Development of the Occupation Fit Algorithm for the Highlands Ability Battery

Research conducted by HumRRO

Prepared by Dori Stiles, Ph.D.,
Industrial/Organizational Psychologist
Highlands Director of Training, Research and Development

March 2020

Background

The Highlands Company (THC) has always been "dedicated to empowering career professionals worldwide with a unique human assessment tool created to objectively identify natural talents. Highlands is firmly committed to maintaining the integrity of the Highlands Ability Battery (HAB), and to expand the reach and effectiveness of its use. Our mission, through the inspiration and professional development of our Highlands Certified Consultants (HCCs), is to create a culture of heightened self-awareness and our goal is to develop the instrument in ways that make good business sense for our HCCs while providing valuable information, tools and resources to those taking the HAB." [HCC training manual, 2018]

In December 2011, Kim Mumola became THC's CEO. Under her direction, the HAB went through a re-evaluation of the reliability and validity by an outside psychometrician, Andrew G. Neiner, Ph.D., Technical Report: Reliability study looking at internal consistency and test-retest, 2013, laying a solid foundation for the development of highly desirable Career Exploration materials for our HCCs to use with their clients.

In 2013, those long-awaited Career Exploration materials were released in the Highlands Career Exploration Supplement (HCES). The HCES included proprietary combinations of HAB-measured abilities in the Highlands Ability Patterns which linked to occupations to explore through the national database of occupations called O*NET. Not only did the HCES provide a multitude of suggestions for occupations, the supplement evolved from a static to an interactive online format.

Highlands received overwhelming feedback on the HCES and by 2019 we were ready to take our Career Exploration materials to the next level. A considerable investment in the product was made and we embarked on a 1 year engagement with the *Human Resources Research Organization*, known as HumRRO, to develop an occupation fit algorithm for the Highlands Ability Battery. This engagement consisted of 2 research projects.

THC's engagement with HumRRO

The goals of our engagement with HumRRO were to:

1. Keep the HCES current with in-demand, growing occupations as identified by the U.S. Department of Labor's Bureau of Labor Statistics 10 year prediction of employment projections.

2. Provide continued evidence of validity – in demonstrating how a client's HAB profile of abilities link to corresponding abilities for occupations, and

3. Join the national movement to prioritize quality Career Development services and technology – a nationwide effort to equip learners with personalized career pathways to accelerate advancements in career readiness. Link to The Right Career Fit: The Path to Closing the Skills Gap, for more on this initiative.

Phase 1 of the research with HumRRO

Beginning in March 2019, principal scientists and project leads from HumRRO evaluated the Highlands Career Exploration Supplement and examined the client information that Highlands used to identify careers to explore. During the discovery process, HumRRO became familiar with THC's philosophy and intended use of our instruments which is for exploration rather than prescription. Based on their analyses, several ways to refine and strengthen our approach were outlined for identifying occupations that are recommended to our end users (clients).

In Phase 1, THC was tasked with reviewing the O*NET database of occupations to be used for Highlands programming. Our determination to eliminate Job Zone 1 (occupations that need little or no preparation) and some of Job Zone 2 (occupations that need some preparation) was based on the demographics of our users. Ultimately, our database of occupations consisted of 595 occupations.

Phase 2 of the research with HumRRO

Beginning in July 2019, HumRRO used a 5 step process to reach our objectives in the development of the HAB occupation fit programming.

1. **Step 1 – Create O*NET-HAB Mapping** - Approximately 2 months

HumRRO assigned a staff of 13 to participate as SMEs (subject matter experts). All SMEs were Ph.D. - level I/O psychologists with training in individual differences and job analysis. They identified those O*NET elements that closely corresponded to each of the 18 HAB scale scores resulting from HAB worksamples. Most of the O*NET elements were from the O*NET Cognitive

Abilities domain with a few dimensions such as Extrovert and Introvert from other domains (e.g., O*NET Work Styles).

The SMEs reviewed HAB worksample descriptions, images of worksamples, HAB score scaling and the definition of what each ability scale measures (provided by THC) and selected related O*NET worker characteristics with descriptions. Each completed and submitted their ratings indicating how strongly they thought test takers' standing on each O*NET characteristic would relate to their scores on each HAB scale. Ratings were on a 1-4 scale with descriptors of 1="not at all related", 2="weakly related", 3="moderately related", and 4="strongly related". This reflected the consistency with which SMEs were able to order HAB scales in terms of their relation to a given O*NET worker characteristic.

The overall Interrater Reliability Estimate for HAB-O*NET Linkage ratings by O*NET Worker Characteristic (treating HAB scales as target of measurement) ranged from .72-.98. The overall Interrater Reliability Estimates for HAB-O*NET Linkage rating by HAB Scale (treating O*NET worker characteristics as targets of measurement) ranged from .87-.97. This reflected the consistency with which SMEs were able to order O*NET worker characteristics in terms of their relation to a given HAB scale. Using these analyses, appropriate linkages were determined to be included in Step 2 – Developing and Evaluating an Occupational Fit Algorithm. For inclusion in Step 2, at least one of the following criteria had to be met: (a) an average rating of 3.0 or greater, or (b) at least 2/3 of SMEs rated the pair 3 or greater.

