

**Technical Report 1432**

**Research on the Cadet Background and Experience  
Form to Support Army ROTC Personnel Assessment:  
2020-2021**

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**United States Army Research Institute  
for the Behavioral and Social Sciences**

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**United States Army Research Institute  
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**August 2023**

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The authors would like to acknowledge the support that the U.S. Army Cadet Command (USACC) has provided for this research program. We dedicate this work to the young men and women in ROTC nationwide who are making considerable sacrifices to become the Army's leaders of tomorrow.

# RESEARCH ON THE CADET BACKGROUND AND EXPERIENCE FORM (CBEF) TO SUPPORT ARMY ROTC PERSONNEL ASSESSMENT (2020-2021)

## EXECUTIVE SUMMARY

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### Research Requirement:

Reserve Officers' Training Corps (ROTC) is the primary commissioning source for Army officers and produces approximately half of its senior leaders who become general officers. The U.S. Army Cadet Command (USACC) manages the four-year national ROTC scholarship program to encourage highly qualified high school (HS) seniors to become Army officers. The USACC awards approximately 2,000 scholarships to entering ROTC students each year, yet a significant portion of these awardees will eventually leave the program. This disenrollment creates substantial costs to the Army in terms of lost scholarship money (over \$20,000 per student per year), lost training time/resources, and lost opportunities to award scholarships to others who might have otherwise completed the program and become successful officers.

In 2007, the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) began a series of projects to develop, evaluate, and support the Cadet Background and Experience Form (CBEF) for improving the selection of four-year ROTC scholarship recipients. The CBEF is a self-report biodata measure of motivational attributes relevant to cadet/officer performance and service continuance. Research findings have shown that the CBEF is a valid predictor of key ROTC training outcomes such as disenrollment, school performance, physical fitness, ranking on the ROTC commissioning Outcome Metrics Score (OMS), and performance in the ROTC Advanced Camp. Accordingly, the USACC has used the CBEF operationally in the award of four-year ROTC scholarships for HS students since 2012, and an On-Campus version of the CBEF in the award of two-year and three-year ROTC scholarships for college freshmen and sophomores since the 2020-2021 academic year. Though both tests (i.e., the High School CBEF and On-Campus CBEF) were designed to predict continuance and performance, the former prioritizes the prediction of continuance and the latter the prediction of performance. The tests measure many of the same constructs but include different item content corresponding to the context of the administration (i.e., college entry versus college continuation). Prior to including the CBEF as part of scholarship assessment, there had been a heavy emphasis on the evaluation of cognitive skills (SAT/ACT scores, HS grade point average [GPA]). Adding the CBEF to the process has allowed for a more holistic assessment by capturing critical motivational attributes related to both performance and withdrawal in the ROTC program—as well as the Army.

The purposes of the current effort were to (a) continue the longitudinal evaluation of the CBEF using both operational and research data, and (b) explore ways to enhance the CBEF's performance in supporting ROTC personnel assessment needs. This document reports the results of activities conducted in support of these objectives from August 2020 to August 2021.

## Procedure:

In the current effort, we continued our evaluation of CBEF operational data by describing the ROTC 4-year scholarship applicant samples for the 2018/2019 and 2019/2020 academic years and evaluating the validity of the applicant CBEF for the 2018/2019 applicant sample.

The on-campus scholarship applicant samples were included as of the 2019/2020 academic year and consisted of ROTC cadets who completed two- and three-year scholarship applications as college freshman or sophomores in 2019-2020. Selected cadets would receive a scholarship for the 2020-2021 academic year. Due to a lack of Student Management criterion data (e.g., disenrollment, GPA) for the on-campus scholarship samples available at the time of the analysis, this report provides an initial descriptive analysis of the On-Campus CBEF data.

The COVID-19 pandemic directly affected two facets of our research. First, in previous years we examined CBEF research (i.e., experimental) data collected from cadets during ROTC Advanced Camp and evaluated the validity of an experimental Advanced Camp CBEF for that sample. However, this analysis was excluded from the current report, as the 2020 Advanced Camp was highly abbreviated due to restrictions related to the COVID-19 pandemic. Second, USACC adjusted its FY21 Order of Merit List (OML) model, which the USACC uses to rank-order cadets for commissioning and branching purposes, to account for changes in ROTC activities that occurred because of the COVID-19 pandemic (i.e., eliminating Advanced Camp metrics and Spring 2020 GPA). We compared the descriptive statistics and subgroup differences in the FY21 OML model with those of the previous models to determine whether the FY21 OML model functioned differently for research validation purposes.

## Findings:

Findings address the ongoing validation of the HS CBEF, an initial descriptive analysis of On-Campus CBEF data, and a comparison of the FY21 OML model to historic OML models to determine its functionality for research validation purposes. Concerning the HS CBEF, results of validation analyses for cadets who were freshman during the 2019-2020 academic year (i.e., the F19 cohort) do not support the inference that the HS CBEF adds utility for selecting four-year ROTC scholarship recipients. The lack of a relationship between the HS CBEF composite and first-year disenrollment in this cohort is a departure from previous longitudinal examinations that span multiple cohorts (Graves et al., 2021; Bynum & Young, 2020). The F19 disenrollment results are more similar to weaker relationships between the HS CBEF composite and first-year disenrollment observed in the F17 cohort (Baldwin & Young, 2020). Additionally, a new, significant relationship emerged where the Whole Person Score (WPS), which is a composite score including physical, motivational, and cognitive dimensions used by USACC to award scholarships, is positively related to disenrollment. This suggests that, during the pandemic, factors other than those measured by the CBEF are influencing disenrollment, and those factors are at least partially accounted for by the components of the WPS. Other psychometric properties of the applicant CBEF continue to hold up over time, and the correlations of individual scales against conceptually related criteria are generally consistent with past findings.

In the second area of our investigation, the On-Campus CBEF demonstrates sound psychometric properties, much like those of the Advanced Camp CBEF, with a few exceptions. Most notable among the exceptions, cadets score higher on the operational On-Campus CBEF than the research-only Advanced Camp CBEF. Additionally, cadets with higher scores on the On-Campus CBEF tend to score higher on a Response Distortion (i.e., faking) scale. It appears, then, that the higher test and faking scores are likely attributable to the high-stakes nature of the test and may be attenuated by correcting for faking in the composite score.

Lastly, we concluded that there were no large discrepancies between the functionality of the FY21 OML model for research validation purposes compared to historic OML models. Thus, we feel confident that our typical approach to account for changes in OML over time within our validation analyses—where we standardize OML outcomes within cohort and combine the standardized variables across cohorts—will be sufficient to eliminate differences in the FY21 OML model compared to previous models.

#### Utilization and Dissemination of Findings:

The current research findings interrupt a trend of empirical support for the validity of the CBEF in improving continuance in ROTC four-year scholars. This may be a function of measuring cadet disenrollment during the academic year of the onset of the Coronavirus (COVID-19) pandemic. Additionally, the HS CBEF composite (version 2.0) examined in this report has already been replaced with a new composite (version 3.0), which has evidenced higher validity in research conducted outside the scope of this report. Further analyses will continue to track the performance of the new composite for the F19 applicant cohort and beyond, as well as determine whether any results for the F19 cohort may be anomalous – and temporary – due to factors related to the COVID-19 pandemic.

The Assistant Secretary of the Army (Manpower and Reserve Affairs), Deputy Chief of Staff, Army G1, U.S. Army Cadet Command, and officer accessions commands across the Department of Defense will reap rewards from this research as it expands the tools used to identify cadets with the most potential for continuance and performance.



RESEARCH ON THE CADET BACKGROUND AND EXPERIENCE FORM (CBEF) TO  
SUPPORT ARMY ROTC PERSONNEL ASSESSMENT (2020-2021)

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# **RESEARCH ON THE CADET BACKGROUND AND EXPERIENCE FORM (CBEF) TO SUPPORT ARMY ROTC PERSONNEL ASSESSMENT (2020-2021)**

## **CHAPTER 1: PROJECT BACKGROUND AND OBJECTIVES**

Christopher R. Graves (HumRRO), Mark C. Young, Peter J. Legree, and Colin L. Omori (ARI)

### **Background**

The Reserve Officer Training Corps (ROTC), managed by the U.S. Army Cadet Command (USACC), is the primary commissioning source for Army officers. The ROTC produces approximately 70% of the Army's new Second Lieutenants annually and roughly half of Army senior leaders who become general officers. The USACC awards approximately 2,000 four-year scholarships annually to encourage highly qualified high school (HS) seniors to become Army officers. However, a significant portion of awardees will ultimately disenroll and leave the program, creating substantial costs to the Army (e.g., lost scholarship money of over \$20,000 per student per year).

In 2007, the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) began a series of projects to develop, evaluate, and implement the Cadet Background and Experience Form (CBEF) for improving the selection of four-year ROTC scholarship recipients. The CBEF is a self-report biodata measure of motivational attributes relevant to cadet/officer performance and service continuance. Previous research findings generally show the CBEF to be a valid predictor of key ROTC training outcomes such as disenrollment, school performance, physical fitness, ranking on the ROTC Outcome Metrics Score (OMS), and performance in the ROTC Advanced Camp. Based on these findings, USACC formally integrated the CBEF into the ROTC scholarship award process for HS students beginning in 2012. The award process previously had a heavy emphasis on the evaluation of cognitive skills (SAT/ACT scores, HS grade point average). Adding the HS CBEF allowed for a more holistic assessment by capturing critical motivational attributes related to both continuance and performance in the ROTC program, as well as the Army.

Given the positive outcomes associated with the use of the HS CBEF, ARI developed an on-campus version of the CBEF in 2017 to inform the award of two- and three-year scholarships to cadets who are already enrolled in the ROTC program. The On-Campus CBEF is designed to prioritize the prediction performance over continuance in the ROTC program. The On-Campus CBEF was developed based on research data collected from cadets at the ROTC Advanced Camp (2014–2016), in which it demonstrated validity for predicting overall ROTC performance as reflected by the ROTC commissioning Order of Merit List (OML). The On-Campus CBEF requires further validation under “high-stakes” operational conditions in which on-campus cadets complete this CBEF form as part of their two- and three-year scholarship assessment process. To this end, USACC began preparations to administer the On-Campus CBEF in 2019 and incorporated the CBEF composite scores into the two- and three-year scholarship decisions for the 2020–2021 academic year. We received the initial On-Campus CBEF data in time to describe the test's psychometric properties within the current report, but outcome data will not be available for validation analyses until our 2021-2022 research effort.

The current report documents activities that occurred between August 2020 and August 2021 to support the longitudinal evaluation of the HS CBEF using both operational and research data and the exploration of ways to enhance the performance of CBEF for supporting ROTC personnel assessment needs.

### **Project Objectives**

Project objectives included: (a) monitoring and refining the content and scoring of CBEF in its HS and On-Campus versions; (b) testing and evaluating the CBEF at Advanced Camp; (c) evaluating the validity evidence of the CBEF for four-year and non-four-year scholarship recipients with pre-commissioning outcomes; and (d) evaluating the performance of the FY21 OML model, which USACC had adjusted due to the 2019 Coronavirus (COVID-19) pandemic. A fifth objective was to examine the potential of additional data (i.e., entry waiver status and scholarship application data, such as participation in sports and other activities) to enhance the CBEF's prediction of continuance in the ROTC program. The evaluation of these additional data will be completed during the 2021-2022 research effort.

The remaining sections of this report summarize our 2020-2021 efforts, including (a) descriptions of the 2019 and 2020 HS Applicant Samples and the 2020 On-Campus Applicant Sample, hereafter referred to as the Freshman 2019 (F19), Freshman 2020 (F20), and On-Campus Applicant 2020 (O20) samples; (b) an evaluation of the validity evidence of the CBEF for four-year scholarship recipients in the F19 sample with pre-commissioning outcomes; (c) an evaluation of the psychometric properties of the On-Campus CBEF in the O20 sample; and (d) an evaluation of the comparability of the FY21 OML performance model to prior-year OML performance models to determine its suitability for use in research. Chapter 2 describes the F19, F20, and O20 data collection efforts. Chapter 3 reports criterion-related validity evidence of the HS CBEF composite in the F19 sample. Chapter 4 reports the psychometric properties of the On-Campus CBEF scales and composite in the O20 sample. Chapter 5 describes evaluation of the FY21 OML, and Chapter 6 provides a summary of the research activities conducted during between 2020 and 2021 as well as directions for future research.

## **CHAPTER 2: DATA COLLECTION OVERVIEW**

Martin C. Yu and Christopher R. Graves (HumRRO)

Annually, ARI coordinates with the U.S. Army Cadet Command (USACC) to administer the CBEF to three samples: the High School (HS) four-year scholarship applicant sample, the On-Campus two- and three-year scholarship applicant sample, and the Advanced Camp research sample. We first describe and provide sample descriptive statistics for the HS four-year scholarship applicant samples for those applying for a scholarship as Freshmen in the 2019 and 2020 academic years (F19 and F20). Next, we describe and provide sample descriptive statistics for the On-Campus two- and three-year scholarship applicant sample for those applying for a scholarship during the 2019-2020 academic year for award in the 2020-2021 academic year (O20). No data were collected for the 2020 Advanced Camp cohort (L20) due to the COVID-19 pandemic.

