

課堂學習研究研討會 研究課堂、改善教學

小一、小四數學科研究課

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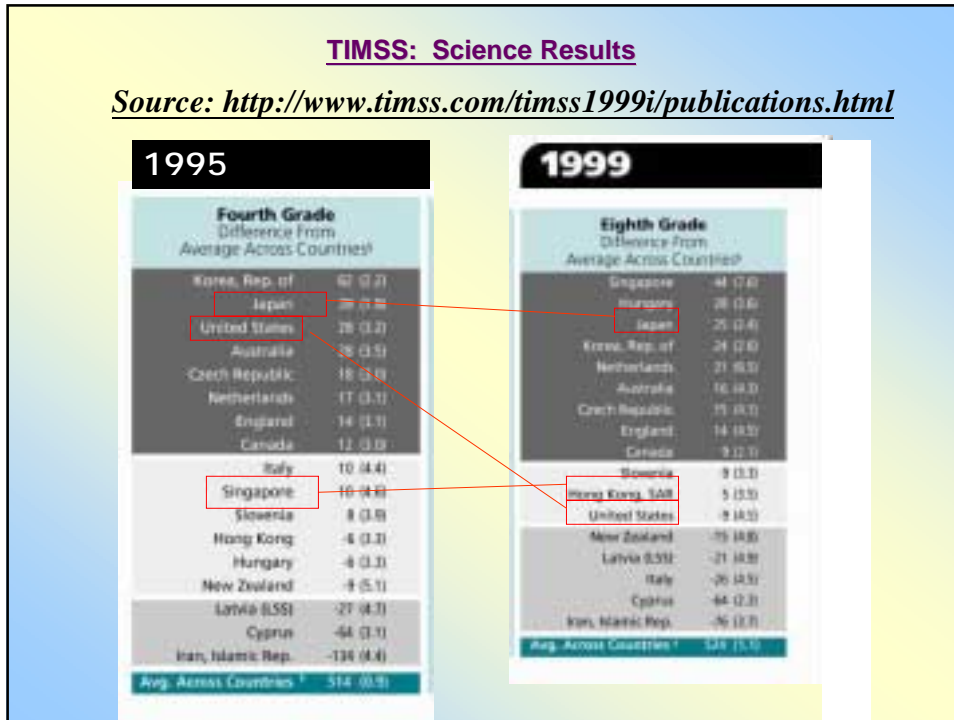
TIMSS: Science Results

Source: <http://www.timss.com/timss1999i/publications.html>

1995		1999	
Eighth Grade Difference From Average Across Countries ¹		Eighth Grade Difference From Average Across Countries ¹	
Singapore	40 (3.2)	Singapore	44 (1.0)
Czech Republic	34 (4.4)	Hungary	28 (2.4)
Japan	34 (3.8)	Japan	27 (2.4)
Korea, Rep. of	25 (2.2)	Korea, Rep. of	24 (2.6)
Netherlands	21 (2.6)	Netherlands	21 (6.5)
Slovenia	20 (2.2)	Australia	16 (4.2)
Hungary	16 (3.7)	Czech Republic	15 (4.7)
England	11 (3.9)	England	14 (4.5)
Australia	6 (2.8)	Canada	9 (2.2)
Canada	-1 (2.7)	Slovenia	8 (3.3)
United States	-4 (3.2)	Hong Kong, SAR	5 (3.5)
New Zealand	-10 (4.2)	United States	-4 (4.5)
Hong Kong	-11 (5.5)	New Zealand	-15 (4.8)
Italy	-23 (3.4)	Latvia (LSS)	-21 (4.9)
Latvia (LSS)	-48 (2.2)	Italy	-26 (4.5)
Iran, Islamic Rep.	-58 (3.2)	Cyprus	-64 (2.2)
Cyprus	-69 (2.2)	Iran, Islamic Rep.	-76 (2.7)
Avg. Across Countries ²	0.0 (1.0)	Avg. Across Countries ²	0.0 (1.0)

