Psychometric Analysis

Introduction

This report summarizes the methods and findings of research conducted on the psychometric properties of the *AchieveWORKS® Personality* assessment.

Analysis began with a data set of 19,483 (55%) females and 15,995 (45%) males, for a combined total of 35,478 subjects. International in scope, the sample is comprised of young people ages 14 through 20 from 41 U.S. states and six countries. All of the subjects were attending school in ninth through twelfth grade or studying at a post-secondary institution at the time of assessment. The states representing the largest portion of the sample are California (16.3%), Connecticut (12.2%) and Texas (9.6%).

A profile is generated based on the subject's assessment responses and the subject is asked to rate its accuracy. Following is a breakdown of the accuracy rating of the 35,478 subjects:

Goodness of Fit – Self-Rated Accuracy

Accuracy Rating	Number of Subjects	Percentage of Subjects
Very Accurate (85% or more)	21,784	61.4
Mostly Accurate (75%)	11,105	31.3
Somewhat Accurate (60%)	2412	6.8
Not Very Accurate (50% or less)	177	0.5

The complete data set of 35,478 subjects contained the 16 personality types in the percentages described in the following table:

Personality Type Results

Dimension	%	%	Dimension
Extravert	41.5	58.5	Introvert
Sensing	62.2	37.8	Intuitive
Thinking	44.1	55.9	Feeling
Judging	55.9	44.1	Perceiving

Type	% from DWYA Sample	% from MBTI Sample	Type	% from DWYA Sample	% from MBTI Sample
ENFJ	3.8	2 - 5	INFJ	5.9	1 – 3
ENFP	6.3	6 - 8	INFP	7.7	4 – 5
ENTJ	2.7	2 – 5	INTJ	4.3	2 – 4
ENTP	3.5	2 – 5	INTP	4.0	3 - 5
ESFJ	5.7	9 – 13	ISFJ	12.8	9 – 14
ESFP	4.8	4 – 9	ISFP	6.6	5 – 9
ESTJ	8.2	8 - 12	ISTJ	13.3	11 - 14
ESTP	5.0	2 - 4	ISTP	5.3	4 - 6

Within the complete data set, the percentages for 12 of the 16 types fall within the ranges found by the Myers-Briggs Type Indicator (MBTI) to represent the general U.S. population[1]. Statistically significant differences between the results of *AchieveWORKS Personality* and the MBTI are indicated for the four types highlighted in the table, ESFJ, ESTP, INFJ and INFP. However, the *AchieveWORKS Personality* sample includes a student population under 20 years of age to whom the assessment was administered, while the MBTI sample spans the general U.S. population and consists of subjects 18 years and over who voluntarily completed the assessment.

From the complete data set of 35,478 subjects an idealized sample was constructed containing equal numbers of each predicted personality type and using only those results where subjects rated their profiles as very or mostly accurate. In the data set, ENTJ accounted for 2.7% or 951 subjects. 951 subjects of each of the other personality types were randomly selected and retained, resulting in a total of 15,216 subjects in the idealized sample. The purpose of employing an equal number of each type for the sample is to eliminate any bias in the item analysis or test of independence that can be caused by an uneven type distribution.

Three analyses were conducted on the idealized sample:

1. Item analysis measuring the predictive power of each question.
2. Internal consistency using coefficient alpha.
3. Correlation of scales to determine if the personality dimensions are independent measures.

Item Analysis

The item analysis conducted was a Bayesian procedure, which shows the predictive power for each question item. Items are deemed predictive if both response options show at least a 67% probability of predicting the correct personality type. This threshold is more rigorous than that used for the MBTI study. Items are also examined to ensure they do not have predictive power on any index other than the one they are assigned. Items are deemed not predictive if they range between 40% and 60%. A 50% predictive ability would be equal to random chance in predictive power for the dichotomous scale used in personality type.

The results from the item analysis showed that **all** items have predictive power only for the intended index. In fact, the results from this analysis show that the assessment has made significant improvement on this measure of reliability since the last major analysis made in 2002.

