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High School Curriculum Study

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Background

- Goals
  - Design a research study to:
    - Determine how ASVAB subtests align with content taught in high schools
    - Explore how ASVAB content is taught
    - Map ASVAB content to other relevant sources
  - Design should include:
    - Review of previous high school curriculum and high school assessment alignment studies with ASVAB content
    - Review of previous mappings between ASVAB and other tests
    - Review of any available National Assessment of Educational Progress (NAEP) transcript studies
    - Method for assessing if there are differences between course-taking patterns of military applicants and the general high school population

Trends in Teaching Practices

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Trends in Teaching Practices

- Most significant (relatively) recent development was the introduction of the Common Core State Standards (CCSS) in 2009 and the Next Generation Science Standards (NGSS) in 2011
- CCSS recommends (a) regular practice with complex texts and writing assignments involving the use of evidence and (b) practices that support gaining a conceptual understanding of mathematical principles
- NGSS recommends emphasis on in-depth development of core explanatory ideas, using ideas to generate and apply models to various phenomena, and treating science as a coherent progression over the course of K–12 education with knowledge built over time and across disciplines
- In both cases, research has produced mixed results regarding impact (Kane et al., 2016; Loveless, 2014, 2015; Song et al., 2019; Gao et al., 2018, 2022)

Trends in Teaching Practices (cont.)

- Integrated Instruction
  - Blending content within or across disciplines
  - Research has shown mixed results with more positive results at lower grades (Becker et al., 2011; Winarno et al., 2020)
- *Learning progressions* is a research-based method for developing instruction
  - Identify ultimate objective of instructional unit/sequence and work back to identify all prerequisites
- *Microlearning* involves breaking material into small chunks and including assessments to gauge incremental understanding
- *Flipped instruction* moves the presentation of content to outside the classroom so class time can be devoted to more in-depth discussion

Trends in Teaching Practices (cont.)

- *Project-based instruction* assigns students real-world issues to work on individually or in groups
- *Use of technology in instruction*
  - Gray et al. (2021) found that 47% of schools reported employing self-contained instructional practices to a moderate or great extent
  - National Center for Education Statistics (NCES) study found that 84% of schools reported using technology for activities normally done in the classroom, and 54% indicated use for activities that would not be possible without technology

Implications for the ASVAB

- Given the largely decentralized status of public education, attempting to adapt to various trends would be difficult
  - Some states adopted, then replaced, CCSS
  - New York moved to integrated math curricula, then returned to traditional format
- Larger implication may be in the way student knowledge is assessed
  - Recent comparison of ASVAB and Smarter Balanced Assessment Consortium (SBAC) math items found the latter required students to demonstrate skills in a more diverse and language-intense context
  - Review of SBAC items found them to often involve fairly lengthy reading passages with multiple questions related to each passage
    - Identify an inference that can be drawn from the passage, then select the portion of the text that supports your answer
  - Also often involve open-ended questions that require students to think critically and cite evidence in their response

Implications for the ASVAB (cont.)

- Could suggest more complex item types, e.g.,
  - Include a passage that presents a particular point of view on a topic
  - Examinee is told that the passage must be shortened by selecting the most relevant points and arranging them in a cohesive order
- Implementation would involve challenges
  - Need valid and reliable automated scoring options for open-ended items given the volume of testing
  - Likely increase in item development costs
  - Significant programming efforts to implement
  - Could result in increased testing times
- Such changes might run contrary to the desire to incorporate more language-free content into the ASVAB to accommodate non-native English speakers

Prior ASVAB Alignment Studies

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Prior ASVAB Alignment Studies

- Oppler et al. (1997) focused on technical tests and General Science (GS)
  - Examined 1990 High School Transcript Study (HSTS) data
  - Conducted an Exposure to Content survey of recruits
    - Both indicated high levels of exposure to GS content; less so for technical tests
    - Recruit sample was “technically better prepared than the HSTS sample”; likely a selection effect
  - Results from a survey of military SMEs indicated that ASVAB content is relevant to military training/jobs
- Waugh et al. (2015) examined content blueprints of ASVAB subtests in relation to educational/assessment programs that address similar subject areas (e.g., NAEP, SAT, ACT)
  - Developed alternate subtest taxonomies
    - Found a good deal of overlap between ASVAB and sources reviewed
    - Revised taxonomies provided more detailed breakouts of content domains that could increase the breadth of the subject matter covered

Prior ASVAB Alignment Studies (cont.)

