

# ***Developments in Apprentice Readiness and Testing***



# What is the skills gap?

**A lack of the core skills necessary  
to be a successful  
skilled trades person.**



# What is the skills gap?

For example, a New Hampshire maker of precision-cutting systems, says half of its applicants can't perform simple math.

Adds a representative of the Mississippi Manufacturers Association: "A lot of kids cannot even read a ruler."



# What is the skills gap?

Many companies also complain that shop classes are being eliminated, so that few high schoolers even know what a lathe is, much less how to work one.



**Is there an answer to the skills gap?**

**One short term answer to the  
skills gap is**

**Apprenticeship  
Readiness**



# What is Apprenticeship Readiness?



# What is apprentice readiness?

Apprentice readiness prepares learners to participate in Apprentice Selection Tests by emphasizing reading comprehension, math, graphic math, mechanical comprehension, and spatial relations.



# Existing Apprentice Readiness Programs

- Chicago Urban League Transportation Construction Apprenticeship Readiness Training Program
- South Suburban College
- Women in Hard Hats
- CISCO-promotes apprentice readiness in Illinois school systems
- School to Work Apprenticeship
- JAMA-Jackson Area College and Career Connection-Early Middle College





# Existing Apprentice Readiness Programs

- Indiana plan
- Delta College
- Oakland Community College
- Genesee Skill Center
- Baker College



# Another Apprentice Readiness Approach

Infuse apprentice readiness, in particular, core skills into current

Michigan CTE programs as a bridge to apprenticeships



# What are the core skills?

- Core foundation skills
- Core technical skills



# What are the core foundation skills?

- Basic Math Skills
- Algebra
- Geometry
- Graphic Math
- Spatial Relations
- Mechanical Comprehension
- Technical Reading Comprehension



# What are the core skills?

## *Fractions Are Key To Math Success, New Study Shows*

What part of math success comes from knowing fractions? More than you might think, according to a new study that analyzed long-term data on more than 4,000 children... These findings demonstrate an immediate need to improve the teaching and learning of fractions and division,” said University of Michigan researcher Pamela Davis-Kean, a co-author of the study and director of the Center for the Analysis of Pathways from Childhood to Adulthood at the U-M Institute for Social Research.

<http://detroit.cbslocal.com/2012/06/17/fractions-are-key-to-math-success-new-study-shows/>



**Many discussions about apprenticeships neglect to include that most apprentice selection processes include passing a test.**



# **Current Apprenticeship Test Resources**

**CAST-Construction and Skilled Trades Test-Edison  
Electric Institute**

**Ramsey-Test publications**

**AON**

**DDI**

**Jack Martin & Associates Educational Services, LLC.**



# Skilled Trades Apprenticeship Test *STAT*





# Why develop an Apprenticeship Test

- The test was developed at the request of a client.
- The client was not satisfied with the current testing options.



# Goal of STAT

The goal of the Skilled Trades Apprenticeship Test (STAT) is to assess the core skills and abilities of the potential apprentice candidate.



# Objectives of the test are:

1. To determine the individual's competencies in manipulating math problems correctly.
2. To determine the individual's competencies in reading and comprehending technical directions.
3. To determine the individual's competencies in interpreting graphic math problems correctly.



# Objectives of the test are:

4. To determine the individual's competencies in interpreting spatial drawings
5. To demonstrate the individual's competencies in mechanical comprehension



# ***STAT* Components:**

- Math-Basic Math,
- Algebra
- Geometry
- Technical Reading Comprehension
- Spatial Skills
- Graphic Math and Blueprint Reading
- Mechanical Comprehension



# Test Design:

The test was designed as a multiple choice format using a Scantron form for participant responses.



# Test Design:

## Basic Math Skills

- ✓ Addition, Subtraction,
- ✓ Division, Multiplication
- ✓ Fractions and Decimals
- ✓ Reading a Scale
- ✓ Ratios and Percents
- ✓ Directed Numbers