### **F19 and F20 Four-Year Scholarship Applicant Samples**

The F19 and F20 scholarship applicant samples consisted of ROTC applicants who had completed the High School (HS) CBEF between June 2018 and February 2019 and June 2019 and February 2020, respectively, as a part of the four-year ROTC scholarship application package. The USACC administers much of the application, including the CBEF, as an unproctored, online assessment. In early investigations of the HS CBEF, prior to its operational administrations, ARI identified several response screening-patterns to flag and remove careless responders. Although many of the response screens used for the HS CBEF are common to other testing programs (e.g., flagging respondents with identical consecutive responses), the combination of flags for the HS CBEF are unique to this testing program. Specifically, we removed from substantive analyses any records flagging on the following rules:

- records with greater than 10% of responses invalid (missing or outside the 1 to 5 range);
- records with 50 or more identical consecutive responses (e.g., 2, 2, 2, 2, 2...2);
- records with at least seven examples of 10 or more identical consecutive responses;
- records with the same response option selected more than 70 times; or
- records with a Mahalanobis distance greater than 300, indicating an extreme outlier (Mahalanobis, 1936). Outlier records can affect the mean statistic, which in turn affects several inferential statistics (e.g., effect size estimates). Removing these records mitigates the likelihood of Type I error in subsequent significance tests.

Of the applicants, the above screening rules flagged and screened out 64 (.6%) F19 records and 23 (.3%) F20 records. Table 2.1 presents the gender and racial demographics of the screened samples.

**Table 2.1. F19 and F20 Applicant Sample Demographics**

Sample	F19		F20	
	<i>n</i>	%	<i>n</i>	%
<i>Full Sample</i>	9,729	-	8,990	-
<i>Gender</i>				
Female	3,272	34	2,985	33
Male	6,456	66	6,005	67
<i>Ethnicity</i>				
Hispanic	1,413	15	1,244	14
Non-Hispanic	8,315	85	7,746	86
<i>Race</i>				
African American	1,457	15	1,301	14
American Indian	287	3	243	3
Asian/Pacific Islander	885	9	825	9
Hispanic	1,413	15	1,244	14
White	7,712	79	7,178	89

*Note.* The *Full Sample* values denote the number of F19 and F20 four-year applicants that passed the response screens during data processing. The values represent all applicants in each academic year, captured prior to selection or non-selection and subsequent assignment to one of the three scholarship categories if selected. Subgroup sample sizes do not necessarily add up to the full sample size due to missing data. Race was self-report and allowed multiple responses; therefore, the sum of race percentages may exceed 100.

Among these applicants, 5,165 F19 and 4,942 F20 had their application reviewed by the selection board (i.e., boarded applicants) with only 2,586 F19 and 2,504 F20 accepting a scholarship. Among those who accepted scholarships, 2,578 accepted a four-year scholarship in F19, and 2,499 accepted a four-year scholarship in F20. Table 2.2 shows the number of four-year scholarships offered, accepted, declined, and withdrawn for the F19 and F20 applicant samples.

The USACC designates the following three scholarships as “four-year scholarship types,” as recipients are expected to participate in ROTC starting in their freshman year (i.e., four years total) and accordingly, selects awardees using the four-year scholarship application process:

- **Traditional four-year (4R):** A 4R scholarship pays benefits for four years starting with a cadet’s freshman year.
- **Three-year advanced designee (3D):** A 3D scholarship is a four-year scholarship that does not pay benefits the first year, pending a one-year validation by the Professor of Military Science (PMS). For benefits to start, a cadet must (a) be enrolled in ROTC classes during the entire first year and successfully complete the first year of Military Science courses; (b) have achieved a 2.5 or higher college GPA and a 3.0 ROTC GPA at the end of their Military Science courses; (c) qualify medically and administratively; and (d) pass the APFT prior to contracting.
- **Four-year historically black colleges and universities (HBCU; QE):** A Quality Enrichment Program (QE) scholarship is a four-year scholarship given at HBCU. According to USACC, schools decide what scholarship codes they record, and although the QE scholarship code has been used previously at HBCUs, currently all HBCUs use one of the other codes for four-year scholarships.

Although the HS CBEF is currently a component of the Whole Person Score (WPS) used to award 4R, 3D, and QE scholarships, ARI originally designed and validated the HS CBEF on 4R scholarship cadets. Therefore, in addition to analyzing the entire scholarship sample, we also analyze the 4R scholarship cadets separately.

**Table 2.2. Four-year Scholarships Offered to the F19 and F20 Applicant Samples and Subsequent Candidate Decisions**

F19				F20		
Scholarship Code	<i>n</i>	Within Scholarship %	Overall %	<i>n</i>	Within Scholarship %	Overall %
<i>4R</i>						
Accepted	1,023	73	11	914	71	10
Offered and Declined	215	15	2	181	14	2
Withdrawn	168	12	2	186	15	2
<i>3D</i>						
Accepted	1,555	84	16	1,585	83	18
Offered and Declined	178	10	2	165	9	2
Withdrawn	118	6	1	142	8	2
<i>QE</i>						
Accepted	0	-	0	0	-	0
Offered and Declined	0	-	0	0	-	0
Withdrawn	0	-	0	0	-	0
<i>Other<sup>a</sup></i>						
Accepted	8	73	0	5	83	0
Offered and Declined	0	0	0	1	17	0
Withdrawn	3	27	0	0	0	0
<i>No Award</i>	6,525	-	67	6,486	-	72
<i>Total</i>	9,729			8,990		

*Note.* “Withdrawn” indicates scholarship applications that were withdrawn from Army consideration before an offer decision was made. Applications are usually withdrawn when candidates choose to attend an alternate school or due to issues with the application.



## **O20 Two- and Three-Year Scholarship Applicant Samples**

The O20 scholarship applicant samples consisted of ROTC cadets who completed two- and three-year scholarship applications as freshman or sophomores in the 2019-2020 academic year, with potential scholarship benefits beginning in the 2020-2021 academic year. Like the HS CBEF, the On-Campus CBEF is an unproctored, online assessment. The careless-responder screens used with the F19 and F20 four-year applicant samples were also employed with the O20 two- and three-year applicant sample.

Of the 4,483 applicants, the above screening rules flagged and screened out 10 (.02%) O20 records. However, the USACC student management records, which provide the demographic and outcome data required for subgroup differences and validity analyses were unavailable. The normal delay between the availability of scholarship application and acceptance data and other student management data was extended due to circumstances related to the COVID-19 pandemic.

## **L20 Advanced Camp Sample**

In previous years, we collected data from cadets about to enter their fourth year of Military Science (MS-IV) coursework at ROTC's annual Advanced Camp. Advanced Camp is an approximately 30-day training event conducted to assess cadets' proficiency at basic officer leadership tasks, typically occurring between May and July. The 2020 Advanced Camp was highly abbreviated due to restrictions related to the COVID-19 pandemic. No data were collected for what would have been the L20 Advanced Camp cohort.

## CHAPTER 3: EVALUATION OF THE CRITERION-RELATED VALIDITY EVIDENCE FOR THE HIGH SCHOOL CBEF: F19 CADET COHORT

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This chapter presents criterion-related validity evidence regarding the potential of High School (HS) CBEF composite scores and scales to predict (a) disenrollment, (b) cumulative GPA, and (c) Army Physical Fitness Test (APFT) scores for four-year scholarship recipients who were freshman ROTC cadets in 2019 (F19). We also report on the incremental validity of the HS CBEF beyond a version of the Whole Person Score (WPS) that excludes the HS CBEF. The operational WPS is a composite score that includes five cognitive and physical components and one motivational component, which is the CBEF. As of 2012, the WPS officially incorporated the HS CBEF as one component of the composite score. We describe the WPS in more detail below. Note that we collect outcome data annually for each four-year scholarship recipient cohort, such that the cohort who began ROTC in 2020 (described in Chapter 2), would have first-year outcome data beginning in 2021, to be received by ARI in the fall of 2021. Currently, the most recent four-year scholarship cohort with first-year outcome data and reported validity analyses is the F19 cohort.

### Method

#### *Validation Sample*

The “four-year validation sample” included four-year ROTC scholarship recipients (4R and 3D scholarships) who enrolled in ROTC on campus in freshman in 2019 and for whom we received HS CBEF data, WPS data, and first-year ROTC outcomes. The USACC uses the WPS with the HS CBEF to award 4R, 3D, and QE scholarships, however, ARI originally designed and validated the HS CBEF on 4R scholarship cadets because 4R scholarships are the most competitive, and USACC wanted to prioritize them in ARI’s research. Accordingly, we also present and discuss results for 4R cadets, specifically.

#### *Predictor Measures*

The USACC uses the WPS composite to rank-order scholarship candidates for the award of four-year scholarships. The discussion in this chapter focuses on the following predictors:

- **Whole Person Score:** The WPS reflects six components: (a) SAT/ACT scores; (b) Scholar-Athlete-Leader scores, which reflect ROTC’s desire for cadets who excel at academics, demonstrate athletic ability, and serve in leadership positions; (c) professors of military science (PMS) interview scores; (d) promotion board scores; (e) Physical Fitness Assessment (PFA) scores; and (f) CBEF scores. All components are rescaled and allotted a maximum number of points. The maximum total WPS an applicant can receive is 1,400 points. For the purposes of our analyses, we compute a WPS that did not include the CBEF scores (where scores range from 0-1,150). This allows us to compare the validity of the other WPS components to the CBEF score and examine CBEF’s incremental validity.

- **HS CBEF Composite:** The HS CBEF consists of a set of rationally-keyed biodata scales designed to assess temperament constructs hypothesized to relate to cadet and officer retention. We calculate the operational HS CBEF composite as the weighted average of only some HS CBEF scales presented in this report. The operational scoring of the four-year scholarship CBEF (i.e., CBEF v2.0; hereafter referred to as the HS CBEF composite) went into effect in June 2015 (Bynum & Young, 2020). The HS CBEF scales that make up the composite (i.e., used to make scholarship decisions) are “operational” or “scored,” and the HS CBEF scales not included in the operational HS CBEF composite (i.e., not used to make operational decisions) are “experimental” or “unscored.” In this report, we intentionally omit references to which scales contribute to the operational HS CBEF composite score and which scales are experimental due to the sensitivity of this test information. In lieu of presenting this information, we will present HS CBEF composite score analyses and analyses for all scales administered on the HS CBEF (scored and unscored).

### *Outcome Measures*

The ROTC outcome data include student data tracked by USACC since they enrolled in ROTC college courses. We capture each of these variables in the fall following a given academic year:

- **Disenrollment:** Enrollment status is a cumulative variable, coded as 0 (enrolled) or 1 (disenrolled), and identifies whether a cadet disenrolled prior to starting the next academic year. We identify cadets as disenrolled in the first-year cumulative variable if they disenrolled during their first year and did not start their second year as an ROTC cadet. Unfortunately, the disenrollment data captured from USACC for this sample do not capture disenrollment reason with precision, thus we cannot disentangle voluntary versus involuntary disenrollment.
- **Cumulative Grade Point Average (GPA):** We cumulate college GPA across academic years, including grades for both ROTC and regular (non-ROTC) college courses. GPA is measured on a 0-4 scale with 4 indicating the highest level of academic achievement. For example, first-year cumulative GPA includes course grades from all classes in a cadet’s first academic year.
- **Army Physical Fitness Test (APFT):** ROTC cadets complete the APFT at least once annually. The academic year APFT score represents the most recent APFT score captured during that academic year in the ROTC outcomes data extract. Higher scores indicate higher physical ability.

## Results

### *Descriptive Statistics*

Descriptive statistics and scale internal consistency (i.e., Cronbach's alpha) reliabilities for the predictor measures appear in Table 3.1. We also present the standardized mean differences between the 4R and 3D scholarship types. We interpret effect sizes in this report of the magnitude .10, .30, and .50 as small, medium, and large (Cohen, 1988). Of note, scores on the Hostility to Authority, Past Withdrawal Propensity, and Response Distortion scales are negatively valenced, such that higher scores reflect greater hostility to authority, greater propensity to quit activities, and greater propensity to distort responses, respectively. Lower scores reflect less hostility to authority, lower propensity to quit activities, and lower propensity to distort responses. Notable descriptive statistics and reliabilities include the following:

- Many HS CBEF scales show acceptable variance and reliability (operationalized here as  $r_{xx} \geq .70$ ). However, some of the scales fall below this cut-off for acceptable reliability, including Goal Orientation ( $r_{xx} = .58$ ), Hostility to Authority ( $r_{xx} = .49$ ), Locus of Winning ( $r_{xx} = .54$ ), Past Withdrawal Propensity ( $r_{xx} = .51$ ), and Stress Tolerance ( $r_{xx} = .66$ ). Though it would be inappropriate to use such scales individually as predictors, the low reliabilities do not exclude their use within a higher-reliability composite.
- Consistent with past research, there were large differences between 4R and 3D cadets on WPS with the HS CBEF excluded and WPS plus the HS CBEF composite scores, with 4R cadets scoring substantially higher than 3D cadets. Regarding WPS components, the 4R cadets were substantially higher than 3D cadets on Board Points and SAT/ACT scores.
- Across scales, 4R cadets scored substantially higher than 3D cadets on Achievement Orientation, Fitness Motivation, Peer Leadership, and Written Communication scales. The 4R cadets also scored substantially lower on Hostility to Authority and Response Distortion.