- Summary
  - Results from Oppler et al. (1997) and more recent work (Adams et al., 2022) indicate that ASVAB science and technical tests are relevant to military jobs
  - Waugh et al. (2015) found a good deal of overlap between ASVAB test blueprints and other relevant sources (e.g., SAT, ACT, NAEP), particularly those tests that address content regularly taught in schools (i.e., Word Knowledge [WK], Paragraph Comprehension [PC], Arithmetic Reasoning [AR], Math Knowledge [MK], and General Science [GS])
    - Technical tests more questionable
    - Relevant comparison sources found for Auto Information (AI) and Shop Information (SI), but not Mechanical Comprehension (MC) and Electronics Information (EI)

High School Course Taking

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High School Course Taking

- Review of literature identified four broad categories of research
  - Course-taking and changes in course-taking over time
  - Impact of course-taking on future outcomes
  - Changes in and impact of Career and Technical Education (CTE) course taking
  - Methodological studies

- Much of the research based on NCES-sponsored studies
  - High School Longitudinal Study (HSLS:2005, 2009)
  - High School Transcript Study (HSTS: 1990, 1994, 1998, 2000, 2005, 2009, 2019)

High School Course Taking (cont.)

- Overall results indicate that students earned more credits and pursued more challenging curricula in 2009 compared to 1990, especially in math and science (NCES, 2011)
  - However, there are findings that suggest course titles may not reflect actual level of course content
  - 2019 data suggest only 12% of students followed a rigorous curricula and 23% were below standard (NCES n.d.)
- Results of several studies suggest students who do well in middle school math and science classes are more likely to take advanced classes in high school
- Students who take Algebra 1 before 9th grade are more likely to be proficient on standardized tests and more likely to go on to postsecondary institutions (NCES 2019)

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CTE Course Taking

- Results from a variety of studies yield the following general conclusions
  - Most students earn Career and Technical Education (CTE) credits while in high school
  - The percentage doing so has declined somewhat from 1990 to 2015
  - Course-taking patterns have shifted over time (e.g., less focus on areas such as agriculture, architecture/construction, and business/marketing, and greater focus on engineering/technology, health care, hospitality/tourism, and human services)
  - Consistent differences between males and females in areas of focus
    - A higher percentage of males earn credits in architecture and construction, engineering and technology, manufacturing, and transportation and logistics, while a higher concentration of females in health care and human services
  - Overall test scores and graduation rates for students taking CTE courses have risen over time
  - Limited data suggest no relationship between CTE course-taking and postsecondary pursuits

Methodological Studies

- Rosen et al. (2017) examined data from HSLS: 2009, comparing student reports of math courses taken to their actual transcripts
  - Overall self-reports were accurate regarding courses taken, with less accuracy about year taken and grade received
  - Greater accuracy in reporting grade received among higher-performing students
- NCES (2020) compared courses students reported taking as part of the NAEP studies conducted in 2000, 2005, and 2009 to their high school transcripts
  - For all math courses except pre-calculus and unified/integrated math, a higher percentage of students reported taking the class than was indicated by their transcript
    - In all standard math classes (Algebra 1, Geometry, Algebra 2), higher percentages of students reported taking the class than was indicated by their transcripts, with differences ranging from 2% to 7%

Current Study

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Current Study

1. Review relevant sources (e.g., NAEP, ACT) to determine if they have been updated/revised in a way that makes them more or less aligned with ASVAB
2. Conduct "pseudo-alignment" study in which SMEs review high school course catalogs with ASVAB test blueprints and make judgments regarding whether content is addressed in schools
3. Work with Joint Advertising, Market Research, and Studies (JAMRS) to include questions on course-taking/extracurricular activities in their Ad Tracking Survey, which examines awareness of and reactions to military advertising campaigns
    - Survey conducted quarterly with a stratified random sample of U.S. youth 16–24 years old who previously responded to the *Futures Survey*, which obtains information on attitudes toward the military and propensity to enlist
4. Explore HSTS: 19 data to identify relevant results that have not been reported in the literature (in process)

Review of Comparable Taxonomies

- PC—ACT Curriculum Study
  - High school ELA teachers indicated topic areas most frequently taught
  - Highest rated were composing skills and strategies, vocabulary, comprehension strategies, analysis and evaluation of texts, and inferential comprehension of texts
  - HumRRO PC editors reviewed findings and agreed that vocabulary is covered (in WK), inferential comprehension is addressed, and analysis and evaluation of texts is partially covered (no evaluation)
  - Composing skills and strategies are not addressed

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Review of Comparable Taxonomies (cont.)