WHAT TO NOTE: Not all HAB measures have corresponding O*NET attributes. And in some cases, HAB measures were combined to relate to a single O*NET attribute. Further career exploration to include HAB abilities that are not connected to O*NET attributes is provided through THC's Ability Patterns.

In some cases, several O*NET attributes were combined to relate to a single HAB measure. Ultimately, 9 common attributes are considered in the person-occupation fit algorithms.

The HAB measures that had corresponding attributes in O*NET (based on the research) are:

1. Classification (4 O*NET attributes)
2. Concept Organization (5 O*NET attributes)
3. Extrovert/Introvert (2 O*NET attributes)
4. Idea Productivity
5. Memorization (VM, DM, NM combined)
6. Pitch Discrimination
7. Spatial Reasoning (SRT/SRV combined)
8. Visual Dexterity (VS/VA combined)
9. Vocabulary

The HAB-measured abilities NOT available for the algorithms (and therefore not taken into account when making recommendations of occupations to explore) are:

1. Generalist-Specialist
2. Timeframe Orientation
3. Separated measures for SRT and SRV
4. Observation
5. Tonal Memory
6. Rhythm Memory
7. Separate measures for Design, Verbal, and Number Memory

2. Step 2 - Develop and Evaluate Occupational Fit Algorithm – Approximately 2 months

Based on the linkages in step 1, HumRRO developed a person-occupation matching algorithm that reflects a simple weighted average of the absolute difference between a client's HAB ability dimension raw score (standardized) and the HAB-O*NET occupation profile element raw scores (standardized). They then applied and evaluated how the algorithm performed using a dataset of HAB client results (N= 8,269) and Highlands database of O*Net occupations (total 595).

Specifically, HumRRO calculated standardized client and occupation profile scores with a target mean of 50 and a target standard deviation of 15. These scores served as input into calculation of a raw fit score for each client-occupation pair. To establish what would be a reasonably good fit for a given client-occupation pair, HumRRO calculated fit scores for all 5,134,255 client-occupation pairs in the dataset provided by THC (8,269 clients X 595 O*NET occupations). They then treated the 10^{th} and 5^{th} percentiles of these scores (10.2, and 8.9 respectively) as two different possible (increasingly stringent) cutoffs for reasonably good fit. These cutoffs were used in algorithm diagnostics (to check the functioning of the algorithms). All diagnostics on the entire dataset were favorable.

3. Step 3 - Develop coding to implement the programming of the Algorithm to the HAB – Approximately 3-4 weeks

As part of this task, HumRRO created the pseudo-code for Highlands to implement the person-occupation fit algorithm to the HAB described under Step 2. Specifically, the pseudo-code illustrated how to use client HAB score profiles and O*NET-HAB occupation profiles (from Step 1) as inputs to an algorithm that produces two types of output:

(a) user-occupation difference scores for each O*NET-HAB profile element for each O*NET occupation included in the occupation dataset (see Step 4), and

(b) user-occupation overall fit scores for each score for each O*NET occupation included in the occupation dataset (again, see Step 4).

4. **Step 4 - Finalize the Occupation Dataset** – Approximately 4 weeks

Expanded information for each of the 595 O*NET occupations used for programming was identified by Highlands for inclusion in the HCES reporting for enhanced exploration. Additional information included job family, career cluster, and Holland interest codes associated for each of the occupations.

5. **Step 5 – Support THC in the implementation of the Algorithms**

Results/Outcomes

Highlands has reinforced its commitment to provide end users with options for explorations (rather than prescribing a career) as well as a means to explore those options. Through the rigorous analyses and research initiative conducted with HumRRO in the development of the occupation fit algorithm for the HAB and the enhanced Highlands Career Exploration Supplement, Highlands can…

1. Ensure that the occupations to explore, as reported in the HCES, are documented, and

2. Data driven, generated by customized algorithms to align HAB profiles to occupations.

3. Report updated occupational information for in-demand jobs based on the Bureau of Labor Statistics most recent projections 2018 to 2028.

4. Equip clients with an individualized list of 50 occupations to explore which are aligned with an expanded number of abilities,

5. Incorporate other considerations such as interest, career cluster (similar skills, competencies) and job family (similar work performed, training) for user experience when exploring careers.

6. Provide further career exploration through our Ability Patterns to include abilities that are not connected to O*NET attributes as well as smaller groupings of abilities related to work roles.

7. Offer an expanded and refined list of occupations to explore for each of our Ability Patterns.

About HumRRO

HumRRO was created in 1951 by the Department of the Army as an office of The George Washington University. It was established to conduct behavioral science research and development in training methodologies and applications. Today, HumRRO is a nonprofit organization that consults with and conducts research and analysis for a wide range of federal agencies, commercial businesses, professional associations, and state and local government agencies.