

## An Item Response Theory Analysis of the Physical Therapist Manual for the Assessment of Clinical Skills (PT MACS) and the Physical Therapist Clinical Performance Instrument (CPI)

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## Research Overview

- PT MACS and CPI
  - Statistically analyzed the items in both tools to determine how well each item was able to evaluate student performance

## Problem

- Clinical assessment tools are used by every physical therapy school for the purpose of determining whether a student has demonstrated a certain level of competence as a clinician
  - Is the student entry-level?
- The PT MACS and CPI are the primary clinical assessment tools used in Physical Therapy Programs
- HOWEVER, neither instrument has research supporting it as reliable or psychometrically sound

## Research Questions

- What is the dimension structure underlying the PT MACS and the CPI?
- Do the items on the PT MACS and the CPI adequately cover a broad range of ability levels?

## Methods

## Subjects

- 841 physical therapy students rated by a clinical instructor on the PT MACS or CPI
  - 449 physical therapy students rated on the CPI
  - 392 physical therapy students rated on the PT MACS

## Instrumentation

- PT MACS (Draft)
  - Physical Therapist Manual for the Assessment of Clinical Skills
- CPI (4<sup>th</sup> Edition)
  - Physical Therapist Clinical Performance Instrument

## PT MACS (Draft)

- 19 items
  - Total of 72 skills and subskills
    - » i.e. Treatment Interventions
- Each skill rated on a 5 point scale
  - (+) surpasses entry-level standards
  - (✓) safe and competent (entry-level)
  - (NE) needs experience
  - (NI) needs improvement
  - (U) unsatisfactory

## CPI

- American Physical Therapy Association
- 4<sup>th</sup> edition, 1997
- 24 skills
- Each skill scored on a 100mm straight line visual analog scale (VAS).



## CPI

- The VAS was broken into 6 categories based on the research of Straube and Campbell (*J Phys Ther Educ*, 2003)
  - 1 = 0 – 30 mm
  - 2 = 31 – 50 mm
  - 3 = 51 – 70 mm
  - 4 = 71 – 90 mm
  - 5 = 91 – 99 mm
  - 6 = 100mm and “With Distinction”

## Procedures

- Director of Clinical Education (DCE)
  - Retrospective PT MACS and CPI scores from **first** clinical rotation only
    - » Received 392 PT MACS and 449 CPIs



## Data Analysis Overview

- Factor Analysis to determine unidimensionality
- Item Response Theory to estimate item parameters

## Item Response Theory (IRT)

- The information that can be gained from IRT
  - Item difficulty
  - Item discrimination
  - Person ability level
  - Item characteristic curve
  - Item information curve
  - Test information function

## Item Difficulty

- Value which indicates where the item falls along a continuum in comparison to other items

## Item Discrimination

- How well the item is able to differentiate between ability levels
  - Does an individual with a higher ability level have a greater probability of doing better on the item?

or

  - Regardless of ability level does everyone seem to fall under the same category?

