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Production Operator Test Battery Validity Study

White Paper

THE STORY

When organizations identify and hire people with the necessary technical, reasoning, and interpersonal skills as well as the right personality traits for the job they succeed and thrive, but when they fail to do so both individual and team performance suffer. Over a century of scientific research has found that leveraging valid cognitive and interpersonal assessments combined with measuring targeted personality traits in the selection process to be highly effective in identifying people who have a high probability of strong individual performance and who succeed on high-performing teams. Unfortunately, many organizations fail to capitalize on the benefits of using valid selection assessments. Some may test one or more cognitive constructs but often overlook the importance of teamwork skills and personality or, they rely on intuition and "gut feelings" to measure underlying personality traits. Others may use assessments with low validity coefficients in their selection processes that fail or do little to identify the individuals who will succeed or struggle within the organization.

Prior to 2004, a U.S. petroleum refinery was using a 60-year old mechanical comprehension test as one of their primary methods for selecting refinery production operators. Though it assessed reasoning skills through mechanical concepts relevant to the work of a production operator, the assessment failed to measure all of the most important skills and traits necessary for success on the job. The refinery often hired people who had the necessary mechanical skills however it was still experiencing performance and production problems related to operator performance. Upon further examination it was determined that these problems related to pervasive interpersonal issues. The teams or groups in the refinery had one or more individuals who:

- Were uncooperative and had difficulty working with others;
- Would ignore safety guidelines and engage in unsafe behavior;
- Were not dependable;
- Lacked organizational commitment.

Not every production operator exhibited all of these traits or necessarily any, but when even one member of the work group started displaying one or more, the whole team's production and performance suffered. **The one rotten apple inevitably spoiled the barrel.**

THE "BAD APPLE" PROBLEM

The problems experienced at this refinery are common in many organizations. Companies often use selection processes that assess people primarily based on their technical skills. Line managers are often focused on hiring people with strong technical skills but often overlook interpersonal skill requirements of the job. Even if they recognize the importance of interpersonal and teamwork skills, line managers with little training in interviewing are left to try to assess these skills and have no valid tools available to measure underlying personality traits. In addition, many applicants are able to make it through the interview process and at least give the impression that they have all the necessary skills. Though having the necessary technical skills and reasoning abilities is essential, the value of these strengths can be offset when the person does not work effectively with others, engages in unsafe behavior, is not dependable, or has low levels of organizational commitment. Workers who exhibit these behaviors can cause serious problems which require excessive amounts of management time to deal with.

Case Study:

Roger was the hiring manager for a sales team. He recently interviewed Sam, a very successful salesman in his last job. The interview went okay and Sam demonstrated a very thorough understanding of the company's products, services, and the customers' needs. He seemed to be the perfect fit and was hired.

When Sam started, he immediately got to work on new leads and learning more about his new company. However, he ignored the other members of his sales team, only interacting with them when he wanted something. On his first team sales call to a client, he dominated the meeting, taking over any comment his coworkers tried to express. They got the sale but Sam left his coworkers wondering how to work with him. When confronted, Sam got angry and told them they weren't helping with the sale anyway.

As Sam worked there longer, he continued to dominate sales calls and even attempted to take on his coworkers' clients as his own. This eventually led to a few lost sales. He never worked with anyone else and when confronted by others or management would argue his coworkers weren't working hard enough or were the ones losing the sales. He was eventually let go after arguing with a coworker in the middle of a sale.

When organizations assess personality, or "soft skills," in addition to the necessary technical and reasoning skills, they are better able to select people who will be successful with both their individual and team responsibilities. Valid assessments take much of the pressure of identifying necessary job-specific personality traits off the shoulders of the interviewers allowing them to focus on the more technical requirements of the position.

Assessment Associates International (AAI) has developed scientifically valid assessments of personality which help organizations avoid hiring the "bad apples" who can be so disruptive to an organization. To help them pick only "good apples" from their candidate pool, the refinery's human resources staff contracted with AAI to develop a multi-faceted selection system that assessed reasoning skills as well as job-specific personality traits.