- PC—ACT Reading and Readiness Standards
  - Standards set for various reading score ranges (i.e., 13–15, 16–19, 20–23)
  - Comparisons with ASVAB are not clear-cut due to inclusion in the standards of the phrases “somewhat challenging” and “challenging” passages
  - ASVAB PC passages limited to 100–180 words to eliminate scrolling;
    ACT averages ~800 words
  - HumRRO PC editors agreed that most standards are addressed
  - Exceptions include determining cause-effect relationships and making comparisons between passages

Review of Comparable Taxonomies (cont.)

- PC—NAEP Reading Assessment and Achievement Level Definitions
  - Again, comparisons not straightforward
  - Reading assessment includes items that require comparisons between two or more texts, and passage length can range from 500–1,500 words
  - Seven item types, only one of which is used in PC (i.e., single-selection multiple choice)
  - PC editors agreed that Basic Achievement Level Standards are addressed in the ASVAB
  - Those at higher levels (i.e., proficient, advanced) not covered or only partially covered
  - Common characteristics of standards not covered include
    - Diagrams and charts
    - Comparison between texts
    - Requiring analysis, evaluation, synthesis, and critique of texts

Review of Comparable Taxonomies (cont.)

- MK/AR—ACT Curriculum Study
  - Math teachers rate most important skills to be developed
  - Four skills not included in MK/AR blueprint are higher level (e.g., Math 3, Algebra 2)
- MK/AR—ACT Math Readiness Standards
  - Standards set for various ACT Math Score Ranges (i.e., 13–15, 16–19, 20–23)
  - Six of the 12 skills at the 13–15 level are addressed, and remainder could be covered in ASVAB, assuming they could be assessed through multiple-choice questions (e.g., locate positive rational numbers on number line, estimate length of line segment based on other lengths in geometric figure)
  - All skills at the 16–19 level are or could be addressed in ASVAB except one involving probability, which is not in the existing blueprints
  - Several skills at the 20–23 score level were judged to be outside the AR/MK blueprint (e.g., add two matrices that have whole number entries); others were judged to be included or candidates for inclusion in AR/MK

Review of Comparable Taxonomies (cont.)

- MK/AR—2022 and 2024 NAEP Mathematics Assessment Framework
  - Includes objectives deemed appropriate for assessment by subtopic and grade
  - All objectives in Numbers Properties and Operations are covered, partially covered, or could be covered in the ASVAB, although addressing some would require expanding item types (e.g., identify situations where estimation is appropriate)
  - Most objectives in Measurement are covered, partially covered, or could be covered, except measurement in triangles (e.g., solve problems using the fact that trigonometric ratios stay constant in similar triangles)
  - Most objectives in Geometry, Algebra, and Data Analysis/Statistics/Probability were judged outside of the MK/AR blueprint
    - Most would require more expansive item types (e.g., describe, analyze, explain)

Review of Comparable Taxonomies (cont.)

- GS—Next Generation Science Standards
  - Cover three broad areas—Physical Sciences, Life Sciences, Earth/Space Sciences, which are also addressed in the ASVAB
  - Subareas within each define skills high school students should be able to demonstrate
  - Emphasis is on application of knowledge rather than retention
  - As a result, most would require alternate means of assessment (e.g., conduct a project, write a paper) or more expansive item types (e.g., develop a model, communicate scientific information)

Review of Comparable Taxonomies (cont.)

- GS—ACT Science Test Topic Areas
  - Cover three broad areas—Life Science/Biology, Physical Science/Chemistry/Physics, Earth/Space Science
  - HumRRO GS editor judged all to be covered in GS
- GS—ACT Science College and Career Readiness Standards
  - Describe what students at various score levels should be able to do (13–15, 16–19, 20–23)
  - Three broad areas—Interpretation of Data, Scientific Investigation, Evaluation of Models/Inferences/Experimental Results
  - HumRRO GS editor indicated that the descriptors do not represent the way in which content is covered by ASVAB (e.g., Compare, Determine) although certain topics are addressed (e.g., understand basic scientific terminology)

Review of Comparable Taxonomies (cont.)