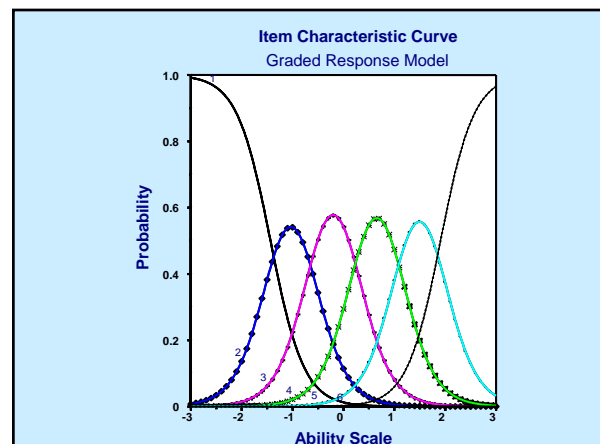
## Person Ability Level

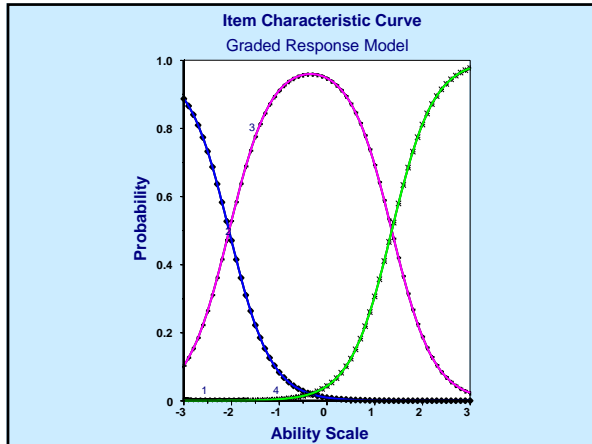
- The ability level of an individual can be determined from his/her results on a test where the item parameters are known
  - Ability level placed on a continuum



## Item Characteristic Curve

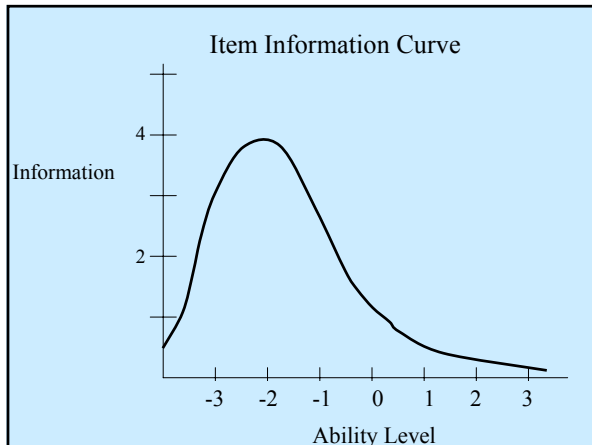
- Graphical representation of an item and its parameters
  - Item difficulty
  - Item discrimination
  - Person ability level





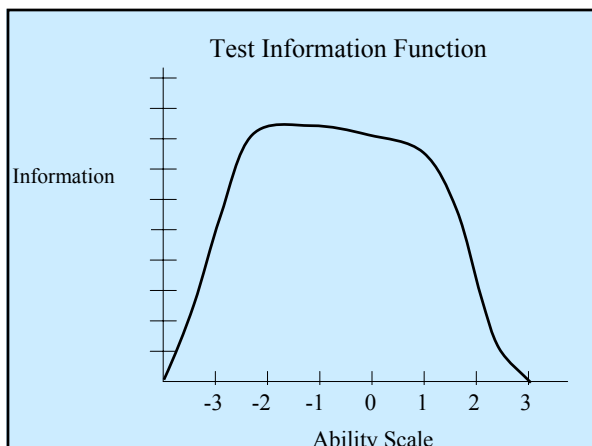
**Item Information Curve**

- Indicates at which ability level(s) the item functions best



**Test Information Function**

- Sum of all the item information curves within a test (clinical assessment tool)
- Provides an estimate of how well a test functions at each ability level



**Results**

## Factor Analysis

- PT MACS unidimensional
  - Students on first clinical rotation (acute or outpatient) unable to complete all skills
  - Removed all items with greater than 25% of the data missing
    - » 20 items remained
- CPI unidimensional
  - 24 items

## Item Response Theory

- PT MACS
  - 5 Rating Categories (U, NI, NE, √, +)
    - » Unable to estimate item difficulty at the lowest category for each item
    - » Reviewed frequency table
      - \*U\* never used as a rating
    - » Reran IRT with 4 categories

## Item Response Theory

- PT MACS
  - 3 Skills Categories
    - » Generic Abilities (10)
    - » Evaluation Skills (8)
    - » Treatment/Intervention Skills (2)

