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Calculator Use on the ASVAB

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Objectives

- Current policy on calculators
- Expressed concerns with current policy
- Background & potential impacts of immediate implementation
- Path forward
- Current status
- MAPWG member input
- DACMPT advice

Current policy with respect to calculators on ASVAB

- ASVAB test-taking policy does not permit use of calculators
- Test questions on the sub-tests Arithmetic Reasoning (AR) and Mathematical Knowledge (MK) are designed and developed to be answered without the use of a calculator
- Content developers assume mental or manual calculation when including numeric values, operations, variables, equations, etc. in test items
- Complexity of calculations is intentionally limited

Previous Research (Buckland et al., 2021)

- 2021 Calculator Use and the ASVAB Study
 - Surveyed Subject Matter Experts regarding the importance of math skills for success in training and on the job, and the necessity of doing math without a calculator
 - Given evidence that math without a calculator is needed in training and on the job, recommended maintaining policy of not allowing calculators during ASVAB.

Math without Calculator	In Training		On the Job	
	#	%	#	%
No Math Required	6	4%	6	4%
Always Have Tool	47	28%	66	40%
Basic Math w/o a Calculator	83	50%	74	44%
Algebra/Geometry w/o a Calculator	23	14%	15	9%
Higher Order Math w/o a Calculator	7	4%	5	3%

N=175 from representatives of 25 different career fields

Expressed concerns over current policy with respect to calculators

- Other national testing programs (e.g. ACT, SAT, GED) allow calculators on the quantitative tests
- Exclusion of calculators may result in the perception that OSD testing program is not keeping up with trends in assessment
- High school curriculum often allows calculators during instruction and exams
- Test items requiring manual calculations may result in increased test anxiety as students are not accustomed to performing such calculations
- Chief of Army has requested immediate implementation of calculators for ASVAB administration

Background

- The ASVAB is a large-scale, high-stakes assessment used for three primary purposes
 - Personnel selection: Determine if an applicant is qualified to enlist based on the Armed Forces Qualification Test (AFQT), which is a composite of Arithmetic Reasoning (AR), Math Knowledge (MK), Paragraph Comprehension (PC), and Word Knowledge (WK) scores
 - Classification: Assign applicants to jobs in the military using Service-specific aptitude area composites
 - Career exploration: facilitate career exploration for high school and early post-secondary students via the ASVAB Career Exploration Program (CEP) composite scores

Concerns regarding immediate implementation of calculators

- Impact(s) on validity
 - Decades of validity evidence is based on ASVAB administered without the use of calculators
 - Thousands of AR and MK items have been developed under assumption of manual calculation conditions
- Unknown psychometric impacts on
 - Difficulty
 - Dimensionality
 - Response time
 - Fairness
 - Norms
 - Composite cut scores
- Score Utility
 - Interpretability of scores (score meaning/definition)
 - Loss of score utility without a clear score meaning
- Statutory compliance
 - USC, Title 10, Sec 520, mandates how AFQT is to be applied for the purpose of enlistment. Specifically, the statute mandates a limitation on enlistment of applicants with an AFQT score between 10 and 30.
 - This implies an ability to accurately estimate aptitude. Immediate implementation of calculators for operational use on the ASVAB will result in changing the definition of the AFQT scores in unknown ways without substantiating science
 - Difficulty in faithfully complying with direction in the statute

Path Forward

- AP and DTAC have recommended and received funding to execute a two-phased approach to incorporating the use of calculators into the accession testing program
- Phase 1: Pilot Analysis (~2.5 years)
 - **A:** Identify “calculator sensitive” items
 - **B:** Data collection and analysis
 - **C:** Provide results to DACMPT members for scientific review and advice
 - **D:** Develop recommendation for moving forward based on pilot analysis results and DACMPT advice
- *E/F/G are contingent on pilot analysis results indicating absence of dimensionality or other substantive measurement issues associated with introduction of calculator use*
 - **E:** Equating study with current MK & AR
 - **F:** Policy updates and guidance
 - **G:** Operational software updates

Path Forward

- Phase 2: Develop new test(s) (~5 years)
 - **A:** Conduct needs/requirements assessment
 - Develop new AR, MK, or special purpose test
 - *B/C/D are contingent on findings in 2A (as well as Phase 1 A-D)*
 - **B:** Test development
 - **C:** Software Development
 - **D:** Data collection and validation analyses

- Phases 1 and 2 can be initiated simultaneously

Current Status

- Phase 1A: Identify calculator sensitive items
 - DTAC has provided HumRRO with ~200 MK and ~200 AR items for SME review of calculator sensitivity
 - Currently underway as of November 2023
- Phase 1B: Pilot analysis
 - Administer linear (non-adaptive) MK & AR forms at MEPS
 - Randomly assign applicants to calculator permitted or not permitted conditions
 - Collect identifying info to link to operational ASVAB records
 - Administer post-assessment questionnaire
 - Target analysis sample size of 1,500 per condition or 3,000 total
 - Data collection scheduled to begin December 2023 and run for approximately 90 days
- Phase 2A: Conduct needs/requirements assessment
 - Concurrent with phase 1A/1B

