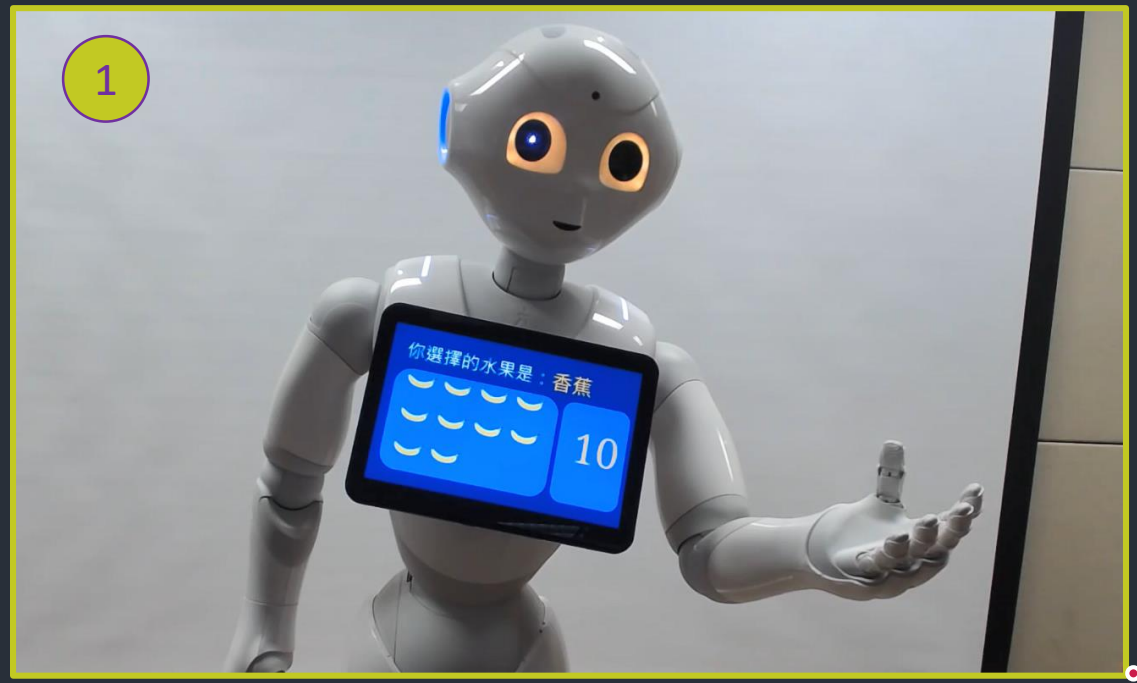


Learning Circle

1



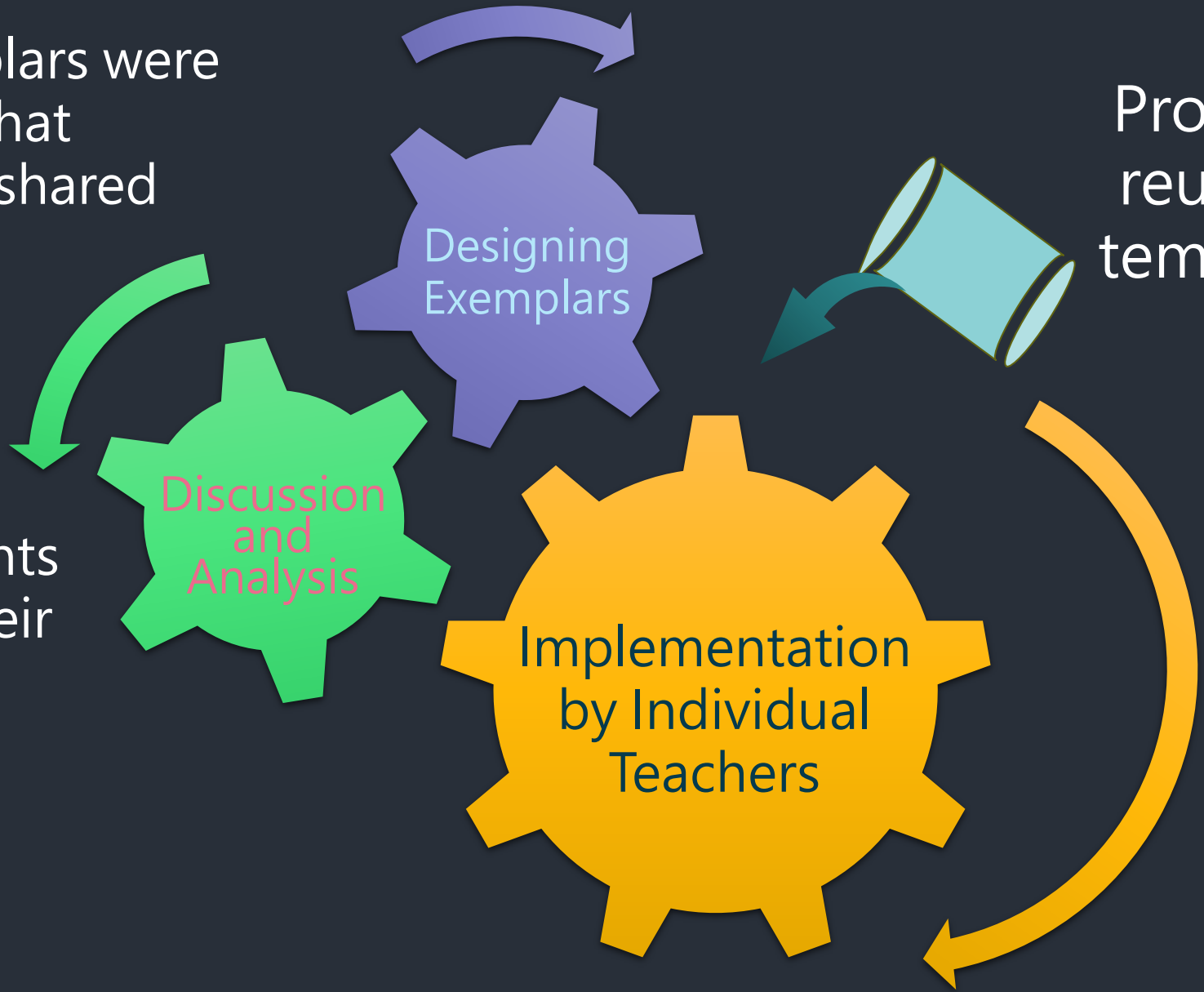
Directions

Numbers

Production (Learning) Stage

Learning Circle – Teaching & Learning Strategy

