Predicting Technical Aptitude:
Relations between Predictor Variables, Technical Aptitude and Technical Training Performance

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SUMMARY

The U.S. Armed Forces are a highly technical and partly high-tech work environment, which for selection and placement of future personnel relies on the Armed Services Vocational Aptitude Battery (ASVAB). The assessment of aptitude for acquiring new technical knowledge and skills is an important target of the ASVAB. Four out of nine tests are Technical Knowledge (TK) tests, viz., General Science (GS), Mechanical Comprehension (MC), Auto Shop (AS), and Electrical Information (EI). As measures of technical aptitude the ASVAB TK subtest have severe limitations, namely, the tests (1) represent a rather arbitrary sample from the domain of technical knowledge and skills; (2) measure only technical knowledge (concepts) not technical skills; (3) have only modest predictive utility.

In a companion paper the authors (Ippel & Glaze, 2011) describe how measures of technical aptitude were directly extracted from post-test measures of eight common modules of the U.S. Navy Apprentice Technical Training (A.T.T.) program, which provides basic electricity and electronics training to 21 Navy ratings. The benefits of this achievement are clear. Having derived a relative "pure" measure of technical aptitude it now becomes possible to (1) evaluate and possibly improve current predictors of technical aptitude (i.e., GS, MC, AS, and EI), and (2) develop new measures of technical aptitude that can be used in the broader context of selection and placement systems of the U.S. Armed Forces.

The present paper evaluates the construct validity of the current set of TK subtest of the ASVAB using structural equations modeling (path analysis) with the aptitude estimate (either aptitude for technical knowledge learning (TA_K) or technical skill learning (TA_S) as the exogenous variable and the ASVAB subtests GS, MC, AS, and EI together with a A.T.T. module post-test score as endogenous variables. The error variances of the TK subtests were allowed to be correlated. Separate analyses were performed with the eight common A.T.T. module post-test scores as dependent variables. As expected the proposed model contains a statistical significant direct path from TA_K to the K-test scores and from TA_S to the S-test scores of the A.T.T. common modules. Although results varied per ATT module the proposed model contains a statistically significant path from technical knowledge aptitude (TA_K) to GS, MC, and EI, but the results suggest that technical knowledge aptitude was not related to AS. Furthermore, none of the indirect effects of technical knowledge aptitude on the post-test scores via the ASVAB technical knowledge predictors were statistically significant. (Notice: the direct effect of technical knowledge aptitude on the post test score was large). Finally, the correlated residuals between the ASVAB technical knowledge predictors were medium to large (ranging from 0.330 to 0.650) suggesting another strong determinant of the TK test scores. Thus, as a general summary statement, it was shown that TA_K and TA_S underlie training performances, but that a large portion of the score variance of the ASVAB technical knowledge predictors was unrelated to training success.