

## SCC / ADEPT CONFERENCE IN SCOTLAND

# Academic Performance of Deaf and Hard-of-Hearing (DHH) Students in the Sign Bilingualism and Co-enrolment in Deaf Education (SLCO) Programme

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# Outline of today's presentation

1. Background of the study
  - Academic performance of DHH students in general and in HK
  - Factors affecting DHH students' performance
  - Development of the SLCO Programme in HK
2. The studies regarding classroom participation and academic performance of DHH students in different levels of programmes
3. Discussion and Conclusion

# Academic Performance of DHH Students

- Academic performance of DHH students continues to be **lagging behind their hearing peers** (Mertens, 1990; Moores & Sweet, 1990; Qi & Mitchell, 2011).
- Deafness not only constrains language development of DHH children, it also has significant impacts on DHH children's development of cognitive functions, as well as academic development (Spencer & Marschark, 2010)

# Background

- Academic failure is a long-standing problem facing DHH students in Hong Kong.
- DHH students are prone to **information inaccessibility** and **nonparticipation in class** especially when there are activities like rapid rate of discussion, rapid turn-taking and topic-change (Stinson & Antia, 1999).

# Background

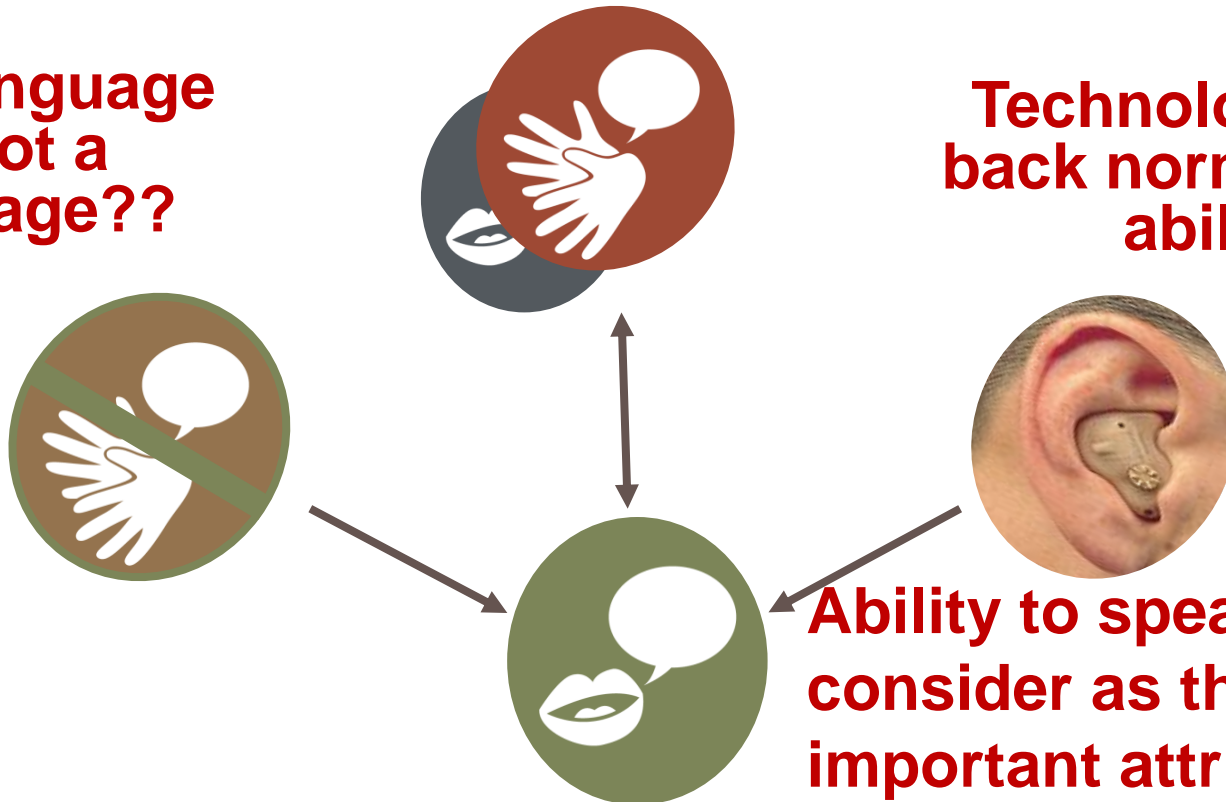
- Hong Kong has long been adopting the oral approach, with **very limited use of sign language in education**, no matter in mainstreamed or segregated settings.
- Hearing parents and deaf educators emphasize much on auditory and speech training.
- Even deaf parents may also **restrict their sign interactions with their children** and rely heavily on the support of hearing relatives or grandparents.
- General misconceptions about sign language still holds.

# Misconceptions about Sign Language in HK

**Sign language deprives  
oral language  
development??**

**Sign language  
is not a  
language??**

**Technology brings  
back normal hearing  
ability??**



**Ability to speak is  
consider as the most  
important attribute of  
DHH children**

# Deaf education: HK Situation

- Deaf education in Hong Kong was mainly conducted in special settings from the 1930s to the 1970s (Sze, Lo, Lo, & Chu, 2012). **Sign language was used at that moment.**
- >90% of DHH students with mild to profound hearing losses are integrated in mainstream schools, following the policy proposed in the White Paper **“Integrating the Disabled into the Community”** in 1977 (Hong Kong Government, 1977).

# Deaf education: HK Situation

- Only **1 Special School for the Deaf** in HK now
  - oral approach before, recently started to incorporate SL as one of the MOI in school
- **>90% in Mainstream Education:**
  - HA/CI + FM system + Speech therapy
  - No sign language support

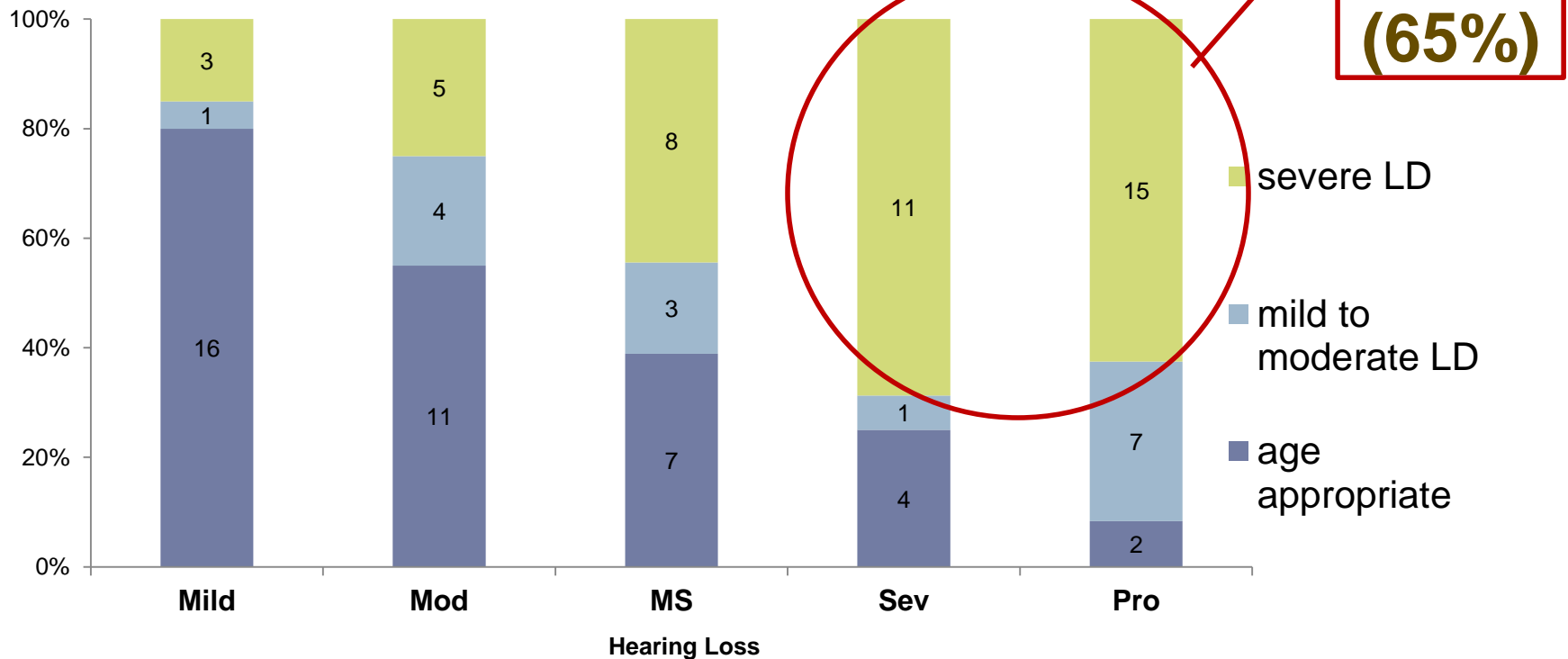


# Background

- Sign language input is always considered as a **‘last resort’**, for those who fail in oral language development for whatever reasons
- Many students started to **learn sign language lately** after the sensitive or critical period of language development
- Many come to mainstream classrooms with **severe language delay**, and that severely creates barriers to communication and learning in class

# Oral Language Development (data collected from 2007-2010)

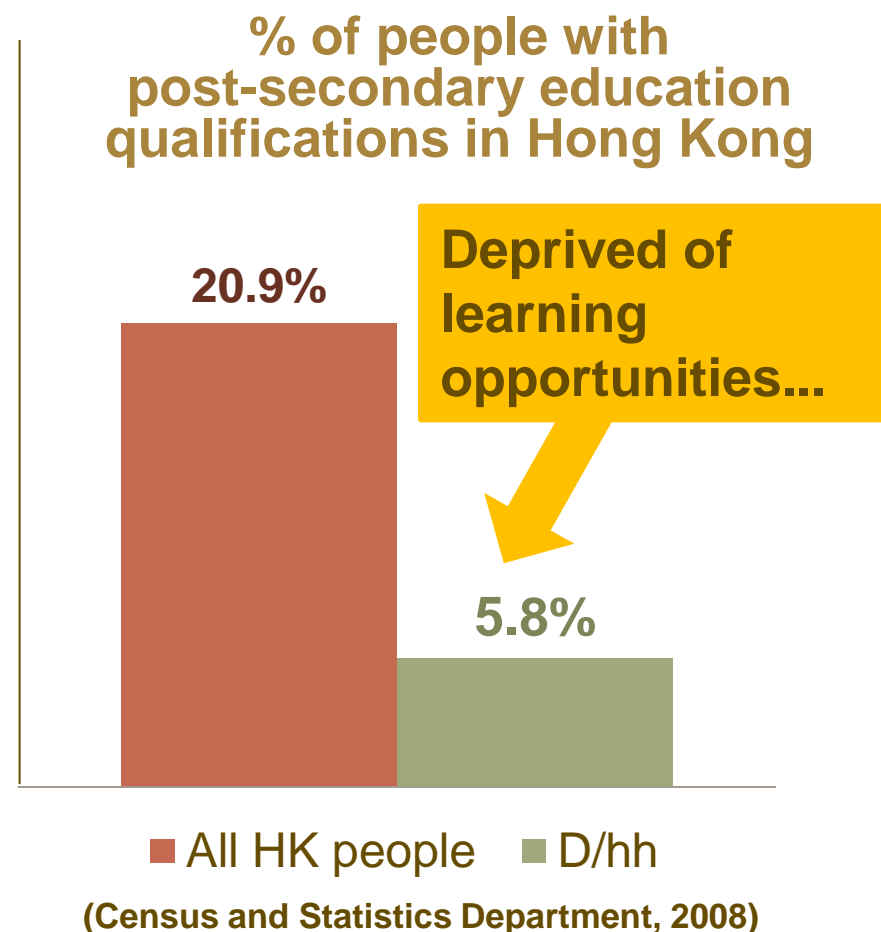
## Language Abilities of 98 Mainstreamed P1-P6 DHH Students (using HKCOLAS)



- **58 (59.2%)** were having different degrees of language delay.

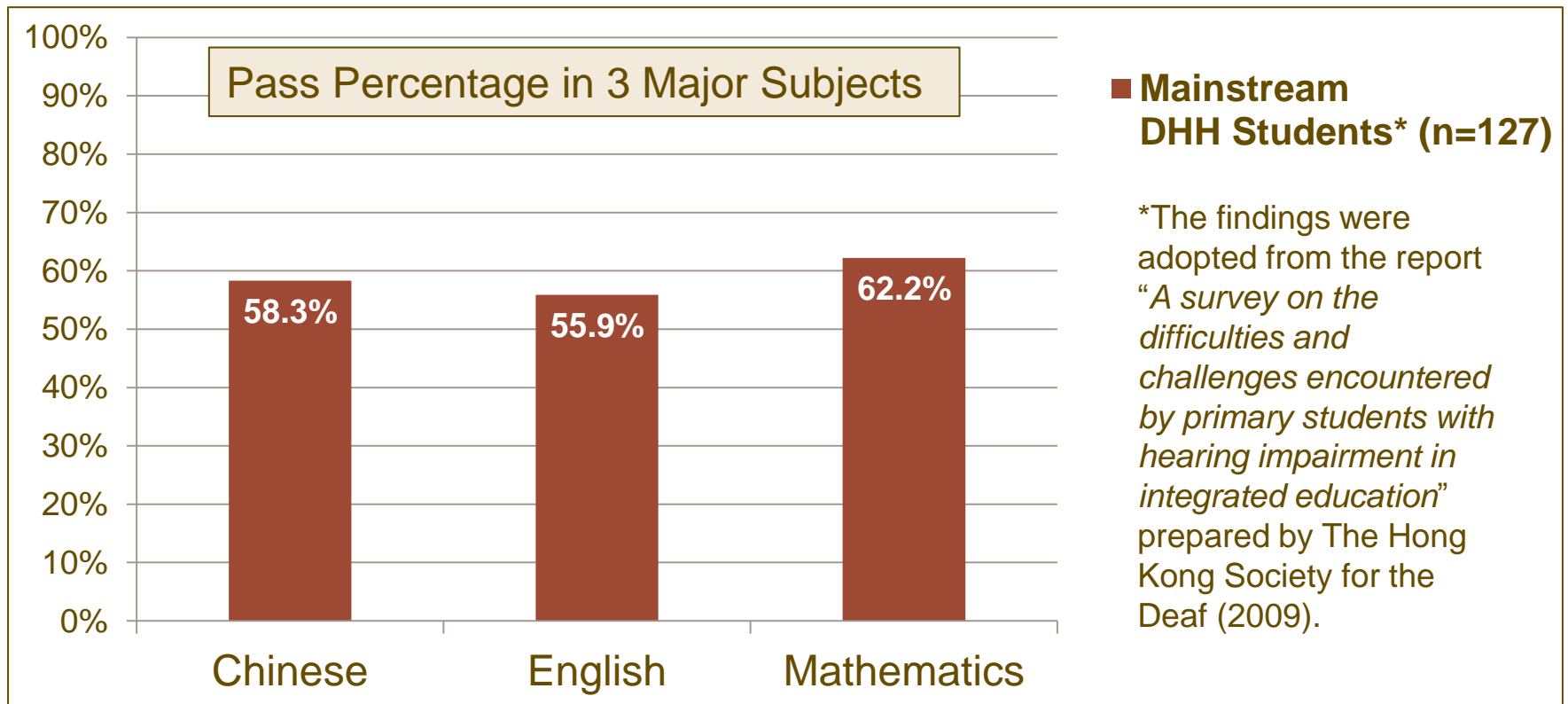
# Observation in the Report of CRPD on HK (United Nations, 2012, p.10)

- “... lack of official recognition of the status of significance of sign language by Hong Kong, China”
- “The Committee is troubled by the low number of students with disability in tertiary education....”