Table 3.2 presents descriptive statistics for the ROTC outcomes:

- The first-year disenrollment rate for the F19 four-year validation sample was 4%, which is substantially lower than the 11% and 15% rates in the F18 and F17 samples, respectively (Graves et al., 2021).

4R and 3D cadets differ significantly on first-year ROTC outcomes, with 4R cadets having higher GPAs, APFT scores, and Disenrollment rates. Previously, the withdrawal rates were similar (Graves et al., 2021), or the 3D subgroup had higher withdrawal rates compared to the 4R subgroup (Bynum & Young, 2020). This year's unexpected pattern in disenrollment rates and low base rate may be due in part to the COVID-19 pandemic as the F19 cohort's first-year spring semester occurred during the beginning of the COVID-19 pandemic, when many students were sent home from college campuses.

**Table 3.1. Reliability and Descriptive Statistics for WPS and HS CBEF Scales in the F19 Validation Sample**

Scale	Four-year (4R + 3D)					4R			3D			4R-3D
	<i>k</i>	<i>ryy/rxx</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>d</i>
HS CBEF Composite Score			2,047	133.92	34.31	821	142.36	32.91	1,226	128.26	34.08	<b>.42</b>
WPS			1,830	839.18	91.04	793	910.59	59.55	1,037	784.58	70.96	<b>1.90</b>
WPS + HS CBEF			1,829	973.92	95.93	793	1053.15	60.27	1,036	913.27	70.57	<b>2.11</b>
<i>WPS Components</i>												
Athlete Points			1,982	40.75	10.85	815	42.89	10.21	1,167	39.25	11.03	<b>.34</b>
Board Points			2,047	229.63	49.11	821	266.53	34.46	1,226	204.92	41.35	<b>1.59</b>
Scholar Points			1,929	30.21	9.19	807	32.72	9.30	1,122	28.40	8.68	<b>.48</b>
Leader Points			1,975	38.17	9.56	812	40.96	9.19	1,163	36.22	9.33	<b>.51</b>
SAT/ACT			2,048	172.19	33.72	821	193.53	29.84	1,227	157.91	28.19	<b>1.23</b>
PMS Interview Score			2,047	187.54	20.89	821	194.79	11.37	1,226	182.68	24.15	<b>.60</b>
Physical Fitness Assessment			2,048	131.26	20.61	821	137.29	15.25	1,227	127.22	22.65	<b>.50</b>
<i>HS CBEF Biodata Scales</i>												
Achievement Orientation	9	.72	2,047	4.29	.36	821	4.40	.32	1,226	4.22	.37	<b>.53</b>
Army Identification	14	.86	2,047	4.07	.47	821	4.11	.44	1,226	4.04	.48	<b>.15</b>
Coachability	5	.72	2,047	3.93	.54	821	3.96	.52	1,226	3.91	.55	<b>.10</b>
Fitness Motivation	8	.81	2,047	3.94	.55	821	4.05	.50	1,226	3.87	.57	<b>.33</b>
Goal Orientation	4	.58	2,047	4.34	.48	821	4.33	.47	1,226	4.35	.49	-.04
Hostility to Authority <sup>a</sup>	4	.49	2,047	1.45	.32	821	1.38	.30	1,226	1.49	.33	<b>-.34</b>
Locus of Winning	6	.54	2,047	2.32	.51	821	2.28	.52	1,226	2.34	.51	<b>-.11</b>
Past Withdrawal Propensity <sup>a</sup>	5	.51	2,047	1.72	.40	821	1.70	.40	1,226	1.73	.41	-.07
Peer Leadership	6	.82	2,047	4.01	.56	821	4.10	.51	1,226	3.94	.58	<b>.28</b>
Response Distortion <sup>ab</sup>	7	.72	2,047	.08	.14	821	.07	.13	1,226	.09	.14	<b>-.18</b>
Stress Tolerance	11	.66	2,047	3.39	.38	821	3.40	.37	1,226	3.37	.38	.08
Written Communication	7	.72	2,047	3.53	.52	821	3.61	.50	1,226	3.48	.53	<b>.26</b>

*Note.* 4R = Traditional four-year scholarship. 3D = 3-year advanced designee scholarship. According to USACC, all HBCU use other scholarship codes (4R, 3D) for four-year scholarships. The sample for analyses includes only those four-year ROTC scholarship recipients (4R and 3D) who had complete HS CBEF and WPS data, enrolled in ROTC on campus as freshman in 2019, and had first-year ROTC outcomes. CBEF = Cadet Background and Experience Form. PMS = Professor of Military Science. WPS = Whole Person Score without the HS CBEF. HS = High School. The HS CBEF Composite score ranges from 0 to 250. The WPS ranges from 0 to 1,150. The WPS + CBEF ranges from 0 to 1,400. *k* = number of items/scales in the composite. *ryy/rxx* = reliability coefficient. Significant Cohen's *d* values, based on an independent sample *t*-test between the group means, are bolded (two-tailed,  $p < .05$ ).

<sup>a</sup>Negatively valenced, such that lower scores indicate more favorable standing on the construct of interest. <sup>b</sup>Response distortion is scored on a 0-1 scale. All other CBEF scales have a 1-5 item response scale.

**Table 3.2. Descriptive Statistics for First-Year ROTC Outcomes in the F19 Validation Sample**

Outcome	Four-year scholarship validation sample			4R			3D			4R-3D
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>d</i>
APFT	1,733	248.07	40.02	770	258.98	29.80	963	239.35	44.75	<b>.51</b>
GPA	1,983	3.40	.48	809	3.48	.49	1,174	3.34	.46	<b>.29</b>
Disenrollment	2,047	.04	.19	820	.09	.28	1,227	.00	.04	<b>.47</b>

*Note.* 4R = Traditional four-year scholarship. 3D = 3-year advanced designee scholarship. APFT = Army Physical Fitness Test. GPA = Grade point average. Significant Cohen's *d* values, based on an independent sample *t*-test between the group means, are bolded (two-tailed,  $p < .05$ ).

### ***Predictor Intercorrelations***

Table 3.3 shows correlations among the predictor scales. On average, CBEF scales demonstrated null to large correlations with each other ( $Min\ r = -.28$ ,  $Max\ r = .65$ ). The pattern of correlations was generally consistent with previous findings (Bynum & Young, 2020; Graves et al., 2021). The strongest correlations among the CBEF scales were observed between Army Identification and Goal Orientation ( $r = .65$ ) and Written Communication and Peer Leadership ( $r = .49$ ).

In addition to examining relationships among CBEF scales, we also examined their relationship to WPS. Recall, that the WPS plays a key role in awarding scholarships. Thus, it is important to examine the relationship between the CBEF composite and WPS to determine potential redundancy of the CBEF. As shown in Table 3.3, there was minimal overlap between the CBEF composite scores and the current WPS ( $r = -.04$ ) and WPS components ( $Min\ r = -.06$ ,  $Max\ r = .05$ ).

**Table 3.3. Correlations Among Predictors in the F19 Validation Sample**

Descriptives				Intercorrelations																					
	<i>n</i>	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1 CBEF Composite Score	2,047	133.92	34.31																						
2 WPS	1,830	839.18	91.04	-.04																					
3 WPS + CBEF	1,829	973.92	95.93	<b>.32</b>	<b>.94</b>																				
<i>WPS Components</i>																									
4 Athlete Points	1,982	40.75	10.85	<b>-.06</b>	<b>.30</b>	<b>.26</b>																			
5 Board Points	2,047	229.63	49.11	-.01	<b>.89</b>	<b>.83</b>	<b>.17</b>																		
6 Scholar Points	1,929	30.21	9.19	<b>.05</b>	<b>.29</b>	<b>.29</b>	<b>.07</b>	<b>.17</b>																	
7 Leader Points	1,975	38.17	9.56	.00	<b>.32</b>	<b>.29</b>	<b>.31</b>	<b>.18</b>	<b>.36</b>																
8 SAT/ACT	2,048	172.19	33.72	.00	<b>.71</b>	<b>.66</b>	<b>-.05</b>	<b>.60</b>	<b>.13</b>	.01															
9 PMS Interview Score	2,047	187.54	20.89	<b>.05</b>	<b>.51</b>	<b>.49</b>	<b>.29</b>	<b>.44</b>	<b>.08</b>	<b>.24</b>	<b>.17</b>														
10 Physical Fitness Assessment	2,048	131.26	20.61	.02	<b>.38</b>	<b>.36</b>	<b>.21</b>	<b>.22</b>	.00	<b>.12</b>	<b>.07</b>	<b>.20</b>													
<i>CBEF Biodata Scales</i>																									
11 Achievement Orientation	2,047	4.29	.36	<b>.26</b>	<b>.21</b>	<b>.28</b>	<b>.05</b>	<b>.25</b>	<b>.12</b>	<b>.19</b>	<b>.14</b>	<b>.18</b>	-.02												
12 Army Identification	2,047	4.07	.47	<b>.57</b>	<b>-.08</b>	<b>.12</b>	.00	<b>-.08</b>	<b>.05</b>	<b>.09</b>	<b>-.09</b>	<b>.05</b>	<b>.07</b>	<b>.25</b>											
13 Coachability	2,047	3.93	.54	<b>.07</b>	.00	.02	-.03	.04	.03	<b>.06</b>	-.01	.00	<b>-.09</b>	<b>.33</b>	<b>.11</b>										
14 Fitness Motivation	2,047	3.94	.55	<b>.11</b>	<b>.22</b>	<b>.24</b>	<b>.28</b>	<b>.13</b>	<b>-.10</b>	<b>.07</b>	.04	<b>.16</b>	<b>.55</b>	<b>.15</b>	<b>.26</b>	-.03									
15 Goal Orientation	2,047	4.34	.48	<b>.31</b>	<b>-.12</b>	-.01	.01	<b>-.11</b>	.03	.04	<b>-.16</b>	.01	<b>.05</b>	<b>.24</b>	<b>.65</b>	<b>.14</b>	<b>.19</b>								
16 Hostility to Authority <sup>a</sup>	2,047	1.45	.32	<b>-.62</b>	.03	<b>-.19</b>	<b>.08</b>	-.03	-.02	.04	.01	-.04	<b>.04</b>	<b>-.21</b>	<b>-.07</b>	<b>-.14</b>	<b>.06</b>	<b>-.12</b>							
17 Locus of Winning	2,047	2.32	.51	.00	<b>-.07</b>	<b>-.07</b>	<b>.10</b>	<b>-.07</b>	<b>-.09</b>	-.01	<b>-.12</b>	.01	<b>.07</b>	<b>-.06</b>	.02	<b>-.10</b>	<b>.10</b>	-.02	<b>.19</b>						
18 Past Withdrawal Propensity <sup>a</sup>	2,047	1.72	.40	<b>-.07</b>	-.03	-.04	<b>-.19</b>	-.03	.00	<b>-.06</b>	<b>.05</b>	<b>-.14</b>	<b>-.10</b>	<b>-.26</b>	<b>-.23</b>	<b>-.10</b>	<b>-.26</b>	<b>-.28</b>	<b>.17</b>	<b>.05</b>					
19 Peer Leadership	2,047	4.01	.56	<b>.05</b>	<b>.11</b>	<b>.12</b>	<b>.07</b>	<b>.12</b>	<b>.12</b>	<b>.26</b>	.03	<b>.15</b>	.03	<b>.48</b>	<b>.26</b>	<b>.19</b>	<b>.20</b>	<b>.27</b>	<b>-.08</b>	<b>-.06</b>	<b>-.26</b>				
20 Response Distortion <sup>abc</sup>	2,047	.08	.14	<b>-.46</b>	-.04	<b>-.20</b>	<b>.05</b>	-.03	.01	.04	<b>-.14</b>	.02	.04	-.03	.03	<b>.12</b>	<b>.09</b>	<b>.22</b>	.01	<b>-.07</b>	<b>-.22</b>	<b>.23</b>			
21 Stress Tolerance	2,047	3.39	.38	-.02	<b>.05</b>	.04	<b>.06</b>	.02	<b>-.05</b>	<b>.05</b>	.03	<b>.05</b>	<b>.13</b>	<b>.15</b>	<b>.24</b>	<b>.05</b>	<b>.26</b>	<b>.19</b>	<b>-.20</b>	<b>-.17</b>	<b>-.28</b>	<b>.16</b>	<b>-.06</b>		
22 Written Communication	2,047	3.53	.52	.00	<b>.12</b>	<b>.11</b>	.00	<b>.14</b>	<b>.16</b>	<b>.18</b>	<b>.12</b>	<b>.10</b>	-.04	<b>.36</b>	<b>.17</b>	<b>.12</b>	<b>.08</b>	<b>.19</b>	<b>-.08</b>	<b>-.13</b>	<b>-.16</b>	<b>.49</b>	<b>.19</b>	<b>.17</b>	

*Note.* CBEF = Cadet Background and Experience Form. PMS = Professor of Military Science. WPS = Whole Person Score. Scales listed as *lie-adjusted* are corrected using the Response Distortion scale. All other scales are based on the raw response values. Bolded values indicate statistical significance at  $p < .05$  (two-tailed).