## Generic Abilities Order of Function

PT MACS	<i>a</i>	SE
<b>Generic Abilities</b>		
Problem Solving	2.40	0.26
Commitment to Learning	2.34	0.32
Communication Skills	2.32	0.30
Interpersonal Skills	2.30	0.32
Responsibility	2.25	0.29
Critical Thinking	2.25	0.26
Use of Constructive Feedback	2.17	0.31
Effective Use of Time and Resources	2.07	0.21
Stress Management	1.96	0.26
Professionalism	1.68	0.26

## Evaluation Skills Order of Function

PT MACS	<i>a</i>	SE
<b>Evaluation Skills</b>		
Plan of Care: Development and Modification	2.80	0.32
Plan of Care: Goals and Functional Outcomes	2.57	0.26
Evaluation and Diagnosis	2.32	0.26
Tests and Measures: Muscle Performance	2.28	0.27
Patient History and Systems Review	2.25	0.26
Plan of Care: Prognosis	2.21	0.26
Tests and Measures: Range of Motion	2.20	0.29
Tests and Measures: Gait and Locomotion	1.90	0.24

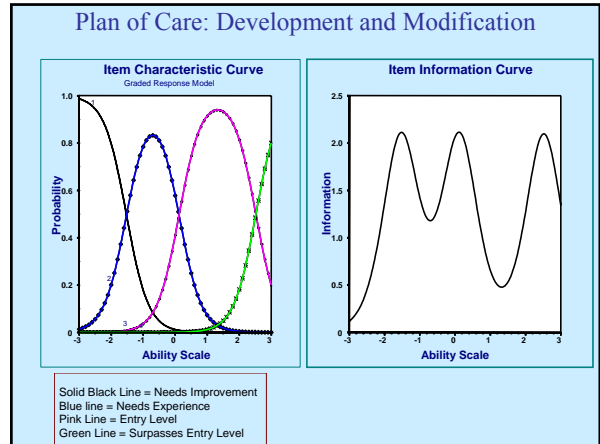
## Intervention Skills Order of Function

PT MACS	<i>a</i>	SE
<b>Intervention Skills</b>		
Interventions: Patient Related Instruction	2.78	0.35
Safety	1.74	0.21

## PT MACS

### Overall Highest Item Discrimination

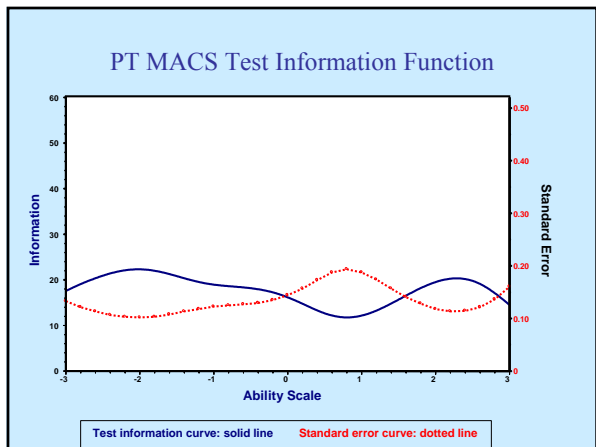
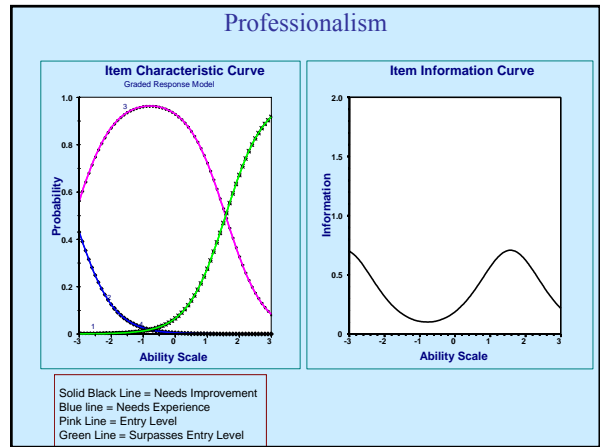
- Plan of Care: Development and Modification ( $a = 2.80$ )