# Academic Performance of DHH Students in HK

- 31% of 127 DHH (P1-P6) students in the mainstream schools **failed in all 3 basic subjects** (The Society for the Deaf, 2009)



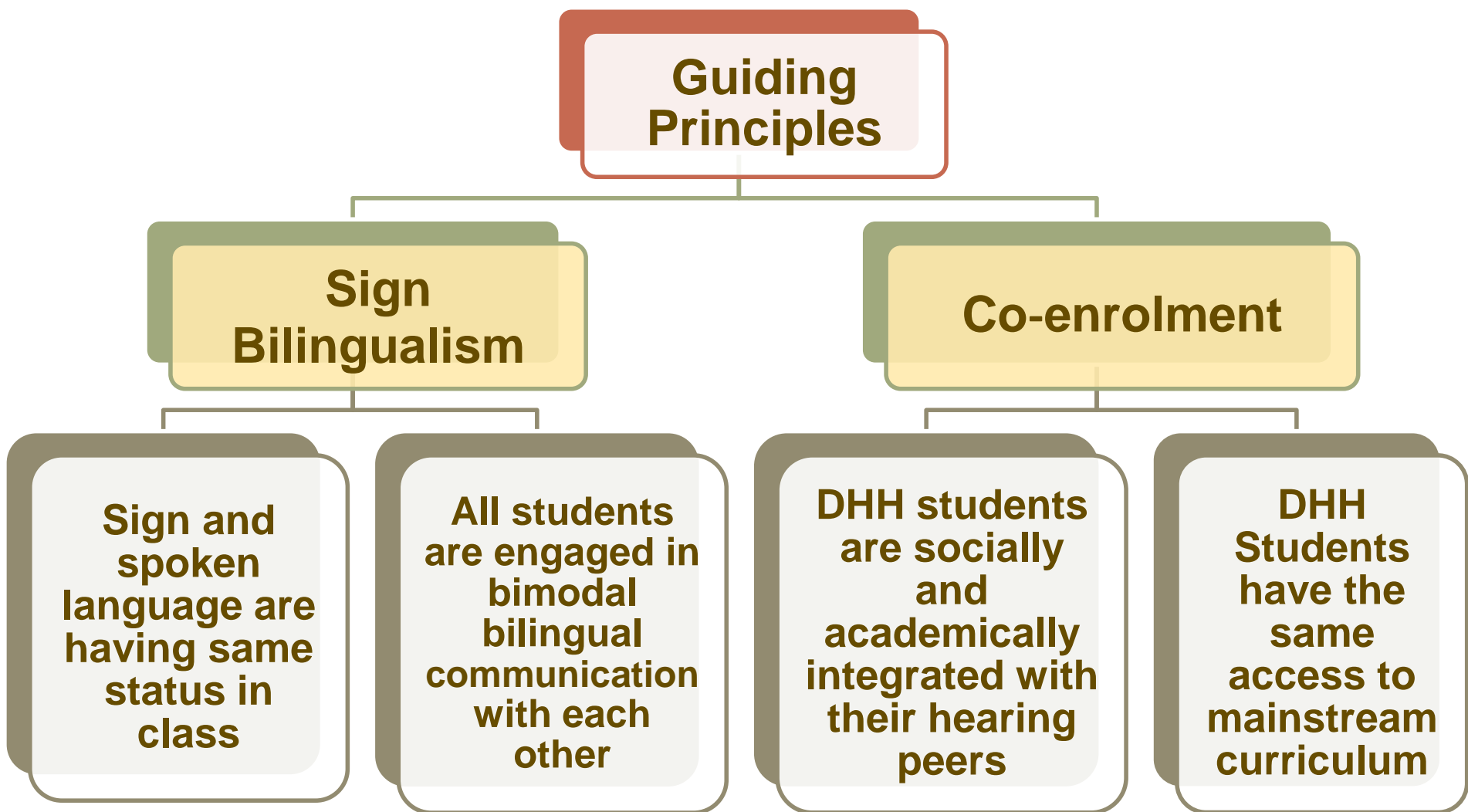
# **Development of Sign Bilingualism and Co-enrollment in Deaf Education Programme**

**(to re-introduce sign language in deaf  
education in Hong Kong in an inclusive  
education setting)**

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**(2006-NOW)**

# Guiding Principles



# Building a “Trough-train” System in HK

Starting from 2006, enrolling the first cohort of 6 students to the Kindergarten (K3 only), every year, 5-6 DHH students join SLCO kindergarten (up to Secondary 4 in 2016-17)

2006



**Fun with  
Speech and  
Sign (FS2)  
Programme**



**Bilingual  
Reading  
Programme**



**Peace  
Evangelical  
Centre KG  
(Ngau Tau  
Kok)**



**Kowloon  
Bay St.  
John the  
Baptist  
Cath. PS**



**Oblate  
Primary  
School**



**Notre  
Dame  
College**

## Children in SLCO Programmes (as at June 2017)

Programmes	DHH
Baby Crèches Programme	1
Baby Signing Programme	26
Sign Bilingual Reading Programme	16
Kindergarten SLCO Programme	14
Primary SLCO Programme	34
Secondary SLCO Programme	24
<b>Total</b>	<b>115</b>



# Key Components of SLCO Programme



**Co-teaching of  
Deaf and Hearing  
teachers**

**Signed and Spoken  
Language as  
Medium of Instruction**

**Critical Mass of Deaf  
Children in a Mainstream  
Classroom  
1:3 or 1:4**



# Programmes Features

Training for sign /spoken  
language development

Lesson  
preparation  
and remedial  
support

Visual  
learning  
materials

Student-  
centered  
activities

Deaf-Hearing  
Co-teaching

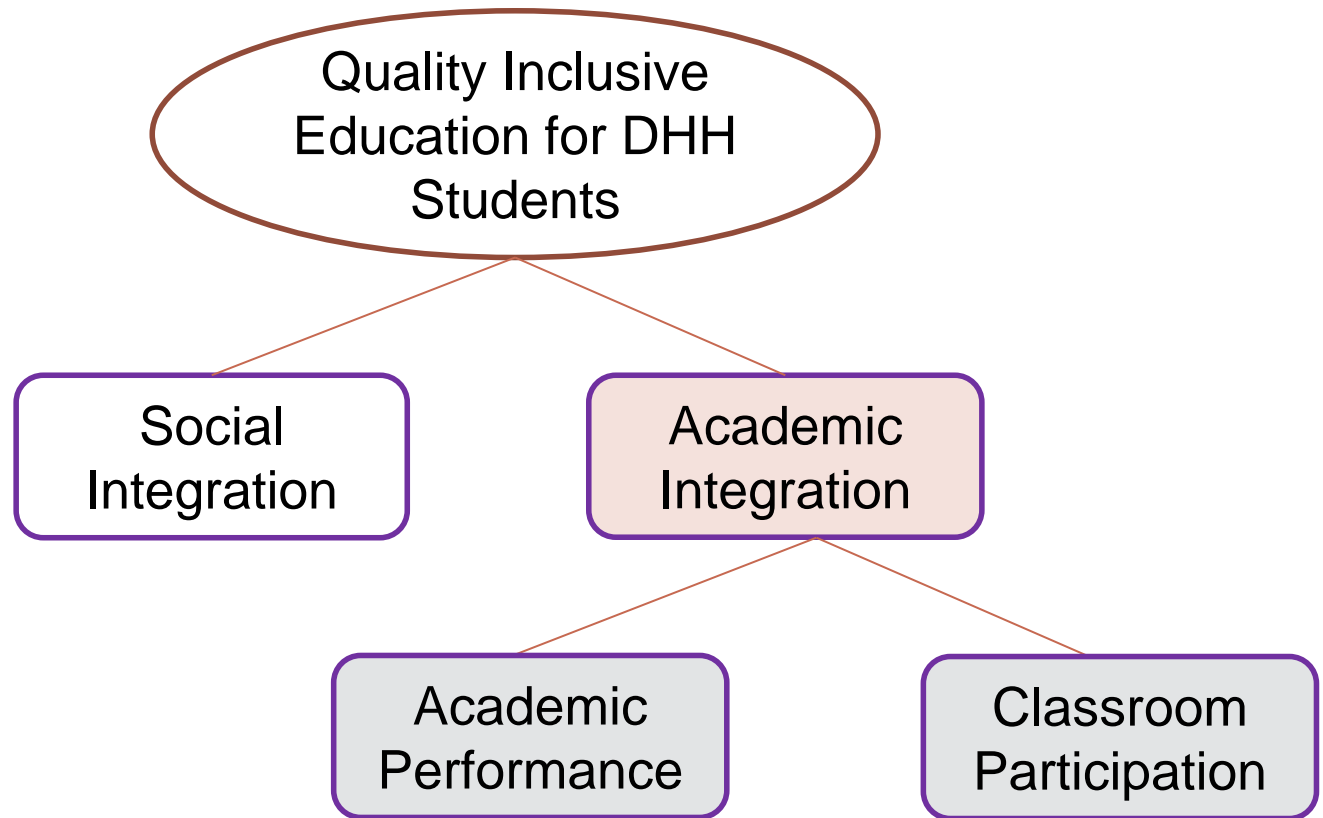
SLCO



# Aim of Study

- The study aims:
  - i. To review academic performance of the deaf and hard-of-hearing (DHH) students in the Sign Bilingualism and Co-enrolment in Deaf Education (SLCO) Programme in Hong Kong; and
  - ii. To investigate factors affecting the students' performance such as hearing status, degree of hearing loss, speech perception ability, age to learn sign language, presence of secondary disabilities or special needs.

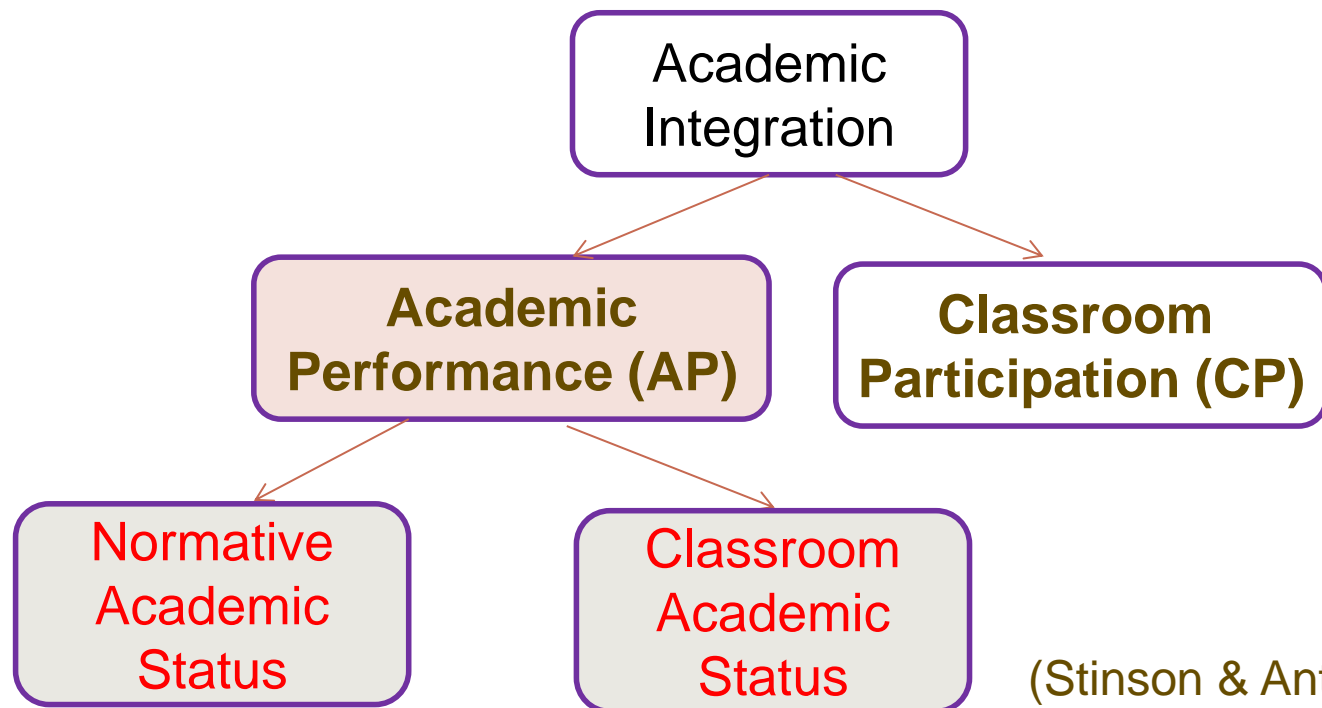
# Indicators for Quality Inclusive Education



(Stinson & Antia 1999)

# How to examine Academic Integration?

- Academic performance (AP) and classroom participation (CP) are indicators reflecting students' academic integration in the mainstream settings.