<sup>a</sup> Negatively valenced, such that lower scores indicate more favorable standing on the construct of interest.

<sup>b</sup> Response distortion items have a 0-1 response scale. All other CBEF scales have a 1-5 response scale.

<sup>c</sup> Response distortion scale is used to adjust scores of scales in the composite.

### ***Bivariate Correlations***

Table 3.4 presents the correlations between the WPS, HS CBEF, and ROTC outcomes for the combined four-year scholarship validation sample as well as for the subset of 4R scholarship recipients. Notable findings include:

- HS CBEF composite scores exhibited negligible correlations with first-year disenrollment ( $r = .03$  in the four-year validation sample;  $r = -.03$  in the 4R sample). This finding may be due to the low base rate of disenrollment. The prior annual validity investigation for the F18 cohort showed small, but significant, correlations with disenrollment ( $r = -.09$  in the four-year validation sample;  $r = -.08$  in the 4R sample; Graves et al., 2021), and an investigation covering the F14-F16 cohorts showed a similar finding ( $r = -.08$  in the 4R sample; Bynum & Young, 2020).
- The HS CBEF composite score exhibited a negligible relationship with APFT ( $r = .04$ ) in the four-year validation sample, whereas WPS and WPS plus the HS CBEF had larger, statistically significant correlations with APFT ( $r = .33$ ;  $r = .33$ , respectively). Among the scales, Physical Fitness Assessment ( $r = .50$ ) and Fitness Motivation ( $r = .38$ ) had the strongest correlations with APFT.
- Higher scores on the WPS were associated with higher disenrollment in the four-year validation sample ( $r = .17$ ).
- The WPS with the HS CBEF excluded and WPS plus the HS CBEF were modestly correlated with GPA ( $r = .23$ ;  $r = .20$ ). This relationship is likely driven by Board Points ( $r = .27$ ) and SAT/ACT ( $r = .18$ ) components. The HS CBEF composite scores were not related to GPA ( $r = -.02$ ).



**Table 3.4. Correlations between Predictors and Criteria in the F19 Validation Samples**

Scale	Four-year validation sample (4R + 3D)			4R		
	APFT	GPA	Disenrollment	APFT	GPA	Disenrollment
HS CBEF Composite Score	0.04	-0.02	0.03	0.01	-0.02	-0.03
WPS	<b>0.33</b>	<b>0.23</b>	<b>0.17</b>	<b>0.16</b>	<b>0.19</b>	0.04
WPS + HS CBEF	<b>0.33</b>	<b>0.20</b>	<b>0.17</b>	<b>0.17</b>	<b>0.17</b>	0.02
<i>WPS Components</i>						
Athlete Points	<b>0.18</b>	-0.02	0.00	<b>0.19</b>	0.02	-0.06
Board Points	<b>0.28</b>	<b>0.27</b>	<b>0.14</b>	<b>0.10</b>	<b>0.23</b>	0.00
Scholar Points	-0.01	<b>0.06</b>	0.02	-0.02	0.03	-0.06
Leader Points	<b>0.05</b>	0.02	<b>0.07</b>	0.05	-0.03	0.01
SAT/ACT	<b>0.16</b>	<b>0.18</b>	<b>0.16</b>	-0.01	<b>0.11</b>	<b>0.08</b>
PMS Interview Score	<b>0.14</b>	<b>0.07</b>	<b>0.06</b>	-0.01	0.01	-0.02
Physical Fitness Assessment	<b>0.50</b>	0.04	0.01	<b>0.33</b>	-0.01	<b>-0.09</b>
<i>HS CBEF Biodata Scales</i>						
Achievement Orientation	0.03	<b>0.10</b>	<b>0.05</b>	0.03	<b>0.08</b>	-0.00
Army Identification	-0.02	<b>-0.11</b>	0.01	-0.06	<b>-0.17</b>	-0.01
Coachability	<b>-0.06</b>	-0.01	0.02	0.01	-0.01	0.02
Fitness Motivation	<b>0.38</b>	-0.02	<b>0.06</b>	<b>0.32</b>	<b>-0.08</b>	0.04
Goal Orientation	-0.03	<b>-0.10</b>	0.01	-0.03	<b>-0.13</b>	0.03
Hostility to Authority <sup>a</sup>	-0.02	<b>-0.06</b>	-0.02	-0.01	<b>-0.08</b>	0.03
Locus of Winning	0.00	<b>-0.09</b>	0.01	0.03	<b>-0.10</b>	0.04
Past Withdrawal Propensity <sup>a</sup>	<b>-0.07</b>	-0.01	0.02	-0.01	0.01	0.05
Peer Leadership	-0.00	0.03	0.03	0.00	0.01	-0.01
Response Distortion <sup>ab</sup>	0.01	-0.00	-0.02	0.02	-0.01	0.00
Stress Tolerance	0.04	-0.04	0.01	-0.00	<b>-0.09</b>	0.01
Written Communication	-0.01	<b>0.08</b>	0.04	0.03	0.05	0.02

Note. CBEF = Cadet Background and Experience Form. PMS = Professor of Military Science. WPS = Whole Person Score without the CBEF. HS = High School. Four-year  $n = 1,575 - 2,047$ . 4R  $n = 749 - 820$ . Bolded values indicate statistical significance at  $p < .05$  (two-tailed).

<sup>a</sup>Negatively valenced, such that lower scores indicate more favorable standing on the construct of interest. <sup>b</sup>Response distortion items have a 0-1 response scale. All other CBEF scales have a 1-5 item response scale.

### ***Incremental Validity***

To evaluate the incremental validity of the HS CBEF beyond the WPS, we computed a series of two-step hierarchical regression models with respect to the criteria of interest. Hellevik (2009) suggests comparable inferences for both linear and logistic regression analyses. Thus, for more parsimonious and interpretable results, we report on linear regression models for all criteria. We regressed scores for each criterion measure onto cadets' WPS without the CBEF, followed by scores on either the (a) HS CBEF composite or (b) individual scored HS CBEF

scales in the second step. We estimated all models using Ordinary Least Squares (OLS) regression. We discuss the results of OLS regression analyses with a focus on R values. We computed cross-validity estimates to adjust the observed R and  $\Delta R$  for shrinkage using Burket's (1964) formula for population cross-validity. Table 3.5 summarizes the incremental validity of the HS CBEF composite scores above WPS in predicting ROTC outcomes.

**Table 3.5. Incremental Validity of HS CBEF Scores beyond WPS**

Outcome		WPS Only		WPS + CBEF				WPS + CBEF Scales <sup>a</sup>			
	<i>n</i>	<i>R</i>	<i>R</i> / <i>r<sub>pb</sub></i>	<i>R</i>	<i>R</i> / <i>r<sub>pb</sub></i>	$\Delta R^b$	$\Delta R$ / <i>r<sub>pb</sub></i> <sup>b</sup>	<i>R</i>	<i>R</i> / <i>r<sub>pb</sub></i>	$\Delta R^c$	$\Delta R$ / <i>r<sub>pb</sub></i> <sup>c</sup>
Four-Year											
<i>1<sup>st</sup> year outcomes</i>											
APFT	1,575	<b>.33</b>	.33	<b>.34</b>	.33	.00	.00	<b>.48</b>	.47	<b>.15</b>	.14
GPA	1,776	<b>.23</b>	.22	<b>.23</b>	.22	.00	.00	<b>.28</b>	.27	<b>.06</b>	.04
Disenrollment	1,828	<b>.17</b>	.16	<b>.17</b>	.16	.00	.00	<b>.17</b>	.15	.00	-.01
4R											
<i>1<sup>st</sup> year outcomes</i>											
APFT	749	<b>.16</b>	.15	<b>.17</b>	.15	.01	.00	<b>.37</b>	.35	<b>.22</b>	.20
GPA	783	<b>.19</b>	.18	<b>.19</b>	.18	.00	.00	<b>.28</b>	.25	<b>.10</b>	.07
Disenrollment	792	.04	.01	.05	.00	.01	-.01	.08	-.04	.03	-.05

Note. 4R = Traditional 4-year scholarship. CBEF = Cadet Background and Experience Form. WPS = Whole Person Score without the CBEF. APFT = Army Physical Fitness Test. GPA = Grade point average.  $R/r_{pb}$  = Estimated population cross-validity.  $\Delta R/r_{pb}$  = Increment in estimated population cross-validity. Significance is not indicated for  $R/r_{pb}$  and  $\Delta R/r_{pb}$  values. Bolded values indicate statistical significance at  $p < .05$  (two-tailed).

<sup>a</sup> CBEF scales include the six scales that are currently included in the CBEF composite. <sup>b</sup>  $\Delta R$  is based on the difference between the WPS only and the WPS + CBEF composite. <sup>c</sup>  $\Delta R$  is based on the difference between the WPS only and the WPS + CBEF scales.

Because of range restriction, the population of four-year scholarship recipients typically has higher WPS and HS CBEF scores and a smaller standard deviation of scores compared to the applicant sample. To estimate the validity in the applicant population from the observed validity in the validation sample, we corrected for the effects of range restriction on WPS and HS CBEF scores. We corrected for indirect range restriction for correlations using the WPS, HS CBEF, and HS CBEF scales because the USACC currently awards scholarships using the WPS plus HS CBEF composite scores.

Table 3.6 summarizes the incremental validity of the HS CBEF composite scores above WPS in predicting ROTC outcomes after correcting for range restriction. These incremental validity analysis results suggest that:

- WPS scores unexpectedly predicted first-year disenrollment in the four-year scholarship sample. Prior results have found that the WPS scores did not predict disenrollment (Bynum & Young, 2020; Graves et al., 2021).
- The HS CBEF composite score added gains in the prediction of first-year APFT, but not disenrollment in the four-year validation sample and the 4R sample. Previous results have found that the HS CBEF composite added significant gains in prediction of APFT and disenrollment (Bynum & Young, 2020; Graves et al., 2021).

- The HS CBEF composite score added gains in the prediction of GPA in the 4R sample only, establishing a recent trend (Graves et al, 2021). Historically, the HS CBEF composite does not result in gains for predicting GPA in any sample (Baldwin & Young, 2020; Bynum & Young, 2020).
- Adding the scored HS CBEF scales to the OLS model resulted in gains for predicting APFT and GPA in both the four-year and 4R validation samples.
- The HS CBEF scales did not add gains in the prediction of disenrollment in the four-year or 4R validation samples. In the F18 sample (not shown in Table 3.6), the HS CBEF scales added gains in the prediction of disenrollment in the four-year validation sample (i.e., the combined 4R and 3D cases) only. In the F17 sample (not shown in Table 3.6), the HS CBEF scales did not add significant gains in the prediction of disenrollment for either the four-year or the 4R validation samples (Baldwin & Young, 2020). In the F14-F16 sample, the HS CBEF scales added significant gains in the prediction of disenrollment for both samples (Bynum & Young, 2020).

**Table 3.6. Incremental Validity of HS CBEF Scores beyond WPS Corrected for Range Restriction**

Outcome		WPS Only		WPS + CBEF				WPS + CBEF Scales <sup>a</sup>			
	<i>n</i>	<i>R</i>	<i>R/r<sub>pb</sub></i>	<i>R</i>	<i>R/r<sub>pb</sub></i>	$\Delta R^b$	$\Delta R/r_{pb}^b$	<i>R</i>	<i>R/r<sub>pb</sub></i>	$\Delta R^c$	$\Delta R/r_{pb}^c$
Four-Year											
<i>1<sup>st</sup> year outcomes</i>											
APFT	1,575	.44	.44	.46	.46	.02	.02	.59	.58	.15	.14
GPA	1,776	.30	.30	.30	.30	.00	.00	.35	.34	.05	.04
Disenrollment	1,828	.23	.23	.24	.24	.01	.01	.25	.23	.02	.00
4R											
<i>1<sup>st</sup> year outcomes</i>											
APFT	749	.38	.38	.51	.51	.13	.13	.64	.63	.26	.26
GPA	783	.39	.39	.48	.47	.09	.09	.54	.53	.15	.14
Disenrollment	792	.06	.04	.06	.02	.00	-.02	.09	-.01	.03	-.05

Note. 4R = Traditional 4-year scholarship. CBEF = Cadet Background and Experience Form. WPS = Whole Person Score without the CBEF. APFT = Army Physical Fitness Test. GPA = Grade point average. *R/r<sub>pb</sub>* = Estimated population cross-validity.  $\Delta R/r_{pb}$  = Increment in estimated population cross-validity. Analyses were run using a correlation matrix corrected for direct and indirect range restriction with outcomes. Statistical significance is not indicated for corrected values.

<sup>a</sup> CBEF scales include the six scales that are currently included in the CBEF composite. <sup>b</sup>  $\Delta R$  is based on the difference between the WPS only and the WPS + CBEF composite. <sup>c</sup>  $\Delta R$  is based on the difference between the WPS only and the WPS + CBEF scales.

