What makes Air Force cyber warfare training hard?

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ABSTRACT
As part of the process of constructing an aptitude test to determine who would be the best fit for cyber warfare operator training in the United States Air Force (USAF), we conducted qualitative interviews with instructors and analyzed existing quantitative course success data. The goal was to determine what makes cyber warfare operator training hard and to see if existing tests could predict who would succeed. The results provide parameters for the goals and current baselines of the United States Air Force Cyber Aptitude and Talent Assessment (USAF-CATA).

CCS Concepts
• **Social and professional topics~ Computer and information systems training** • *Social and professional topics~ Computational thinking* • Social and professional topics~ Student assessment • Applied computing~ Cyberwarfare

Keywords
Aptitude testing; job analysis; task analysis; cybersecurity workforce; selection.

1. INTRODUCTION
The field of cyber operations includes a wide array of work roles that are distinct from each other in terms of tasks, required expertise, and cognitive demands. As such, it is next to impossible to identify a single metric for assessing cyber operations ability that will fit every situation. The Cyber Aptitude and Talent Assessment (CATA) framework is being developed as a way to create assessments for selecting personnel for a variety of cyber work roles [1] [2] [3]. The framework characterizes both work roles and candidates along a pair of orthogonal dimensions.

The work of the Air Force (USAF) cyber warfare operator is demanding and requires a great deal of flexibility. Therefore, the initial test of the effectiveness of the USAF-CATA prototype is whether it can predict success in the training program that qualifies people for the job. As a first step, we assessed the situation to determine what makes the course difficult and what requirements would need to be met for the instrument to improve on the current selection system for the course.

2. METHODS
The needs analysis study for the USAF-CATA consisted of two components. First, we conducted an interview with a group of training course instructors to collect qualitative data on the course characteristics that are factors in how difficult the course is, as well as the learner characteristics related to how well students adapt to the challenges. We compiled and annotated the instructors' responses to extract emergent themes and identify the key outcomes of interest. Outcome measures included overall course completion, grades, need for remedial instruction interventions during training, and post-training success.

Second, we identified quantitative metrics that were expected to be predictive of success, including four composite scores from the Armed Services Vocational Aptitude Battery (ASVAB), scores on the Electronic Data Processing Test (EDPT), and demographic information about students that included their educational background. We then used linear and logistic regression models to assess how well these metrics would predict performance on the outcome measures identified in the first phase of the study.

3. RESULTS
The Air Force provided data on the measures from 344 professionals who had completed the training since the field's inception in 2011. The rate of course completion was very high overall (92%), allowing very little variability in the measure for discriminating among students, and therefore model results were very mixed. In contrast both the results of the instructor interviews and the statistical modeling highlighted two outcomes as being particularly important – students' need for remediation during the course and students' block grades in the Windows and Linux operating system training blocks. Education, EDPT scores, and the AQE_MECH composite of the ASVAB were all found to be negatively related to students' need for remediation. For average GPA in the operation system training blocks, the best model included only the AQE_ELECT composite of the ASVAB, but that model did not account for very much variation in outcome, leaving room for additional measures to improve prediction.

Other general factors that were identified by instructors as being related to success in the course were course intensity, as well as students' motivation level, general intellectual capacity, and prior experience with course material. These observations, in combination with the model outcomes, served as the core guidance for what tasks to develop and include in the USAF-CATA.

4. REFERENCES
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