(Stinson & Antia 1999)

# Academic Performance of DHH Students (US)

- In Qi and Mitchell (2011), based on normative data of **3569 DHH students** by the standardized assessment “SAT” (the Stanford Achievement Test) from 1974-2003
- 3 major areas :
  - Reading
  - Mathematical Problem Solving
  - Mathematical Procedures

# Academic Performance of DHH Students in US (Reading)

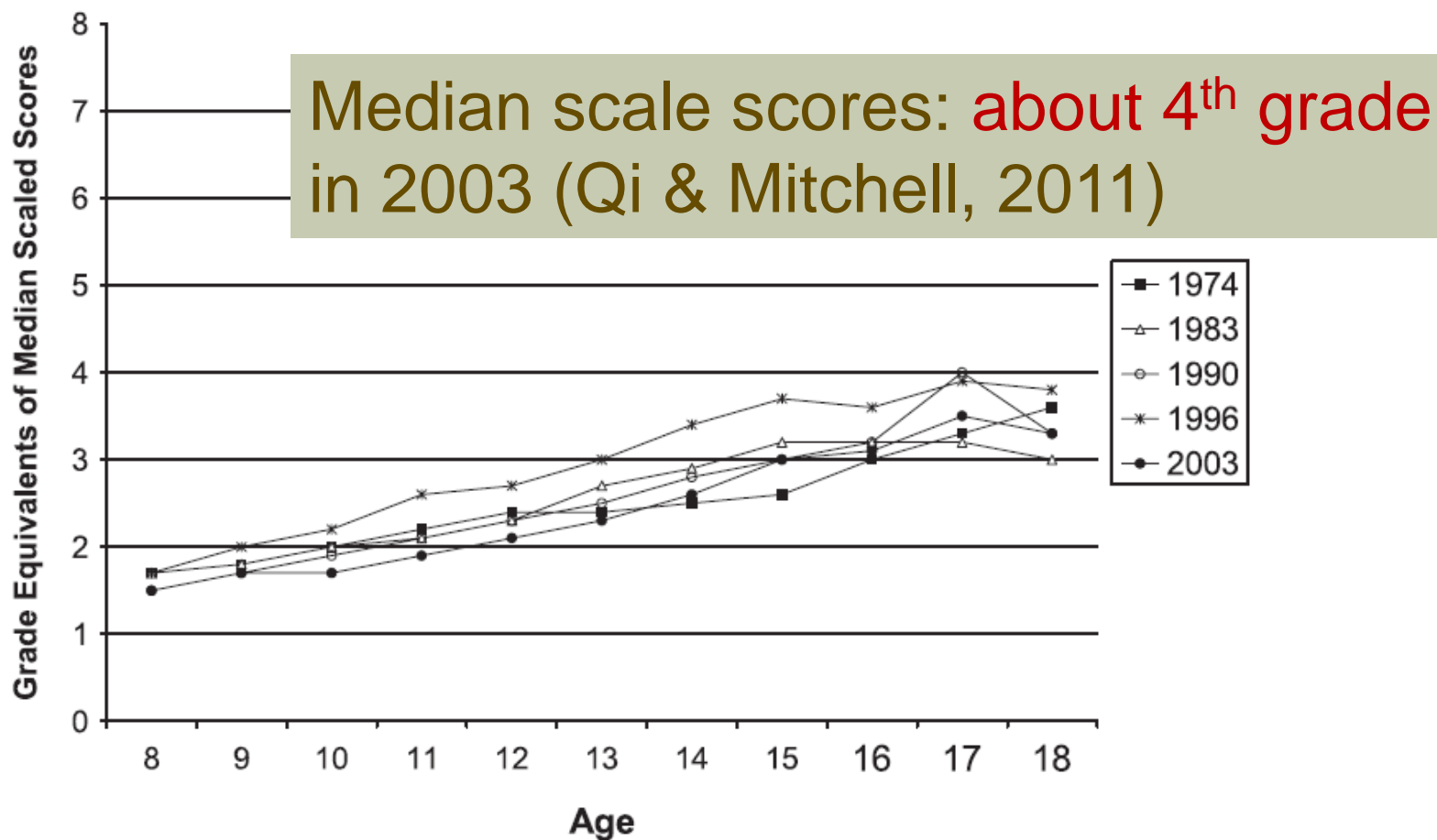


Figure 1 Grade equivalents of median scaled scores on Stanford Achievement Test for Deaf and hard-of-hearing student norming samples in the United States, by age, 1974–2003: reading comprehension.

# Academic Performance of DHH Students in US (Mathematical Problem Solving)

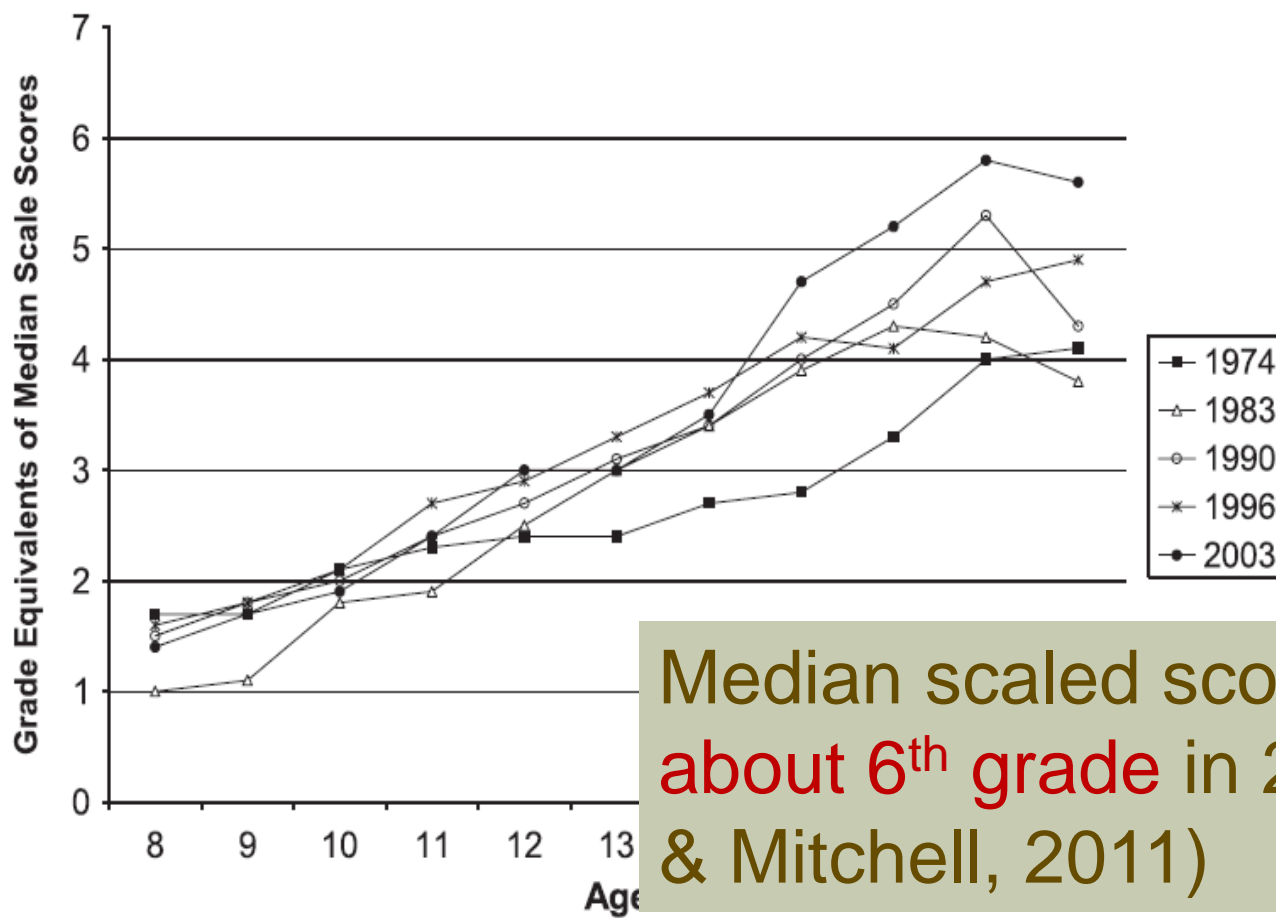


Figure 2 Grade equivalents of median scaled scores on Stanford Achievement Test for Deaf and hard-of-hearing student norming samples in the United States, by age, 1974–2003: mathematical problem solving.



# Academic Performance of DHH Students in US (Mathematical Procedures)

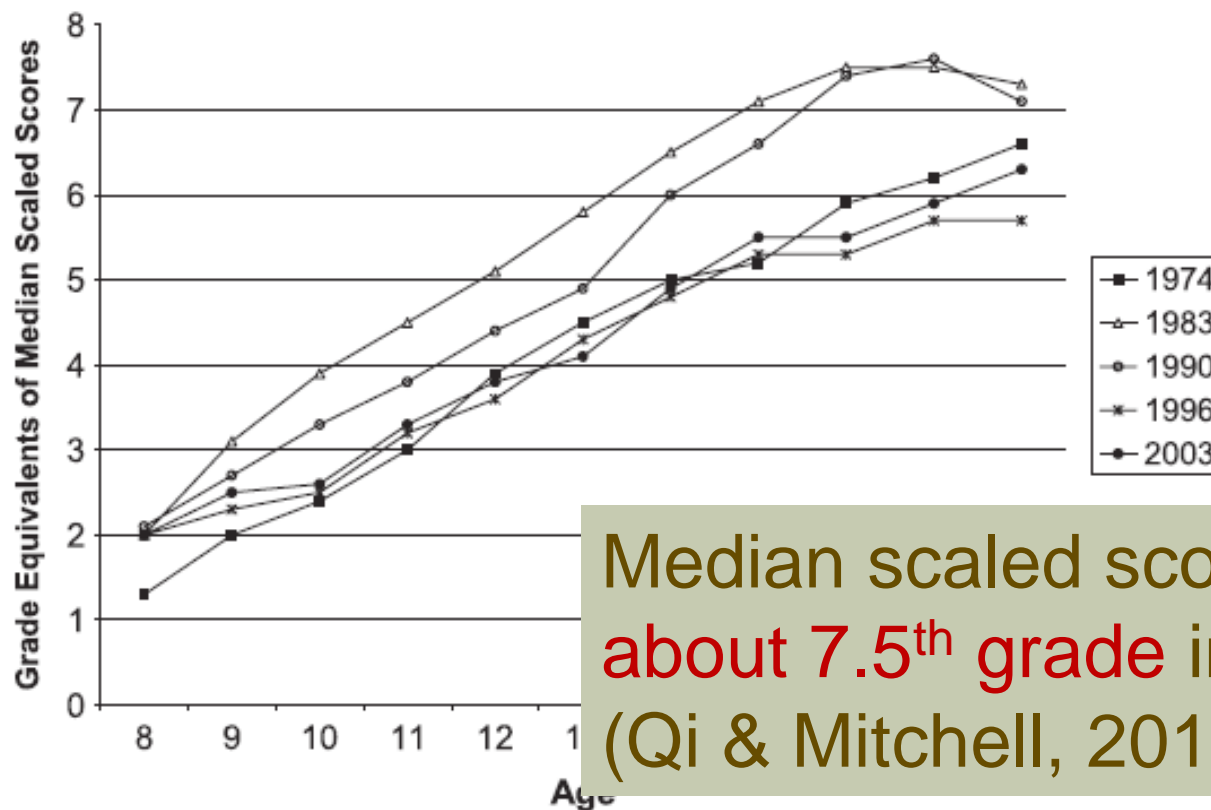


Figure 3 Grade equivalents of median scaled scores on Stanford Achievement Test for Deaf and hard-of-hearing student norming samples in the United States, by age, 1974–2003: mathematical procedures.

# Academic Performance of Mainstreamed DHH Students in US

Antia et al. (2009), in a 5-year study on 197 mainstreamed DHH in public schools, found that there are:

- i. A 0.5 standard deviation below the hearing norm on average; and
- ii. A positive growth in academic attainment.

# Academic Performance of Mainstreamed DHH Students in UK

- Investigating educational outcomes of >700 Year 11 students in different areas of England.
- Collecting GCSE results in 1995 and 1996, and students' background data through a teachers' questionnaire.
- **Typical > Mainstreamed DHH**

	DHH Students in Deaf Schools (93/94)	Mainstreamed DHH Students (95/96)	All Schools in England (95/96)
Pass in $\geq 5$ subjects	29%	70-75%	86%
Good pass in $\geq 5$ subjects	8%	14-18%	44-45%

# Factors Affected Academic Performance

Qi & Mitchell (2011) attributed the gaps to:

- i. **Language acquisition delays**; and
- ii. **Deficiency of curriculum and instruction.**

Antia et al. (2009) suggested that **communication-related factors** like hearing ability and communication skills were relatively more prominent.

# Factors Affecting Academic Performance

- Powers (1999) stated that the followings are relatively strong predictors of examination success:
- **socioeconomic status;**
- **age at onset of deafness;**
- **parents' hearing status; and**
- **presence of additional learning difficulty**

# Factors Affecting Academic Performance

- **Degree of hearing loss** did not appear to have an important effect on examination success (Powers, 1999).
- **Functional hearing ability** like aided speech perception seems to be a better predictor (Antia et al., 2009)

# Speech Perception

- Functioning hearing ability can be represented by children's aided speech perception ability
- It is especially important for Cantonese-speaking DHH children, considered to have significantly long-term impacts on DHH children's overall spoken language development (Lee, & van Hasselt, 2005).