## PT MACS

### Overall Lowest Item Discrimination

- Professionalism ( $a=1.68$ )



## Item Response Theory

- CPI
  - 6 Rating Categories
    - » 1 = 0 – 30 mm
    - » 2 = 31 – 50 mm
    - » 3 = 51 – 70 mm
    - » 4 = 71 – 90 mm
    - » 5 = 91 – 99 mm
    - » 6 = 100mm and “With Distinction”

## Item Response Theory

- CPI
  - 3 Skills Categories
    - » Generic Abilities (13)
    - » Evaluation Skills (5)
    - » Treatment/Intervention Skills (6)

## Generic Ability Order of Function

CPI	$a$	SE
<b>Generic Ability Skills</b>		
Critical Inquiry	3.25	0.40
Resource Management	3.21	0.32
Fiscal Management	2.93	0.23
Documentation	2.71	0.22
Communication	2.69	0.21
Support Personnel	2.45	0.39
Lifelong Learning	2.41	0.21
Professional Responsibility	2.25	0.23
Cultural Differences	2.11	0.22
Ethical Practice	2.08	0.22
Responsible Behavior	1.96	0.22
Legal Practice	1.90	0.21
Professional Behavior	1.89	0.21

## Evaluation Skills Order of Function

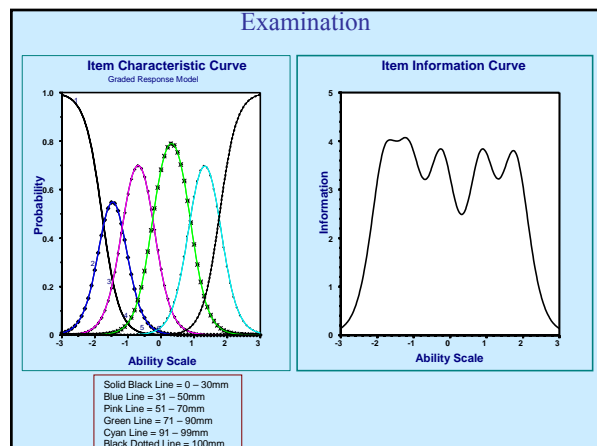
CPI	$a$	SE
<b>Evaluation Skills</b>		
Examination	3.84	0.28
Plan of Care	3.75	0.30
Evaluation	3.41	0.25
Screening	3.01	0.28
Consultation	2.54	0.33

## Treatment/Intervention Skills Order of Function

CPI	$a$	SE
<b>Treatment/Intervention Skills</b>		
Intervention	3.83	0.31
Quality of Service Delivery	3.42	0.28
Wellness and Health Promotion	3.10	0.42
Management of Patient Services	3.04	0.53
Education	2.97	0.27
Safety	2.46	0.23

