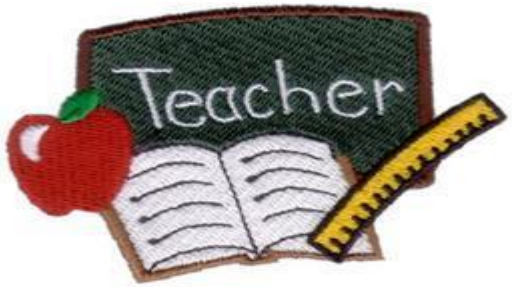
The Impact of the Medium of Instruction on Students' Learning in Physics at the Senior Secondary Level in Hong Kong



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Medium of Instruction Guidance for Secondary Schools (7TH to 13TH grade Levels)

- English as the medium of instruction (EMI) and Chinese as the medium of instruction (CMI)
- Approximately 300 out of the total of 400 secondary schools were required to switch their MOI from EMI to CMI starting from the academic year 1998/1999.
- Individual schools no longer had the autonomy to choose the language medium for their junior level students (S1-S3 or seventh to ninth-graders).

Medium of Instruction Guidance for Secondary Schools

- In its entirety, the Guidance not only rigidly assigned the MOI for individual schools, but also banned the mixed mode of instruction.
- Most schools that were required by the government to use CMI for their junior years continued to use EMI to teach their senior graders so that they could remain as popular choices amongst parents

Studies of MOI in HK

- Studies over the years indicated that using Chinese –the native language in Hong Kong – had positive effects on students 'motivation and achievement in learning science at grades 7 to 9 (e.g. Marsh & Hau, 2000; Yip, Tsang, & Cheung, 2003).
- On the other hand, a later study showed a discrepant result that students using English to learn science could still show greater interests in the subject (Yip, Coyle & Tsang, 2007).

Background of the Study

- A three-year longitudinal study was launched in Hong Kong (HK) to investigate the effects of the medium of instruction (MOI) on the learning of certificate level physics.
- A total of 199 Secondary Four (S4 or tenth-grade) students, divided into three major ability groups, participated in a teaching intervention and a series of learning activities to demonstrate the effect of the MOI on their learning achievement and motivation.
- English as the medium of instruction (EMI) and Chinese as the medium of instruction (CMI)

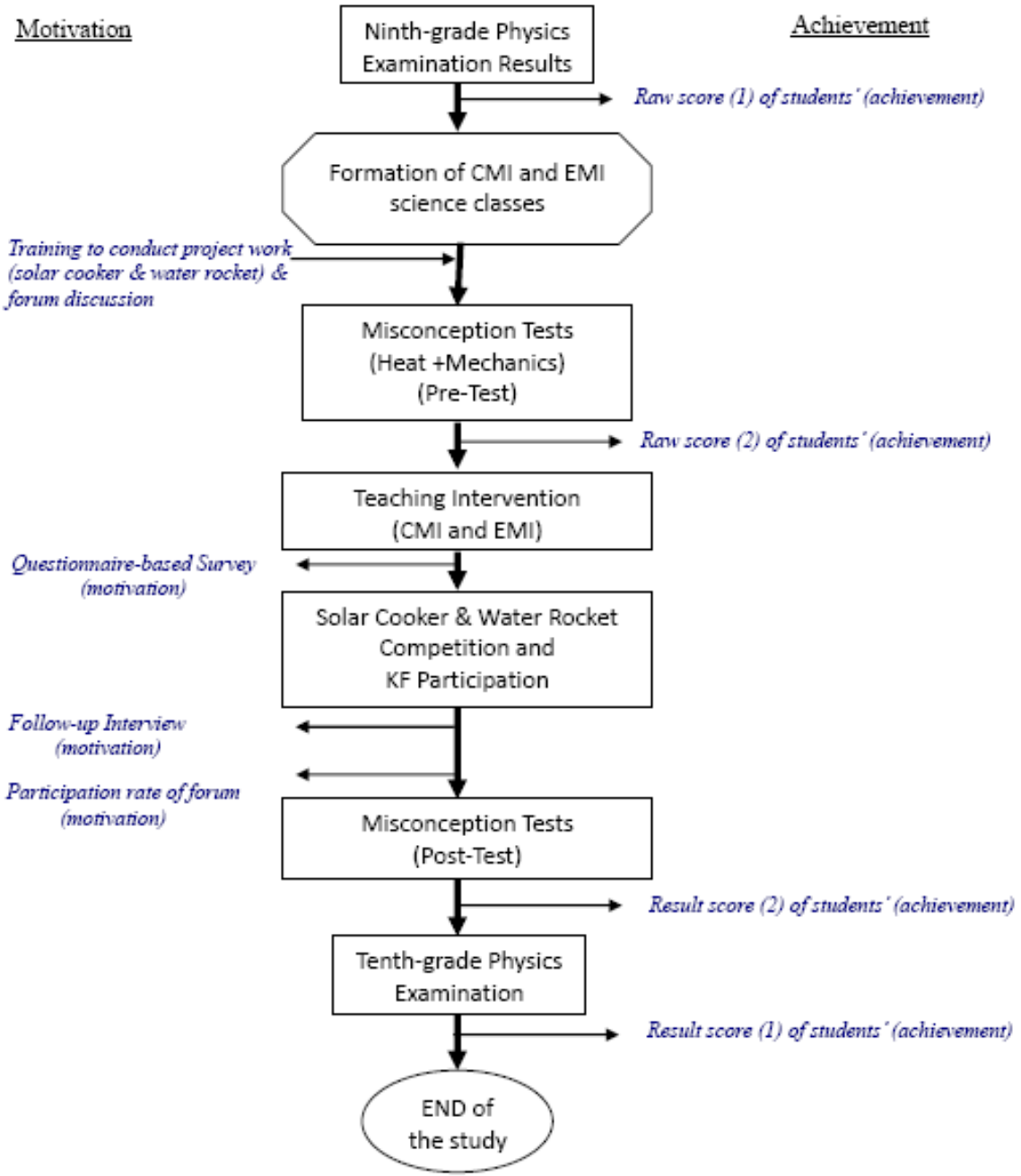
English as Second Language in Science Education