# What do they mean?

- /maa1//maa1/

(mother)

- /maa5//maa5/

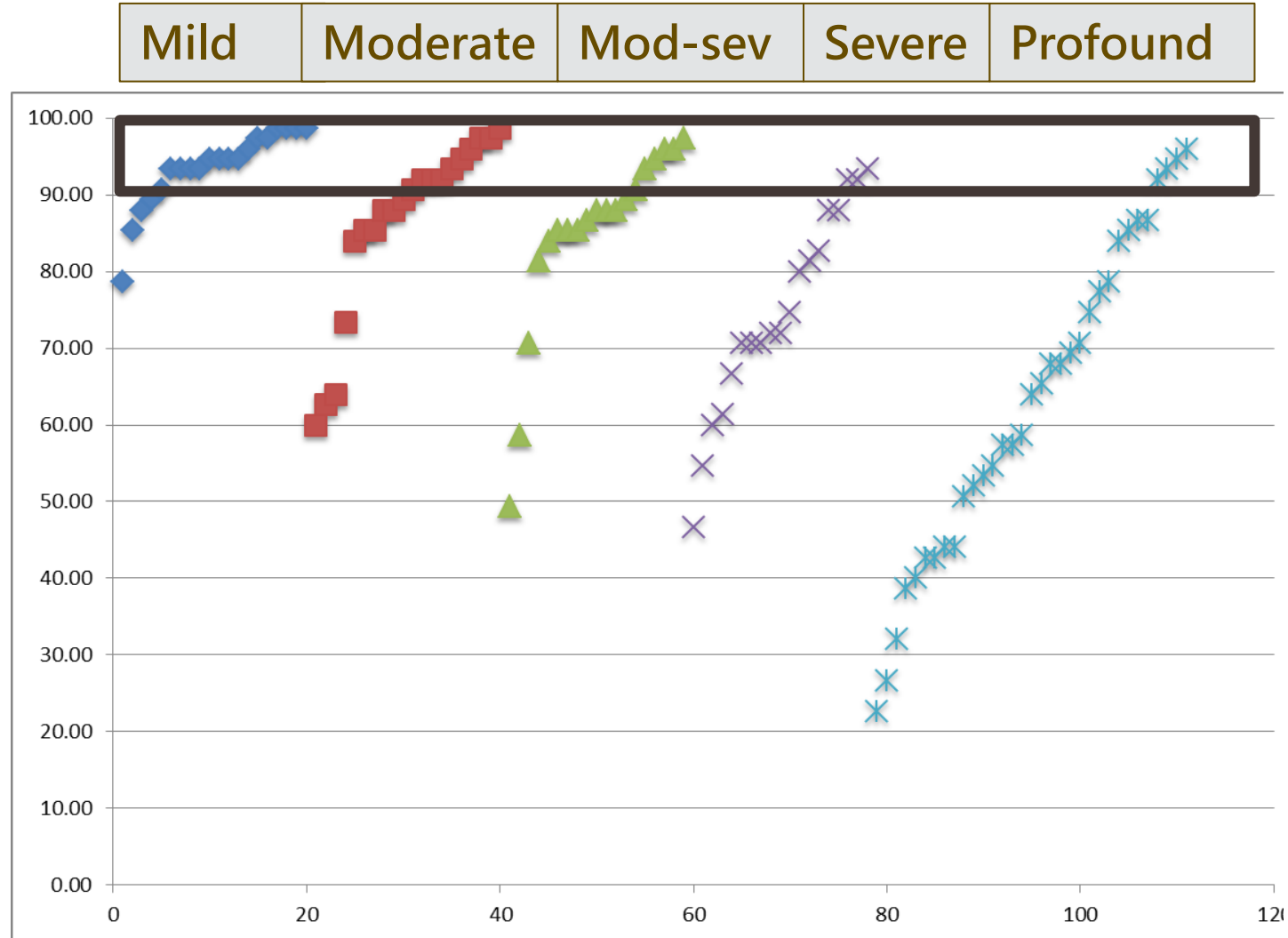
(horse)

They sound similarly, but are having totally different meanings.



# Diverse speech perception ability by CanTIT (Lee, 2012)

- **111 mainstreamed deaf or hard-of-hearing students**
- **Range of scores: from 23-100%**
- **Very diverse performance especially for those with severe to profound loss**



# Factors Affecting Academic Performance

- Some other possible factors affecting DHH students' academic development include:  
**socio-economic status of family, intellectual functioning, oral language ability, reading skills, cochlear implants, sign language proficiency**, etc. (Mertens, 1990; Marschark, Rhoten, & Fabich, 2007; Spencer & Marschark, 2010).

# Factor Affecting Academic Performance (CI)

In Australia, based on 151 completed survey by teachers and follow-up interviews, the study found that:

- **37.3%** of the children participated well in a regular class.
- **38.8%** of the children achieving at the expected level for their age.
- **Slightly less than half** reported to be independent like hearing children.

# Factors Affecting Academic Performance

- Cochlear implants are able to help alleviate the barriers to learning and communication in class and enhance DHH students' academic potential, but **the impact on their attainment still varies** (Marschark, Rhoten, & Fabich, 2007).
- A study by Spencer, Gantz, & Knutson (2004) on a group of 27 CI students who **also receives sign interpretation** in schools:
  - Their academic attainments are **comparable to the norm** (within 1 SD) based on hearing individuals

# Factors Affecting Academic Performance

- **Proficient sign language skills** remains a consistent and effective predictor of reading comprehension for secondary DHH students in bilingual secondary schools (Scott & Hoffmeister, 2017).
- Based on students' academic growth, Lange, Lane-Outlaw, Lange, & Sherwood (2013) suggested that bilingual approach to education has considered **a safety net for DHH students** with notably diverse hearing and speech perception ability.

# Factors Affecting Academic Performance

- Classroom participation (CP) refers to students' ability to participate in classroom activities and discussion, especially how they communicate and engage in daily classroom activities. (Long, Stinson, & Braeges, 1991; Antia, Sabers, & Stinson, 2007).
- DHH students' classroom participation is considered as **a significant factor affecting academic performance** (see also Long, Stinson and Braeges, 1991; Antia, Sabers, & Stinson, 2007) **and their quality of life** (Hintermair, 2010).

# Classroom Participation (CP)

- The construct of CP comprises of two dimensions, including:
  - i) **the “cognitive” dimension (Cog)** which focuses on “students’ self-perception of the amount and quality of information received and expressed in the classroom” and
  - ii) **the “affective” component (Aff)** which focuses on “students’ subjective communication experience in the classroom” (Long, Stinson, & Braeges, 1991, p.415)

# Factor Affecting Academic Performance

- Co-enrolment programming has been well recognized in promoting **social integration** between DHH and hearing students (Yiu & Tang, 2014; see also other chapters in Marschark, Tang & Knoors, 2014).
- Its impact on academic performance of DHH students has not yet been confirmed. More research evidence is required (Marschark, Tang & Knoors, 2014).



# STUDY 1:

## CLASSROOM PARTICIPATION OF DHH STUDENTS IN SLCO CLASSROOMS

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# Research Questions:

- How well are DHH students' participation in class when compared to their hearing peers?
- What are the preferred mode(s) of communication of the DHH and hearing students in the SLCO classroom?
- What are the relationships between DHH students' classroom participation (CP) and their language skills including sign language, oral and inged language abilities

# Subject

## 1) Subjects:

- 17 DHH and 62 hearing students
- studying in P4-P6

## ➤ Detailed information of DHH students:

- Have been studying in the SLCO classes for 4-6 years
- 14(82%) have severe (N=4) or profound (N=8) hearing loss
- 8(47%) of them are using hearing aids

# Methodology

- Classroom participation
  - The 28-item Classroom Participation Questionnaire (CPQ; Antia, Sabers & Stinson, 2007) was used after translating into Chinese
  - The Chinese version was verified by linguistically trained personnel through back-ward translation

# Dimensions and Subscales

Dimensions	Subscales
<b>A) Cognitive</b>	Understanding teachers (UT)
	Understanding other students (US)
<b>B) Affective</b>	Positive affect (PA)
	Negative affect (NA)

# Sample Items

- UT:
  - My teachers understand me.
- US:
  - I understand other students during group discussion
- PA:
  - I feel good when I talk to other students
- NA:
  - I feel lonely because I cannot understand other students (negatively worded)

# Language Assessments

- Students' Cantonese, written Chinese and Hong Kong Sign Language were assessed using:
  - The Cantonese Grammar Subscale of the Hong Kong Cantonese Oral Language Assessment Scale (HKCOLAS-CG)(T'sou, Lee, Tung, Chan, Man & To, 2006)
  - The Hong Kong Sign Language Elicitation Tool (HKSL-ET)
  - The Assessment of Chinese Grammatical Knowledge (ACGK)

# Results: Preferred mode of communication

- DHH students
  - >70% **preferred a mixed code** to communicate with hearing peers and teachers
  - Half of them **preferred using sign language** to communicate with their DHH peers (53% in RC; 65% in EC)
- Hearing students
  - 71% **preferred using both sign and/or speech** to express themselves
  - In RC, they **accept different modes of communication**: speech-only (26%), sign-only (32%) and the mixed code (34%)



# Results

## ➤ CPQ

The items of the CPQ were categorized into four subscales (Cronbach's  $\alpha = 0.85$ ):

- i) Understanding Teachers (UT)
- ii) Understanding Students (US)
- iii) Positive Affect (PA)
- iv) Negative Affect (NA)

According to the correlations between subscales, UT/US/PA were grouped together (Cronbach's  $\alpha = 0.93$ ) and NA seemed to be a separate component (results similar to Antia et al., 2007)

# Results

## DHH and H had similar extent of self-perceived classroom participation

Table 1. Comparing the perceived CPQ scores between DHH and hearing students

CPQ	Hearing Students (N=62)		DHH Students (N=17)		t
Subscales	Mean	SD	Mean	SD	
UT	3.35	0.45	3.13	0.42	1.97
US	3.33	0.47	3.01	0.36	2.54*
PA	3.15	0.56	3.18	0.41	-0.23
NA <sup>@</sup>	3.52	0.45	3.86	0.14	-3.13**
UT/US/PA	3.28	0.44	3.11	0.38	1.58

@ Reverse scoring; \* $p < .01$ ; \*\* $p < .001$

1. No significant difference between H and DHH students ;
2. H>DHH in US (Understanding Students)
3. DHH>H in NA (Negative Affect)

## ➤ Relations between classroom participation and language abilities:

- **No correlations** were found between CPQ and the DHH students' morphosyntactic knowledge in HKSL and Cantonese
- **Significant associations** were found between **DHH students' grammatical knowledge in written Chinese** (i.e. ACGK) and CPQ in UT/US/PA ( $r=0.523$ ,  $p<0.01$ ) and the subscales UT ( $r=0.520$ ,  $p<0.01$ ) and US ( $r=0.506$ ,  $p<0.01$ )

# Conclusions

- Both DHH students and hearing students communicate with each other with a flexible use of code choice according to the hearing status and language preference of the interlocutors.
- No significance difference can be found in terms of DHH and hearing students' participation in class
- Literacy skills in the setting is important in supporting DHH students' classroom communication.

STUDY 2:

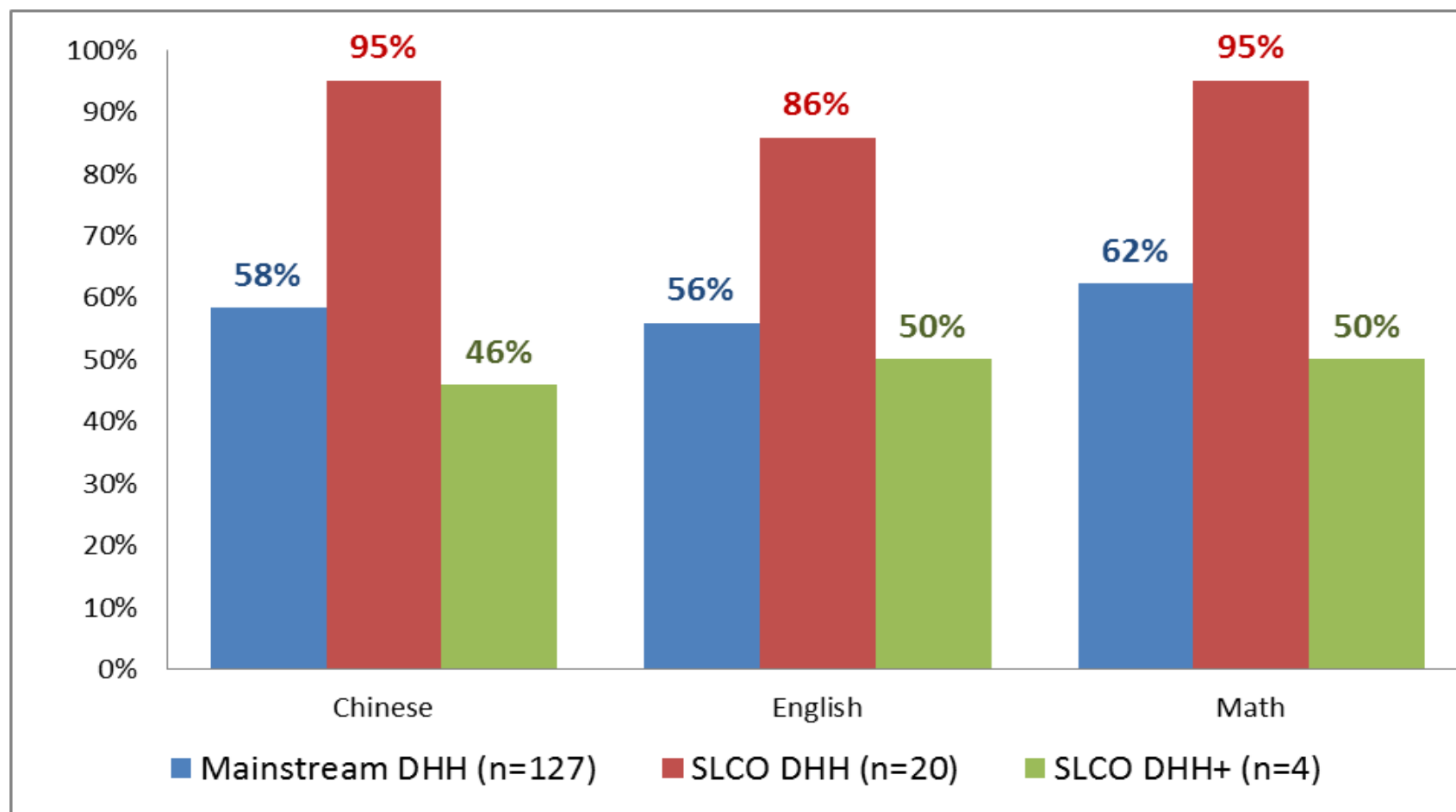
ACADEMIC PERFORMANCE  
IN PRIMARY EDUCATION

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# A General Picture

- “A survey on the difficulties and challenges encountered by primary students with hearing impairment in integrated education” was conducted in 2009 (the Hong Kong Society for the Deaf, 2009)
- The passed percentages of 127 Mainstreamed DHH students in the 3 major subjects: Chinese, English and Math range from 55.9-62.2%.

