

Normative data for tonal language speakers, FM systems and co-morbidity with reading disorders.

Current issues in auditory processing disorders:

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AUDITORY PROCESSING DISORDER

- Listening difficulties in the absence of clearly identifiable peripheral auditory deficit

There is no universally accepted diagnostic criteria for APD.

- ASHA (2005)
Poor performance in two or more tests within the APD battery
- American Academy of Audiology (2010)
Poor score in at least one ear on two or more APD tests
- British Society of Audiology (2011)
Failed at least two APD tests – one speech test and one non speech test

No universally agreed standard tests

- Speech-based
- Non-speech based
- Auditory evoked potential

APD TESTS In Multilingual Countries

- The need to develop Language-based tests in specific language/recorded in local accent
- Non-language –based tests
Can same normative values be adopted across languages?

Studies on Tonal language speakers

- Speakers of a tonal language have superior perceptual and categorization abilities for both linguistic and non-linguistic stimuli

Deutsch et al (2006), Krishnan et al (2009)

- Native speakers of a tonal language are better able to discriminate pitch interval

Research Question

- Do tonal language speakers need different normative data for Temporal Sequencing Tests?

Methods

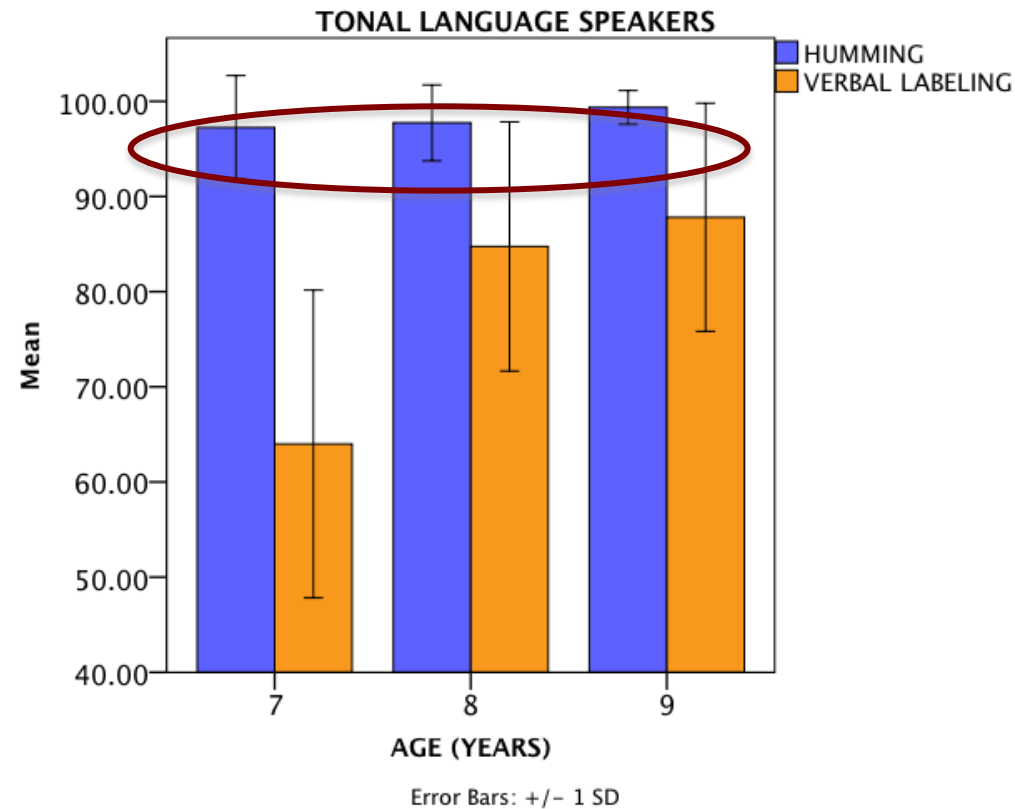
Participants

- 28 native Mandarin and 29 native Malay (7 to 9 years).
- Right-handed
- Pass hearing screening
- Do not play musical instruments