Average predictive power for extravert-introvert questions was 80%, intuitive-sensing was 76%, thinking-feeling was 79%, and judging-perceiving was 79%. For comparison, all questions ranged between 43% and 56% when measured against scales for which they were not intended. This means the items were specifically predicting the intended dimension of personality and were not predicting one of the other three dimensions. The specific probabilities for each item and the personality type preferences are shown in Table A of the appendix.

Reliability via Internal Consistency

An internal consistency analysis was performed to evaluate the reliability of each of the dimensions. The method employed was coefficient alpha. The minimum level of correlation for acceptable reliability is 0.60. The following tables show the coefficient alphas for each of the dimensions. For reference, values from 0.70-0.79 are considered "acceptable", values of 0.80-0.89 are "good", and values of 0.90 or greater are "excellent" but rare.

Dimension	Coefficient Alpha
E/I	0.85

S/N	0.78
T/F	0.84
J/P	0.87
Average	0.84

In a 2009 review of the MBTI Form M[2], reliabilities for the <20 age group were E/I 0.91, S/N 0.86, T/F 0.87, and J/P 0.89. However, the *AchieveWORKS Personality* assessment is a much shorter instrument with 36 items, compared to the MBTI Form M with 93 items. Also, the MBTI requires special certification to administer the assessment and interpret the results. The *AchieveWORKS Personality* assessment can be administered by any educator, counselor or human resources professional.

Independence of Scales (Personality Dimensions)

The third analysis is the independence of the scales. This procedure correlates each dimension to the others. The indices of a Jungian instrument should not correlate since the constructs are independent and separate ideas. Thus a correlation of the indices should not yield coefficients greater than 0.30 in magnitude. Below are the results of the test of independence for the idealized sample.

Correlation of Dimensions

	E/I	S/N	T/F	J/P
E/I	1.00	0.03	-0.03	-0.09
S/N	0.03	1.00	0.15	-0.19
T/F	-0.03	0.15	1.00	-0.08
J/P	-0.09	-0.19	-0.08	1.00

These results show that all correlations between different dimensions are well below the 0.30 threshold. The highest is SN/JP, reaching 0.19. The majority of correlations were below 0.10, which shows the dimensions have a high level of independence.

Goodness of fit data is recorded as subjects report the accuracy of their results. Thus, fit can also be an approach to measure criterion validity. The Goodness of Fit Table at the beginning of this report shows that 93% of the subjects rate their type descriptions as mostly or very accurate.

The *AchieveWORKS Personality* assessment attempts to increase accuracy by asking subjects to read different type descriptions and, if they had very close scores on a dimension, select the better fitting description. Goodness of fit can therefore be further examined by a variable called "typesame", which records whether the subject picked the type as scored (all four dimensions the same) or picked a type different than scored (one or two dimensions different).

The findings show that people who picked the same type as scored by the assessment had a significantly higher percentage of very good fit.

Parallel studies on the MBTI measured percentage of agreement with assessment results and a type chosen as the subject's best fit after a feedback session with a trained professional. The method is similar to the *AchieveWORKS Personality* assessment's approach to clarifying close scores. Studies show that, on average, 75% of people select a type that matches their MBTI results.

In studies where participants were asked to pick a description blind to their results and without professional feedback, an average of 50% of subjects picked the same type description as their results predicted.

Conclusions

These results show that the psychometric properties of the *AchieveWORKS Personality* assessment instrument are indeed stable. They, in fact, appear very good for a short assessment. The item probabilities average 79%, well above the accepted threshold of 67%.

The factor analysis supports the item analysis finding and shows that the items group with their respective dimensions.

The reliability results (average 0.84) are excellent for an instrument this short. While the longer MBTI scales achieve only slightly higher levels of reliability (average 0.88) due to their length, the *AchieveWORKS Personality* assessment's reliabilities are very respectable. The 0.04 difference in magnitude appears to be attributable to the difference in the number of items in the assessments. It is harder for a shorter measure to push people away from the midpoint.