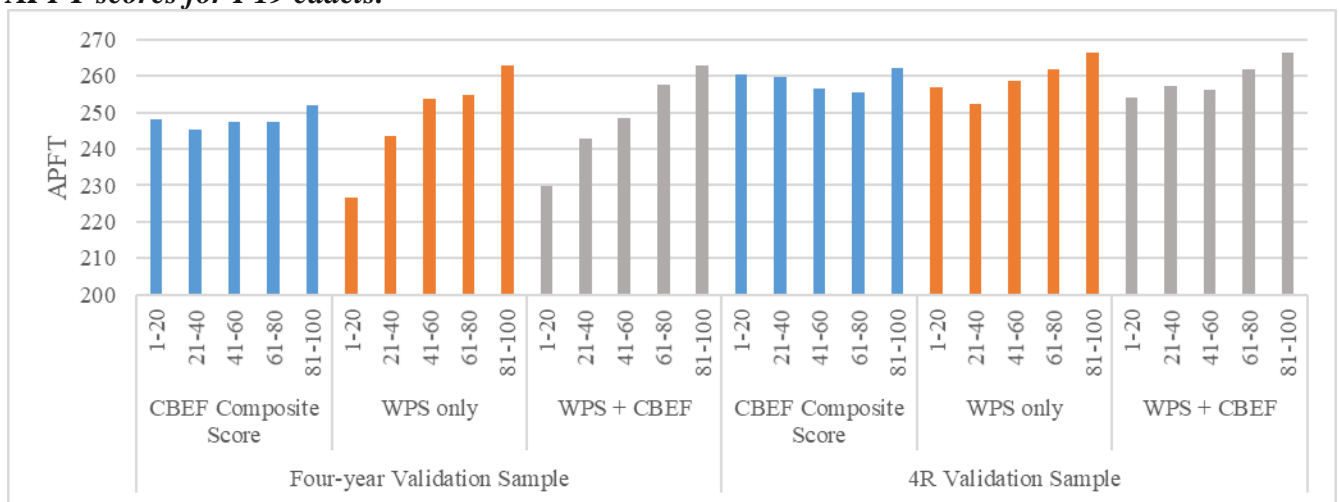
### Operational Validity

Figure 1, Figure 2, and Figure 3 compare differences in first year APFT, GPA, and disenrollment for those scoring in different quintiles on the (a) HS CBEF composite score, (b) WPS only (i.e., with the HS CBEF excluded), and (c) WPS with the HS CBEF. The figures present results for the four-year validation sample and the 4R validation sample, which show:

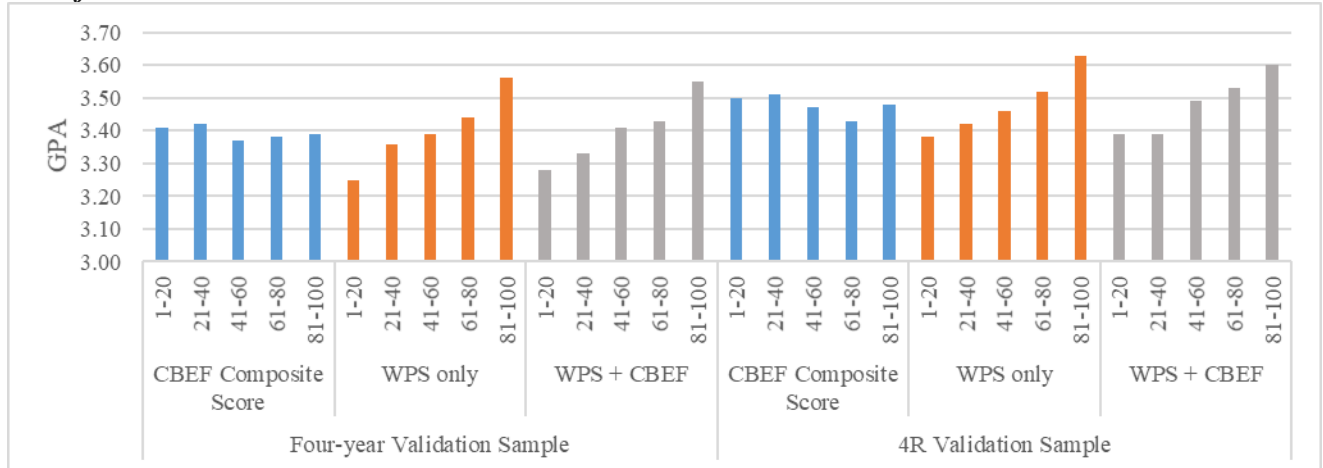
- For APFT and GPA, criterion performance generally improved in a linear fashion by WPS plus the HS CBEF percentile groups, such that the top 20% were among the highest performers. Conversely, the bottom 20% were always the lowest performing.

- Selecting candidates in the top 80% of the WPS including the HS CBEF component would result in higher performance, on average, for APFT and GPA. This was not the case for disenrollment.
- In general, there was less differentiation among cadets' performance based on the HS CBEF composite percentile scores for APFT and GPA when compared to WPS only or WPS plus HS CBEF composite.
- When focusing on first-year disenrollment, the HS CBEF composite percentile scores did not consistently differentiate cadets for the four-year validation sample and the 4R sample.
  - Selecting candidates in the top 80% of the HS CBEF composite would result in less disenrollment for the 4R validation sample. This trend is reversed for the four-year validation sample.
  - In general, higher scores on the WPS are associated with higher disenrollment.

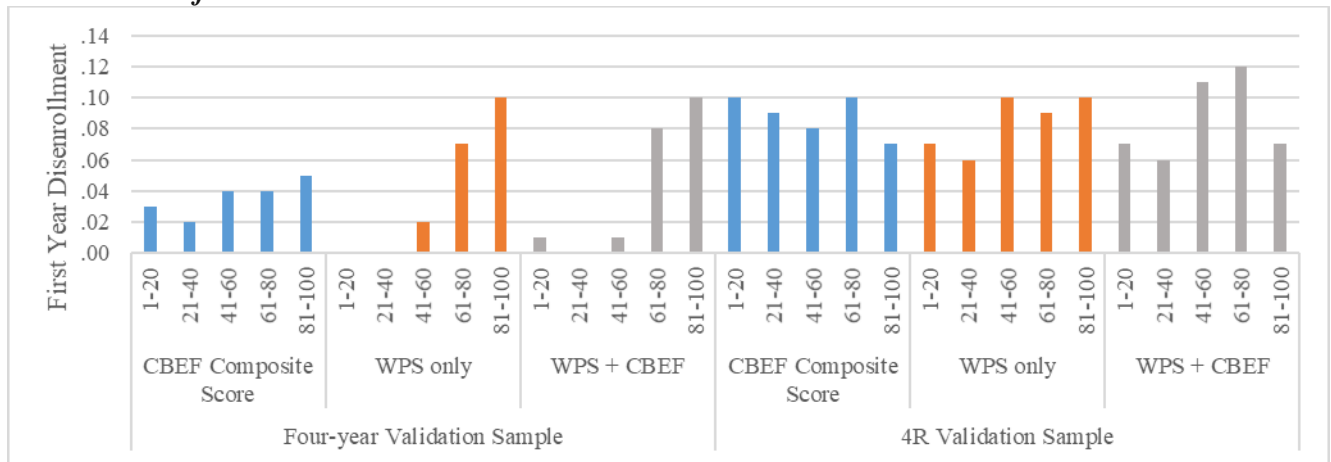
**Figure 1. Relationship between the four-year scholarship applicant screens and first-year APFT scores for F19 cadets.**



**Figure 2. Relationship between the four-year scholarship applicant screens and first-year GPA for F19 cadets.**



**Figure 3. Relationship between the four-year scholarship applicant screens and first-year disenrollment for F19 cadets.**



## Summary

Compared to that of most prior cohorts, with F17 being the exception, the results of the F19 validation analyses provide thinner evidence for the inference that the HS CBEF adds utility for selecting four-year ROTC scholarship recipients. The lack of a relationship between the HS CBEF composite and first-year disenrollment is a departure from previous longitudinal examinations that span multiple cohorts (Grave et al., 2021; Bynum & Young, 2020). These F19 disenrollment results are more similar to weaker relationships between the HS CBEF composite and first-year disenrollment observed in the F17 cohort (Baldwin & Young, 2020). Additionally, a new, significant relationship emerged where the WPS was positively related to disenrollment.

## CHAPTER 4: ANALYSIS OF THE 2020 ON-CAMPUS CBEF DATA

Timothy C. Burgoyne and Nicholas Howald (HumRRO)

This chapter describes the major findings of On-Campus Cadet Background and Experience Form (CBEF) preliminary predictor analyses. In 2017, the Army Research Institute for the Behavioral and Social Sciences (ARI) developed a version of the CBEF to inform the award of two- and three-year scholarships to cadets who are already enrolled in the ROTC program. This version of the CBEF, the On-Campus CBEF, prioritizes the prediction of performance in the ROTC program over continuance in the program. The On-Campus CBEF was developed based on research data collected from cadets at the ROTC Advanced Camp (2014–2016), in which the form demonstrated validity for predicting overall ROTC performance as reflected by the ROTC commissioning Order of Merit List (OML). Though most of the constructs measured by the On-Campus CBEF are also measured by the High School CBEF, item content is largely different between the tests.

The form requires further validation under “high-stakes” operational conditions in which on-campus cadets complete this CBEF form as part of their two- and three-year scholarship assessment process. To this end, the USACC began preparations to administer the On-Campus CBEF in 2019 and incorporated the CBEF composite scores into the two- and three-year scholarship decisions for the 2020–2021 academic year (i.e., the O20 cohort). This chapter provides the initial reporting on the first year of On-Campus CBEF data.

### Method

#### *Sample*

The O20 scholarship applicant samples consisted of ROTC cadets who completed two- and three-year scholarship applications as freshman or sophomores in the 2019-2020 academic year, for potential award in the 2020-2021 academic year. In the O20 On-Campus CBEF data, the USACC Student Management data which were to provide demographic information were not available due to pandemic-related factors. As a result, we were unable to conduct subgroup and validity analyses.

#### *Predictors*

The On-Campus CBEF consists of a set of rationally-keyed biodata scales designed to assess various temperament constructs hypothesized to relate primarily to cadet performance. The CBEF scores are rescaled and allotted a maximum of 250 points. The CBEF composite reflects operational and experimental (i.e., not used to make operational decisions) scales. In this report, we intentionally omit references to which scales contribute to the operational On-Campus CBEF composite score and which scales are experimental due to the sensitivity of this test information. In lieu of presenting this information, we will present On-Campus CBEF composite score analyses and analyses for all scales administered on the On-Campus CBEF (scored and unscored). The nine scales administered on the On-Campus CBEF include: (1) Achievement Orientation, (2) Fitness Motivation, (3) Goal Orientation, (4) Hostility to Authority, (5) Peer

Leadership, (6) Response Distortion, (7) Self-Efficacy, (8) Stress Tolerance, and (9) Written Communication.

## Results

### *Descriptive Statistics*

Table 4.1 includes reliability estimates, sample sizes, and distributional properties (means and standard deviations) for the CBEF scales in the O20 sample. As a reminder, scores on the Hostility to Authority and Response Distortion scales are negatively valenced. All CBEF scales demonstrated sufficient reliability (defined here as  $r_{xx} \geq .70$ ) except for Written Communication ( $r_{xx} = .69$ ).

**Table 4.1. Reliability and Sample Descriptive Statistics for CBEF Scales in the O20 Sample**

	Reliability		Descriptives					
	<i>k</i>	<i>ryy/rxx</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>min</i>	<i>max</i>	<i>range</i>
1 CBEF Composite Score			4,465	135.91	36.77	0.00	250.00	250.00
2 Achievement Orientation	7	.72	4,465	4.26	.43	2.29	5.00	2.71
3 Fitness Motivation	9	.85	4,465	3.90	.57	1.22	5.00	3.78
4 Goal Orientation	7	.78	4,473	3.59	.59	1.43	5.00	3.57
5 Hostility to Authority <sup>a</sup>	9	.73	4,465	2.11	.46	1.00	4.00	3.00
6 Peer Leadership	6	.81	4,465	3.83	.60	1.67	5.00	3.33
7 Response Distortion <sup>b</sup>	9	.73	4,469	.15	.18	0.00	1.00	1.00
8 Self-Efficacy	6	.80	4,465	4.48	.40	2.83	5.00	2.17
9 Stress Tolerance	7	.78	4,465	3.21	.59	1.14	5.00	3.86
10 Written Communication	7	.69	4,465	3.46	.62	1.29	5.00	3.71

Note. CBEF = Cadet Background Experience Form. *k* = number of items/scales in the composite.  $r_{xx}/r_{yy}$  = reliability coefficient.

<sup>a</sup>Negatively valenced, such that lower scores indicate more favorable standing on the construct of interest. <sup>b</sup>Response distortion items have a 0-1 response scale. All other CBEF scales have a 1-5 response scale.