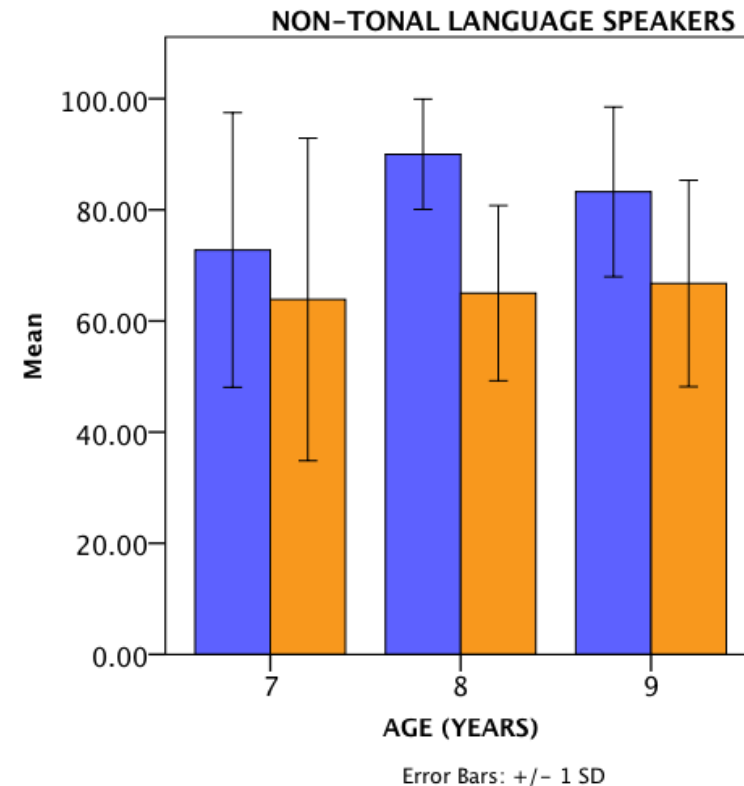
Research Procedure

- Digit Span Backward Test (DSBT)
- Pitch Pattern Sequence Test
Humming and linguistic labeling responses
- Duration Pattern Sequence Test
Humming and linguistic labeling responses