# Overall Passed Percentages Compared to Mainstreamed DHH Students



\* 4 cohorts of DHH students who have completed their primary education from in the SLCO Programme (P1-P6)

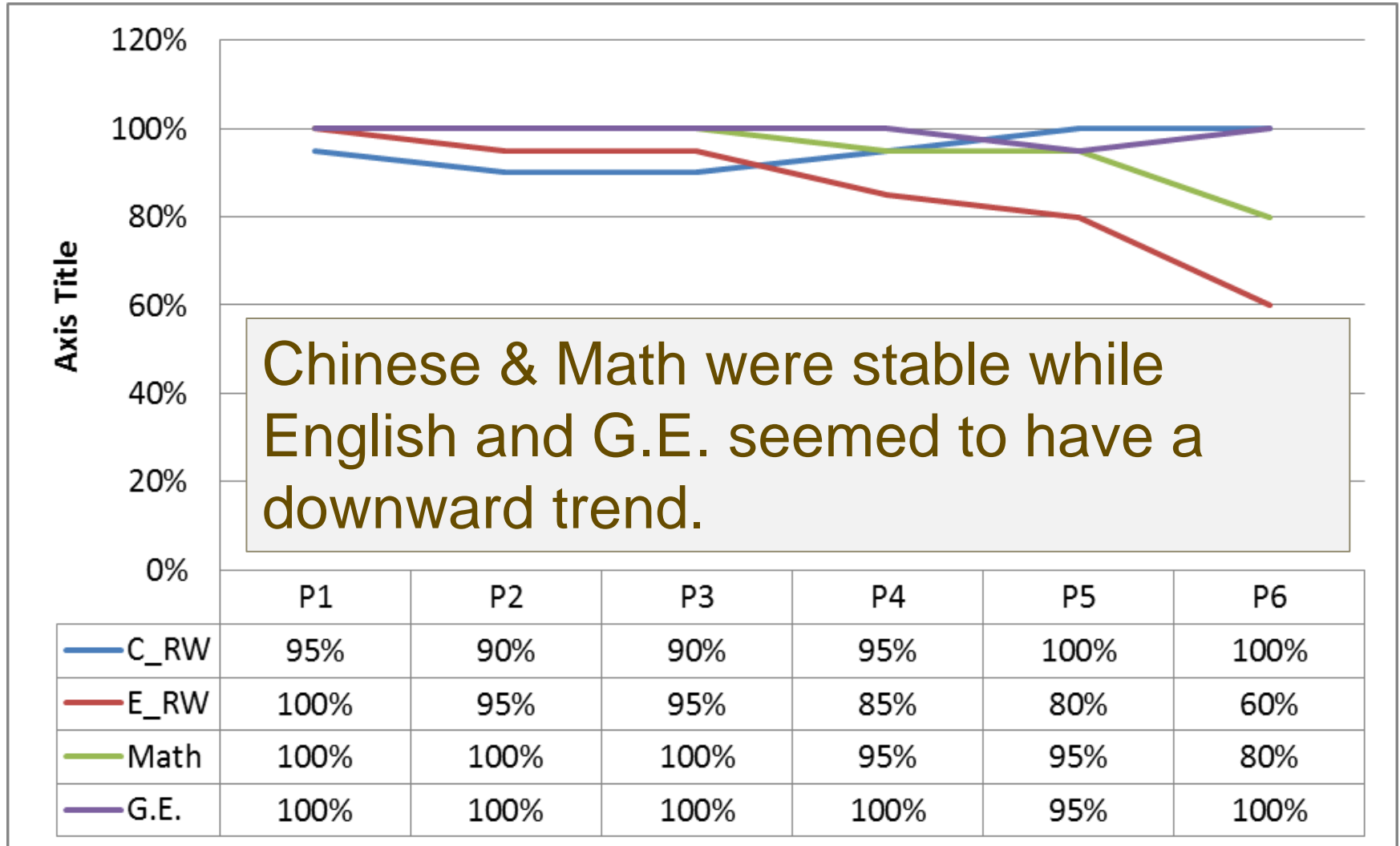
Based on a Standardized Attainment Test “LAMK”  
developed by the Education Bureau

Grade Level Achieved at Grade 6	Chinese (n=24)	English (n=24)	Math (n=24)
Grade 4 or Above	22	24	22
< Grade 4	2	0	2
Median	Grade 5	Grade 6	Grade 6

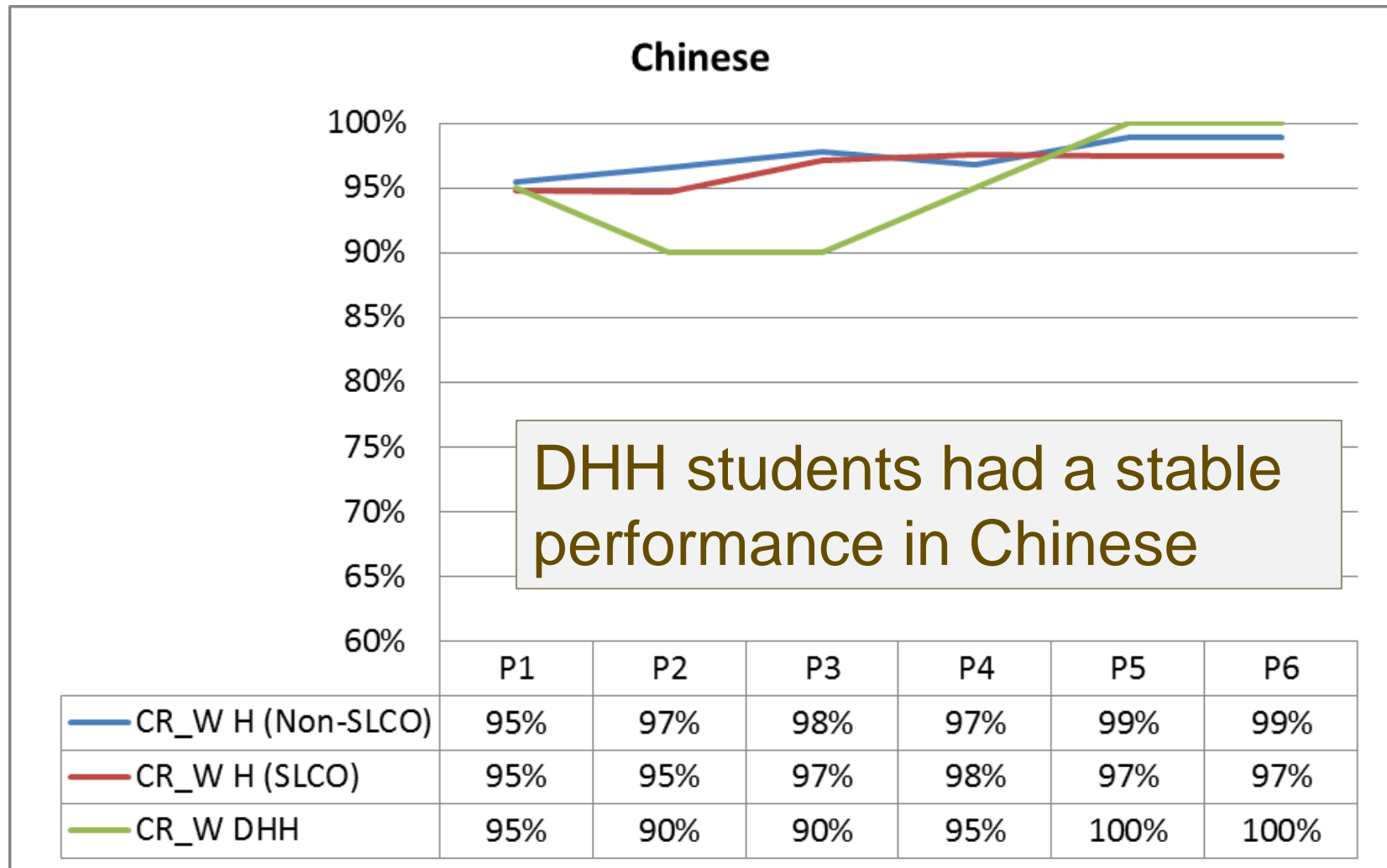
Taking away results of 4 DHH+ cases, all  
students were graduated at  $\geq$ Grade 4.



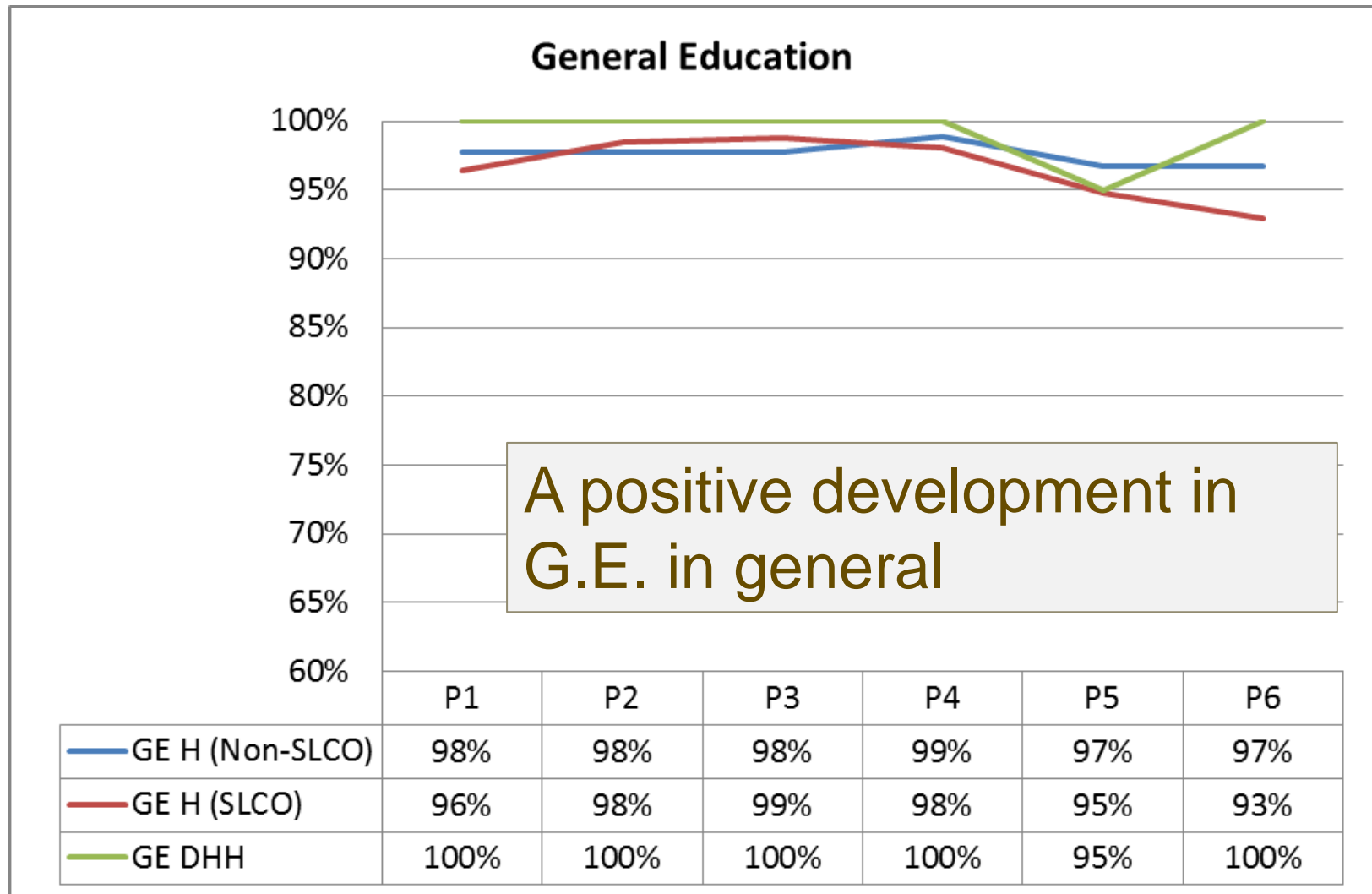
# The trend...



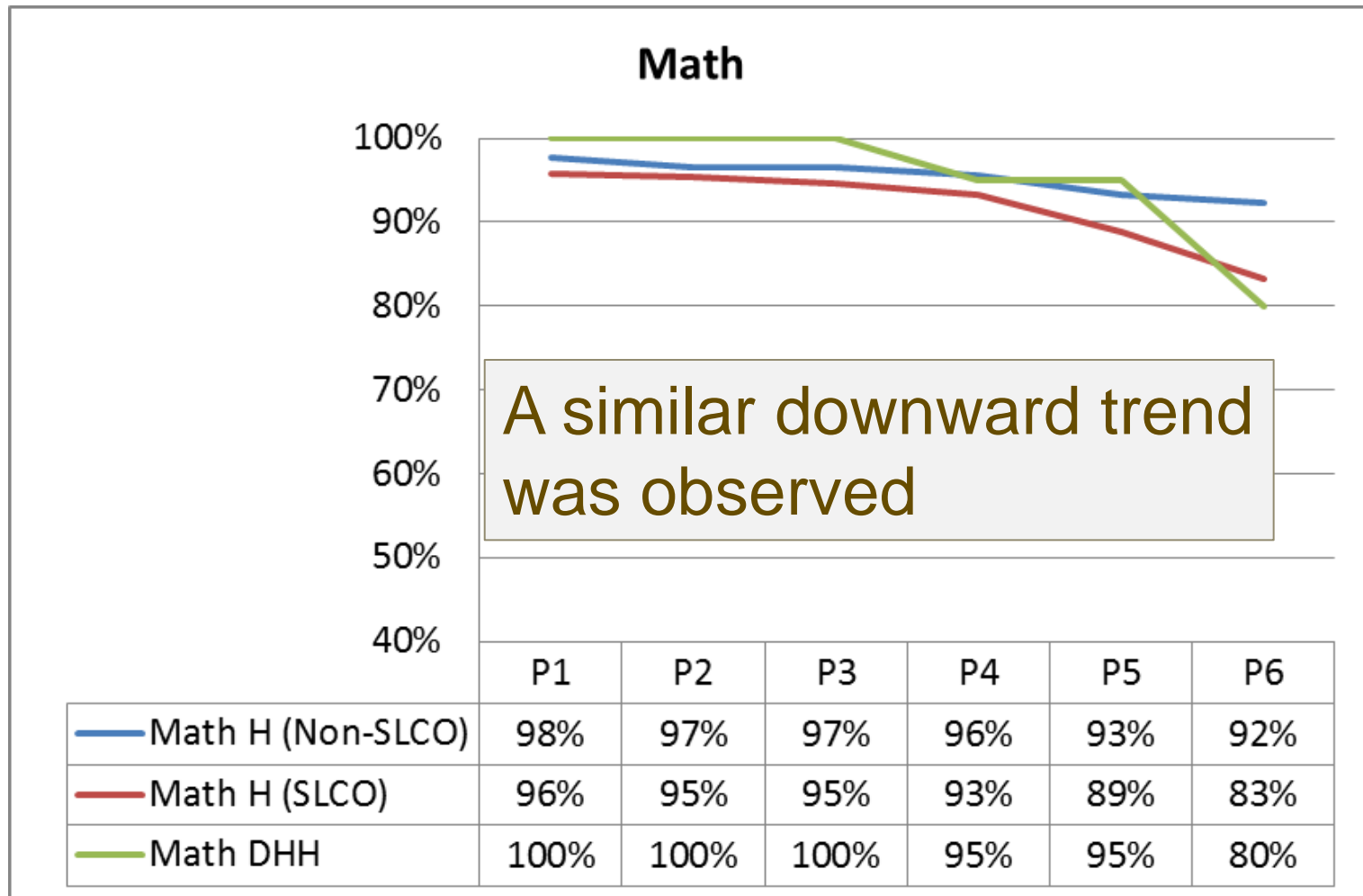
# When compared to their hearing peers...