- There is a strong consensus that English is widely recognised as indispensable for the science communication and development in the international context (Rollnick, 2000).
- This accounts for the increasing dominance of English as the world's leading MOI in science education, although it is acknowledged that learning science through the medium of a second language is a formidable task for students, since it involves having to master both science content and language (Isa & Maskill, 1982; Strevens, 1980).

The Effects of MOI on Learning Achievement and Motivation in HK

- While the existing literature in HK shows a general consensus that the use of the native language is beneficial when learning science, particularly for under-achievers, these studies have arguably focused too exclusively on junior secondary students.
- What will happen if the language of instruction changes from the native language to English when students progress from S3 (junior secondary) to S4 (senior secondary)? Will these students have poorer academic results and lower motivation to learn science than those who continue using Chinese?

Flow Chart of Data Collection and Procedures of the Study



Samples of Thermal Concept Evaluation (Heat)

1 What is the most likely temperature of ice cubes stored in a refrigerator's freezer compartment?

電冰箱的冰格內儲存了一些冰塊，它的溫度最可能是：

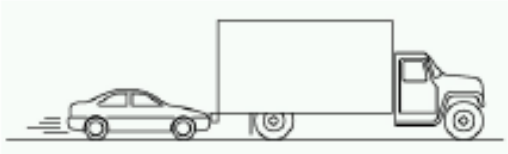
A	-10°C	☐	A	-10°C
B	0°C	☐	B	0°C
C	5°C	☐	C	5°C
D	It depends on the size of the ice cubes.	☐	D	視乎冰塊的大小而定

2 Ken takes six ice cubes from the freezer and puts four of them into a glass of water. He leaves two on the countertop. He stirs and stirs until the ice cubes are much smaller and have stopped melting. What is the most likely temperature of the water at this stage?

