

Task 1: Longitudinal Validation of ATC Specialist Selection Instruments: Assessment of Cognitive Aptitude (Bleckley, Pierce)

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Project Start Date: 1 October 2005 **Anticipated End Date:** On-going

Requirements Statement
<i>Operational Shortfall or Knowledge Gap</i> The FAA developed the Air Traffic Selection and Training (AT-SAT) test battery and conducted a concurrent validation using en route ATCSs and related job performance criteria. Our goal continues to be assessment of the longitudinal validity and incremental improvement of the predictive utility of the Air Traffic Selection and Training (AT-SAT) battery, so that it will continue to serve the needs of the agency.
<i>Benefit in Closing the Shortfall or Gap</i> Validation and incremental improvements in AT-SAT will help reduce the costs to the agency of hiring Air Traffic Control Specialists (ATCSs) by refining selection. Better selection would reduce the number ATCS trainees who are unable complete training and increase the number of applicants who would make good ATCSs, but are not currently being selected.
<i>Description of the Desired Product</i> The FAA needs evidence of validity and reliability for the AT-SAT. In pursuit of this goal, we need to conduct a formal study that documents the degree to which AT-SAT predicts job performance of air traffic control specialists. Interim validations will continue to be conducted using training performance criteria, but in order to fully validate the instrument, we will need job performance measures. Additionally, with the current levels of testing and hiring, it is important to ensure that AT-SAT is still performing as intended. The potential for litigation concerning adverse impact and inappropriate pass rates creates the need to examine if AT-SAT is vulnerable to such claims.
<i>Schedule</i> ongoing

We are proposing four research objectives for this task.

1. Analyze the archival concurrent validation data for adverse impact.
2. Use Performance Verification and AT-SAT data for selection to option analyses.
3. Determine if the SDI+ can be used to replace the AT-SAT Experience Questionnaire (EQ).
4. Develop a data base for selection research

1. Research Objective

Analyze the archival concurrent validation data for adverse impact.

Background

To date, there have been no litigations or enforcement actions concerning the role AT-SAT plays in selection and whether it would contribute to a lack of fairness in the selection of ATCS trainees. Despite this lack, it is prudent to assess the potential for adverse impact. Previously, adverse impact has been examined by AHR-4. However, they assessed pass rates without regard to score band and found no evidence of adverse impact using the four-fifths rule.

Recent increases in applications have resulted in a much larger ratio of applicants to positions available. This has led to 85, the minimum score of the 'well-qualified' band, becoming the de facto cutoff score for applicants who take AT-SAT as part of the hiring process. The degree of adverse impact resulting from this de facto change was assessed. However, the score distribution of the 12-15% of applicants providing RNO/gender information was significantly different from the score distribution of the applicants who chose not to divulge that information.

Adverse impact was found based on these analyses; however, the results are problematic due to the non-representative sample. Therefore, ACR and AHR have requested a reanalysis of the archival concurrent validation data before determining whether to re-weight the AT-SAT subtests to reduce adverse impact. If AT-SAT is creating a barrier to employment, it may be prudent to reduce the barrier. However, it is also important to retain the validity of the test.

See memorandum report

Bleckley, M. K. Air Traffic Selection and Training Battery: Barrier to Employment Analyses. Unpublished memorandum report produced for the Assistant Director for Civil Rights and the Manager of the Human Resources Air Traffic Organization Support Team.

Previous Activity on this Task

Analyses were conducted for Fanny Rivera (ACR-1) on potential barriers to employment in selection resulting from AT-SAT. An internal memorandum concerning the analyses was provided to ACR, AGC and AHR on June 30, 2009.

Proposed or Planned Research

We will examine data collected during the concurrent validation study in 1997 to assess whether there are sufficient data from women and minorities to allow us to determine if selecting from only the well-qualified score-band would have produced a barrier to employment in the concurrent validation sample. If there are not sufficient data, we will determine if a data augmentation technique (e.g. bootstrapping) would create a data set that would produce a technically feasible analysis.

Research Question(s)

Is there adverse impact in the archival validation data at the de facto cutoff score of 85? If so, which groups are affected?