- GS—National Academy of Sciences, National Research Council Framework for K–12 Science Education
  - Covers four broad areas—Physical Sciences, Life Sciences, Earth/Space Science, Engineering/Technology/Application of Science
  - HumRRO GS editor judged nearly all are covered in GS except Engineering, Technology, and Applications of Science
- GS—2028 NAEP Science Framework
  - Addresses the first three of the four topic areas above
  - HumRRO GS editor identified all topic areas as addressed in GS except Evidence of Common Ancestry and Diversity

Review of Comparable Taxonomies (cont.)

- Conclusions
  - ASVAB addresses the preponderance of content covered in other reviewed sources
  - Possible additions to test blueprints identified
  - Many skills not assessed by ASVAB would be difficult to address through a test or would require more complex/varied item types
  - Differences in underlying purpose of the ASVAB (selection/classification) and other tests (diagnostic/developmental) may obviate the need to assess knowledge/skills in similar ways

Preliminary Results—Alignment Study

- School Sampling Approach
  - Randomly selected one state from each of the 9 Census Regions: RI, PA, MI, MN, VA, TN, AR, MT, and CA
  - Created an extract of Common Core of Data public school directory for each state
  - Sorted schools by level and eliminated Pre-K, elementary, and middle schools
  - Sorted schools by type and eliminated special education, unknown, and alternative schools
  - Generated random numbers to select 5 schools from each state

Preliminary Results—Alignment Study (cont.)

- Compared distribution of jurisdiction sizes to national data
  - Significant underrepresentation of City/Large (national = 15.08% of schools; sample = 8.41% of schools)
  - Three states in sample have no City/Large jurisdictions (AR, MT, and RI)
  - MN had two City/Large schools randomly chosen
  - PA, MI had none—randomly chose one City/Large school from each
- Added TX and FL to represent high-recruitment states

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Preliminary Results—Alignment Study (cont.)

- Logged on to school websites and sought course catalogs
  - Found detailed course descriptions for 40 of 57 schools
  - Schools lacking course catalogs tended to have small student populations (e.g., < 250)
- Drew additional sample within state/size jurisdiction groups, when necessary, until catalogs located
  - Implication: Smaller schools may be underrepresented

Preliminary Results—Alignment Study (cont.)

- Identified SMEs (item writers/editors) for MK/AR, GS, EI, AI, SI, MC, Cyber
- Created ratings spreadsheet
- Conducted meetings to provide overview of task
  - Purpose
  - How schools were selected
  - Use of rating sheet
- As of the time these slides were generated, ratings still in progress
- Results reflect data obtained to date

Preliminary Results—Alignment Study (cont.)

- AR/MK—All ASVAB content covered either in prerequisite courses (to those in the catalogs) or by basic courses in the catalogs
  - Possible exception: ASVAB time/temperature, with SMEs identifying few explicit mentions in catalogs
- GS—Almost all topics covered in a mixture of basic and advanced courses
  - Exception: ASVAB Life Science/Botany, which was not addressed in ~60% of high school course catalogs
- AI—Of the 56 catalogs reviewed thus far, 34 were identified as having no automotive technology/repair classes

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Preliminary Results—Alignment Study (cont.)

- SI—Content available in approximately two-thirds of the catalogs reviewed thus far
- MC—All six blueprint elements covered in the catalogs reviewed thus far
- Cyber—10 schools offered no related classes, and 8 provided courses only in use of IT and software
  - All test components covered in 14 schools
  - Topics most likely to be omitted were Network Configuration, Offensive Methods, and PC Configuration and Maintenance

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Ad Tracking Survey Results—Course Taking

- Small number of propensed respondents (89 of 880)
- Significantly higher proportions of respondents *not* considering military service reported taking biology, chemistry, physics, calculus, and statistics/probability
- Significantly higher percentage of those in the “definitely not enlist” category compared to those in the “probably not enlist” category took chemistry and statistics/probability
- Significantly higher proportion of those in the “definitely not enlist” category took business/marketing compared to those in the propensed group