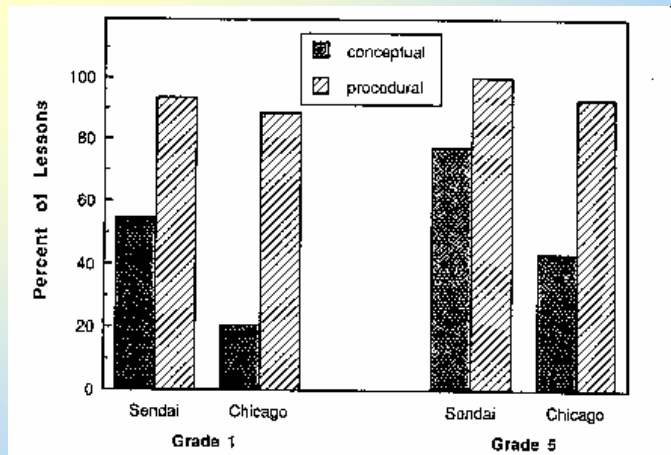
TIMSS: Science Results

Source: <http://www.timss.com/timss1999i/publications.html>



Rohlen and Letendre (1998)

Book title: *Teaching and Learning in Japan*



Percentage of lessons in which conceptual and procedural information was presented.

Japanese Lesson Study (Jugyou Kenkyuu)

Every teacher engages in at least one lesson study to produce a research lesson each academic year.

A Cycle of Lesson Study

- (1) Choosing a topic*
- (2) Planning a lesson*
- (3) Teaching the lesson*
- (4) Evaluating the lesson and reflecting on its effect*
- (5) Revising the lesson*
- (6) Teaching the revised lesson*
- (7) Evaluating and reflecting*
- (8) Sharing the results*

Comments from Japanese teachers:

"Why do we do research lessons? I don't think there are any laws [requiring it]. But if we didn't do research lessons, we wouldn't be teachers."

"Research lessons help you see your teaching from various points of view ... A lesson is like a swiftly flowing river; when you are teaching you must make judgment instantly."

Stigler & Hiebert, 1999

The CID (v) Project: to improve teaching and learning through a **practice-based** teachers' professional development model (<http://cidv.hku.hk>)

Special features of the study

- (i) *Using the Japanese Lesson Study Approach*
- (ii) *Collaboration between the university team and teachers on equal basis to facilitate mutual learning*
- (iii) *Use of pre-test and post-test*
- (iv) *Video-taping some of the lessons for the purpose of diagnosis and evaluation*
- (v) *Employing a theoretical framework of variation*

Catering for Individual Differences – Building on Variation

- *What causes “individual differences”?*
- *Motivation?*
- *Learning styles?*
- *Intelligence Quotient?*
- ...
- *What do children already know and how they experience the world.*

A theoretical framework of variation

V1. Variation in terms of pupils' understanding of what is taught (i.e. object of learning)

V2. Variation in teachers' ways of dealing with particular topics

V3. Variation as a pedagogical tool

Ways of dealing with I.D. in the Classroom

- **Depends on how I.D. is conceptualised**
- **One way is to conduct “ability streaming” (but often without appropriate curriculum adaptation)**
- **Creating strong labeling effects**
- **Another way is to claim that 40 unique human beings need 40 curricula**
- **Creating an impossible teaching task**

