Use of PIAAC Education & Skill Cognitive and Noncognitive Modules to Investigate Workplace Success: An Expanded Human Capital Perspective

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Expanded View of Human Capital To Inform Our Understanding of Workplace Success

• Human Capital moves from “degree” to “skill” (cf. Kirsch and Braun, 2016)

• Skill understood as individual difference factors combining cognitive ability, motivation, and interest fit (cf. Dawis & Lofquist, 1984, "Theory of Work Adjustment"; ) and their alignment to work expectations and demands

• Cattell’s (1987) “Investment Theory”: the promotion of crystallized intelligence requires interest or “investment” in pursuit of knowledge (e.g., gender gaps in Mathematics diminish when you control for investment)

• Zeitgeist: Role of agency, epigenetic principles and human x social capital interactions
An expanded framework of human capital: Pyramid for Success

Prior Research: Education Context

• Three individual difference factors differ in predicting education outcomes (e.g., performance, retention, completion):
  ❖ Prior academic achievement and conscientiousness “C” predict first year college success and return (Allen & Robbins, 2010)
  ❖ Career Interest Fit uniquely predicts college major stability and time to degree attainment (Allen & Robbins, 2010)

• Ability and Interest Fit independent and significant predictors of STEM related engagement and degree completion (Le & Robbins, 2012)
Prior Research: Workforce Context

- Career Interest Fit predicts earnings or wage (Neumann, Olitsky & Robbins, 2012, *Labour Economics*).

- U.S. National Academies of Sciences Report (2017), “Building America’s Skilled Technical Workforce” reframes "zone 3", middle skill jobs. These jobs require executing complex tasks and demonstrating behavioral effectiveness (e.g., initiative, cooperation, persistence, adaptability).

- Meta-analytic and synthetic research highlight cognitive competencies as critical to workplace success (cf. Lang & Kell, 2020).
Research Study Goals

**Goal 1:** Establish evidence-based literacy and work style standards and benchmarks tied to workplace performance expectations for success

**Goal 2:** Test our psychological model of human capital:

- Hypothesis A: each factor has unique and incremental effects on work performance, and
- Hypothesis B: interest fit and emotional stability would be predictive of employee well-being

**Goal 3:** Demonstrate importance of career interest fit on workplace success to help inform guidance and decision-making practices
Study Description

Sample

• Large R & D organization. Volunteers across a range of occupations including, Manager (19%), Professional (26%), Technicians (8%), Clerical/Support workers (32%), Service/Sales (6%), and Craft and related trades workers (10%)

• A total of 489 completed batteries linked to standardized supervisor ratings (response rate of over 80% of the solicited employees)

• Slightly more women, n=284 (58%) than men n=205 (42%).

• The average age of incumbent workers was 43.76 (Min=18; Max=65; SD =11.80).
Occupational Grouping: Manager and Professional vs Technical/Clerical/Trades

- Grouped sample occupations into broad job families based on the first two digits of the O*NET codes (O*NET Code Connector, [https://www.onetcodeconnector.org/find/family](https://www.onetcodeconnector.org/find/family))

- Our sample includes 16 job families out of total 23 families available in O*NET

- **Grouping:** This variable reflects the level of the job (education and autonomy characteristic) and is operationalized as a categorical (dichotomous) variable with two levels based on participant occupations
  
  - Level 1 (“High”) includes managers (n=91) and professionals (n=127) with 4 year and above education.
  
  - Level 0 (“Low”) include the remaining occupations (n=271) includes technical, clerical, and trades (secondary and some post-secondary).
Instrumentation: Predictors

PIAAC E & S Online cognitive and noncognitive battery:

**Cognitive Achievement**: Numeracy and Literacy scales derived from PIAAC. An Ability score derived from either scale controlling for N vs L interactions with outcomes (none found)

**Big 5 Personality Traits**: 13 underlying “Facets” linked to either “C, N, A, E, O” trait scores

**Career Interest Fit**: O*NET™ Career Interest Profiler consists of 60 items that ask individuals to rate the extent to which they would enjoy performing different work-related activities. Calculate profile correlation (Pearson R similarity-dissimilarity) by comparing individual interest profile (RIASEC) with “typical” profiles based on expert ratings (Golubovich, Su & Robbins, 2017)
Criteria

Standardized Supervisor Rating of Work Performance:

- We can reliably measure workplace performance across different work expectations using supervisor-based Likert scales (cf. Le, Oh, Robbins, Ilies, Holland, & Westrick, 2011):
  1. Task Performance
  2. Organizational Citizenship Behavior
  3. Counterproductive Behavior

- We derived an overall work performance composite

Employee Well Being:

- Optimism/Well Being self-report (E & S Online)
Data Analyses

Research Goal 1: Descriptive or Benchmark Averages

Research Goal 2: Hierarchical Multiple Regression Models

Model 1: Control variables (gender, age, job level, and the categorical variable specifying if scores for the ability variable come from the Numeracy or Literacy tests)