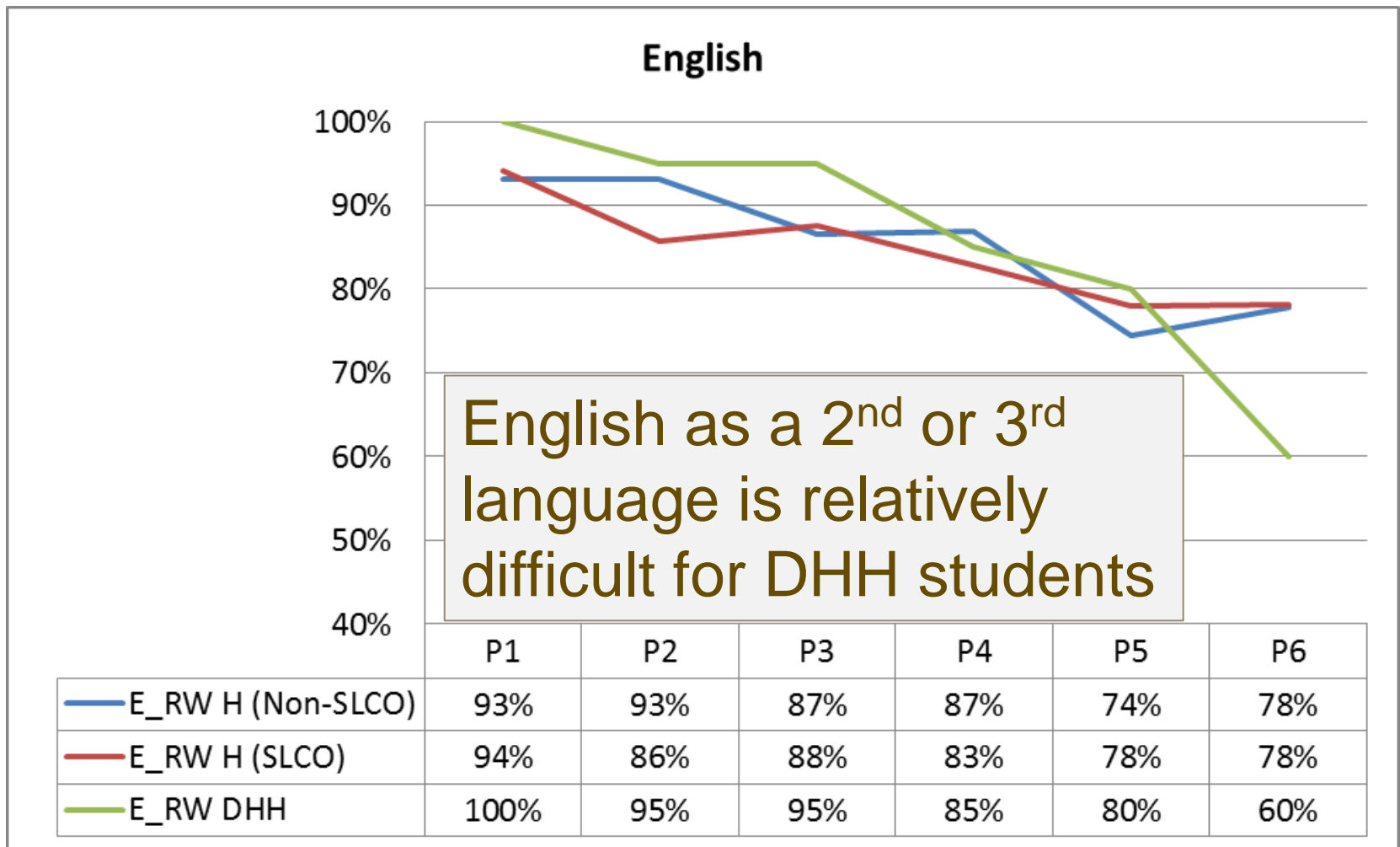
# When compared to their hearing peers...



# When compared to their hearing peers...



# When compared to their hearing peers...



# Further investigations required

- Comparing passed percentages of DHH and hearing students can only provide a very general trend.
- To determine if hearing status is a factor, further statistical analysis was conducted.
- Other possible factors that may affect classroom academic status of DHH students was also explored based on longitudinal academic data.

# Research questions:

- Do DHH and hearing students perform differently in their overall academic performance in school examinations?
- What is the effect of classroom participation on students academic performance?
- Is speech perception a better predictor of academic performance than their degree of hearing loss?

# Subjects

- Academic data from **534 students** were collected from the school from 2007 to 2016.
- All of the students, no matter DHH or hearing, had **completed their 6-year primary education** at the school during the aforementioned period.
- **24 DHH students**, out of which:
  - 21 (87.5%) were having severe to profound loss.
  - 4 deaf students (16%) were born to deaf parents, others (n=14, 84%) born to hearing parents.



# Subjects

- All, except 2 students, (n=22; 91.7%) were having severe to profound hearing loss : one was having mild-to-moderate loss and other unilateral hearing loss.
  - **13 (54.2%)** students were using cochlear implants (all implanted at < aged 3 except one at aged 6.5);
  - **10 (41.7%)** were using hearing aids.
- 4 students were having secondary disabilities or special educational needs like Attention Deficit and Hyperactivity Disorder (ADHD) or intellectual disability.

# Subjects

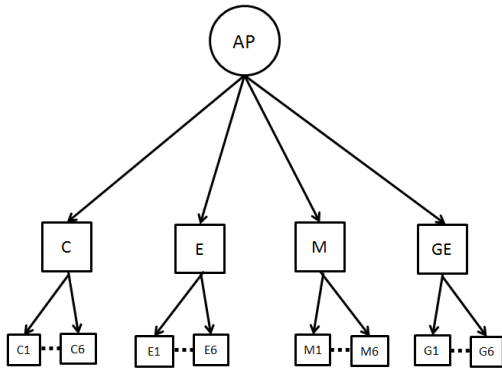
- For the 510 hearing students:
  - 83 of them (16.2%) had at least four years of SLCO experience (SLCO-H).
  - Others (n=427; 83.8%) were mainly studying in the regular classrooms (Non-SLCO-H).

Cohort	Year of Study	Students (No.)			
		DHH	SLCO-H	Non-SLCO-H	Total
Cohort 1	2007-2013	6	21	114	141
Cohort 2	2008-2014	6	23	112	141
Cohort 3	2009-2015	6	19	96	121
Cohort 4	2010-1016	6	20	105	131
Total:		24	83	427	534

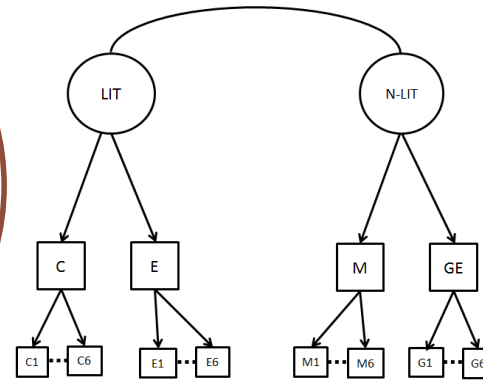
# Academic Performance (AP)

- In order to examine the classroom academic status of DHH students in the SLCO Programme from P1-P6, school examination data for different subjects were collected.
- The z-scores were calculated based on their school examination results and were used for statistical analysis.
- A Confirmatory Factor Analysis (CFA) using MPlus Version 7.2 (Muthen & Muthen, 1988-2014) was then conducted - a one-factor model is adopted for AP. Scores of individual subjects were thus analyzed together as one variable.

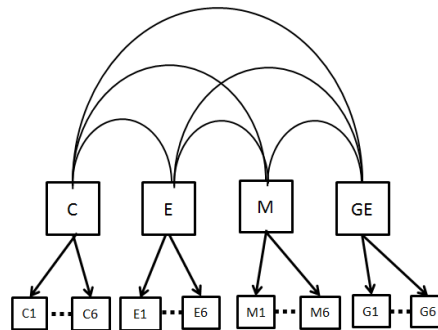
One-factor Model for AP



Two-factor Model for AP



Four-factor Model for AP



**Figure 1: Three possible models for AP of the students in the SLCO Programme.**

# Speech Perception (CANTIT)

- “In tone languages such as Cantonese, a change in tone denotes a change in lexical meaning” (Lee, van Hasselt, & Tong, 2010, p.1079).
- The 30-item Cantonese Tone Identification Test (CANTIT; Lee, 2012) was used to assess DHH students’ tone perception ability.
- Each item scored one mark, the maximum total is 30 and the minimum is 0.

# Classroom Participation Questionnaire (CPQ-HK)

After reviewing the psychometric properties of the CPQ (Antia, Sabers, & Stinson, 2006), some modifications was done to enhance the reliability of the instrument for both DHH and hearing students in the mainstreamed settings.

- A 48-item 4-point rating scale, composed of 2 domains:
  - a) Cognitive domain
  - b) Affective domain
- The original questionnaire lacked of more difficult items (that represent higher level participation of students). New items were included to provide a wider range of items.
- The scale was then re-assessed again on its psychometric properties through Rasch Analysis.

# Hearing Status & Degree of Hearing Loss

- The degree of hearing loss was defined according to the assessment results from professional audiologists. There are 4 categories classified according to students' hearing loss:
  - 0=normal (N);
  - 1=Hard-of-hearing (HH) (from mild to moderately-severe loss);
  - 2=Deaf (D) (from severe to profound loss);
  - 4=Deaf with secondary disability (D+)

## Results: Is Hearing Status a factor?

One-way ANOVA result found that there were major group difference on overall academic scores among students with different hearing status ( $F=31.78$ ,  $df=3203$ ,  $p<.005$ ).

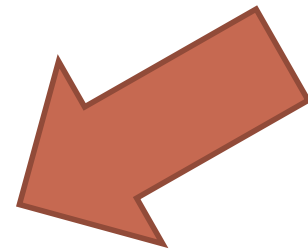
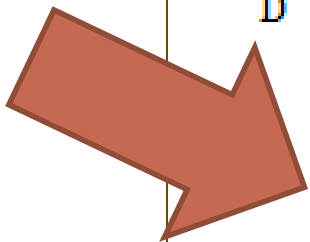
Results of the Tuckey HSD post-hoc test indicate that there were differences in academic z-scores among the four sub-groups.



**Table 3: Results of ANOVA and Post-hoc Tests on AP and Individual Subjects**

		H	HH	D
HH	AP	-0.062		
	C	0.0546		
	E	-0.313		
	M	0.302		
	GE	-0.291		
D	AP	0.324**	0.386	
	C	0.497**	0.443	
	E	0.176	0.490	
	M	0.217**	-0.848	
	GE	0.406**	0.697	
D+	AP	1.492**	1.554**	1.168**
	C	1.837**	1.783**	1.340**
	E	0.856**	1.170**	0.680*
	M	1.518**	1.217**	1.301**
	GE	1.758**	2.049**	1.352**

The difference was significant between H & D/D+, but not significant between H & HH.



# Results: Does CP associate with AP?

- In order to test on the relationships between CP and AP, a MIMIC model was used to examine if “Hearing Status (HS)” and “Speech Perception (SP)” have any effects on either AP or CP.
- Results showed that **CP was highly correlated with AP**, indicating that better classroom participation of students may lead to better academic performance in school.

# Results of Regression Analysis

<i>Variables</i>		<i>Estimates</i>	<i>S.E.</i>	<i>Estimates/S.E.</i>	<i>p-value</i>
AP	ON				
CP		0.300	0.087	3.466	0.001**
SP		0.077	0.149	0.519	0.604
HS		-0.169	0.147	-1.150	0.250
CP	ON				
SP		0.241	0.293	0.822	0.411
HS		0.016	0.228	0.071	0.944

When longitudinal data was considered, regression results indicated that Speech Perception (SP) and Hearing Status (HS) did not predict either AP or CP of the students.

# Classroom Participation & AP

- Results indicated that:
  - Students' self-perceived classroom participation associate well with their academic performance.
  - By reducing barriers of communication and participation through bimodal bilingual instructions in class, it helps promote more active involvement of DHH students in class – that may reduce the barriers arisen from deafness or their limited speech perception ability, and that may eventually bring to positive academic progress.

STUDY 3:

ACADEMIC PERFORMANCE  
IN JUNIOR SECONDARY EDUCATION

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# Academic Performance of DHH Students compared to their hearing peers (S1-S3)

- No standardized assessments available at the secondary level of education in HK.
- By using Item Response Analysis (Rasch, 1960), students' responses to all individual items were considered in projecting students' ability.
- The performance of DHH and hearing students in Chinese, English and Maths was compared with students at the same grade.

# Subjects

- 17 DHH and 244 hearing students in the secondary SLCO Programme were included in the analysis.
- 14 students were having severe to profound hearing loss, out of them 9 were using cochlear implants, 5 were using hearing aids.
- 1 student is having unilateral hearing loss, another is having mild loss.

# Analysis

- Examine the psychometric properties of the examination papers of the school using the Rasch model (Rasch, 1960)
- Evaluate the effectiveness of the papers in terms of reliability, dimensionality of the scale, and fitness of items.