阿建於冰格中取出6塊小方型冰塊，把其中4塊放進一杯水內，其餘2塊置於櫃台上。他攪拌至杯中的冰塊變得愈來愈小，直至停止溶解，現在哪杯水之溫度最可能是：

A	-10°C	☐	A	-10°C
B	0°C	☐	B	0°C
C	5°C	☐	C	5°C
D	10°C	☐	D	10°C

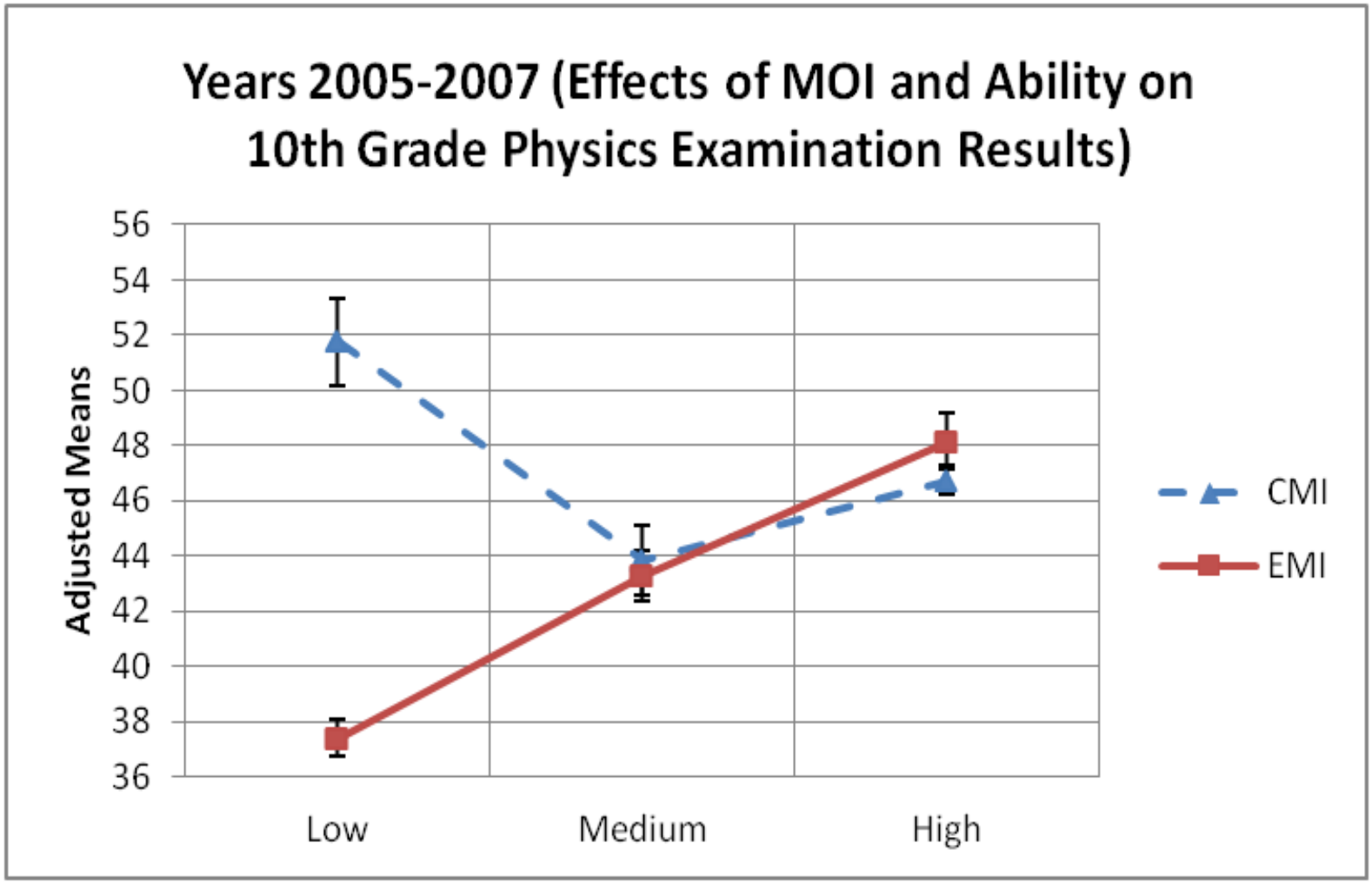
Sample of Force Concept Inventory (Mechanics)