# Test Design:

Algebra

Geometry

Graphic Math

Spatial Relations

Mechanical Comprehension

Technical Reading Comprehension





# Validation Process

Generic Test Development Cycle:		
CYCLE STEP OR PHASE	ACTIVITIES	OUTPUTS OR PRODUCTS
1. Determine Test Purpose	<ul style="list-style-type: none"> <li>--Conduct clarification discussions with a range of stakeholders</li> <li>--Incorporate standards for certifications &amp; assessment-based certificates</li> <li>--Embed process within "stackable certificates" models if desired (articulation, etc.?)</li> </ul>	<ul style="list-style-type: none"> <li>--Overall Test Plan with Test Purpose Statement</li> <li>--ID &amp; benchmark competitors (WorkKeys, Test of Workplace Essential Skills--TOWES)</li> <li>--Commitment to best practice standards</li> <li>--Management systems &amp; project management</li> </ul>
2. Define Content Domain (Competencies or Task-KSA from Occupational Analysis)	<ul style="list-style-type: none"> <li>--Conduct DACUM (or other) analysis using enhanced Knowledge-Skill set</li> <li>--Conduct task verification with occupation incumbents</li> <li>--Conduct task analysis for critical tasks to elaborate content domain further</li> <li>--Consider alignment requirements</li> </ul>	<ul style="list-style-type: none"> <li>--Specification of content domain for test build</li> <li>--DACUM charts (initial/revised)</li> </ul>
3. Create/Evaluate Test Blueprint	<ul style="list-style-type: none"> <li>--Apply task verification results using spreadsheet tools</li> <li>--Establish sharing forums for stakeholders (include incumbents)</li> <li>--Ensure balance (TBD) between choice, construction, performance formats</li> </ul>	<ul style="list-style-type: none"> <li>--Test specification draft created for discussion</li> <li>--Finalized test blueprint from discussions</li> </ul>
4. Items: Develop, Manage, Evaluate	<ul style="list-style-type: none"> <li>--Plan and recruit workshop participants (diverse, high-performers)</li> <li>--Test build workshops (facilitated is good practice)</li> <li>--Create constructed and performance format items (with rubrics for evaluation for latter)</li> <li>--Test item review workshops (ensure some overlap with item writers, and new individuals to provide independent scrutiny of items)</li> </ul>	<ul style="list-style-type: none"> <li>--Item bank in MS Access (tables for items &amp; tags; SME names; occupational information) OR spreadsheet for low-stakes system</li> <li>--Write items (distance) with submission sign-in</li> <li>--Manage initial bank (items, tagged information), including item review data</li> </ul>
5. Set Cutoff Scores	<ul style="list-style-type: none"> <li>--Establish defensible cutoff scores (performance standards) using performance level descriptions (2-3 categories most often recommended)</li> <li>--Analyze incumbent judgments using spreadsheet or statistical packages</li> </ul>	<ul style="list-style-type: none"> <li>--Bank with item-level weights (from review &amp; cutoffs)</li> <li>--Compromise judgment data for adjustments</li> <li>--Brief summary report</li> </ul>



# Validation Process

Generic Test Development Cycle:		
<i>CYCLE STEP OR PHASE</i>	<i>ACTIVITIES</i>	<i>OUTPUTS OR PRODUCTS</i>
6. Develop, Evaluate, Refine Test Forms	<ul style="list-style-type: none"> <li>--Create 2+ test forms containing a blend (choice, construction, performance)</li> <li>--Field test forms through some tool</li> <li>--Conduct field test data analysis to refine &amp; revise</li> <li>--Write report summarizing creation, field test, data analysis)</li> </ul>	<ul style="list-style-type: none"> <li>--Test forms</li> <li>--Field test plan with implementation/evaluation</li> <li>--Brief description of process</li> </ul>
7. Yardsticks: Reliability, Validity, Fairness	<ul style="list-style-type: none"> <li>--Using all activities &amp; data, develop test form quality argument with data support</li> <li>--Conduct reliability analyses</li> <li>--Conduct validity analysis (content validation strategy:review field test)</li> </ul>	<ul style="list-style-type: none"> <li>--Documentation for quality assurance and validation</li> </ul>
8. Deliver Tests; Interpret & Report Scores	<ul style="list-style-type: none"> <li>--Deliver operational test forms through portals (choice &amp; ratings)</li> <li>--Develop scoring strategy (R-W, guessing correction)</li> <li>--Create score interpretations for persons; integrate scores from different formats if needed</li> </ul>	<ul style="list-style-type: none"> <li>--Need to develop system business rules and procedures, weights for combinations if needed (for example, knowledge+performance)</li> </ul>
9. Maintain Testing System	<ul style="list-style-type: none"> <li>--Conduct annual or testing cycle maintenance activities (item, test score, pass-fail rates)</li> <li>--Document test quality through ongoing research</li> <li>--Prepare technical reports and other reports as needed and agreed</li> <li>--Collaborate to conduct research with workforce development programs</li> </ul>	<ul style="list-style-type: none"> <li>--System business rules and procedures, monitored and reported periodically</li> </ul>



# Pilot Test Group Dynamics

- Population Size 38
- Population Make-up
  - Skilled Trades Journey Persons-20
  - Current Apprentices-18
- Cross Section of trades represented



# Pilot Test

## Score Data

Number of Graded Items 121

Total Points Possible 121

Maximum Score 115

Minimum Score 61

## Statistics

Mean Score (average) 96.08



# Pilot Test Results Statistics

## Confidence Intervals (Level of confidence)

➤ 1%            90.34

➤ 5%            91.79



# Pilot Test Results Statistics

## Test Reliability:

$\leq 1.0$

Kuder-Richardson Formula 20                      0.91

Coefficient (Cronbach) Alpha                      0.91



# Selection Test Administration

- Testing 425 Applicants
- Participant registration handled by company
- Test administration conducted by independent source