THE WORK OF REFINERY PRODUCTION OPERATORS

To better understand the nature of the work of production operators, AAI compiled a list of 25 work competencies based on refinery work job descriptions provided by the Occupational Information Network (O*NET), a comprehensive database of information about all jobs in the US economy. From this list, three competencies around knowledge and skill areas were selected and 22 were selected around personality traits. A group of highly experienced production operator managers and employees rated each of the 25 competencies in terms of importance and level of competence required.

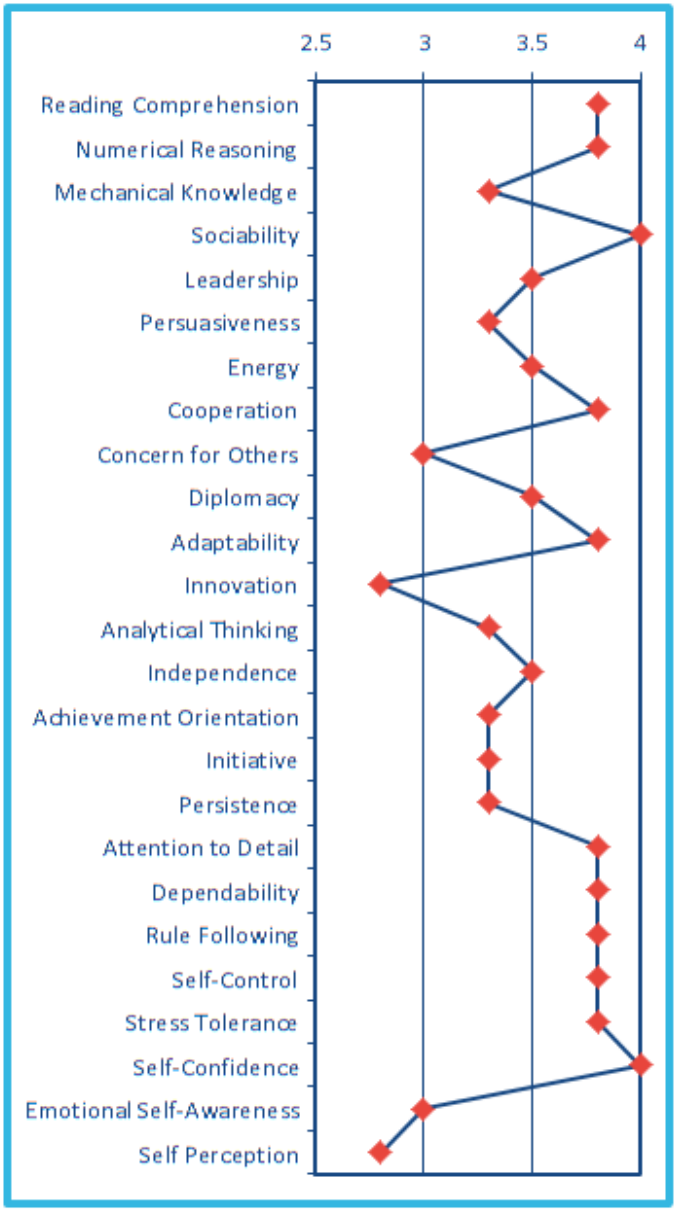
❖ IMPORTANCE

Across the 25 competencies, personality traits were deemed highly important to the work of production operators. In fact, the two most important were Sociability and Self-Confidence. The next few included two of the three reasoning abilities but also another seven competencies around personality, largely focused on dependability. Mechanical Knowledge, which had been the primary assessment, was ranked in the bottom half of the 25 competencies in terms of importance.

Clearly, production operators found personality extremely important to their work. The characteristics deemed most important deal largely with a person's ability to work in teams (Sociability, Cooperation, Self-Control) and with being dependable and safe (Attention to Detail, Dependability, Rule Following). These are the very issues that the refinery was struggling with.

But, reasoning skills are also important. Though the importance of Mechanical Knowledge was lower than many of the other competencies, Reading Comprehension and Numerical Reasoning were two of the highest rated competencies.