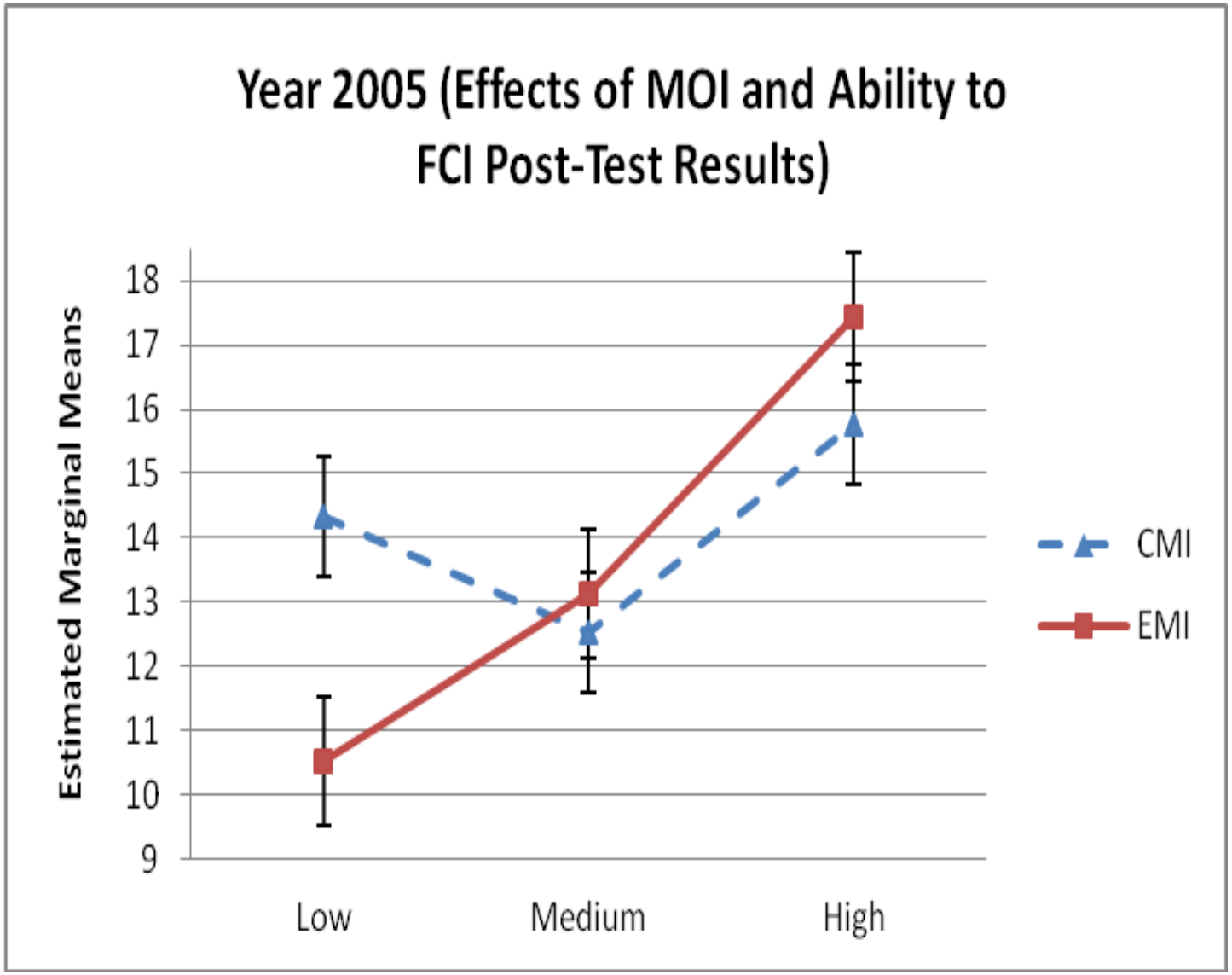


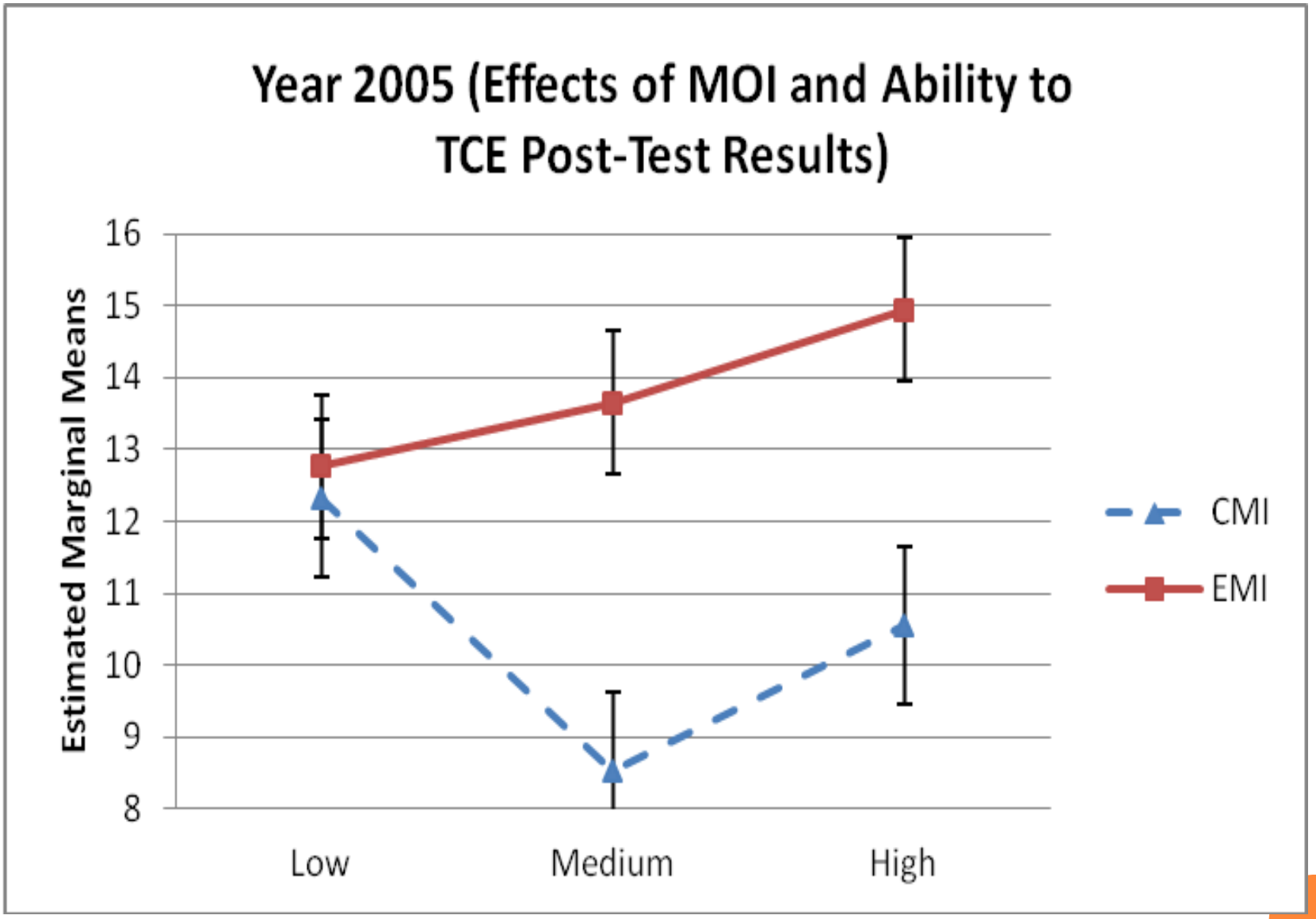
1 While the car, still pushing the truck, is speeding up to get up to the desired speed,

A	the amount of force with which the car pushes on the truck is equal to that with which the truck pushes back on the car.	A	小型汽車推動卡車的力與卡車作用於小型汽車的力相等。
B	the amount of force with which the car pushes on the truck is smaller than that with which the truck pushes back on the	B	小型汽車推動卡車的力小於卡車作用於小型汽車的力。
C	the amount of force with which the car pushes on the truck is greater than that with which the truck pushes back on the car.	C	小型汽車推動卡車的力大於卡車作用於小型汽車的力。
D	the car's engine is running so the car pushes against the truck, but the truck's engine is not running so the truck cannot push back against the car. The truck is pushed forward simply because it is in the	D	小型汽車的發動機運轉，所以它能推動卡車。而卡車的發動機沒有開動，所以卡車沒有反作用於小型汽車的力。卡車被推向前只是因爲它阻礙小型汽車的前進。
E	neither the car nor the truck exerts any force on the other. The truck is pushed forward simply because it is in the way of	E	小型汽車和卡車彼此都沒有相互作用力。卡車被推向前只是因爲它阻礙小型汽車的前進。

當小型汽車一邊推著卡車，一邊正在加速時，


Years 2005-2007 (Effects of MOI and Ability on 10th Grade Physics Examination Results)
Adjusted Means
56
54
52
50
48
46
44
42
40
38
36
Low
Medium
High
CMI
EMI


Year 2005 (Effects of MOI and Ability to FCI Post-Test Results)
Estimated Marginal Means
18
17
16
15
14
13
12
11
10
9
Low
Medium
High
CMI
EMI


Year 2005 (Effects of MOI and Ability to TCE Post-Test Results)
Estimated Marginal Means
16
15
14
13
12
11
10
9
8
Low
Medium
High
CMI
EMI

Results

- The results of the tenth-grade examination and misconception tests generally revealed conclusive evidence that, for the low ability students at the senior secondary level, Chinese was a better MOI than English to attain a higher level of achievement in physics.
- In contrast to the results of a longitudinal study (Yip, Tsang, & Cheung, 2003), EMI seemed to be a better MOI for the high ability students in this study.
- In the interviews, both the CMI and EMI students supported the mixed-mode instructional approach.

Implications

- The Influence of Language on the Conception of Heat Transfer

What is 'heat'?	
English (Heat)	Chinese (熱)
'Heat' is a kind of energy (noun)	熱 (noun + adjective) 
To describe the temperature is high, 'hot' (adjective)	

Confusion?

- 鎔 (melt) -- 溶 (dissolve)
- 容 (capacity)

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