What do children already know and how they experience the world

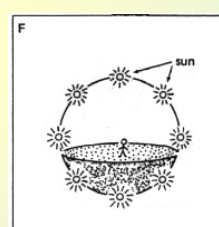
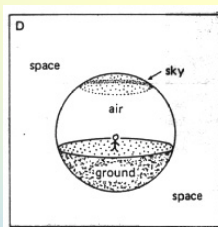
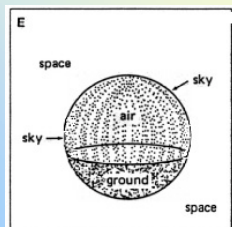
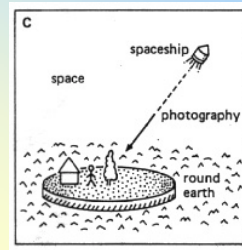
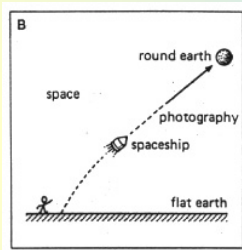
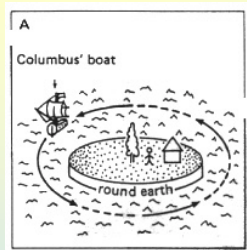
- Assume children's "thinking" is logical, only that we (as adults) don't understand them enough
- Their "ways of thinking" derive from their experience with the world
- What they are able to see and not yet able to see
- These ways of experiencing (for a particular theme) are reducible to a limited number

Pedagogy

- If we can identify these "ways of thinking" we can use them to plan our classroom teaching
- And make learning more effective
- "Individual Differences" becomes an "input" to classroom teaching

Building on Variation (V1)

- *Identify “differing understandings”*
- *Make use of them productively in teaching*



Learning Outcomes Desired

- **Not to stamp out all individual differences**
- **BUT everyone to proceed to a new level of understanding**

Teacher Development

- **Teachers know more - by becoming sensitive to children's "ways of experiencing"**
- **Not just to follow the textbook**
- **Teachers know more – by sharing with colleagues**
- **Not to fight a "lonely" battle**

Building on Variation (V2)

- *Teachers know more – through reflecting on one's own experience,*
- *Sharing others' experiences*
- *And action*
- *Not to sow seeds without harvesting, but by contrasting one's own practice with those of others*
- *Ask for evidence of student learning*

Building on Variation (V3)

- *How a “Lesson” can bring together “different ways of thinking”*
- *For learning “something”*
- *Creating meanings by creating figure and ground, and by comparisons and contrasts*

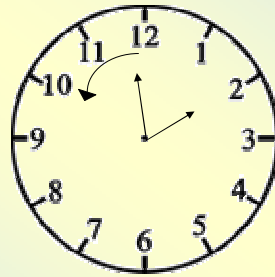
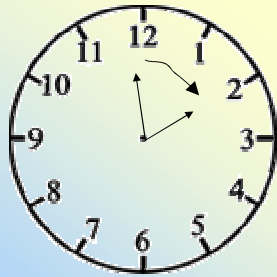
2001-2002年度
一年級下學期
課題：鐘面的認識
(報時)

教師估計學生在學習報時所遇到的困難：

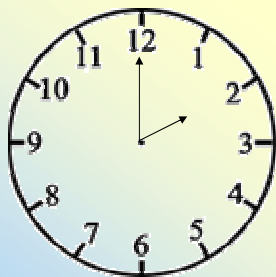
- 未能理解時半
例如：三時半，長針指著六字，短針指著三字
- 未能掌握長、短針的互動關係

設計前測的理念：

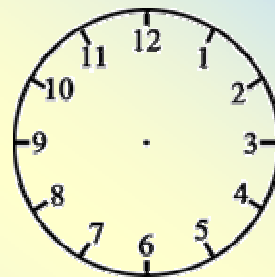
估計大部份學生掌握時針和分針移動的方向：
1.長短針在鐘面上是向那方向走？請在正確的 中加✓