PPST Scores Of Tonal And Non-tonal Language Speakers

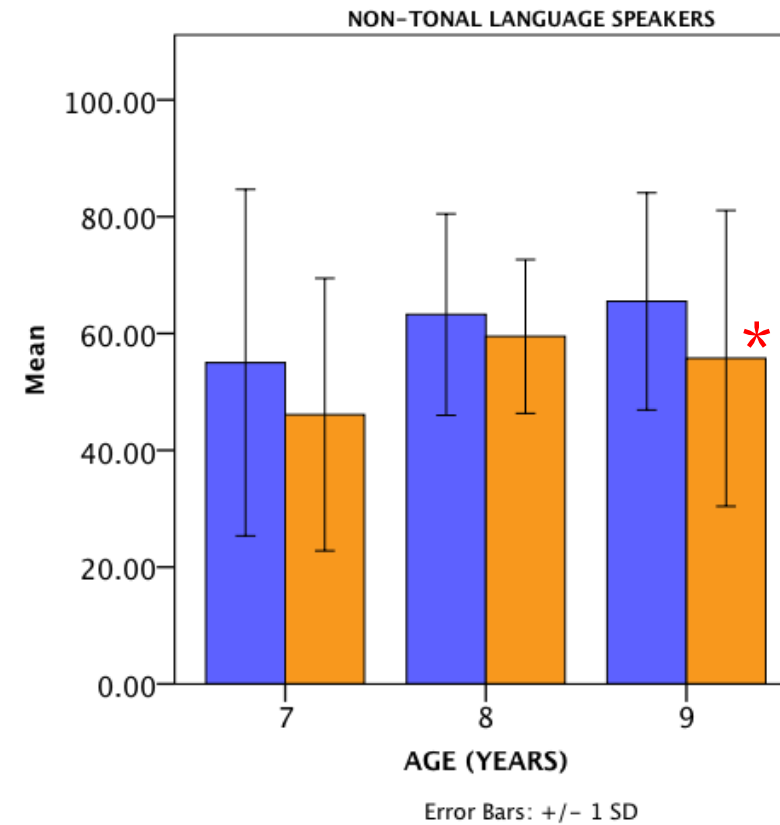
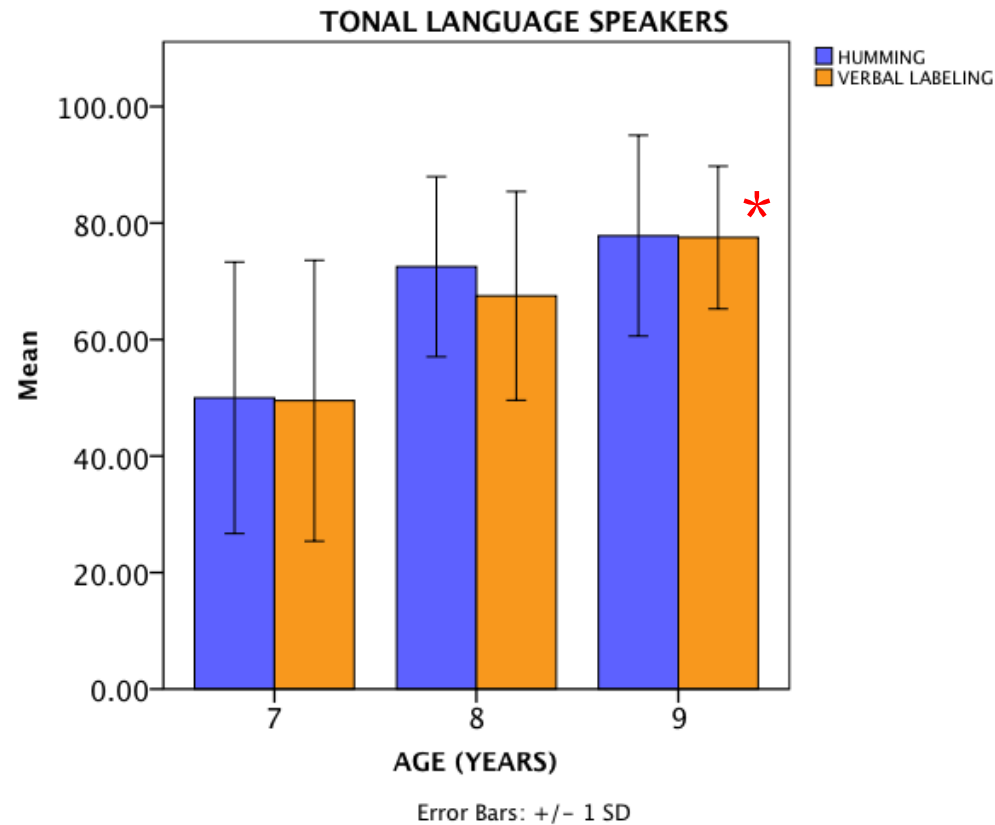


Tonal language speakers master humming response much earlier



Tonal language speakers had significantly higher scores in humming and verbal labeling than nontonal language speakers

DPST Scores Of Tonal And Non-tonal Language Speakers



No significant difference between groups ($p > 0.005$), except for 9 years old group*

Language Effect on PPST Scores

- Not all non-language based APD tests are resistant to the effect of language
- Different normative data should be used when interpreting PPST results of Tonal and non-tonal language speakers