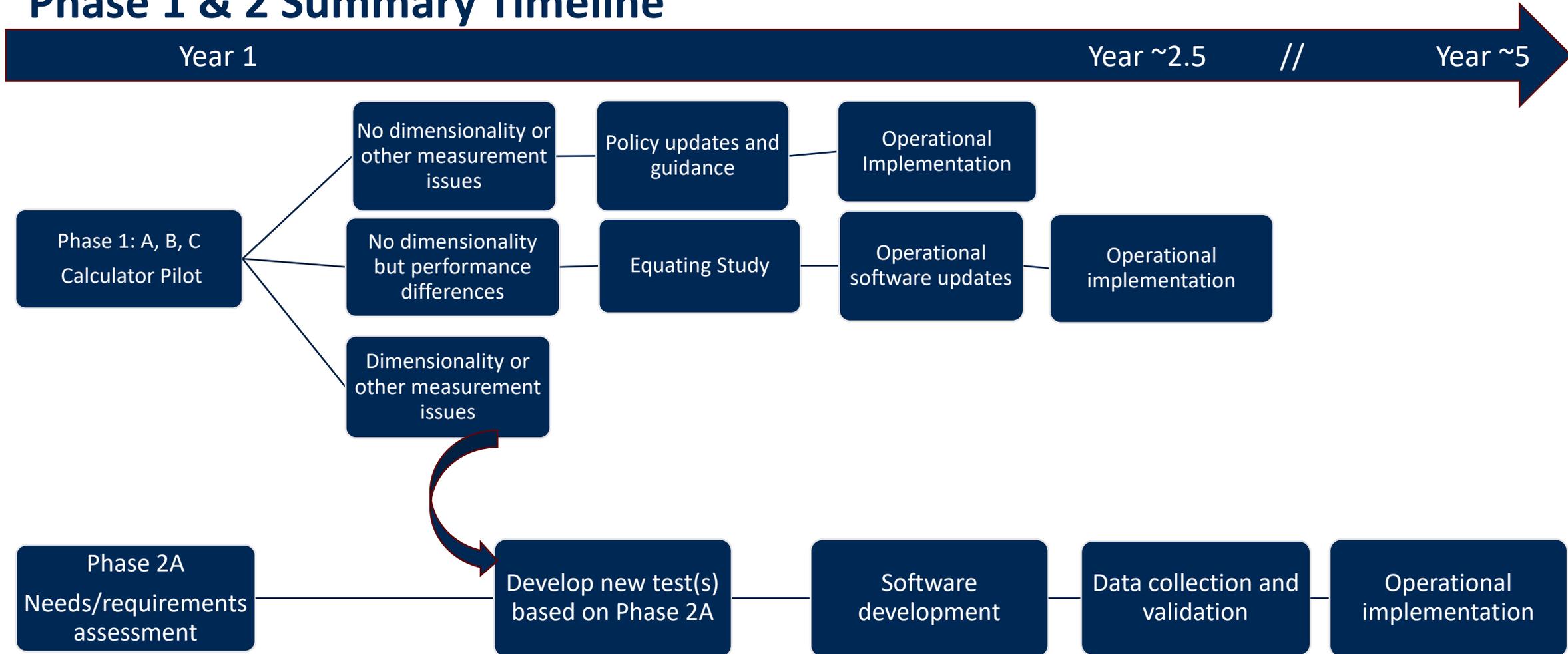
Phase 1B: Pilot analysis

- The research questions to be answered in this study include:
 - Does allowing calculators differentially impact examinee performance (e.g., scores, response time) on AR, MK, and AFQT?
 - Is this impact comparable across groups?
 - Does allowing calculators differentially impact item characteristics (e.g., IRT parameters, classical item statistics)?
 - Does allowing calculators impact test dimensionality?

Phase 2A: Needs/requirement analysis

- Determine whether it is appropriate to develop new MK, AR, or special purpose test that incorporates calculators
 - Review findings from previous research, including
 - Calculator Use and the ASVAB (Buckland et al., 2021)
 - ASVAB Training Relevance Survey (Adams, et al., 2022)
 - Collect training and technical job requirements data from Services to
 - Define job taxonomy
 - Define constructs to be measured
 - Inform item types and test specifications

Phase 1 & 2 Summary Timeline



Manpower Accession Policy Working Group (MAPWG)

- MAPWG met on October 10, 2023 to discuss calculator use on ASVAB
- AP representative informed the group of the Army's request for immediate operational implementation of calculators and summarized interwoven legal and scientific risks
- MAPWG representatives from the Navy, Marine Corps, Air Force, Space Force, and Coast Guard all concurred with the statutory and scientific risks associated with the absence of evidence on the potential impact
- The Marine Corps representative hypothesized that if only Army allows use of calculators more applicants may be drawn to Army if they perceive an easier route to accession in the zero-sum recruiting context
- All MAPWG Service representatives, except for the Army, are not in favor of immediate operational implementation of calculators on the ASVAB without substantiating science

DACMPT input/advice

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