估計學生未能理解在「時正」時，長、短針的確實位置

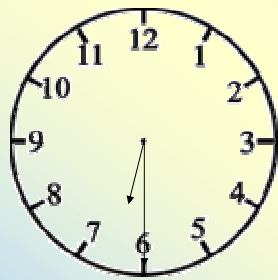


— 時正

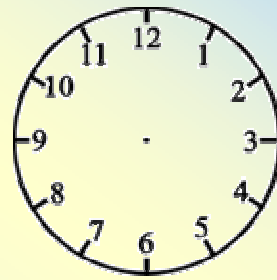


10時正

估計學生未能理解在「半時」時，短針的確實位置

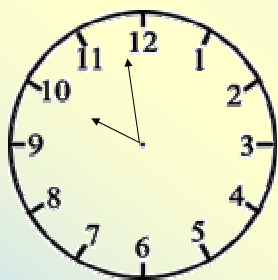


___ 時半

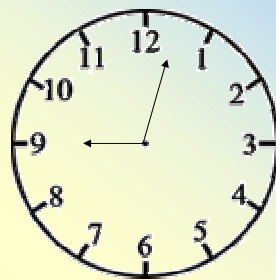


9時半

估計學生未能理解「差一些」和「多一些」的報時法



- 10 時 正
- 10 時 半
- 差 一 些 10 時 正
- 10 時 多 一 些



- 9 時 正
- 9 時 半
- 差 一 些 9 時 正
- 9 時 多 一 些

學生在學習辨別時間出現的困難：

- 未能完全掌握長、短針的互動關係
- 少部份學生不能辨別長短針
- 部份學生認為長針動、短針不動
- 部份學生認為長針走一圈、短針突然走1/12格

前測結果顯示

- 大部份學生掌握時鐘移動的方向
- 部份學生未能掌握時正(填時)
- 學生未能理解長短針的互動關係
- 學生未能掌握讀時「時半」
- 學生未能掌握填時「時半」
- 部份學生未能掌握「差一些」、
「多一些」

前測結果:

(1) 對時鐘的基本認識					
a. 時針移動的方向：	正確	88.51%	b. 辨別長、短針	正確	85.63%
	不正確	11.49%		不正確	14.37%
(2) 時正					
a. 填寫 8 時正：	正確	90.23%	b. 畫 10 時正：	正確	81.61%
	不正確	9.77%		不正確	18.39%
(3) 時半					
a. 填寫 6 時半：	6 時半 / 6 時 30	59.20%	b. 畫 9 時半：	兩針位置正確	9.20%
	7 時半	8.05%		分針正確，時針指向 9	31.61%
	6 時正 / 6 時	9.20%		分針正確，時針指向 8, 9 之間	1.72%
	6 時 6	9.20%		時針正確，分針指向 9 / 12	8.05%
	6 時 7	2.30%		時、分針倒放了	0.57%
	7 時 6	2.30%		兩針位置均不正確 *	29.89%
	9 時半 / 9 時 6	1.72%		兩針均指向 9	1.15%
	其他	4.02%		其他	12.07%
	漏空	4.02%		漏空	5.75%
			* 例如：時針指向 9，分針指向 12（即 9 時正），共 46 位		
			時針指向 9，分針指向 8, 9 或 9, 10 之間，共 4 位		
			時針指向 9，分針指向 12, 1 或 11, 12 之間，共 2 位		

教學重點：

- 時鐘的移動方向
- 時正的認識
- 時半的認識
- 「差一些」到？時
- ？時「多一些」
- 強調時針與分針的互動關係

教學計劃設計構思：

- 設計情景教學（春季嘉年華會一天遊），透過故事與遊戲讓兒童學懂讀時、填時與撥時
- 藉活動讓兒童自行發現時針與分針的互動關係
- 針對兒童學習難點「時半」作重點教學

教學計劃：

- 長短針的移動方向
- 以兒童已有知識為基礎，能引起兒童的興趣
- 長短針的互動關係：
 1. 介紹「時正」題型示例（早上10時小明一家到達春季嘉年華會）
 2. 介紹「時半」題型示例（小明要玩旋轉木馬，看看時鐘，剛好是11時半）
- 分組進行比賽
- 以問題鞏固學生所學
- 在課堂上進行練習以作評估