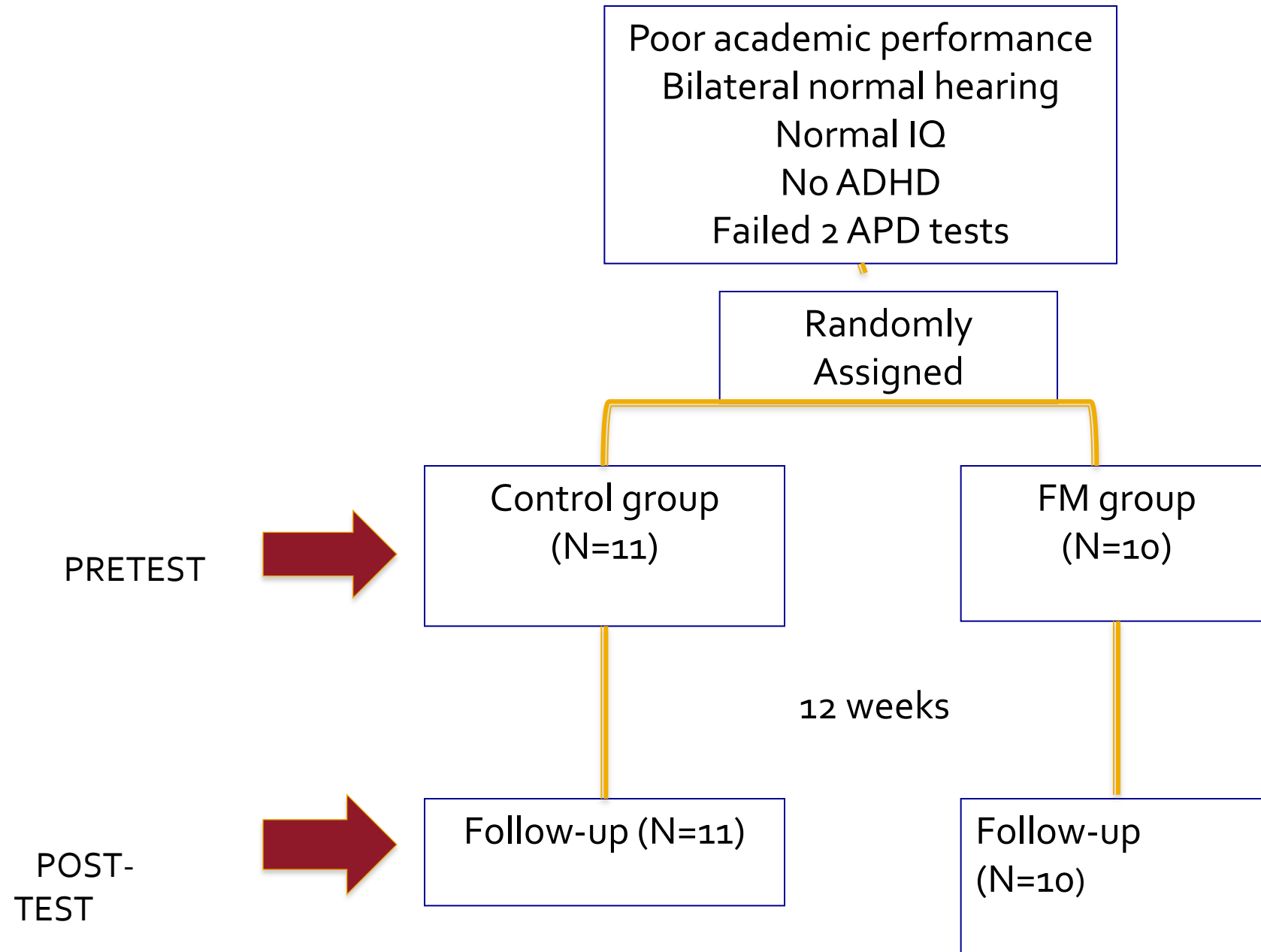
**FM SYSTEMS IMPROVE
AUDITORY PROCESSING AND ACADEMIC
PERFORMANCE IN CHILDREN WITH APD**

FM Systems

- Increase SNR of speaker of interest and provide a more stable acoustic input by reducing the interference by the background noise on speech sounds
- Improve sound quality and auditory attention lead to increase academic achievement, literacy, and phonological awareness

Question...

Will FM use improve cognitive and auditory processing abilities?