# Selection Test Statistics

## Score Data

Number of Graded Items 130

Total Points Possible 130

Maximum Score 128

Minimum Score 37

Range 91

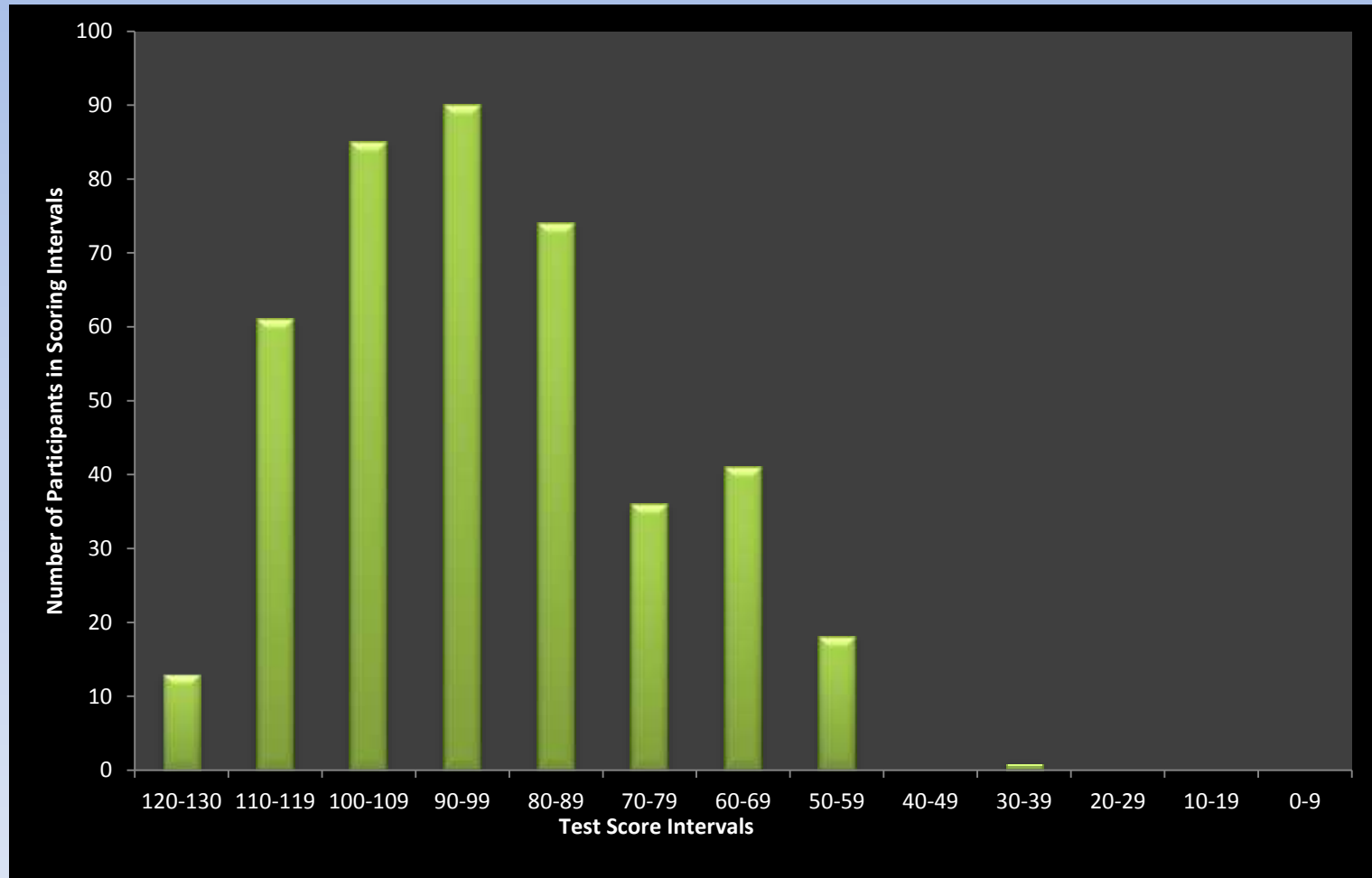
## Statistics

Mean Score (average) 96.08





# Selection Test Results



# Comments:

- After three months of training, all apprentices are passing their college Algebra class-most are doing well
- Previous apprentice group required to complete remedial basic math before taking college Algebra again



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# Another Apprentice Readiness Approach

- Introduction to the Trades and Pre-Test
- Basic Math
- Alg.
- Geometry
- Graphic Math
- Mechanical Comprehension
- Spatial Relations and basic electricity
- Technical Reading and Interview Exercise
- Post Test