Figure 1:
Importance Ratings
(1 = Not Important, 5 = Extremely Important)



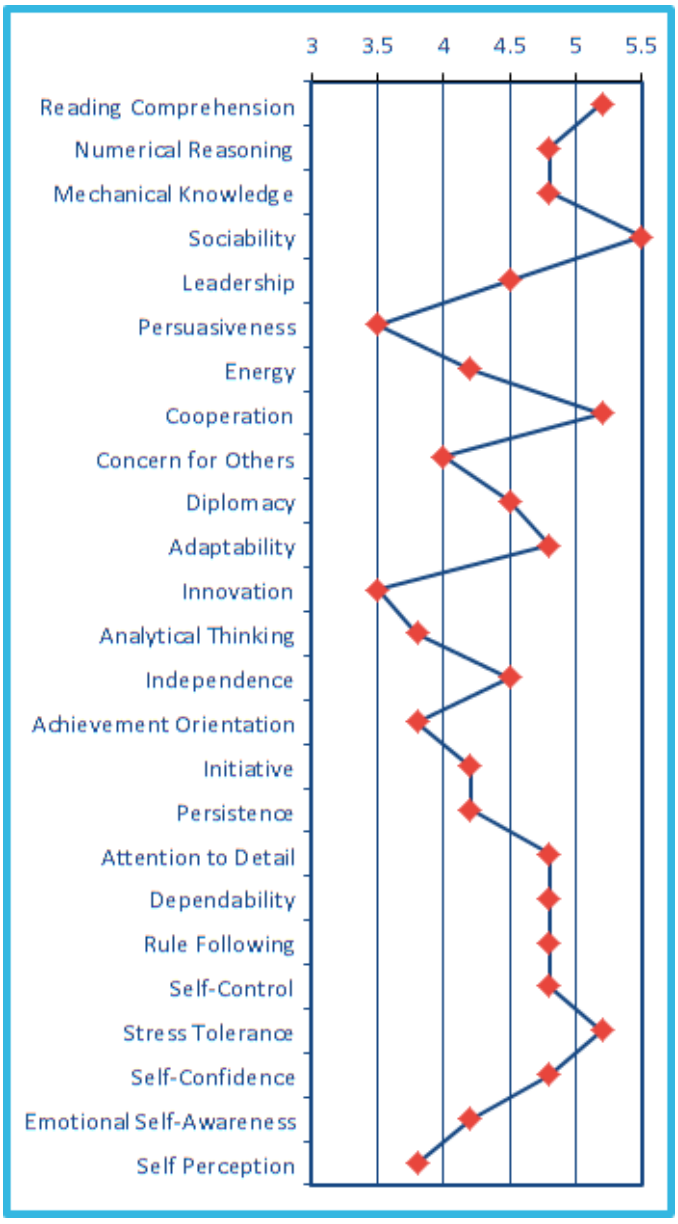
❖ COMPETENCE

Beyond what workers deem is important to their work, it is critical to know the level of competence required. Again, personality traits rated as requiring a high level of competence in order to be successful as a production operator at the refinery. In addition to being ranked as one of the most important competencies, Sociability was rated as requiring the highest level of competence. The next highest in terms of required competence included two more personality characteristics and one of the reasoning skills. The required level of Mechanical Knowledge was higher than several of the personality competencies but was still in the bottom two thirds.

In addition to being highly important, production operators need to be highly competent across many aspects of personality. The areas requiring the greatest competence were around teamwork (Sociability, Cooperation, Self-Control) and dependability and safety (Attention to Detail, Dependability, Rule Following). These are the same areas that were deemed extremely important and are the issues the refinery was currently facing.

As mentioned, Mechanical Knowledge was considered to require a high level of competence but so was Numerical Reasoning. Reading Comprehension was considered to require the highest level of competence of the reasoning abilities assessed. But, again, many personality characteristics were considered to require an equal or higher level of competence to the reasoning skills.