Items	Student A	Student B	Difficulty (0-10)
Item 1	√		2
Item 2	√		2
Item 3	√	√	5
Item 4	√	√	2
Item 5		√	8
Item 6		√	6
Item 7	√	√	2
Item 8			10
	50%	50%	

# Academic Performance in Wright Map

Item Difficulty

Person Ability

M=MEAN

MEASURE ITEM - MAP - PERSON											
	<rare>	<more>									
5	XXX										
4											
	X	T									
3	X										
		T									
	XX										
2	X		3A04								
			3A01	3A25							
	XX		3A12								
	X	S									
	XX		3A24D	3A31	3B30						
	X		3A32	3B15							
1		S	3A03	3A21	3B04						
	X		3A02	3A06	3A11	3A16D	3A20	3A28	3A29	3A30	
			3C10								
	XX		3A07	3A09	3A26	3B02	3B14	3C11	3C26		
	XX		3A10	3A14	3A15	3A27	3B03	3B19	3C25		
	X		3B07	3B22	3B24	3B25	3C31				
	XX		3A13D	3B23	3B31	3C03	3C21	3C24			
0	XXXXXX	M	3A05D	3A17	3B08	3C01					
	XXXXXXXX		3A18	3A22D	3B05	3B16					
	XX	M	3B01	3B13							
	XXXXX		3A08	3A19	3B11	3B17	3B20	3C12	3C15		
	XX		3C14	3C30							
	X		3A23D								
-1	XXXX		3C28								
	XX		3B12	3B29	3C06						
			3B10								
	XX	S	3B28	3C09	3C27						
	XX		3B09	3C02	3C05	3C20					
-2	X	S									
	XXX		3C04	3C17	3C18	3C29					
	XXX										
	X		3C22	3C23							
	X		3C07								
-3	X		3C08	3C16							
			3B18	3B21	3C13						
		T									
			3B27	3C19							
-4			3B26								
			3B06								

DHH

# Assessing the Psychometric Properties of Exam Papers

Grade	Subject	Reliability	Reliability after clearance of Outfit Items	Dimensionality				Fitness	
				Explained Variance	Eigenvalue	2nd largest dimension (variance)	Eigenvalue	No of Outfit items (MNSQ >2)	Total No. of Items
S1	Chinese	0.9	0.9	42.9%	60.1574	4.2%	5.8548	1	80
	English	0.94	0.95	48.4%	61.9632	5.4%	6.8545	6	70
	Maths	0.91	0.91	40.6%	56.7577	5.3%	7.4754	4	72
S2	Chinese	0.88	0.88	31.8%	32.6633	5.3%	5.4074	3	71
	English	0.94	0.95	39.4%	42.2408	5.5%	5.9301	7	66
	Maths	0.9	0.9	42.4%	60.4204	5.0%	7.1335	3	68
S3	Chinese	0.88	0.89	54.6%	86.7154	3.0%	4.8110	1	83
	English	0.96	0.97	44.3%	54.1139	3.6%	4.3365	1	84
	Maths	0.92	0.92	48.5%	80.1080	2.5%	4.0553	3	85

The reliability, dimensionality and item fitness of the exam papers were checked and confirmed that Rasch analysis was appropriate.

# Comparing Persons Ability of DHH & H

Subject	Grade	H			DHH			<i>t</i>
		N	M	SD	N	M	SD	
Chinese	S1	74	-0.358	0.507	5	-0.116	0.238	-1.056
	S2	82	-0.054	0.556	6	0.205	0.288	-1.124
	S3	88	0.428	0.530	6	0.048	0.126	1.746
English	S1	74	0.131	1.290	5	0.638	0.500	-1.883
	S2	82	-0.321	1.290	6	0.623	0.826	-1.761
	S3	88	-0.452	1.821	6	<b>0.588</b>	0.532	<b>-3.574*</b>
Math	S1	74	0.184	1.111	5	0.750	0.653	-1.122
	S2	82	-0.678	1.062	6	<b>0.375</b>	0.808	<b>-2.373*</b>
	S3	88	0.050	1.154	6	0.127	0.289	-0.161

\*  $p < .05$

# Secondary 1

## Chinese

## English

## Mathematics

Chinese										English F1										Mathematics									
MEASURE										ITEM - MAP - PERSON										MEASURE									
<rare>   <more>										<rare>   <more>										<rare>   <more>									
2	X									3	XX	+	1A23							4	+								
	X												1A08																
	X										XX		1A12	1A32	1B02					3	+								
	X										T		1A05	1A15															
	XXXX												1B18																
1	X	+	1A18										1A16	1A17	1A22														
	XXXXXX	S											1A13	1A14															
	XX										XX	S	1A24D																
	XX										X		1A27																
	XXXXX	T									X		1A09	1A30	1C21														
	XXXXX										X		1A31	1B03															
0	XXXXX	S	1A02D	1A05	1A16	1A23	1A32			1	XXX	S+	1A07																
	XXXX	M+	1A08	1A10	1A14	1A24D	1A28	1A31	1B08		X		1A21																
	XXXXXX		1A04	1A06	1A09	1A15	1A19D	1A20	1A25	1B01	X		1B11	1B21															
	XXXXXXXXXXXX		1B03	1B05							XXXX		1A03D	1A11	1A26D														
	XXXXXXXXXXXX		1A01	1A07	1A12	1A17	1A26D	1A27	1A30	1B10	XX		1A04	1B16															
	XXXXXXXXXX		1B12	1B17	1B23	1C16					XX		1A06	1A20	1C13														
	XXXXXXXXXX	M	1A03D	1A11	1A13	1A22	1A29	1A30	1B14	1B16	XXXXX	M	1A01	1A10	1A19D	1B17	1B20												
			1C10										1B05	1C07															
			1B02	1B04	1B09	1B13					XX		1A28	1C05															
			1B11	1B19	1B24						XXXX		1B01	1B10	1C18														
			1B15	1C06	1C08						XX																		
-1			1B20	1C02							X		1C03	1C04															
			1C01	1C15							XXXX		1B04	1B19															
			1C07	1C11							X		1C15	1C20															
			1B18	1C17							S+		1A29	1C01															
											X	S	1B14	1C06															
											XX		1B09	1B23															
											X		1A25																
											XXXX		1B06	1C10	1C23														
											XX		1C11																
													1B15	1C12	1C22														
													1C08																
														1C17															
											X	T																	
-3													1C09																
<freq>   <less>																													

MEAN

# Secondary 2

# Chinese

# English

## Mathematics

										Math F2																					
										MEASURE ITEM - MAP - PERSON																					
										<rare> <more>																					
2	XX	+								3	X	+	2B11							2	XX	+									
	T										X	+									X	T	+	2A24D							
	X																				XX	T									
	X																														
1	XX	+	2A18							1	XXXX	S	+	2A09 2A15							0	XXXX	M	+	2A02 2A03 2A04 2A05 2A06 2A07 2A08 2A09 2A10 2A11 2A12 2A13 2A14 2A15 2A16 2A17 2A18 2A19 2A20 2A21 2A22 2A23 2A24 2A25 2A26 2A27 2A28 2A29 2A30 2A31 2A32 2B01 2B02 2B03 2B04 2B05 2B06 2B07 2B08 2B09 2B10 2B11 2B12 2B13 2B14 2B15 2B16 2B17 2B18 2B19 2B20 2B21 2B22 2B23 2B24 2B25 2B26 2B27 2B28 2B29 2B30 2B31 2B32 2C01 2C02 2C03 2C04 2C05 2C06 2C07 2C08 2C09 2C10 2C11 2C12 2C13 2C14 2C15 2C16 2C17 2C18 2C19 2C20 2C21 2C22 2C23 2C24 2C25 2C26 2C27 2C28 2C29 2C30 2C31 2C32 2C33 2C34 2C35 2C36 2C37 2C38 2C39 2C40 2C41 2C42 2C43 2C44 2C45 2C46 2C47 2C48 2C49 2C50 2C51 2C52 2C53 2C54 2C55 2C56 2C57 2C58 2C59 2C60 2C61 2C62 2C63 2C64 2C65 2C66 2C67 2C68 2C69 2C70 2C71 2C72 2C73 2C74 2C75 2C76 2C77 2C78 2C79 2C80 2C81 2C82 2C83 2C84 2C85 2C86 2C87 2C88 2C89 2C90 2C91 2C92 2C93 2C94 2C95 2C96 2C97 2C98 2C99 2C100						
	XX	S	2B11								XX	X		2A15 2A18 2A29								XXXX	S	+	2A06 2A12 2A13 2A19						
	XXX		2A09 2B17								X			2B08 2C27								XXXX	S	+	2A21 2A22D 2A24D 2A25D 2A26 2A27 2A28 2A29 2A30 2A31 2A32 2B01 2B02 2B03 2B04 2B05 2B06 2B07 2B08 2B09 2B10 2B11 2B12 2B13 2B14 2B15 2B16 2B17 2B18 2B19 2B20 2B21 2B22 2B23 2B24 2B25 2B26 2B27 2B28 2B29 2B30 2B31 2B32 2C01 2C02 2C03 2C04 2C05 2C06 2C07 2C08 2C09 2C10 2C11 2C12 2C13 2C14 2C15 2C16 2C17 2C18 2C19 2C20 2C21 2C22 2C23 2C24 2C25 2C26 2C27 2C28 2C29 2C30 2C31 2C32 2C33 2C34 2C35 2C36 2C37 2C38 2C39 2C40 2C41 2C42 2C43 2C44 2C45 2C46 2C47 2C48 2C49 2C50 2C51 2C52 2C53 2C54 2C55 2C56 2C57 2C58 2C59 2C60 2C61 2C62 2C63 2C64 2C65 2C66 2C67 2C68 2C69 2C70 2C71 2C72 2C73 2C74 2C75 2C76 2C77 2C78 2C79 2C80 2C81 2C82 2C83 2C84 2C85 2C86 2C87 2C88 2C89 2C90 2C91 2C92 2C93 2C94 2C95 2C96 2C97 2C98 2C99 2C100						
	XXX		2A13 2A15 2A29 2B08 2B26 2C08								X	S	+	2A16 2A28D 2A31 2B09								XXXX	S	+	2A04 2A18 2B20 2C24						
	XX	S	2A22D								XX	X		2A17 2B15 2A19 2A25D								XXXX	M	+	2A02 2B25 2A10 2A14 2A25D 2A27D 2A29 2A31 2A32 2B08						
	XXX		2A02 2A03 2A08 2A10 2A12 2A16 2A28D 2A31 2B09								XX	X		2A06 2A08 2A12 2A19 2A25D								XXXX	M	+	2A02 2B25 2A10 2A14 2A25D 2A27D 2A29 2A31 2A32 2B08						
	XXX		2B10 2C02 2C24 2C26 2A28D 2A31 2B09								XX	X		2A06 2A08 2A12 2A19 2A25D								XXXX	M	+	2A02 2B25 2A10 2A14 2A25D 2A27D 2A29 2A31 2A32 2B08						
	XXX		2A04 2A07 2A11 2A20 2A24D 2A25D 2A26 2A30 2B18								XX	X		2A06 2A08 2A12 2A19 2A25D								XXXX	M	+	2A02 2B25 2A10 2A14 2A25D 2A27D 2A29 2A31 2A32 2B08						
	XXXX		2C01 2C11 2C27								XX	X		2A06 2A08 2A12 2A19 2A25D								XXXX	M	+	2A02 2B25 2A10 2A14 2A25D 2A27D 2A29 2A31 2A32 2B08						
	XXXX		2A01 2A06 2A14 2A27D 2A32 2B27 2C03 2C16								XX	X		2A06 2A08 2A12 2A19 2A25D								XXXX	M	+	2A02 2B25 2A10 2A14 2A25D 2A27D 2A29 2A31 2A32 2B08						
	XXXX	M	2A21 2A23 2B16 2B25 2C04 2C10 2C08								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17						
	XXXX		2A17 2A19 2B04 2B05 2B06 2B12 2B20 2B24 2C06								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17						
	XXXX		2C15 2C23 2A05D 2B22 2C05 2C12 2C20								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17						
	XX		2B21 2C09 2C10 2C12 2C20								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17						
	XX		2B13 2B23 2C14								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17						
	XX	S	2B02 2C07 2C17 2C22								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17						
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	XX	S	2B01								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17						
	XX	+	2B15 2C18 2C21 2C25								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17						
	XX	T	2B03 2B19								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17						
	X		2B07								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17						
	XX										XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17						
	X										XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17						
	X	T									XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17						
-2		+	2B14								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17						
	<freq>	<less>									XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17								XXXX	M	+	2A01 2A07 2A10 2A21 2B19 2C17						
										<freq> <less>																					
										<freq> <less>																					

# Secondary 3

## Chinese

## English

## Mathematics

MEASURE ITEM - MAP - PERSON									
<rare>   <more>									
2	X	T	3A28						
			3A04						
	X	T	3A19	3A25	3A27	3B24			
1	XX	+	3B11						
	X	S	3A01	3A02	3A31	3A32	3B13	3C03	3C11
	XX		3A08	3A12	3A30	3B30	3C27	3C31	
	XXXX		3A03	3A18	3B29	3C19			
	XXXX		3A18	3B02	3B07	3B18	3B19	3C02	3C28
	XXXX	S	3A09	3A10	3A20	3A26	3B04	3B23	3B31
			3C20						3C30
			3A11	3A15	3A29	3B01	3B12	3B21	3B22
			3C29						3B28
	XXX	M	3B06	3B15	3B25	3C01	3C05	3C07	3C09
									3C17
	XXX		3A07	3A14	3B03	3B08	3B14	3C14	3C25
	XXX		3A06	3A22d					
	XX		3A05d	3B20	3C23				
			3C15						
			3A13d	3A23d	3C06	3C21			
			3A16d	3A24d	3B26	3B27	3C10	3C26	
			3A17	3B09	3C12				
			3B17						
			3B16						
	XX	S							
	X	T	3B05						
	XX		3C08						
	XX		3B10						
	X								
	X								
	T								
	XX								
			3C04	3C22					

4	XX	+							
3	X	T	3A04						
	X		3A29						
	XX		3B02	3B04					
	XX		3A11	3A32					
2	X	+	3A30						
			3A12	3A18					
	XX								
	XXXX	S	3A01	3A06					
	X	S	3B30						
			3A20	3A24d	3A25				
1	XX	+	3A23d	3A26	3A28	3B15	3B16	3C11	
	X		3A02	3A05d	3A21	3A31			
	X		3A10	3A16d		3B22	3C21	3C31	
	XXXX		3A03	3A08					
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	XXXX		3A22d	3A27	3B01	3B24	3C01	3C24	3C26
0	XXX	M	3B03	3B13	3C10				
	XXXX		3B08	3C03	3C30				
	X		3A14	3A19	3B11	3B20	3C12		
	XXXX								
	X	+	3B17	3C06					
-1	XXXX		3B29	3C02					
	XXXX		3C14						
	XXXX	S							
	XX		3B12	3C28					
	X								
-2	X	+	3B21	3C27					
			3C08	3C15	3C20				
			3B09						
	XX		3B10	3C04					
	X		3C05	3C13					
			3B27	3C09	3C16	3C17			
-3	X	T	3B06	3C19					
	X								
			3B26	3C29					
		T	3B18	3C07	3C22				
-4		+	3C23						
-5		+	3C18						

3		+	3A04						
	X	T	3A21	3A32					
	X		3A28						
2	X	+							
	X		3A10	3B30					
	XXX								
	XXXX		3A31	3B04					
	XX		3A09	3A14	3A25				
	X	S	3A11	3A18	3A20	3B08			
1	XX	+	3B13	3B24					
	XXXX		3A29						
	XXXX		3A01	3A02	3A26	3C08	3C11	3C13	3C27
	XX		3A03	3A05d	3A30	3B25	3B31	3C31	
	XX		3A06	3A07	3A08	3A13d	3A19	3B01	3B14
	XXXX		3C24	3C29					3B23
			3A17	3A24d	3A27	3B02	3B06	3B11	3B21
	XXXX		3C28						3B22
0	XXXX	M	3A12	3A22d	3A23d	3B15	3B16	3C03	
	XX		3B05	3C17					
	XX		3A16d	3B07	3C10	3C15	3C16	3C25	3C26
	XXXX		3B03	3B27	3B29	3C20	3C21		3C30
	XXXX								
	XX		3B18	3B28	3C06	3C23			
-1	XX	+	3B12						
	XX	S							
	XXXX		3B20	3C01	3C09	3C14	3C19		
	XX		3C05						
	XX		3B17						
-2	X	+	3B26	3C22					
	X	T	3B09						
			3B10	3C07					
	X		3B16						
-3		+	3C04						
-4	X	+							
		<freq>   <less>							

MEAN

DHH

# Discussion

- DHH students' academic performance were, in general, comparable to the hearing students in the school.
- Some may have lower attainment- possible reasons may rest on delayed signed or spoken language development, which in most of the cases, also affect their academic development.