### *Bivariate Correlations*

Table 4.2 summarizes the intercorrelations among all nine scales and the CBEF composite. The CBEF scales exhibited small to large intercorrelations. Notable relationships included:

- The CBEF composite had high positive correlations with Fitness Motivation ( $r = .80$ ) and Achievement Orientation ( $r = .69$ ).
- Achievement Orientation had high positive correlations with Self-Efficacy ( $r = .64$ ) and Peer Leadership ( $r = .55$ ).
- Self-Efficacy had moderate to high correlations with several scales including Achievement Orientation ( $r = .64$ ), Goal Orientation ( $r = .58$ ), Peer Leadership ( $r = .58$ ), Fitness Motivation ( $r = .46$ ), and Written Communication ( $r = .41$ ).
- Hostility to Authority had negative correlations with the CBEF composite ( $r = -.42$ ) as well as the other eight CBEF scales ( $Min\ r = -.14$ ,  $Max\ r = -.34$ ).

**Table 4.2. Intercorrelations for CBEF Scales in the O20 Sample**

		Intercorrelations									
		1	2	3	4	5	6	7	8	9	10
1	CBEF Composite Score										
2	Achievement Orientation	<b>.69</b>									
3	Fitness Motivation	<b>.80</b>	<b>.43</b>								
4	Goal Orientation	<b>.47</b>	<b>.48</b>	<b>.47</b>							
5	Hostility to Authority <sup>a</sup>	<b>-.42</b>	<b>-.24</b>	<b>-.16</b>	<b>-.14</b>						
6	Peer Leadership	<b>.48</b>	<b>.55</b>	<b>.37</b>	<b>.50</b>	<b>-.15</b>					
7	Response Distortion <sup>b</sup>	<b>.22</b>	<b>.43</b>	<b>.21</b>	<b>.35</b>	<b>-.34</b>	<b>.30</b>				
8	Self-Efficacy	<b>.54</b>	<b>.64</b>	<b>.46</b>	<b>.58</b>	<b>-.23</b>	<b>.58</b>	<b>.39</b>			
9	Stress Tolerance	<b>.55</b>	<b>.21</b>	<b>.28</b>	<b>.28</b>	<b>-.33</b>	<b>.27</b>	<b>.36</b>	<b>.37</b>		
10	Written Communication	<b>.53</b>	<b>.49</b>	<b>.26</b>	<b>.30</b>	<b>-.21</b>	<b>.49</b>	<b>.30</b>	<b>.41</b>	<b>.18</b>	

Note. CBEF = Cadet Background Experience Form. k = number of items/scales in the composite. <sup>a</sup>Negatively valenced, such that lower scores indicate more favorable standing on the construct of interest. <sup>b</sup>Response distortion items have a 0-1 response scale. All other CBEF scales have a 1-5 response scale.

### Comparison to Research Setting

We compared the O20 CBEF findings with those from the 2018 and 2019 Advanced Camp data (L18 and L19, respectively) to allow for a comparison between the CBEF scales in an operational setting and a research setting. Overall, we were able to compare eight of the nine scales on the On-Campus CBEF to scales administered during the 2018 and 2019 Advanced Camp CBEF forms. Goal Orientation was not administered during 2018 and 2019. In addition, the items on four scales (i.e., Achievement Orientation, Hostility to Authority, Response Distortion, and Stress Tolerance) differed between the research and operational settings. Given these constraints, we compared means, effect sizes, and intercorrelations for the CBEF scales. Table 4.3 includes reliability estimates, sample sizes, distributional properties, and intercorrelations for the CBEF scales in the L18 and L19 samples. Table 4.4 includes the Cohen's *ds* for CBEF Scale reliability estimates, descriptives, and intercorrelations between both Advanced Camp samples and the 2020 On-Campus sample.

### Scale and Item Mean Differences

Mean scores for all individual scales were significantly higher in the O20 sample compared to the L19 sample. Based on Cohen's *d*, the largest difference was found in the Achievement Orientation scale ( $M_{On-Campus} = 4.26$ ,  $M_{Advanced Camp} = 3.96$ ,  $d = .59$ ). The smallest difference was found in the Stress Tolerance scale ( $M_{On-Campus} = 3.21$ ,  $M_{Advanced Camp} = 3.16$ ,  $d = .09$ ), although this difference was still significant.

Only the negatively valenced scale (where lower scores indicate more favorable standing on the construct of interest), Hostility to Authority, had a significantly lower mean score in the O20 sample than in the L18 sample ( $M_{On-Campus} = 2.11$ ,  $M_{Advanced Camp} = 2.37$ ,  $d = -.57$ ). All other scales in the L18 sample, similar to those in the L19 sample, demonstrated lower scores compared to the O20 sample. Based on Cohen's *d*, the largest difference was found in the Self-Efficacy scale ( $M_{On-Campus} = 4.48$ ,  $M_{Advanced Camp} = 4.25$ ,  $d = .55$ ). Overall, scale means tended to be significantly higher in an operational setting compared to the research setting.



Mirroring the scale-level differences, most individual item means were higher for the O20 sample than either Advanced Camp (L18 or L19) sample. Items also tended to have a higher item-total correlation in the O20 sample compared to the L18 and L19 samples.

**Table 4.3. Reliability, Descriptive Statistics, and Intercorrelations for CBEF Scales in the 2018 and 2019 Advanced Camp Samples**

		Reliability		Descriptives			Intercorrelations									
		<i>k</i>	<i>ryy/rxx</i>	<i>n</i>	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10
<i>2018 Sample</i>																
1	CBEF Composite Score			5,538	94.90	43.36										
2	Achievement Orientation	9	.72	5,538	4.06	.52	<b>.20</b>									
3	Fitness Motivation	8	.81	5,538	3.73	.64	<b>.11</b>	<b>.18</b>								
4	Goal Orientation <sup>a</sup>															
5	Hostility to Authority <sup>b</sup>	9	.69	5,538	2.37	.47	<b>-.25</b>	<b>-.19</b>	-.02							
6	Peer Leadership	6	.79	5,537	3.65	.61	<b>.04</b>	<b>.38</b>	<b>.24</b>	.00						
7	Response Distortion <sup>c</sup>	7	.71	5,538	.10	.16	<b>-.35</b>	<b>.18</b>	<b>.08</b>	<b>-.35</b>	<b>.16</b>					
8	Self-Efficacy	6	.77	5,538	4.25	.44	<b>.09</b>	<b>.45</b>	<b>.39</b>	<b>-.16</b>	<b>.47</b>	<b>.27</b>				
9	Stress Tolerance	10	.72	5,538	3.11	.49	<b>-.18</b>	<b>.12</b>	<b>.27</b>	<b>-.48</b>	<b>.20</b>	<b>.26</b>	<b>.35</b>			
10	Written Communication	7	.73	5,538	3.23	.65	.01	<b>.37</b>	<b>.06</b>	<b>-.08</b>	<b>.36</b>	<b>.13</b>	<b>.21</b>	<b>.14</b>		
<i>2019 Sample</i>																
1	CBEF Composite Score			6,178	90.10	44.51										
2	Achievement Orientation	9	.72	6,208	3.96	.55	<b>.20</b>									
3	Fitness Motivation	8	.81	6,213	3.74	.64	<b>.11</b>	<b>.17</b>								
4	Goal Orientation	12	.47	6,243	3.32	.41	<b>.14</b>	<b>.45</b>	<b>.32</b>							
5	Hostility to Authority	4	.54	6,208	1.86	.54	<b>-.54</b>	<b>-.22</b>	.00	<b>-.08</b>						
6	Peer Leadership	6	.78	6,242	3.66	.62	<b>.04</b>	<b>.39</b>	<b>.24</b>	<b>.31</b>	<b>-.03</b>					
7	Response Distortion	7	.72	6,243	.11	.17	<b>-.36</b>	<b>.16</b>	<b>.06</b>	<b>.08</b>	<b>-.34</b>	<b>.16</b>				
8	Self-Efficacy	6	.77	6,242	4.29	.45	<b>.05</b>	<b>.43</b>	<b>.35</b>	<b>.33</b>	<b>-.16</b>	<b>.50</b>	<b>.27</b>			
9	Stress Tolerance	11	.70	6,197	3.16	.50	<b>-.17</b>	<b>.10</b>	<b>.29</b>	<b>.13</b>	<b>-.26</b>	<b>.20</b>	<b>.29</b>	<b>.34</b>		
10	Written Communication	7	.73	6,243	3.21	.66	.01	<b>.37</b>	<b>.06</b>	<b>.18</b>	<b>-.11</b>	<b>.36</b>	<b>.14</b>	<b>.22</b>	<b>.16</b>	

*Note.* CBEF = Cadet Background Experience Form. *k* = number of items/scales in the composite. *rxx/ryy* = reliability coefficient. <sup>a</sup>Scale not administered during the 2018 Advanced Camp. <sup>b</sup>Negatively valenced, such that lower scores indicate lower standing on the construct of interest.

<sup>c</sup>Response distortion items have a 0-1 response scale. All other CBEF scales have a 1-5 response scale.

**Table 4.4. Cohen's Ds for CBEF Scale Reliabilities, Descriptives, and Intercorrelations in the 2018 and 2019 Advanced Camp Samples and the 2020 On-Campus Sample**

		Reliability			Descriptives		Diff - Intercorrelations									
		Diff - k	Diff - ryy/rxx	Diff - n	Cohen's D - M	Diff - SD	1	2	3	4	5	6	7	8	9	10
<i>2018 Advanced Camp Sample and 2020 On-Campus Sample</i>																
1	CBEF Composite Score		0.00	-1,073	<b>1.01</b>	-6.59										
2	Achievement Orientation	-2	0.00	-1,073	<b>.40</b>	-0.09	.49									
3	Fitness Motivation	1	0.04	-1,073	<b>.27</b>	-0.07	.70	.24								
4	Goal Orientation <sup>a</sup>															
5	Hostility to Authority		0.04	-1,073	<b>-.57</b>	-0.01	-.17	-.05	-.14	-.14						
6	Peer Leadership		0.03	-1,072	<b>.29</b>	-0.01	.44	.17	.13	.50	-.15					
7	Response Distortion	2	0.02	-1,069	<b>.29</b>	0.02	.57	.25	.13	.35	.01	.15				
8	Self-Efficacy		0.03	-1,073	<b>.55</b>	-0.03	.45	.19	.08	.58	-.06	.12	.12			
9	Stress Tolerance	-3	0.06	-1,073	<b>.18</b>	0.10	.73	.09	.02	.28	.15	.07	.10	.01		
10	Written Communication		-0.04	-1,073	<b>.36</b>	-0.03	.52	.13	.20	.30	-.13	.13	.17	.20	.04	
<i>2019 Advanced Camp Sample and 2020 On-Campus Sample</i>																
1	CBEF Composite Score		0.00	-1,713	<b>1.11</b>	-7.74										
2	Achievement Orientation	-2	0.00	-1,743	<b>.59</b>	-0.12	.49									
3	Fitness Motivation	1	0.04	-1,748	<b>.26</b>	-0.07	.70	.25								
4	Goal Orientation	-5	0.31	-1,770	<b>.56</b>	0.18	.33	.03	.14							
5	Hostility to Authority	5	0.19	-1,743	<b>.49</b>	-0.08	.12	-.02	-.16	-.07						
6	Peer Leadership		0.03	-1,777	<b>.28</b>	-0.02	.45	.16	.13	.19	-.13					
7	Response Distortion	2	0.01	-1,774	<b>.22</b>	0.01	.58	.27	.15	.28	.00	.14				
8	Self-Efficacy		0.03	-1,777	<b>.44</b>	-0.05	.49	.21	.11	.26	-.06	.08	.12			
9	Stress Tolerance	-4	0.07	-1,732	<b>.09</b>	0.09	.72	.11	.00	.15	-.07	.07	.07	.02		
10	Written Communication		-0.03	-1,778	<b>.39</b>	-0.04	.52	.13	.20	.12	-.10	.13	.16	.19	.02	

*Note.* Negative values indicate that the On-Campus results are higher than the Advanced Camp results. <sup>a</sup> Scale not administered during the 2018 Advanced Camp.

### ***Intercorrelation Differences***

Scales tend to be more strongly intercorrelated in the O20 sample compared to both Advanced Camp samples. For example, Achievement Orientation and Fitness Motivation have a correlation of .43 in the O20 sample and a correlation of .17 in the L19 sample. Similarly, Hostility to Authority and Peer Leadership have a higher magnitude correlation ( $r = -.21$ ) in the O20 sample than in the L18 sample ( $r = -.08$ ).

The scales and weights for the On-Campus CBEF composite are different from those of the Advanced Camp CBEF composite, so it is not expected that scale correlations with the composite would match across samples. However, these correlations are useful for examining the extent to which the different composites are related to the same scales. Individual scales tended to be much more highly correlated with the CBEF composite in the O20 sample than in the L18 and L19 samples, perhaps because the scales included in the On-Campus composite are not corrected for response distortion. For example, Fitness Motivation and Achievement Orientation demonstrated the highest magnitude correlations with the CBEF composite ( $r = .80$  and  $r = .69$ , respectively) in the O20 sample. In the L18 and L19 samples, these correlations are .11 and .20, respectively.