METHODS: Measures

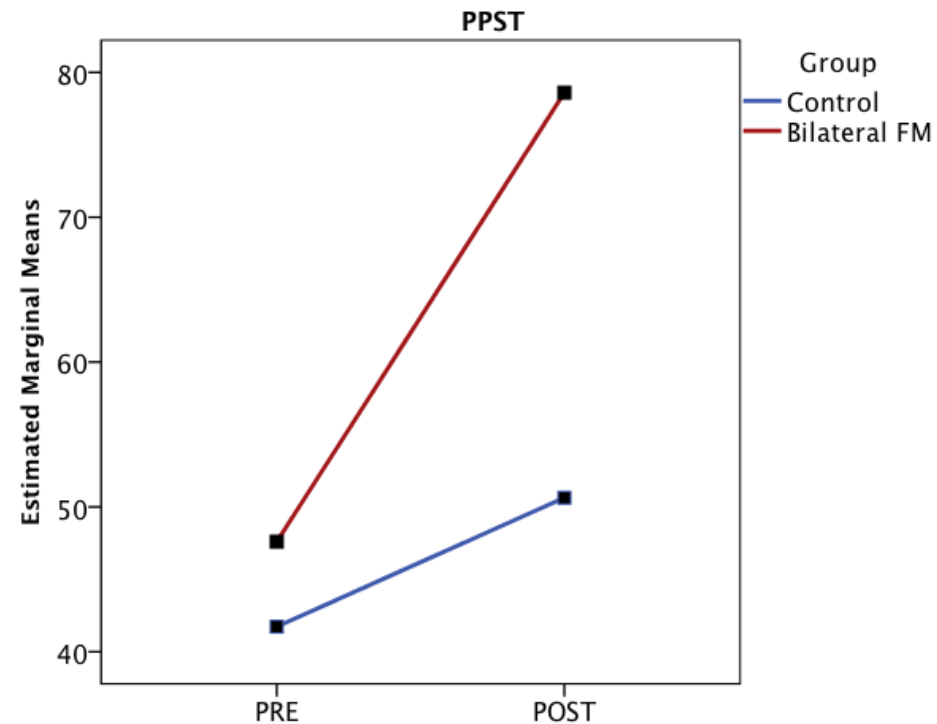
- Cognitive tests
 - Digit span forward
 - Digit span backward
- APD test
 - Dichotic digits test
 - PPST
- Classroom performance
 - Screening Instrument for Targeting Educational Risk (SIFTER)

Results

Tests	Between groups Pre-posttest difference
Digit span forward	✘
Digit span backward	✘
Dichotic Digits Test	
Right ear score	✘
Left ear score	✘
Pitch Pattern Sequence Test	✓
SIFTER	
Academic skills	✓
Communication	✓
Attention	✘
Classroom participation	✘
Behavior	✘

RESULTS: PPST

- Significant effect of condition (pre and post tests) $p=0.001$
- Significant interaction between condition and group ($p=0.039$)
- FM group had significantly greater improvement than control



RESULTS: SIFTER

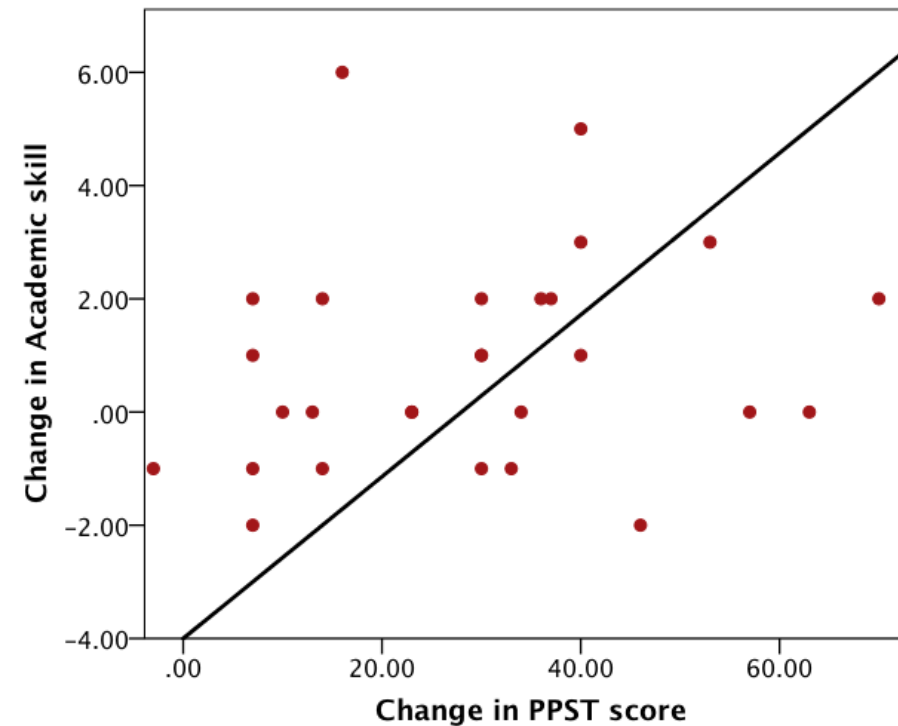
- FM group showed significantly greater improvements than control group in:

Academic skills ($p=0.02$)