Technical Approach

Current Year

1. Verify Isomorphism of the test used in the concurrent validation with the current version of AT-SAT.
 - 1.1. Each subtest must be examined to determine whether the number of items is the same as the current version.
 - 1.2. Each subtest must be examined to determine whether the difficulty of the items is similar to the current version.
2. To increase the number of valid cases, we will determine if the data from Certified Professional Controllers (CPCs) are statistically the same as pseudo-applicant data. If so, the CPC data may be used to increase the number of valid cases for analysis.
3. Analyses
 - 3.1. Values representing the current subtest weights must be computed.
 - 3.2. Selection ratios as defined by the Uniform Guidelines must be computed.

Out-years

The final internal memorandum will be completed in FY11.

Air Traffic Resources Required

None

Calibration

None

2. Research Objective

We propose to use Performance Verification data to examine the utility of using AT-SAT for selection to option.

Background

AT-SAT was concurrently validated using ARTCC ATCS. It was not validated for use in assigning trainees to en route or tower/cab positions. The concurrent validation of AT-SAT for selection to option is underway, but there is a pressing need for a way to determine whether an applicant is better suited to en route or terminal ATC.

Previous Activity on this Task

A memorandum report was prepared in FY09 that examined the relationship between AT-SAT scores and PV outcomes.

Proposed or Planned Research

We will examine whether AT-SAT can differentially predict success in Academy training for en route and tower ATCS trainees. The outcome variable will be successful completion of Academy training as measured by Performance Verification. Two equations will be generated: one for en route and one for tower/cab. These equations will then be examined to determine if the subtest weights are different for the two types of controllers.

Research Question(s)

Are there interim steps that can be taken to examine the utility of AT-SAT for selection to option and/or assignment to level of facility?

Technical Approach

Current Year

Due to the rate of hiring and training in the past 3 years, we should have sufficient data to look at selection to option. We will use logistic regression to determine whether AT-SAT can differentially predict success in Academy training for tower/cab vs en route specializations. We plan to provide a briefing for AJE, AJT, and AHR by the close of FY 10.

Out-Years

Because this project is intended to provide a stop-gap answer while Dr. McCauley completes the Co-VATCH project, no further work is planned.

Air Traffic Resources Required

We will need continued access to Academy training data from AMA-500 and AJL-11.

Calibration

None.

3. Research Objective

The Experience Questionnaire (EQ) subtest of AT-SAT may not be providing as much predictive validity as another self-disclosure measure could. Other personality/self-description tasks should be examined to determine if the EQ could be replaced.

Background

The EQ was developed quickly to fill the need for an instrument that would measure personality and interpersonal behaviors. Previous FAA technical reports have called into question the validity of its factor structure; therefore, it would be prudent to examine other instruments. The Five Factor Model (FFM) of personality, in various forms, have been shown to predict job performance across a wide range of occupations. The SDI+, developed for use by the USAF, measures the FFM. Additionally, it provides measures of service orientation and teamwork orientation.

Previous Activity on this Task

In FY08, we developed a memorandum of understanding for the USAF Force Management Liaison Office for use of the SDI+. Also in FY08, we developed a computerized version of the SDI+ and since then, we have administered it to 1,499 Academy students.

Proposed or Planned Research

For FY 10, we will conduct a series Confirmatory Factor Analyses (CFA) to determine if the theoretical factor structure of the SDI+ is supported in this population. Based on these CFA, we will drop items that are shown to be unnecessary or invalid.

Additionally, we will test the convergent validity of the SDI+ against a known FFM scale, the Goldberg Adjective Checklist. Because the SDI+ has 220 items and the Goldberg has 100, we will need a minimum of 960 valid cases. We will conduct a three-tiered analysis, examining structural equivalence, tau-equivalence, and parallel forms equivalence.

Research Question(s)

If the SDI+ is a valid FFM measure, will it provide greater validity in predicting Academy training performance than the EQ?

Technical Approach

Current Year

CFA for FFM factor structure.

Three-tiered measurement equivalence analysis.

Out-Years

Determine the predictive validity of SDI+ as compared to EQ, using PV as the outcome measure. Separate analyses may be necessary if the differences in PV for these positions are significant.

Administer test to incumbent CPCs to validate it as a job performance predictor.