All the intercorrelations of the scales are well below the 0.30 threshold, demonstrating virtually no overlap. Only the SN/JP correlations edge toward the threshold with a score of 0.19. The *AchieveWORKS Personality* assessment benefits from the shorter scales, reducing the chances of higher correlations.

The validity test examining fit, while not exactly the same test performed with the MBTI, shows that the *AchieveWORKS Personality* assessment has comparable results.

One unique approach taken by the *AchieveWORKS Personality* assessment is that subjects with very close scores can examine descriptions and choose a type they believe fits best. The comparison of reported goodness for subjects accepting their type results versus subjects picking another type show that people who agreed with their assessment reported the highest goodness of fit with the description. While the difference is statistically significant it is modest and likely improved due to the approach, although this has not been empirically demonstrated.

The Selection Ration Type Table (SRTT) analysis showing a statistically significant difference in the type distribution of this sample with samples drawn to estimate the U.S. population cannot be explained by any of the analysis conducted in this study. The most likely explanation is that it is due to the voluntary nature of the MBTI sample. The MBTI literature has documented the inclination of NF types to be drawn to activities in the nature of psychological and personal discovery. Choosing to take a personality assessment on the internet clearly fits that description.

While validation is a process and one study alone cannot absolutely prove validity, this study, with this very large sample, takes a very large first step in this process and demonstrates that the *AchieveWORKS Personality* assessment has stable and admirable psychometric properties.

Table A

Item Analysis - Positive Predictive Value

	E	I	S	N	T	F	J	P
E/I 1	89	88	50	50	50	50	49	49
E/I 2	78	82	50	50	51	51	47	46
E/I 3	88	81	51	50	50	50	49	49
E/I 4	81	76	52	51	48	49	51	51

E/I 5	86	74	49	49	49	49	48	49
E/I 6	75	75	51	51	50	50	48	48
E/I 7	77	73	51	51	51	51	43	44
E/I 8	87	80	51	51	49	49	51	50
E/I 9	74	76	52	52	49	48	51	51
S/N 1	51	51	79	77	51	51	48	48
S/N 2	49	49	85	79	50	50	48	48
S/N 3	45	45	69	70	53	53	49	49
S/N 4	51	51	83	78	55	54	48	48
S/N 5	50	50	74	72	53	53	47	47
S/N 6	53	52	79	74	53	53	45	46
S/N 7	51	51	84	80	53	53	47	47
S/N 8	50	50	70	72	51	51	47	47
S/N 9	52	51	77	74	53	53	45	46
T/F 1	51	51	50	50	81	87	49	49
T/F 2	48	48	52	52	82	80	47	47
T/F 3	50	50	49	49	81	82	49	49
T/F 4	50	50	55	55	80	78	48	48
T/F 5	49	49	54	54	80	79	50	50
T/F 6	49	49	52	52	75	80	48	47
T/F 7	50	50	52	52	81	85	49	48
T/F 8	47	48	51	51	78	72	48	48
T/F 9	50	50	55	56	72	77	48	47
J/P 1	45	47	43	46	50	50	83	71
J/P 2	47	47	47	48	50	50	92	86
J/P 3	49	49	48	48	49	49	85	87
J/P 4	46	47	48	48	49	49	82	74
J/P 5	49	48	48	47	50	50	77	85
J/P 6	48	49	46	47	49	49	91	79
J/P 7	49	49	49	48	49	48	72	87
J/P 8	49	49	47	46	49	49	79	85
J/P 9	50	50	47	45	49	47	69	87

References

1. Estimated Frequencies of the Types in the United States Population. From the Center for Applications of Psychological Type, Inc. Retrieved from http://www.capt.org/mbti-assessment/estimated-frequencies.htm on August 30, 2013.

2. MBTI® FormM Manual Supplement. Retrieved from https://www.cpp.com/pdfs/MBTI_FormM_Supp.pdf on August 30, 2013.