The Response Distortion and Stress Tolerance scales both exhibited negative correlations with the CBEF composite in the L18 ( $r = -.35$  and  $r = -.18$ , respectively) and L19 ( $r = -.36$  and  $r = -.17$ , respectively) samples. These correlations were in the opposite direction for the O20 sample ( $r = .22$  and  $r = .55$ , respectively), meaning that higher Response Distortion scores corresponded to higher On-Campus CBEF composite scores.

### **Summary**

The On-Campus CBEF demonstrated sound psychometric properties, including acceptable reliabilities for most scales. Compared to the Advanced Camp CBEF, the On-Campus CBEF demonstrated higher mean scores, more strongly intercorrelated scales, and scales more strongly correlated to the CBEF Composite. Further, Response Distortion (i.e., faking) scale scores were positively correlated with On-Campus composite scores, whereas they were negatively correlated with Advanced Camp composite scores (i.e., faking more was associated with higher On-Campus composite scores but lower Advanced Camp composite scores). Each of these differences is likely attributable to the “high-stakes” nature of the On-Campus test and might be attenuated with a correction for faking in the On-Campus composite.

## **CHAPTER 5: EVALUATION OF FY21 OML MODEL**

Jennifer P. Green, Angela Lee, and Timothy C. Burgoyne (HumRRO)

This chapter presents analyses comparing the current USACC Order of Merit List (OML) performance model (i.e., the FY21 OML model for the graduating class of 2021) against the recent FY18, FY19, and FY20 OML models. The OML includes three outcome components: Academic (e.g., GPA, academic discipline scores), Leadership (e.g., professor of military science ratings of cadet potential, Advanced Camp performance, extracurricular activities), and Physical (e.g., APFT scores, college athletic participation). The USACC uses the OML to rank-order cadets for commissioning and branching purposes. Its relevance to our research lies in our use of the OML, as well as its supporting Outcome Metrics Scores (OMS) as key performance outcomes for validating the On-Campus and Advanced Camp CBEF composites and scales. In 2020, USACC adjusted the FY21 OML model to account for changes in ROTC activities as a result of the COVID-19 pandemic. Adjustments included eliminating Advanced Camp metrics from the Leadership and Physical OML components and Spring 2020 GPA from the Academic component of the model. Our analyses compare the descriptive statistics and subgroup differences in the FY21 OML model with those of the previous models. Additionally, we compare the FY21 OML model's correlations with the WPS and the High School CBEF with previous models' correlations.

### **Method**

The samples consisted of four-year ROTC scholarship recipients (4R and 3D scholarships) within a four-year validation sample (i.e., FY18-FY21) who had complete High School CBEF, WPS, and OML data.

### **Results**

#### ***Evaluating the FY21 OML Model on Historical Data***

We evaluated the current FY21 OML performance model against previous models using historical OML data from FY19 and FY20. Specifically, we applied the current FY21 OML model to previous ROTC graduating classes and calculated an FY21 alternative OML score for cadets graduated in FY19 and FY20. We then correlated the FY21 OML scores for the FY19 and FY20 graduates with those cadets' original FY19 or FY20 OML scores to observe the similarity in scores across OML models.

Although the FY21 OML model could not be entirely replicated (e.g., the FY21 model used Fall GPA instead of Spring GPA, and only Spring GPA was available for the FY19 and FY20 cadets in the OML data), the FY21 OML scores for the FY19 and FY20 classes were almost perfectly correlated with the FY19 OML scores ( $r = .966$ ) and FY20 OML scores ( $r = .968$ ). These near-perfect correlations imply that the rank-order of cadets by OML score in the ROTC graduating classes of 2019 and 2020 would not have significantly changed had the FY21 OML model been used.

### *Descriptive Statistics*

Table 5.1 presents the descriptive statistics of OML rank and scores by OML model for the four-year validation sample. The OML score mean for FY21 was relatively unchanged compared to OML score means for the three previous models.

**Table 5.1. OML Outcome Descriptives by OML Model for the Validation Sample**

OML Model	Descriptives				
	<i>N</i>	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
FY18					
OML Rank	856	2081.66	1537.74	3.00	5513.00
OML Score	856	60.56	14.30	18.33	91.08
FY19					
OML Rank	978	2056.94	1485.41	1.00	5499.00
OML Score	978	60.47	14.25	16.70	92.64
FY20					
OML Rank	860	2309.27	1678.67	1.00	5974.00
OML Score	860	59.81	14.95	13.99	91.17
FY21					
OML Rank	1,269	2466.45	1710.30	7.00	6188.00
OML Score	1,262	60.28	16.03	13.18	91.02

*Note.* OML = Order of Merit List. Samples included only four-year ROTC scholarship recipients (4R and 3D scholarships) who had complete High School CBEF, WPS, and OML data.

### *Subgroup Differences*

We calculated the magnitude of subgroup differences on OML ranks and scores. Tables 5.2 and 5.3 report the standardized mean differences for racial-ethnic and gender comparisons, respectively, by OML model. Overall, the race and ethnicity differences for the FY21 OML model were similar to the FY20 OML model, and both were smaller than the race and ethnicity differences for the FY18 and FY19 OML models. The gender differences for the FY21 OML model were similar to the FY20 OML model, and both were slightly larger than the gender differences for the FY18 and FY19 models. Gender differences were not significant for any model.

**Table 5.2. Descriptive Statistics for Racial and Ethnic Comparisons by OML Model for the Validation Sample**

OML Model	White, Non-Hispanic			Black, Non-Hispanic			Hispanic			W-B	W-H
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>d</i>	<i>d</i>
FY18											
OML Rank	721	1974.76	1505.83	26	3342.35	1426.63	35	3006.63	1575.75	<b>-0.91</b>	<b>-0.68</b>
OML Score	721	61.57	14.05	26	49.03	13.68	35	52.04	14.41	<b>0.89</b>	<b>0.68</b>
FY19											
OML Rank	809	1902.74	1433.19	36	2978.67	1247.61	56	2926.95	1614.78	<b>-0.76</b>	<b>-0.71</b>
OML Score	809	61.89	13.92	36	51.64	11.20	56	52.30	14.86	<b>0.74</b>	<b>0.69</b>
FY20											
OML Rank	700	2209.85	1653.47	39	3102.10	1745.77	45	2680.40	1852.11	<b>-0.54</b>	-0.28
OML Score	700	60.67	14.79	39	53.11	15.81	45	56.51	16.58	<b>0.51</b>	0.28
FY21											
OML Rank	1,041	2362.59	1692.23	34	3232.32	1806.04	80	3000.70	1818.62	<b>-0.51</b>	<b>-0.38</b>
OML Score	1,036	61.21	15.95	34	52.76	16.92	80	55.54	17.11	<b>0.53</b>	<b>0.35</b>

*Note.*  $W-B\ d = (M_{White} - M_{Black})/\text{Pooled White-Black } SD$ .  $W-H\ d = (M_{White} - M_{Hispanic})/\text{Pooled White-Hispanic } SD$ . Bolded values indicate significant differences at  $p < .05$  (two-tailed). Race and ethnicity determined via the ethnicity coding from USACCC (i.e., the REDCAT variable in the multi-cohort database), due to missing data with race and ethnicity applicant variables typically used for racial-ethnic comparisons in the annual validation analyses. OML = Order of Merit.

**Table 5.3. Descriptive Statistics for Gender Comparisons by OML Model for the Validation Sample**

OML Model	Male			Female			M-F
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>d</i>
FY18							
OML Rank	703	2090.32	1550.95	153	2041.85	1479.80	0.03
OML Score	703	60.52	14.46	153	60.76	13.58	-0.02
FY19							
OML Rank	789	2060.02	1478.63	189	2044.07	1517.27	0.01
OML Score	789	60.47	14.16	189	60.47	14.68	0.00
FY20							
OML Rank	690	2332.16	1683.56	170	2216.35	1660.37	0.07
OML Score	690	59.63	14.97	170	60.55	14.89	-0.06
FY21							
OML Rank	992	2508.69	1734.19	277	2315.17	1615.84	0.11
OML Score	987	59.91	16.28	275	61.59	15.02	-0.10

*Note.* M-F  $d = (M_{\text{Male}} - M_{\text{Female}})/\text{Pooled Male-Female } SD$ . Bolded values indicate significant differences at  $p < .05$  (two-tailed). OML = Order of Merit.

### ***Bivariate Correlations***

Table 5.4 presents the scale-level bivariate correlations between the WPS, the High School CBEF, and OML outcomes across the four OML models. The CBEF scales administered to the cohorts with FY18 – FY21 OML scores were consistent, with the following exceptions: three scales were added starting with the FY19 OML cohort, and a fourth scale was added starting with the FY20 OML cohort. The correlations were relatively similar across models, with an average difference in correlations of .04 when comparing FY21 OML score correlations with WPS and CBEF scores to previous OML score correlations. Of the minor differences in correlations, the FY21 OML scores tended to have slightly weaker correlations with WPS components compared to historic OML scores. There were no clear patterns regarding differences in correlations with CBEF scales when comparing the FY21 OML model to historic models, likely because the differences in correlations were relatively small.

### **Summary**

The results of these analyses suggest no large discrepancies between the functionality of the FY21 OML model for research validation purposes compared to historic OML models. Thus, we feel confident that our typical approach to account for changes in OML over time within our validation analyses—where we standardize OML outcomes within-cohort and combine the standardized variables across cohorts—will be sufficient to eliminate differences in the FY21 OML model compared to previous models. These efforts ensure that we capture within-cohort rank-order while centering all OML scores onto a common scale.



**Table 5.4. Correlations between Predictors and OML Outcomes by OML Model for the Validation Sample**

	OML Model							
	FY18		FY19		FY20		FY21	
	OML Rank	OML Score	OML Rank	OML Score	OML Rank	OML Score	OML Rank	OML Score
<i>Composite Scores</i>	<i>n = 777 - 856</i>		<i>n = 893 - 978</i>		<i>n = 766 - 860</i>		<i>n = 1146 - 1269</i>	
CBEF Composite Score	-.02	.02	-.03	.03	.02	-.01	-.02	.02
WPS	<b>-.25</b>	<b>.26</b>	<b>-.32</b>	<b>.32</b>	<b>-.39</b>	<b>.40</b>	<b>-.26</b>	<b>.27</b>
WPS + CBEF	<b>-.25</b>	<b>.26</b>	<b>-.30</b>	<b>.30</b>	<b>-.37</b>	<b>.38</b>	<b>-.27</b>	<b>.27</b>
<i>WPS Components</i>	<i>n = 855 - 856</i>		<i>n = 978</i>		<i>n = 860</i>		<i>n = 1196 - 1269</i>	
Athlete Points	-.06	.07	<b>-.10</b>	<b>.09</b>	<b>-.16</b>	<b>.17</b>	-.05	.05
Board Points	<b>-.20</b>	<b>.21</b>	<b>-.30</b>	<b>.30</b>	<b>-.33</b>	<b>.34</b>	<b>-.29</b>	<b>.29</b>
Scholar Points	<b>-.07</b>	<b>.07</b>	-.02	.02	<b>-.09</b>	<b>.09</b>	.03	-.02
Leader Points	-.05	.05	<b>-.11</b>	<b>.11</b>	<b>-.10</b>	<b>.10</b>	-.01	.00
SAT/ACT	<b>-.23</b>	<b>.23</b>	<b>-.16</b>	<b>.16</b>	<b>-.26</b>	<b>.26</b>	<b>-.19</b>	<b>.20</b>
PMS Interview Score	<b>-.07</b>	<b>.08</b>	<b>-.12</b>	<b>.13</b>	<b>-.21</b>	<b>.22</b>	<b>-.12</b>	<b>.12</b>
Physical Fitness Assessment	<b>-.17</b>	<b>.17</b>	<b>-.20</b>	<b>.22</b>	<b>-.25</b>	<b>.27</b>	<b>-.18</b>	<b>.17</b>
<i>HS CBEF Biodata Scales</i>	<i>n = 856</i>		<i>n = 944 - 978</i>		<i>n = 834 - 860</i>		<i>n = 1262 - 1269</i>	
Achievement Orientation	<b>-.13</b>	<b>.13</b>	<b>-.10</b>	<b>.10</b>	<b>-.15</b>	<b>.16</b>	<b>-.14</b>	<b>.14</b>
Army Identification	-.01	.01	<b>.09</b>	<b>-.09</b>	<b>.08</b>	<b>-.08</b>	.02	-.02
Fitness Motivation	<b>-.12</b>	<b>.13</b>	<b>-.09</b>	<b>.10</b>	<b>-.20</b>	<b>.21</b>	<b>-.15</b>	<b>.15</b>
Hostility to Authority <sup>a</sup>	.00	.00	.02	-.03	.01	-.02	.02	-.02
Stress Tolerance	-.06	.06	.02	.00	.00	.00	-.02	.02
Response Distortion <sup>ab</sup>	.04	-.04	<b>.08</b>	<b>-.08</b>	-.01	.00	.03	-.03
Goal Orientation	--	--	<b>.15</b>	<b>-.15</b>	<b>.09</b>	<b>-.10</b>	<b>.09</b>	<b>-.09</b>
Past Withdrawal Propensity <sup>a</sup>	--	--	-.06	.05	-.01	.01	-.01	.00
Peer Leadership	<b>-.08</b>	<b>.07</b>	.01	.00	<b>-.09</b>	<b>.09</b>	<b>-.08</b>	<b>.08</b>
Self-Efficacy	.01	.00	.05	-.05	-.04	.04	-.02	.02
Tolerance for Injury	--	--	.04	-.03	-.03	.02	.00	.01
Written Communication	--	--	--	--	<b>-.13</b>	<b>.13</b>	<b>-.08</b>	<b>.07</b>

*Note.* CBEF = Cadet Background and Experience Form. PMS = Professor of Military Science. WPS = Whole Person Score. APFT = Army Physical Fitness Test. GPA = Grade point average. For Disenrollment, point-biserial correlations are reported. Bolded values indicate statistical significance at  $p < .05$  (two-tailed). <sup>a</sup> Negatively valenced, such that lower scores indicate more favorable standing on the construct of interest. <sup>b</sup> Response distortion items have a 0-1 response scale. All other CBEF scales have a 1-5 response scale.