結果和檢討：

- 教師滿意結果
- 印証先前教師的想法
- 針對困難而設計教學方法
- 學生整體有進步
- 提升教師專業發展

一年級下學期
課題:29以內兩位數
減個位數的退位減法

意念

學生知識背境的差異

- 大部份學生熟習10的數字組合
- 極少部份學生熟習18以內數字組合
- 大部份學生以實物、數數解18以內數字組合

$$\begin{array}{r} 23 \\ - 7 \\ \hline \\ \hline \end{array}$$

•學生運算模式：

$$23-7 = 10 + 13 \quad \begin{array}{l} \swarrow 7 \\ \searrow 6 \end{array} = 10 + 6$$

$$23 - 7 = 10 + 10 + 3 = 10 + 10 \quad \begin{array}{l} \swarrow 7 \\ \searrow 3 \end{array} = 10+3+3$$

•皆建基於數字組合

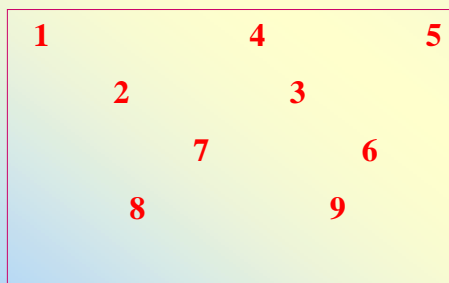
- 希望學生脫離數數階段，有意識運用「破十法」於計算中
- 希望提昇整體學生退位減法的成績

前測的目的

- 在學生身上找出數據，指示學生未能掌握的範疇

前測內容

- 10的組合純熟度(湊十法)



1 ()

4 ()

7 ()

2 ()

8 ()

5 ()

3 ()

9 ()

6 ()

10以內的加、減數

第二部份

1. $5 + (\quad) = 10$

2. $(\quad) + 6 = 10$

3. $10 - (\quad) = 8$

4. $(\quad) - 9 = 1$

5. $(\quad) + (\quad) = 10$

計算個位減法、19以內不退位減法

19以內退位減法

29以內不退位減法、29以內退位減法

第三部份題型示例：

1. $6 - 5 = (\quad)$

2. $16 - 3 = (\quad)$

3. $18 - 9 = (\quad)$

4. $25 - 4 = (\quad)$

5. $22 - 6 = (\quad)$

學生能否運用湊十法在加法中

$$\begin{array}{r} 9 \\ 1 \quad 2 \end{array}$$

答案：()

$$\begin{array}{r} 8 \\ 4 \quad 2 \end{array}$$

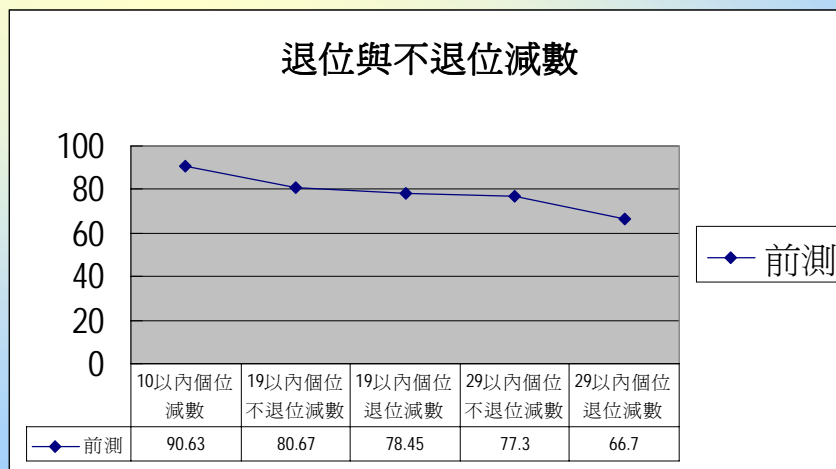
答案：()

$$\begin{array}{r} 3 \\ 7 \quad 6 \end{array}$$

答案：()

前測結果

退位與不退位減數



前測結果

- 10以內個位加、減最高分
- 較大的跌幅均與退位減數有關
- 九成學生掌握10以內的加法

教學計劃設計構思：

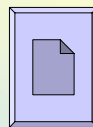
運用情景教學（遊海洋公園）為經，退位減法為緯，輔以不同活動，讓兒童透過活動，發現運用「破十法」將實際情境與數式結合。