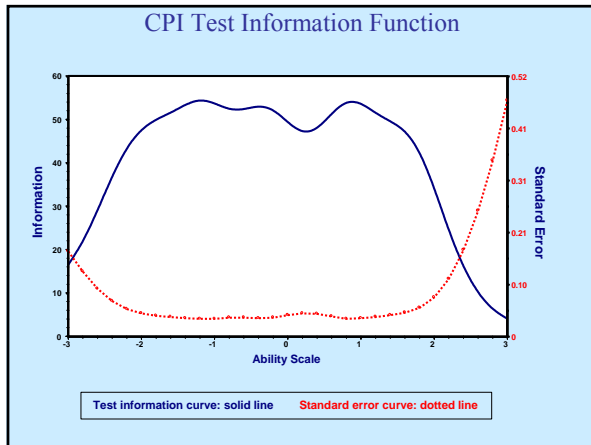
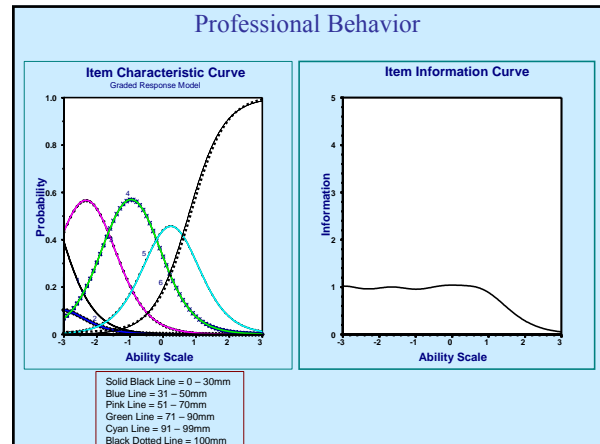
## CPI Overall Highest Item Discrimination

- Examination ( $a = 3.84$ ) ICC



## CPI Overall Lowest Item Discrimination

- Professional Behavior ( $a = 1.89$ ) ICC



# Discussion

- ## PT MACS
- The majority of the 20 items from the PT MACS function adequately
  - Test Information Function
    - The low, below average, and high ability levels are targeted by these items in the PT MACS
    - The items do not function well at the average to above average ability levels

- ## Recommendation for PT MACS
- Use a dichotomous rating
    - The item information functions suggested that the CIs were rating the students as entry level or not entry level
    - For all items the use of the NI rating is <5%
    - The rating “U” was never used for any subject

## Recommendation for PT MACS

- Utilize a separate indicator for unsatisfactory student performance
  - “U” was never used for any subject
  - Does not add precision or accuracy to the rating scale, however it still important to document

## Shortcomings

- 20 of the 72 skills were analyzed
  - Results for the 20 items are sound
  - Opens the door for future research
- Suggestions made are based on the 20 items

## CPI

- Strong functioning clinical assessment tool
- Majority of the items provide a high level of precision and accuracy
- Test information function cover all ranges of abilities except the extreme high and low

## Recommendation for CPI

- Remove or revise the five lowest functioning items
  - Responsible Behavior
  - Professional Behavior
  - Ethical Practice
  - Legal Practice
  - Cultural Differences
- Each of these items provide information to the CPI, but it is recommended that these items be reviewed in attempt to match the strength of the other nineteen items

## Recommendation for CPI

- The VAS should be divided into six categories for grading criteria purposes
  - Or
- The CPI should use 6 specific categories in place of the VAS

## Shortcomings

- The 100mm rating was not separated from the 100mm + “With Distinction” rating
  - Test information function

## Future Research

## Future Research Considerations

- PT MACS
  - Edition 1 of the PT MACS is now being used (Texas Consortium, 2004)
    - » Rating scale change
- CPI
  - Electronic version with some significant changes from the fourth edition

## Future Research

- Understand how each tool functions throughout the complete clinical education process of a student
- IRT Analysis
  - Different clinical settings (acute, rehab, OP...)
  - Different clinical rotation numbers
  - Different lengths of rotations

## Significance of the Data

- Enables for the selection of items and/or a minimum standard to be met specific for each
  - Clinical rotation number
  - Clinical setting
  - Clinical length
- Accurate assessment of student ability level and his/her progress over multiple clinical rotations
- Accurate identification of student weakness
- Curriculum deficits accurately identified
- Develop a psychometrically sound clinical assessment tool

## In Conclusion...

- Groundbreaking research for understanding the PT MACS and CPI
- Foundation has been laid for analyzing these instruments
  - New methodology
  - IRT provides very useful information
- Overall, the results of this research can be used in furthering the understanding of clinical education and clinical assessment.
- Combined with the efforts of future research, an accurate and efficient clinical assessment tool will be developed.

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## Questions

## Thank You

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## Thank You