Figure 2:
Level of Competence Required
(2 = Moderate, 6 = Very High)



VALIDITY STUDY

With the confirmation from managers and employees that personality was seen as important, if not more important, than reasoning skills for production operators, AAI implemented a validation study using tests of the 25 competencies with current employees: three separate reasoning tests to measure cognitive ability and the Work Behavior Inventory (WBI) to measure personality. The employees' responses were then compared to ratings of their performance to find out whether using the AAI assessments could identify better production operators. The reliabilities and validities are displayed in Table 1. In general, the higher the reliability and validity, the more effective the selection tools will be in identifying individuals who will have higher levels of job performance.

Table 1:
Reliability and Validity of 3 Reasoning Skills & 3 Personality Scales

Scale	Reliability	Validity
Reading Comprehension	.93	.34*
Numerical Reasoning	.89	.53**
Mechanical Comprehension	.76	.55**
WBI: Leadership	.82	.37*
WBI: Achievement Orientation	.82	.43*
WBI: Self-Perception	.78	.33*
Sum of the 3 Reasoning Scores	-	.60**
Sum of the 3 Personality Scores	-	.66**
Sum of the 3 Reasoning and 3 Personality Scores	-	.82**

* Significant at $p \leq .1$.
** Significant at $p \leq .01$.

❖ RESULTS

The above results indicate there is a high degree of reliability for all six measures recommended by AAI as well as significant relationships to performance. Specifically, the three reasoning tests were found to be strongly related to effective job performance. This reinforces the previous analyses that multiple reasoning abilities are critical to performance as a production operator. Three of the 22 personality scales from the WBI were also strongly related to effective performance: Leadership, Achievement Orientation, and Self-Perception and coincide with the previous importance and competence analyses.

The Leadership scale addresses communicating with and motivating others. Achievement Orientation addresses setting goals and striving to reach goals. Individuals high on these scales tend to be extraverted, willing to speak up and take charge of situations, goal oriented, and willing to exert themselves in reaching goals. Self-Perception addresses how accurate and realistic one's self-perception is and helps control for the possibility that an individual may present an inflated (inaccurate) description of themselves. Individuals who do inflate their score tend to be poorer performers.

When the three personality scales are combined with the three reasoning skills, the relationship with job performance increases from .66 to .82. This indicates that the WBI measures something different than the reasoning assessments. Moreover, the WBI complements the reasoning skills and increases the accuracy of identifying the best performers for the job. **Using measures of both cognitive ability (reasoning skills) and job-specific personality traits produced a selection tool that could better identify the "good" and "bad apples."**

SUMMARY

- Three cognitive abilities relate to successful job performance of Production Operators: Reading Comprehension, Numerical Reasoning, and Mechanical Comprehension.
- Certain personality traits, frequently referred to as "Soft Skills," are also related to the successful job performance of Production Operators, including: leading and motivating others, showing motivation to achieve results and goals, and possessing and presenting a realistic description of oneself.
- The selection system that was developed for the Production Operator positions reliably assesses job applicant capabilities on a set of valid selection instruments including Reading Comprehension, Numerical Reasoning, and Mechanical Comprehension as well as job-specific Personality Traits. Because of the demonstrated validity, we have evidence that individuals scoring higher on these selection assessments are, in fact, better job performers.
- After implementing the new selection system, the U.S. based refinery was able to hire individuals with the full set of necessary cognitive and reasoning skills as well as the personality traits necessary to work cooperatively, safely, and successfully on high performing teams. Consequently, refinery production and performance increased while interpersonal issues decreased. For the past nine years they have been selecting refinery workers with the right skill sets and have been able to weed out the "bad apples" during the selection process.

NOTE:
Please note that a caveat must be provided regarding the results of the validation study. Because of scheduling constraints and the availability of employees, the assessment results and performance ratings of only 20 employees were used in this validity study. This is a rather small sample and the results may be influenced by error variance. Nevertheless, the correlations are quite large and statistically significant. This suggests that there is less than one chance in 100 for finding a correlation of this magnitude, when no relationship exists within the broader population.