Megatrends Paper 2015-01

"Ensuring a Technically Proficient Future Joint Force"

Background:

The United States has traditionally produced the world's top research scientists and engineers, leading to breakthrough advances in science and technology. Technological innovation improves the competitive position of U.S. industries, drives export growth, and supports high-quality jobs. As U.S. (and global) industrial and economic progress builds upon the outputs from that research, additional scientists, engineers, and technologists are needed to operate, maintain, repair and improve these new engines of industry and commerce. For the US to fully capture the benefits of existing and undiscovered technologies, it will require a steady stream of Americans equipped with science, technology, engineering, and math (STEM) knowledge, skills, and abilities. [1]

The need for workers with STEM skills is heightened in today's global economy. While it is difficult to project trends in the labor market, the demand for STEM-skilled workers is expected to continue to increase in the future, as both the number and proportion of "high-tech" jobs are projected to grow. Bureau of Labor Statistics data show that employment in STEM occupations is expected to expand faster than employment in non-STEM occupations from 2010 to 2020, [2] and it is reasonable to assume that trend will continue further into the future – probably at an accelerating pace.

Despite the clear demand for STEM talent by domestic employers, the U.S. is failing to produce an ample supply of workers to meet the growing needs of both STEM and non-STEM employers. While the number of students receiving degrees from four-year institutions has increased in the U.S. as access to higher education has expanded over the past several decades, the share of students graduating with STEM degrees has declined. The share of bachelor's degrees awarded in STEM fields peaked at 24 percent in 1985; by 2009, the share had fallen to 18 percent.[3]

There are a number of issues with the educational pipeline in the United States that can lead to a shortage of STEM professionals. Without a strong foundation in math and science from elementary and secondary school, students may find themselves unprepared to train for and pursue careers in STEM

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[1] "STEM Education: Preparing for the Jobs of the Future;" A Report by the (US Congress) Joint Economic Committee Chairman's Staff; April 2012; p1
http://www.jec.senate.gov/public/index.cfm?a=Files.Serve&File_id=6aaa7e1f-9586-47be-82e7-326f47658320

[2] Ibid, p2

[3] Ibid, p3

NOTE: This is the latest in a series of "Megatrends" papers produced by the Joint Information Operations Warfare Center (JIOWC) Information Operations Futures Working Group (IOFWG). It is the result of literature review/analysis and the expert insights and opinions of team members. The subject matter deals with potential issues which may arise in the future, and thus is necessarily speculative. The paper is meant to highlight issues specific to IO which may not have been raised previously, for the consideration of IO practitioners, leaders and decision makers.

fields. However, science and technology curriculums are often thin in K-12 education, and may not be enough to provide students with a solid foundation in STEM upon which to build.[4]

Results on international tests suggest that there are deficiencies in the current education system. On the most recent Trends in International Mathematics and Science Study (TIMSS), from 2007, U.S. fourth grade students ranked eleventh in math and eighth in science out of 36 countries, and U.S. eighth grade students ranked ninth in math and eleventh in science out of students in 48 countries. Scores on the 2009 Programme for International Student Assessment (PISA) test were more discouraging, as U.S. 15-year-olds ranked below students in 24 other OECD countries in math and 16 other OECD countries in science. The poor results on the PISA examination are particularly problematic because, as the NSF notes, the PISA tests (in contrast to the TIMSS exams) "emphasize students' abilities to apply skills and information learned in school (or from life experiences) to solve problems or make decisions they may face at work or other circumstances."[5]

A possible contributing factor could be a dearth of qualified teachers in the STEM fields. In its annual report "The Condition of College & Career Readiness," and its corollary "The Condition of STEM 2014" report, ACT, Inc. (producer of the ACT college admission and placement exam) states "interest in teaching STEM subject areas is low."[6] Of 1.8 million ACT test takers surveyed, merely 4424 expressed a desire to teach math, and even fewer (1115) were interested in teaching science. This compares with Asia where 15-year-olds tested far ahead of U.S. 15-year-olds in 2012 and where they put greater emphasis and value the teaching profession; recruiting top students into the teaching field and paying good salaries.[7]

The cited trends highlight a concerning dichotomy for the United States, and by extension its military force, in the coming years. While the need for workers who are strong in STEM fields is rapidly increasing, the quantity (and quality, in relative global terms) of such workers available in the U.S. is declining.

