The development of a test of letter and number reversal tendency for primary school children

Janet Richmond
Edith Cowan University

Ted Brown
Monash University

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The Development of a Test of Letter and Number Reversal Tendency for Primary School Children

Janet Richmond - Edith Cowan University
Dr Ted Brown - Monash University

RESEARCH AIM
- To develop a standardised instrument to assess visual perceptual skills using letters and numbers
- Collect performance norms on a cohort of 5 to 12 year old children
- To complete validation and reliability analysis to ensure psychometrically sound norms relevant to Australia

BACKGROUND
- Limitations of existing tests of letter and number reversals require that a new, superior instrument must be developed
- Visual perception is a complex process which is defined as: obtaining information from the environment (receiving), organising and deciphering this visual information, recalling previous experience related to this information and giving an appropriate motor, verbal or cognitive response
- Occupational performance areas of academic achievement, self-care activities, work related/play endeavours, and leisure pursuits such as reading a menu/recipe, writing a cheque/filling out forms, using public transport, and telling the time involve visual perception
- A number of clinical diagnostic groups have poor visual perception as a major or minor component of the condition, including neurological, developmental, degenerative or congenital conditions
- This study is concentrates on the connection between visual perceptual concepts and academic performance as seen in reversal recognition skills in primary school children
- Academic learning requires the development of conceptual skills such as learning to read words, multiply numbers, write letters, apply, contract, compare and integrate what is learned today with what was learned yesterday
- Visual perceptual skills are related to learning readiness, and academic achievement in early school years

DEVELOPING A MODEL
- In the model of Visual Perceptual Letter and Number Recognition Skills, input is either from an external visual source, other sensory input or driven from within (a thought, need, desire)
- There are three pre-requirements to the input being moved to the throughput – visual attention, visual discrimination and visual memory
- Throughput / Integration phase includes the non-motor visual perceptual concepts
- Integration of basic concepts allows interpretation of letters and numbers in isolation, combination or in mental manipulation
- The output phase demands understanding and results in an occupational performance, in leisure/ play, verbal/oral, self care/ADL or productivity/educational
- Feedback loops to higher centres are active throughout this process

TEST STRUCTURE
- The test has selected response items (multiple choice options)
- The assessment was developed with an overall concept of visual discrimination which is seen to drive all other visual perceptual skills
- Six subscales to ensure comprehensive evaluation of visual perceptual constructs related to letter and number reversal recognition skills:
  - Visual discrimination (VD) of letter and number form
  - Visual letter and number matching
  - Visual letter and number sequences
  - Visual upper case, lower case letters and numbers
  - Visual letter and number pairs
  - Visual letters and numbers in context (figure ground)

RESEARCH DESIGN
- A cross-sectional research design will be used with the field test version:
  - Evidence to support the reliability and clinical utility of the test items will also be collected across ages and gender
  - Participants: 400 school children aged 5 to 12 years from the Perth metropolitan area will be recruited. An equal number of boys and girls with at least 24 children from each age band
  - Ethics granted by Monash university, the WA Department of Education and the Catholic Education Board
  - Inclusion criteria: signed parental consent and English as the primary language spoken at home
  - Exclusion: known intellectual impairment, learning disability, neurological impairment, vision problem or developmental delay (determined by completion of a screening checklist) will be used to establish discriminative validity

METHODOLOGY
- Sample test items – developed after an extensive ongoing literature review, including a critique of existing assessment tools which had been completed
- A preliminary test manual contains instructions on administration and scoring
- Six paediatric occupational therapists critiqued the content of the items and the subscales
- Measurement will include the Item Response Theory (Rasch) & Classical Test Theory

STATISTICAL ANALYSIS
- Evidence of validity will be collected for test content, response processes, internal structures, & relationship to other variables
- Construct validity will be explored using Principal Confirmatory Factor Analysis (Classical Test Theory) and the person-item fit with the Rasch Measurement Model (Item Response Theory)
- Concurrent criterion validity will be examined by correlating the outcomes on the new test with the Jordan Left-Right Reversals test (Jordan, 1996)
- Reliability
  - Test-retest reliability will be completed with a 2 week interval
  - Cronbach alpha will be used to evaluate the internal consistency of the subscales.
- Clinical utility will be assessed by conducting discriminative validity
- Differential item functioning based on gender will be examined through the Rasch Measurement Model

PRELIMINARY RESULTS
- December 2007 to January 2008, the field test version of scale was tested on 20 children. One child's results were excluded due to refusal to participate
- Currently data collection at schools has begun.
- January to April 2009 - Data analysis including the completion of reliability and validity analysis
- Scale refinement by discarding poorly performing items and promoting the generation of a research version of scale is to follow

PRELIMINARY CONCLUSION
- The test is still in the field test stage and remains very extensive as the poorly performing items have not been removed
- In the pilot study, the means increased with grade
- The standard deviation still high due to small sample size
- This research promises clinical utility in application to guide occupational therapists in effectively plan and implement interventions for children presenting with learning disabilities, developmental delays and neurological impairments in order to support them in neurological rehabilitation and learning ability
- This assessment tool will provide occupational therapists with a reliable and valid tool with adequate sensitivity and clinical utility to effectively assess visual perception and letter/number

References