Communication skill ($p = 0.018$)

RESULTS: RELATIONSHIP BETWEEN PPST AND SIFTER

- Δ PPST was significantly correlated with Δ SIFTER (Academic); $r = +.705, (p=0.000)$



Summary

- FM system did not affect measures of cognitive performance
- FM system improved PPST test scores, SIFTER (academic) and SIFTER (communication)
- Improvement in PPST score was positively correlated with SIFTER (academic) and SIFTER (communication)

Conclusions

- Benefits of FM systems are beyond providing better SNR.
- The findings suggest that increased auditory attention and sound quality from the use of FM systems may improve auditory processing ability and academic skill

Co-morbidity of Auditory Processing Disorder in
Children with Low Literacy and Numeracy

- 0.15% out of 445,000 primary school children in Malaysia did not pass the literacy and numeracy screening
- Common diagnosis
 - Borderline Intellectual Disability (ID, 37.6%)
 - Mild ID (19.4%)
 - Attention Deficit Hyperactive Disorder (11.8%)
 - Specific Learning Disability(10.8%).

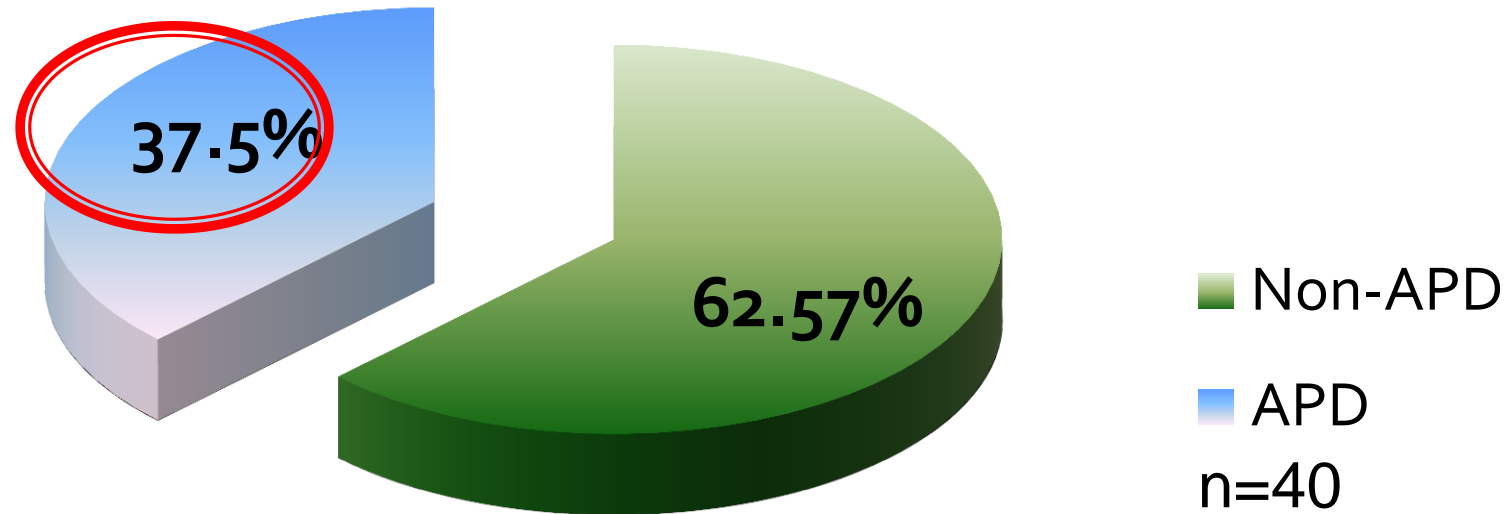
(Toh, 2011)

- What is the prevalence of APD among children with poor literacy and numeracy?
- Identification is important so that appropriate management can be provided to strengthen foundation for learning

METHODS

- Participants
 - 80 children aged 7 to 9 years
 - Normal hearing and cognitive function
- APD Tests
 - Dichotic Digit Test (DDT)
 - Pitch Pattern Sequence Test (PPST)
 - Gap-In-Noise Test (GIN)
 - 500Hz Binaural Masking Level Difference (BMLD)
 - Bisyllabic Words-In-Noise Test (WIN)

Prevalence of APD



APD defined as failing in at least
2 APD tests

- Prevalence of APD (37.5%) among children with low academic performance in this study is high.