Air Traffic Resources Required

FAA Academy ATCS trainees for test validation purposes.

4. Research Objective

Develop a research database to support personnel selection, to include the longitudinal validation of the Air Traffic Selection and Training (AT-SAT) test battery.

Background

Personnel selection is central to the development of a productive and satisfied workforce. As the FAA moves toward new technologies, the selection of employees for ATCS and other occupations will need to be updated to ensure the safety of the flying public.

Previous Activity on this Task

The FAA has been actively engaged in selection research since its inception. CAMI researchers are involved in the collection of data pertaining to the FAA workforce. We currently receive AT-SAT scores for all ATCS applicants who take the test. We are developing memoranda of

understanding with the owners of other data that are critical to our ability to improve personnel selection for the agency.

Proposed or Planned Research

For FY10, we will continue to search for sources of data that may be suitable for selection research. We will finalize memoranda of understanding with the owners of data that have been identified as relevant to our various projects.

Research Question(s)

There is no research question per se; we will use the database to answer numerous personnel selection research questions.

Technical Approach

Current Year

Identify additional sources of data that may be suitable for selection research. We are especially interested in locating or developing appropriate job performance measures. Continue to develop and finalize MOUs with database owners.

Out-Years

Develop data extraction, importation, and transformation procedures for data sources. Continue to identify data sources and develop MOUs for those sources.

Air Traffic Resources Required

We will need to coordinate with the owners of the ATO field training databases. We will seek continued cooperation from AJL-11. Other known data sources are owned by AJL-15. We will add other data sources as we identify them.

Calibration

None

FY10 Milestone Schedule

Description	Proposed Start Date	Proposed Completion Date
1. Archival Data	10/01/09	12/31/10
Verify Isomorphism with Current Version	10/01/09	5/31/10
Determine if CPC= Pseudo Applicants	3/31/10	6/30/10
Analyses: weights, 4/5, etc	6/30/10	9/30/10
Report	10/01/10	12/31/10
2. Selection to Option	10/01/09	9/30/10
Ensure that we have latest PV data from AJL-11	1/15/10	3/31/10
Verify PV to ATSAT match	3/31/10	4/30/10
Analyses	5/01/10	6/30/10
Report	7/01/10	9/30/10
3. SDI+	10/01/09	9/30/11
CFA	7/01/09	9/30/09
Convergent Validity	10/01/09	6/30/10
Report	6/30/10	9/30/10
EQ equivalency	10/01/10	3/31/11
Incumbent CPCs	10/01/11	3/31/12
Report	4/30/12	9/30/12
4. Database	10/01/08	9/30/11
identify data sources	10/01/08	10/01/09
Establish MOUs	1/05/09	9/30/11

FY10 Deliverables		
Description	Proposed completion date	Actual completion date
Draft Technical Report on Selection to Option	09/30/2010	
Draft Technical Report SDI+ (CFA, convergent validity)	09/30/2010	
Draft Report on archival data analysis	12/31/10	
Archival Data Analysis Briefing for AHR-4 and ACR-1	1/31/11	
MOU drafts for data sources identified for selection database	On-going	
Periodic technical reports and management briefings on AT-SAT reliability, fairness, validity, and utility in accordance with 29 CFR 1607.15 and relevant professional standards and principles.	As needed	
Supporting materials will be provided at the request of the AJP-61 Program Management. These include power point charts and briefing slides for TCRG meetings, abstracts for reports that don't already include them, quarterly reports, and text for the annual report summarizing the year's activities.	As needed	
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Continue to archive the results of AT-SAT testing, both the test scores obtained operationally as a hiring tool and data from other tests obtained for research purposes as a result of informed consent.	On-going	
Development of appropriate job performance measures for use with developmental ATCS and CPC.	On-going	
Coordination with Principal Investigators and sponsors of Tasks 3 and 10 so that revisions of AT-SAT will produce an instrument that will continue to serve the ATO.	On-going	

Funding Estimates	FY10	Total
FTEs	5.8	
Supplies (only if significant)		
Contracts		
Software development for auditory attention task	50.0	
Xyant proctoring	50.0	
Procure equipment to modernize testing lab	70.0	
Grants		
Total (excluding FTE cost)	170.0	