Model 2. Ability and the interaction term between ability and numeracy

Model 3: 13 personality facets

Model 4: Interest fit

Model 5: Interaction term between interest fit and job level
Research Goal 1: Literacy and Numeracy Descriptive Statistics

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<th>Numeracy</th>
<th>Literacy</th>
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<tr>
<td></td>
<td>N</td>
<td>Mean</td>
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<td>Non-Managers</td>
<td>136</td>
<td>283.61</td>
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<tr>
<td>Managers</td>
<td>101</td>
<td>351.05</td>
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</table>
Research Goal 1: Personality Benchmarks

Mean FACETS scores for Non-Managers and Managers

Personality Attributes

Diligence, Stability, Collaboration, Inquisitiveness, Assertiveness, Generosity, Creativity, Intellectual Orientation, Organization, Dependability, Self Discipline, Friendliness, Optimism

Non-Managers, Managers
Research Goal 2: Predicting Overall Job Performance

<table>
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<tr>
<th>Model</th>
<th>R</th>
<th>R-square</th>
<th>Adjusted R-square</th>
<th>R-square Change</th>
<th>Sig. F change</th>
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</table>
Results: Overall Job Performance

• Ability significantly predicts overall job performance
• Two personality facets (Diligence, “C” and Generosity, “O”)
• Interest fit was not significantly related to job performance, but
• Interaction between interest fit and job level included in model, both the main effect and interaction effect of interest fit became significant:
  • Interest fit predicts job performance differently in High vs. Low job level: interest fit is positively and statistically significantly related to job performance for participants with low job levels
Ability and Job Performance

Unstandardized Slopes:
Non-managers = 0.001
Managers = 0.0003
Personality and Job Performance

Unstandardized Slopes:
Non-managers = 0.11
Managers = 0.09

Unstandardized Slopes:
Non-managers = 0.03
Managers = 0.09
Career Fit and Job Performance

Unstandardized Slopes:
Non-managers = 0.001
Managers = -0.001
Research Goal 2: Predicting Employee Optimism and Well Being

• Ability is negatively related to well-being
• Four personality facets (diligence, stability, collaboration, and friendliness) are positively related to well-being
• These facets represent four out of five dimensions of the Big Five (conscientiousness, neuroticism, agreeableness, and extraversion)
• Career Interest Fit not related to well-being
## Hierarchical Multiple Regression Model Summary: Well-Being

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R-square</th>
<th>Adjusted R-square</th>
<th>R-square Change</th>
<th>Sig. F Change</th>
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</thead>
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<td>0.238</td>
<td>0.000</td>
<td>0.618</td>
</tr>
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</table>
Personality and Well-being

Unstandardized Slopes:
Non-managers = 0.22
Managers = 0.02

Unstandardized Slopes:
Non-managers = 0.12
Managers = 0.38

Unstandardized Slopes:
Non-managers = 0.40
Managers = 0.46

Unstandardized Slopes:
Non-managers = 0.30
Managers = 0.21
Ability and Well-being

Unstandardized Slopes:
Non-managers = -0.0004
Managers = -0.001
Next Steps in Research

Replication and Extension

• Underway in collaboration with the Singapore Institute of Adult Learning (funder) and the National University of Singapore

• Create expectancy models of job success based on composite scores. Is this controversial?

• Create benchmark reports tied to jobs that highlight Literacy and Work Style skill expectations for current and future skilled technical jobs

Further Exploration Needed

• Investigate negative relationship between literacy and employee well-being

• Investigate moderation of job type on career interest fit and outcomes
Practice and Policy Implications:

• Importance of holistic assessment to inform career—decision making: “Right person in right job”

• Creating transparency or “signal behavior” tied to occupational classification and job expectations

• Promote collaboration between employers and training institutions as part of “talent supply chain” planning

• Promoting Essential Skill Development (i.e., Literacy benchmarks and Work Style expectation) for adult learners

• Skilled Technical Jobs still require essential skill benchmarks, co-curricular strategies
**Use Cases Highlighted in E & S Online (2018)**

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Relevance</th>
<th>Information Included in Score Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employers (businesses and trade associations)</td>
<td>• Recruit nontraditional and returning workers</td>
<td>• Skill use indices to identify which skills individuals use regularly in their personal and work lives</td>
</tr>
<tr>
<td>Academic systems</td>
<td>• Engage and develop work readiness</td>
<td>• Skill use indices to identify which skills individuals use regularly in their work and personal lives</td>
</tr>
<tr>
<td>Policymakers</td>
<td>• Research</td>
<td>• Skill use indices help identify potential barriers to participation in the workforce and society</td>
</tr>
<tr>
<td>Individuals</td>
<td>• Job preparation and search</td>
<td>• Skill use indices to identify which skills individuals use regularly in their work and personal lives and identify areas for learning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Career-choice matching based on skill inventory</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Skill use indices help identify potential barriers to participation in the workforce</td>
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</tbody>
</table>
Thanks to all the colleagues and co-workers who contributed to this work.
References


References Continued