教學焦點為：

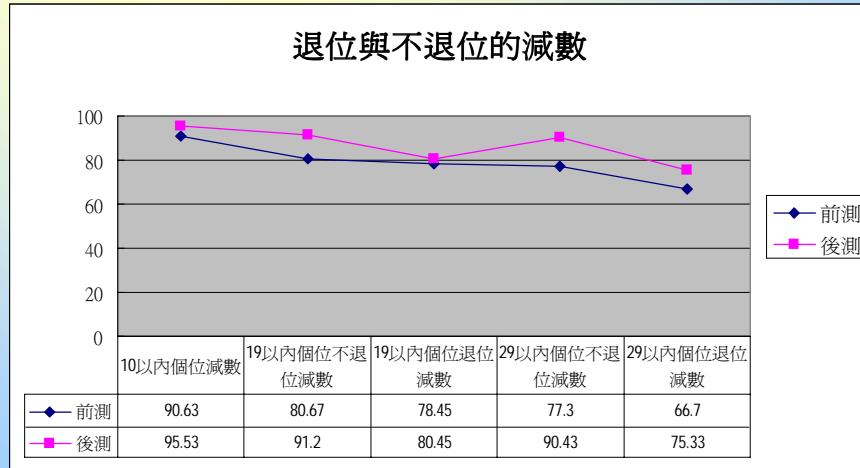
- 學生分辨退位與非退位減法
- 計算退減數，有運用「破十法」與不運用「破十法」之別。

教學計劃

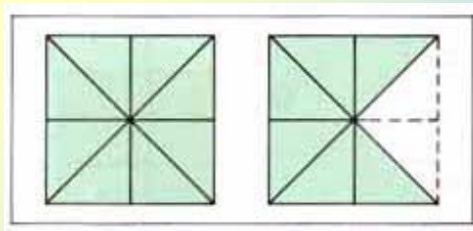
- 以訓練員餵魚故事，引入30以內不退位減法
- 由情景過渡到算式階段，並引入「破十法」
- 鞏固練習
- 下堂延續活動



後測結果



小四數學科研究課：分數



上圖淺綠色的部分佔全圖的幾分幾？

$$\frac{14}{8} ? \quad \frac{14}{16} ?$$

分數的單位與及單位化的重要

小四數學科研究課：分數

研究課的引入部分：捐錢的故事

① 引起動機
說《捐錢的故事》
② 李嘉誠先生在東華三院籌款活動捐了五百萬元。
③ 陳小明在他的儲蓄箱中取了一半出來，共捐了50元。
④ 王大勇把袋中的錢全拿出來，捐了5元。
問題：① 他們三人中誰捐錢最多呢？
② 誰人最慷慨？
* 答案留待下課前才解答

Dividing Paper Clips (1)

- 5 groups
- Each group with 24 clips
- Work on $\frac{1}{8}$, $\frac{2}{8}$, $\frac{3}{8}$, $\frac{5}{8}$, $\frac{7}{8}$
- Observe, report and compare
- Numerator changes; denominator unchanged

Dividing Paper Clips (2)

- Repeat with
- $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{6}$, $\frac{1}{8}$
- Observe, report and compare
- Denominator changes; numerator unchanged

Comparing fractions (advanced)

- $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{5}{6}$, $\frac{7}{8}$
- Which fraction is larger?

Dividing Candies

- Fraction kept constant = $\frac{1}{6}$
- Five groups
- Bag sizes varied: 12, 18, 24, 36, 48
- Observe, report and compare
- “Why are the results different when the fraction is the same?”

Waffle Cake – the unit matters?

- Given one disc
- Cut $\frac{1}{6}$

- Given two discs
- Cut $\frac{1}{6}$

- Given one and a half discs
- Cut $\frac{1}{6}$

Back to the beginning

- ① 引起動機
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