Teaching exemplars were first made and that experience was shared



Provided reusable templates

Inspired participants and stimulated their creativity

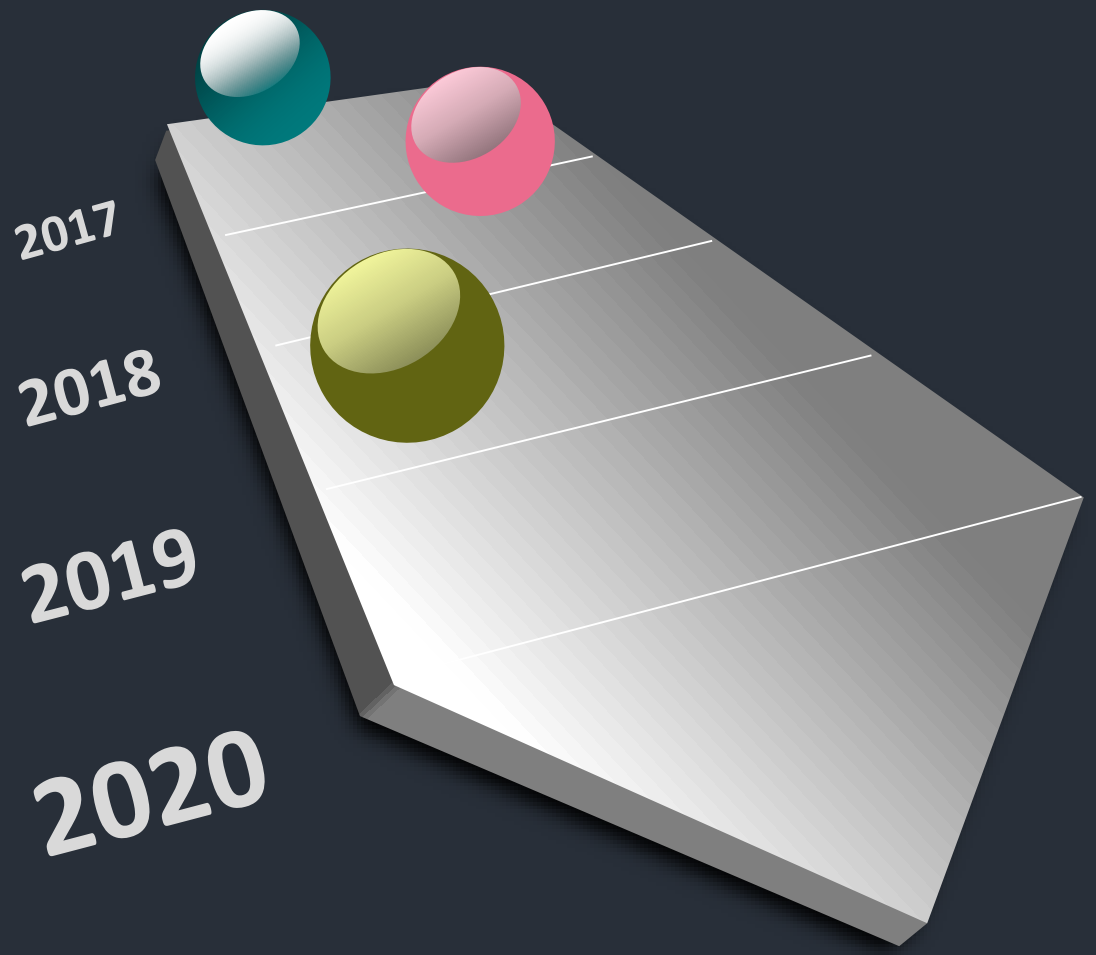
Questions already discussed in Learning Circle