# Discussion

- Using normative assessment is a general practice to review DHH students' academic performance, however, reliable assessment tools may not be available at some circumstances
- By looking at their classroom academic status can also provide insights on their development as all students involved will be under the same or at least similar curriculum in school.

# Discussion

- To raise the reliability of the results, Item Response Analysis may be a good choice for within-school performance measures and comparisons.
- It may also inform the school and teachers more detailed information about the development of the students for further interventions.

# Aim of Inclusive education

- “One of the aims of integrated education is to help all students/teachers/parents **recognize, accept and respect individual differences**, and even **celebrate differences**. This serves as a driving force for personal growth and the development of an inclusive society.” (Education Bureau, 2008)
- How SLCO Programme may achieve this?

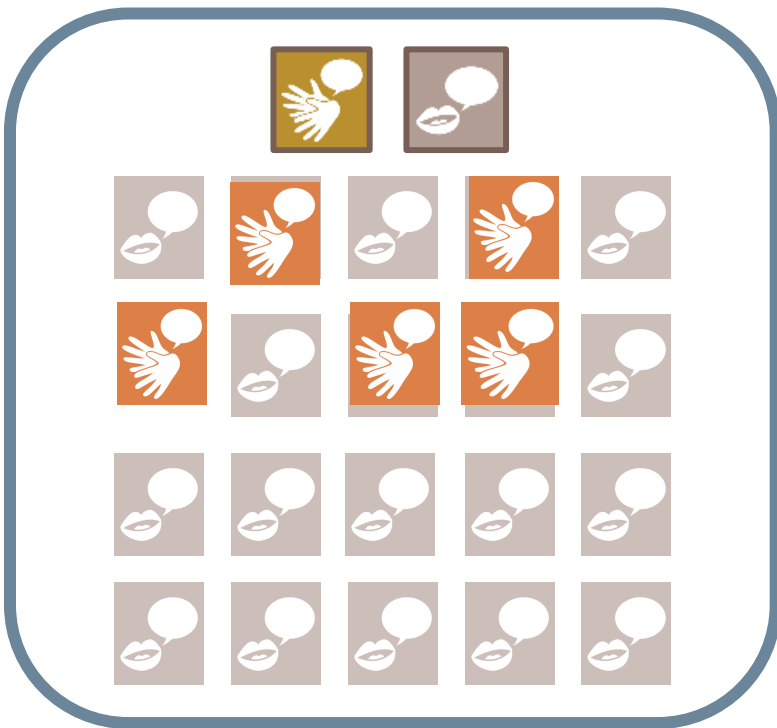
# Accepting individual difference

## 接納差異

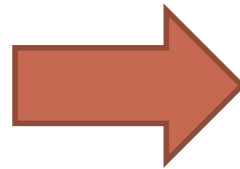
- There are different components in SLCO Programme that may foster active participation of DHH students in classroom and school activities at all times.
- It promotes **mutual acceptance and respect** of uniqueness and individual differences of each other.

# Reducing individual difference 減低差異

**Both deaf and hearing  
children become bilinguals**



Two-way  
Immersion



**\*\*AND it also reduces barriers to communication**

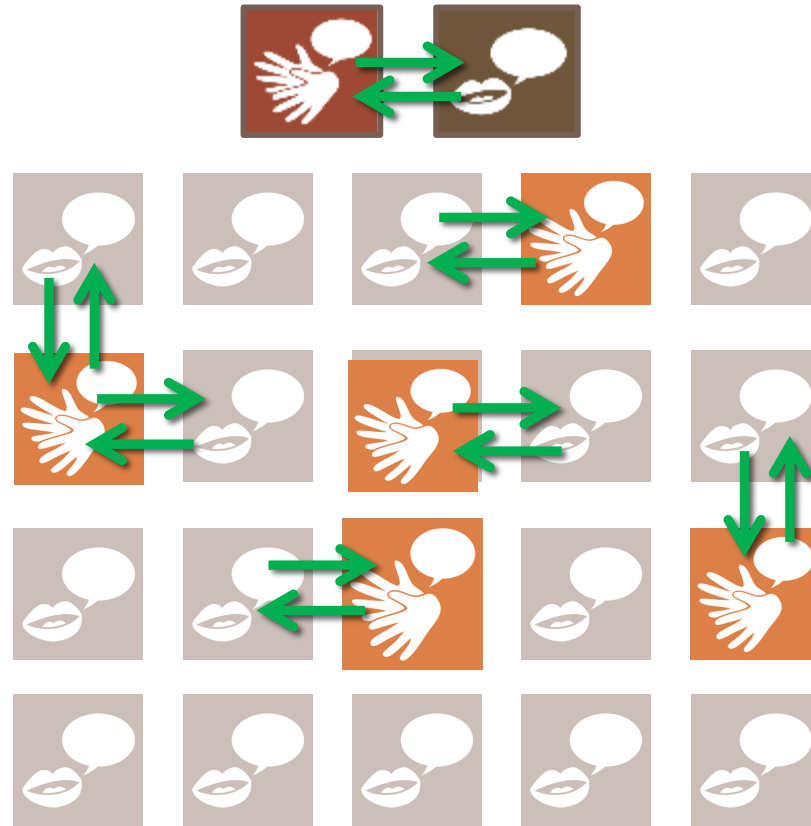
# Respecting individual difference

## 尊重差異

D & H teachers  
as models to  
D & H students

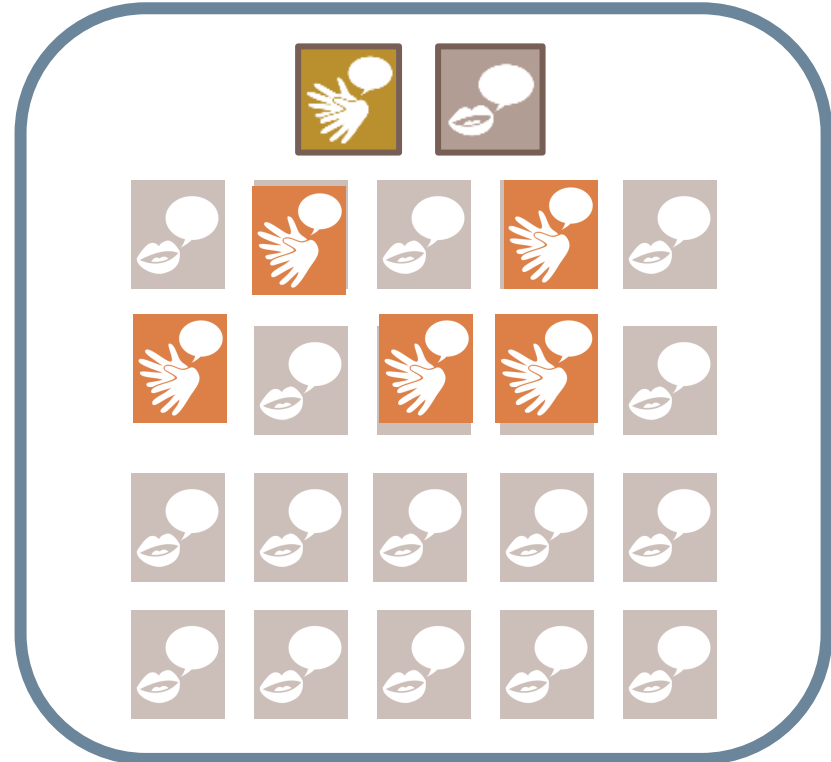
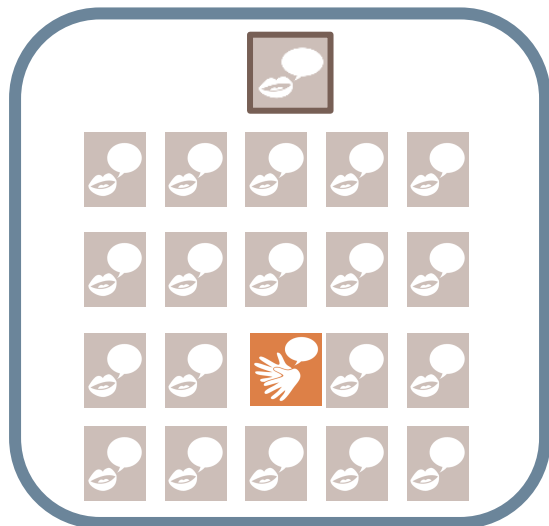
Students observe  
equal status  
between:

- D & H teacher
- SL and spoken language



# Recognizing individual difference

## 認識差異



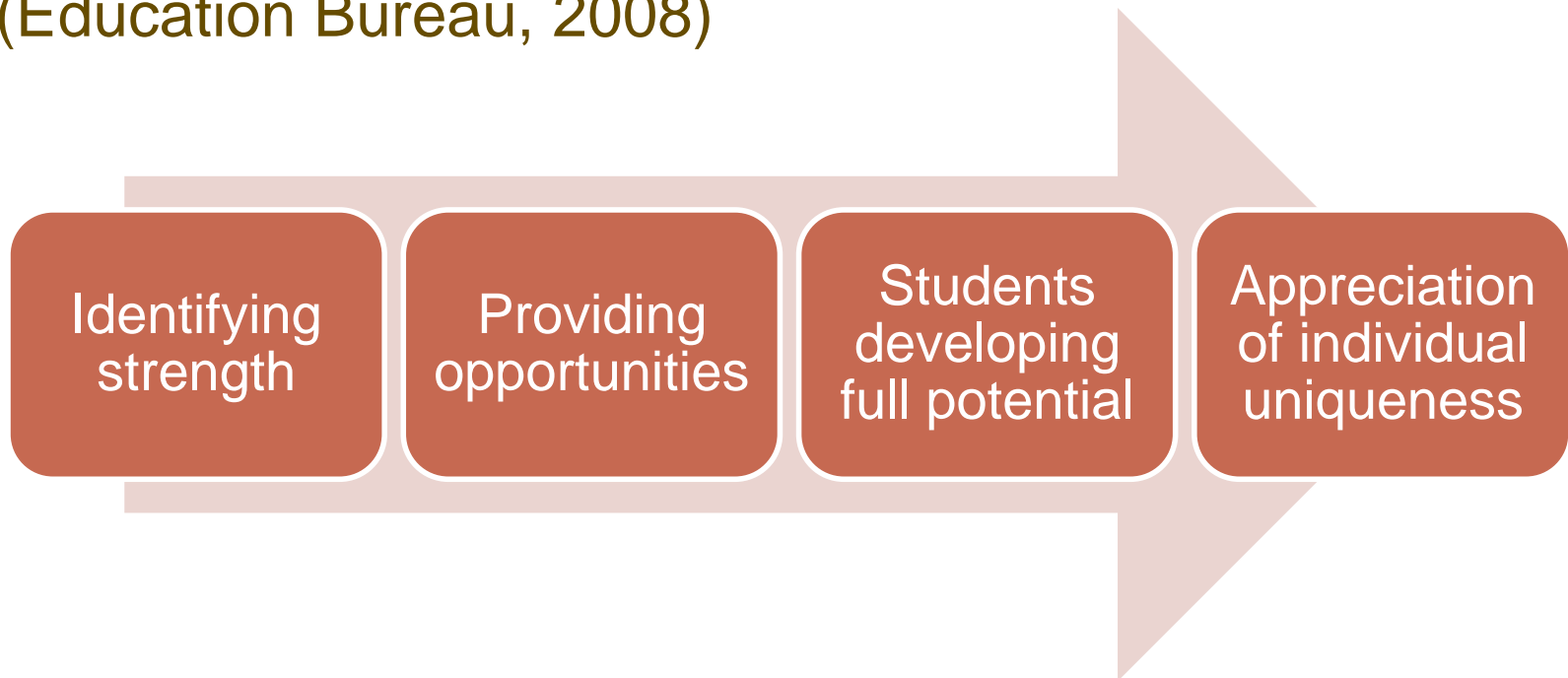
A critical mass of DHH students facilitates mutual understanding and support

# Appreciating individual difference

## 欣賞差異

Allowing development of full potential

- “...**every student has unique potentials** and the school should provide room for the students to **fully develop their multiple intelligence.**”  
(Education Bureau, 2008)





# Junior Sign Interpreters:

As a Bridge between DHH and hearing persons



P2 –P6 hearing students  
were selected as Junior  
Sign Language  
Interpreters



Taiwan PTS Sign Language news on Junior Sign Language Interpreters

# Conclusions

- By creating a language-rich environment that nurtures a community of bimodal bilingual users within a regular school environment, both DHH and hearing students make good use of the languages they possess to engage themselves in classroom learning and classroom interactions.
- The DHH students do not perform differently in their participation in classroom communication with their peers and teachers. Their communication is not limited by which mode(s) of communication they are using. And that eventually promote positive academic development.

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# Thank you!

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