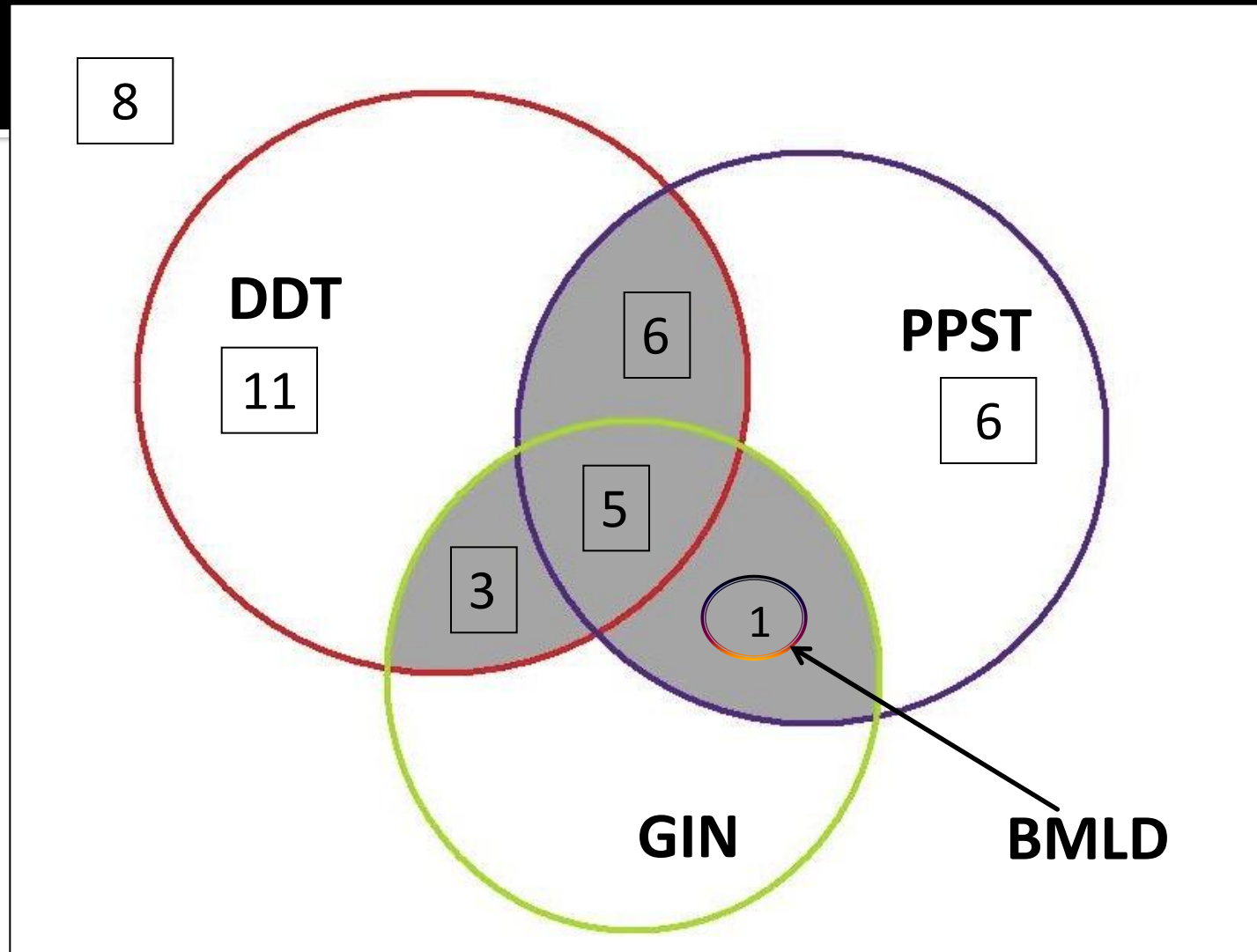


Figure 4: The number of subjects failed in each test. (n=40)

Conclusions

- The percentage of APD cases among children with low academic performance in this study is high.
- This study also suggests that APD tests should be routinely conducted on children with low academic performance in order for APD to be diagnosed so that a proper management can be carried out.