Production (Learning) Stage

- Pepper/Nao 可否用手接東西
- Pepper 的Tablet可否於Projector同步顯示
- Pepper / Nao 做手語.....
- Pepper 量度置於空間物件的距離(垂直/水平)
- 辨識圖形/物件
- Pepper屏幕上玩砌圖
- 正確詞語讀音
- 辨識水杯中的水量（滿瀉 / 適量）
- 儲存學生 / 老師輸入的資料
- 識別大量同學的樣貌，講出姓名，打招呼
- Pepper能夠接收某類發射器的訊息 (例如傳送現時身處的方位)
- Nao /Pepper 自行完成一組運動
- Pepper play video 的問題
- Pepper 攝錄及在屏幕上顯示錄影片段
- 編程 ：怎樣比較兩個變數的數值

- Pepper/Nao 可否用跟著老師/學生的步伐移動
- Pepper可否在拍攝前先在屏幕顯示同學樣貌並在同學笑時即自動拍攝
- 可否將幾個指定的教案(apps)安排放在AppLauncher 的指定位置
- 如何將程式上載及安裝至Pepper/Nao內
- 如何利用Nao身上的sensors操控螢幕上的網頁變化
- 如何令Pepper/Nao懂得辨別方向(東、南....)
- 如何防止同學錯誤(或刻意)啟動Sensors

Stages of Change in Exemplars Development

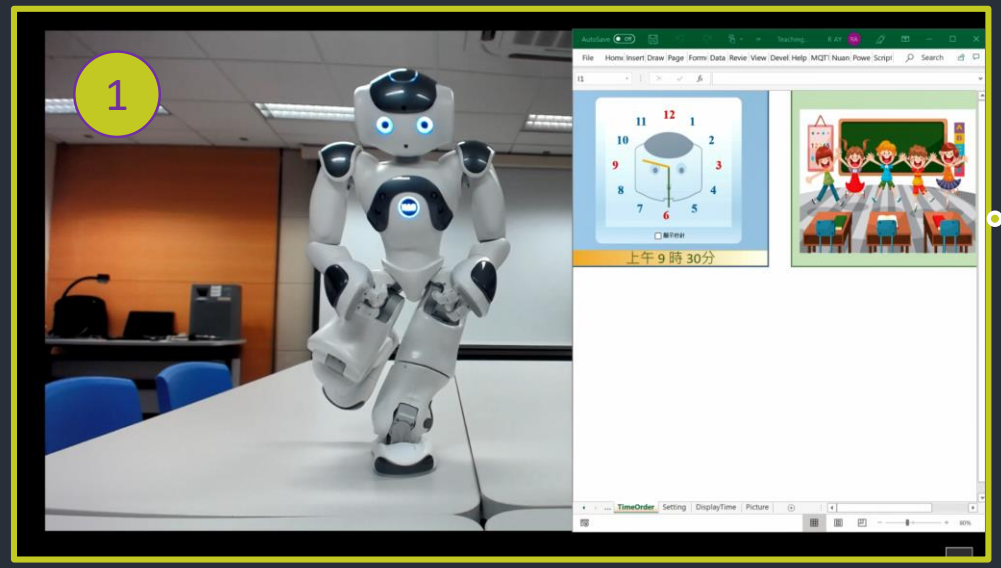


Further Practice Stage

- Resolved limitations of robots
- Worked with other effective teaching aids
- Aimed at develop packages for many participants at a time
- Integrated cloud-based AI with robots