Ad Tracking Survey Results—Course Taking

Courses	Total (n = 880)	Probably/Definitely Enlist (n = 89)	Probably Not Enlist (n = 357)	Definitely Not Enlist (*n* = 433)
Algebra	79%	69%	82%	80%
Biology	74%	56%	74%↑	76% ↑
Geometry	67%	52%	71%↑	67%
Chemistry	63%	35%	60%↑	71%↑↑
Health Sciences	45%	31%	45%	47%
Physics	39%	19%	39%↑	42%↑
Calculus	31%	5%	29%↑	36%↑
Computer Science	27%	18%	25%	30%
Statistics/Probability	26%	5%	23%↑	32%↑↑
Business/Marketing	21%	14%	17%	24%↑
Agriculture/Food Science	17%	19%	17%	15%
Engineering	13%	17%	13%	12%
Woodworking	12%	10%	15%	11%
Electronics/Electrical Systems	9%	15%	8%	8%
Manufacturing/Welding	7%	14%	8%	6%
Architecture/Construction	5%	11%	4%	5%
Transportation/Auto Repair	3%	10%	4%	2%
None of the Above	4%	3%	6%	4%
Refused	10%	19%	10%	8%

↑ = higher than propensed youth

↑ = higher than "Probably Not" propensed youth

Ad Tracking Survey Results—Extracurricular Activities

- Participation in extracurricular activities below 10% in most cases
- Highest participation levels in social service/volunteer efforts, sports and cheerleading, computer-related pursuits
- Few significant differences across groups
- Most notable difference was higher percentages of those in the medium- and high-propensity groups taking part in automobile and construction activities

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Ad Tracking Survey Results—Extracurricular Activities

Activity	Total (n = 1,150)	Probably/ Definitely Enlist (n = 134)	Probably Not Enlist (n = 443)	Definitely Not Enlist (n = 573)
Sports/Cheerleading/Drill Team	17%	20%	20%	14%
Academic Clubs				
Mathematics	4%	8%	6%↑	2%
Biology	3%	2%	4%	3%
Chemistry	2%	1%	1%	2%
English/Creative Writing	4%	6%	3%	5%
Debate	2%	5%	2%	2%
History	2%	4%	2%	1%
Foreign Language	7%	4%	8%	7%
Special Interest Clubs				
Cooking	3%	5%	4%	1%
Film	2%	1%	3%	2%
Photography	3%	4%	3%	3%
Chess	4%	5%	6%	2%
Art (Painting, Pottery)	8%	9%	7%	9%
Music (Band, Orchestra, Choir)	15%	14%	16%	13%
Social Service (Animal Welfare, Food Bank)	23%	21%	26%	21%
Computers/Electronics (Assembly, Repair, Programming)	11%	17%	13%	8%
Automobiles (Repair, Restoration)	7%	14%↑	10%↑	3%
Construction (Buildings, Furniture)	8%	17%↑	11%↑	3%
Boy/Girl Scouts	2%	2%	3%	2%
Agriculture (4-H, Future Framers of America)	4%	9%	4%	3%
Other	10%	7%	12%	8%
None of the Above	29%	22%	24%	35%↑↑
Refused	9%	14%	8%	9%

↑ = higher than propensed youth

↑ = higher than "Probably Not" propensed youth

↑ = higher than "Definitely Not" propensed youth

Conclusions

- ASVAB content largely addressed in relevant frameworks (e.g., ACT, NAEP)
  - Some suggestions for additions to blueprints
  - Addressing some skills would require expansion of item types
- ASVAB academic content areas (e.g., GS, AR/MK) typically addressed in high school courses
- Technical content coverage is spottier
- Some indication of course-taking differences between propensed and non-propensed youth, with the latter taking higher-level courses
- Some indication that propensed youth more likely to take part in extracurricular activities relevant to ASVAB (e.g., automotive, construction)

Questions for the DAC

- Does the DAC have recommendations on how this work can improve the composition of the ASVAB for selection and classification purposes?
- ASVAB currently assesses both knowledge learned in school and knowledge and skills needed in the military that may not be addressed in formal education.
  - Do you have any thoughts on how Next Generation ASVAB can continue to bridge that gap?

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Thank you!

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