## **CHAPTER 6: SUMMARY AND FUTURE DIRECTIONS**

Christopher R. Graves (HumRRO), Mark C. Young, Peter J. Legree, and Colin L. Omori (ARI)

In this final chapter, we summarize key findings and lessons learned from ARI's ROTC research effort for the August 2020 to August 2021 cycle. Next, we describe some promising future directions for the program. Although our discussion focuses primarily on the testing program for four-year scholarships, the issues raised will largely generalize to other applications.

### **Background**

ROTC is a core commissioning source for Army officers, producing a significant portion of individuals who ultimately serve in senior leadership positions. Thus, the four-year national ROTC scholarship program, managed by the USACC, is an integral program to the US Army for encouraging highly qualified high school (HS) seniors to become Army officers. Each year, the USACC awards approximately 2,000 scholarships to entering ROTC students. Disenrollment from the scholarship program creates a significant cost to the Army in terms of lost scholarship money (over \$20,000 per student per year), lost training time/resources, and lost opportunities for awarding scholarships to others who might have otherwise completed the program and become successful officers.

The current effort described in this report extends an ongoing program of research that began in 2007. Our initial focus was to develop a new non-cognitive motivational measure (now called the Cadet Background and Experience Form [CBEF]) to help inform the award of four-year ROTC scholarships. The goal was to identify applicants who were more likely to complete the ROTC program and become commissioned officers. Prior to including the CBEF in the scholarship assessment process, there had been a heavy emphasis on the evaluation of cognitive skills (SAT/ACT scores, HS grade point average). Such skills have been consistently related to program performance outcomes (e.g., GPA and APFT), but have not been predictive of program completion. Adding CBEF to the process allowed for more of a holistic assessment by capturing critical motivational attributes important to both continuance and performance in ROTC, and possibly to the Army as well.

### **Supporting the Award of Four-Year Scholarships**

Compared to those of prior cohorts, the results of the F19 validation analyses provide less evidence for the inference that the HS CBEF adds utility for selecting four-year ROTC scholarship recipients based on predicting outcomes valuable to the USACC (e.g., continuance, APFT, GPA). In the absence of additional information, we might hypothesize that the near-zero relationship between the HS CBEF composite and first-year disenrollment was due strictly to the uncharacteristically low rates of disenrollment for 4R and 3D scholarship recipients; however, two pieces of information cut against this conclusion. First, we suspect the reduced disenrollment rates were not random but due to the onset of the COVID-19 pandemic. In March of 2020, students were sent home, potentially increasing continuance as students waited out the pandemic. Second, if the change in disenrollment was random, we would expect little change in the relationship between other predictors and disenrollment. Instead, a new, significant relationship

surfaced between the WPS and disenrollment. This suggests that, during the pandemic, factors other than those measured by the CBEF influenced disenrollment, and those factors are at least partially accounted for by the components of the WPS. Additionally, the direction of the relationship – higher WPS scores predicting higher disenrollment – would unintuitively mean negatively weighting the WPS. We do not propose that this be done, but rather results should be monitored in future analyses to determine whether this could be an anomalous result due to factors related to COVID-19.

Besides these results, the present research confirmed many of the psychometric properties evidenced in prior research, such as acceptable estimates of scale reliability and meaningful relationships with other measures in the nomological network and criterion space. This is an impressive finding, given that the testing is taking place on such a large scale, in a very high-stakes environment, and without the benefit of proctoring (i.e., online administration). In addition, the key outcomes we are predicting (e.g., GPA, APFT, OMS) occur years after applicants complete the CBEF as a part of the scholarship application package. There are long delays between the point at which the CBEF scores are captured (during the four-year scholarship application process), the time that a cadet begins his/her first year of college ROTC, and the maturation of the outcomes that emerge over the subsequent one, two, three, and four years of the cadet's pre-commissioning career.

As documented in earlier chapters, the psychometric properties of both operational and experimental scales administered on the CBEF align with previous trends. Most CBEF scales evidence adequate estimates of reliability and theoretically meaningful relationships with other related scales. Notably, some of the reliability estimates presented in this report are for experimental, unscored scales that do not contribute to the assignment of four-year ROTC scholarships. The zero-order correlation of the CBEF composite with key outcomes for the HS applicant sample and the Advanced Camp sample are weak and some are non-significant. Incremental validity analyses also show the utility of using the CBEF to predict continuance above and beyond the WPS (without the CBEF) is low for the F19 cohort. Further, quintile plots provide more evidence for the utility of the WPS rather than the CBEF regarding differences between the top and bottom percentile group's performance and disenrollment rate. As noted in Chapter 3, the HS CBEF composite (version 2.0) examined in this report has already been replaced with a new composite (version 3.0) which has evidenced higher validity in ongoing research conducted outside the scope of this report. This tool for selecting ROTC four-year scholars is one that is undergoing continual improvements, and further analyses will continue to track the performance of this new composite for the F19 applicant cohort and beyond, as well as determine whether any results for the F19 cohort may be anomalous – and temporary – due to factors related to the COVID-19 pandemic. Below, we discuss limitations of the current research and directions for future effort.

### **Supporting the Award of Two- and Three-Year Scholarships**

ARI has recently supported the USACC in its implementation of the On-Campus CBEF nationwide. Each year, the USACC awards approximately 2,000 two- and three-year scholarships to freshman and sophomore cadets who have already enrolled in ROTC, and this new CBEF version informs that award decision process. The On-Campus CBEF is similar to the

HS CBEF (used to award four-year scholarships) but designed to prioritize the prediction of performance in ROTC over continuance. The instrument became operational in 2019 for selecting 2020-2021 scholarship recipients (O20). Our scoring algorithm combines applicants' scores on this CBEF with other information currently used in the scholarship award process (e.g., selection board scores, GPA, interview, physical fitness test scores), contributing to a "whole person" assessment.

The On-Campus CBEF demonstrated sound psychometric properties and validity based on research data collected from cadets at the 2014-2016 ROTC Advanced Camps, but the test required further validation under "high-stakes" operational conditions. As described earlier in this report, we began this verification by comparing the O20 operational On-Campus CBEF data to those data collected during the 2018 and 2019 Advanced Camps to allow for a comparison of CBEF scales in operational and research settings.

In brief, the On-Campus CBEF demonstrates sound psychometric properties, similar to those of the Advanced Camp CBEF, with a few exceptions. Most notable among the exceptions, cadets score higher on the operational On-Campus CBEF than the research-only Advanced Camp CBEF. Additionally, cadets with higher scores on the On-Campus CBEF tend to score higher on a Response Distortion (i.e., faking) scale. It appears, then, that the higher test and faking scores are likely attributable to the high-stakes nature of the test and may be attenuated by correcting for faking in the composite score.

### **Technical Constraints to Validating the CBEF**

There are several factors that constrain the observed validities of the CBEF for predicting ROTC continuance and providing incremental validity beyond the WPS (without CBEF). One validity limitation is a function of the available applicant samples with CBEF data. Only a small subset of newly enrolled cadets entered ROTC under a four-year scholarship (about 2,000 out of 11,000). Out of approximately 6,000 applicants, the USACC awards approximately 2,000 scholarships each year to those with the highest WPS (with CBEF) scores. Further, our model development has generally focused on the subset of scholarship awardees (about 1,000 cadets per academic year) who receive funding throughout the entire four years of ROTC. These are the awardees that USACC considers to be the most competitive and desirable. Because our sample of applicants/cadets is so highly vetted, there is considerable range restriction on the predictor measures, which constrains our validation findings. To account for the known range restriction in our prediction model, we report validity coefficients corrected for range restriction.

A second limitation results from the composition of the disenrollment data provided by USACC. Currently, the cadet disenrollment data only allow us to partially disentangle voluntary from involuntary (e.g., due to illness, death, extreme personal hardship, or academic failure) separation among cadets. We believe that the undesired but necessary inclusion of both separation categories in our disenrollment criterion causes CBEF validity coefficients to be attenuated. That is, our validity estimates may be lower than necessary due to the inclusion of cadets who separated as a result of poor academic performance or involuntarily (e.g., perhaps due to an injury, illness, or a family emergency that requires a cadet to leave school). It would be useful to be able to eliminate cases in which the former category of involuntary separation is the

primary separation factor, however, we are still interested in tracking separations that are, to some degree, under a cadet's control. These latter cases may represent a significant proportion of involuntary separations, as U.S. Air Force cadet research suggests that lower cognitive ability has a greater impact than motivation/commitment on involuntary separation (Mowday & Lee, 1986). In the future, we will continue to work with USACC to obtain more detailed ROTC separation codes to allow us to make finer distinctions regarding the reasons for withdrawal. This would provide us greater granularity in distinguishing between voluntary and involuntary separations, thereby allowing more accurate validity estimates.

### **Future Directions**

Broadly speaking, there are four avenues for future research that might help to significantly exceed the validity limitations currently experienced in our ROTC research. In addition, there is an emerging opportunity to begin examining the relationship between CBEF scores and long-term outcomes well beyond the point of officer commissioning.

Among the approaches for enhancing validity, one involves using the existing CBEF, but applying a new scoring approach. This avenue of investigation has demonstrated that the use of profile similarity metrics (PSMs) can significantly increase the criterion-related validity of CBEF scales relative to the currently used conventional scoring approach (Legree, Ness, Kilcullen & Koch, 2019; Legree, Purl, Kilcullen, & Young, 2019; Legree, Traylor, Shewach, & Kerner, 2022). In this method, analysts optimally weight individual difference scores (against a key) for each applicant to create scale and composite scores for predicting targeted criteria. These investigations have involved ROTC cadets, and the prediction of training and school performance outcomes (OMS, APFT scores, and GPA), which are of great importance to USACC. This research is continuing and shows promise for our ability to significantly boost the operational validity of the CBEF.

Second, we are pursuing an opportunity to evaluate whether additional existing data might enhance the CBEF's capability to predict continuance in the ROTC program. Specifically, we are examining information on entry waiver status (e.g., whether or not a cadet entered under a waiver and the type of waiver involved) and scholarship applicant data (e.g., self-reported HS activities such as sports participation) not currently captured by the CBEF and only non-algorithmically reflected in WPS scores. If promising new predictors are identified from this research, we will outline "best practice" recommendations for how the predictors could be used in the scholarship assessment process (e.g., incorporate them systematically into the WPS).

Third, we are considering alternative measurement approaches for future research. We might consider an implicit approach to predictor measurement (e.g., a conditional reasoning test) to improve the measurement of some scales, which may otherwise be transparent to respondents. Another possibility involves exploring methods, such as those used in the Army's Tailored Adaptive Personality Assessment System (TAPAS), which are intended to make measures more fake-resistant, efficient, and, powerful via item response theory and computerized adaptive testing (CAT).

While the initial focus of our research program was to investigate the validity of the CBEF against relatively short-term outcomes (e.g., ROTC continuance and performance), it has now become possible to examine CBEF's validity against relatively long-term post-commissioning outcomes. These include officers continuing to and beyond their Active Duty Service Obligation (ADSO), as well as performance outcomes such as promotion rates, awards, and supervisor ratings of performance. In the context of Officer Candidate School, we have already reported positive findings for predicting continuance beyond the ADSO (Allen & Young, 2012; Green & Burgoyne, 2020). Because the HS CBEF testing of scholarship applicants under operational conditions began in 2010 (for the 2011/2012 academic year), applicants who were originally tested at that time could now have reached the point of their four-year ADSO. In addition, cadets we first tested under our annual Advanced Camp testing program in 2010 will have had the opportunity to have served up to 10 years as Officers. This is well beyond the point of their ADSO, and some within this cohort will have already reached the rank of Major (O4). We are already in the process of validating the CBEF against critical post-commissioning outcomes (including supervisor performance ratings) under a related project focused on the officer branching process (Legree, Purl, Kilcullen, & Young, 2019). Results to date show CBEF scales to have statistically significant and practically important incremental validity above and beyond the cadet OML scores for predicting Officer performance (Ford, Russell, Legree, Kilcullen, & Young, 2021).

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