Further Practice Stage

Other Teaching Aids



Whole Class/School

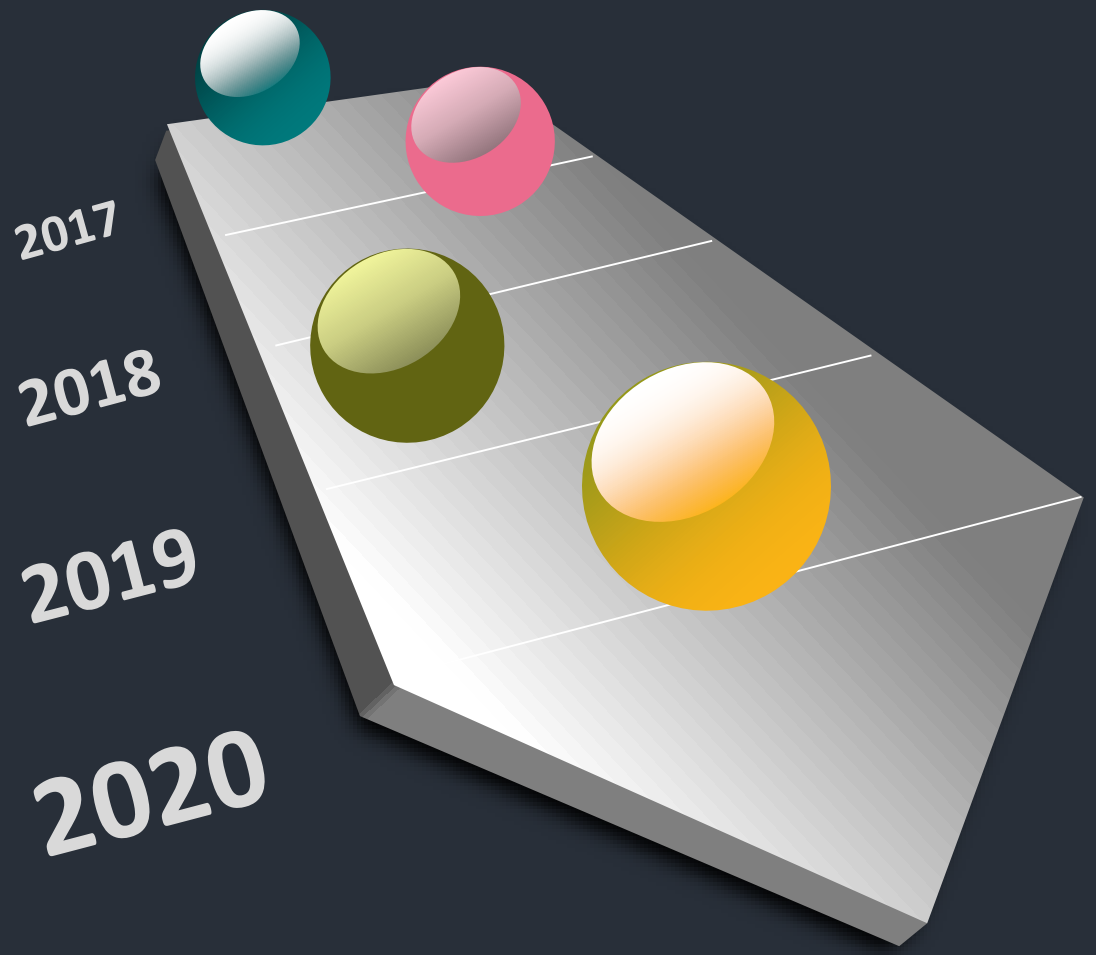
Cloud-based AI

Further Practice Stage

Reflection on Design

- Treat it as a tool to assist teaching a particular part of a topic only (Not the whole topic). Teacher can handle it with more confidence
- Able to use it freely at any time that is convenient to students
- Provide real time authentic information as far as possible
- Able to handle individual differences (Learning Diversities) easily
- Can allow many students to participate together (Not every student likes to interact with robot alone)
- Able to avoid students from triggering sensors at inappropriate time
- T&L effect depends on how the teacher uses it in the class (just like other traditional teaching tools)
- When no distinctive features of Humanoid Robots are involved, please consider to use an iPad, a computer or other handy teaching tools

Stages of Change in Exemplars Development



Extension Stage

- A New Project
- Make Robots smarter
- Integrate IoT with Robots
- Work with other devices and make use of Computer Vision, Artificial Intelligence, Machine Learning, Deep Learning
- ……

Thank You