Potential impact on IE and Joint Force ops in 2020+

These modern trends threaten to converge in the coming years to the specific detriment of the U.S. armed forces. Coupled with the continuing decline in the quality of prospective military members in terms of academic (particularly STEM) achievement and international competitiveness; the growing complexity of the Information Environment (our information operations battlespace) is increasing on par with that seen in the global industrial marketplace.

When considering the expected complexity of the Information Environment and employment of Information Related Capabilities (IRC) in 2020 and beyond, and the highly technical information

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[4] Ibid, p8
[5] Ibid, p8
[6] ACT Inc., "The Condition of STEM 2014", http://www.act.org/stemcondition/14/pdf/National-STEM-Report-2014.pdf
[7] NBC News, "New Survey Ranks U.S. Students 36th In The World – How Do We Improve"?, December 3, 2013, http://www.cnycentral.com/news/story.aspx?id=978874#.VTqGeP4fpYI

capabilities we can expect to acquire and employ, it is prudent to consider if the U.S. education system is producing a future force that is educated sufficiently to be able to master the integrated plans and capabilities needed to achieve the outcomes required by our military leaders – outcomes which they will be expecting our future Information Operations corps to provide. In fact, several even more fundamental questions impacting our future readiness resonate. Will the high school graduates of 2020 and beyond have the basic skills necessary to successfully complete their technical training schools? And, will their technical abilities be sufficient for them to operate information systems of the future and to execute intricate tasks using those systems?

Effect on the Information Environment and U.S. DoD Capabilities:

As we consider these questions regarding the education/knowledge, skills, and abilities of our own force, we should also consider them in relation to the education/knowledge, skills, and abilities of future adversaries operating in the Information Environment. Are they more highly educated? Various international assessments say yes, at least some of them. The questions then become, are they more skilled, flexible, and able to quickly adapt to a rapidly changing environment due to better critical thinking (analysis, assessment, and understanding) abilities?

Recent Indicators:

Major General Allen Batschelet, commanding general of the U.S. Army Recruiting Command noted, "The quality of people willing to serve has been declining rapidly". He indicates only about 1% of youths are both "eligible and inclined to have a conversation with us about military service" [8].

Today it is estimated that more than two-thirds of America's youth would fail to qualify for military service for a host of reasons, including factors other than education. However we know that as of 2007, only 79% of those enlisting in the Army had completed high school. The standard was lowered after 2001 when the percentage was 90%.[9]

Implications for Future Joint IO Force:

Based on a cursory reading of several openly published reports and news items, it is possible today's recruiting pool is already experiencing decline in preparedness based on education levels. If atrophy is already setting in, the next few budget cycles could be critical in the implementation of solutions in time to prevent a shortage of qualified service members and a subsequent decline in readiness. The DoD may be rapidly approaching a point where it may be forced to dedicate a disproportionate share of its training budget to the basic skills (reading, math, science) necessary for basic military training graduates to successfully learn and master the service war planning and war fighting specialties.

DOTMLPF Change Recommendations:

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[8] U.S. News, "Recruits' Ineligibility Tests the Military; More than Two-Thirds of American Youth Wouldn't Qualify for Service, Pentagon Says", June 27, 2014, http://online.wsj.com/articles/recruits-ineligibility-tests-the-military-1403909945?mod=WSJ_hppMIDDLENexttoWhatsNewsSecond

[9] Ibid

Training:

- T.1. The Services may need to incorporate some type of education (similar to a Preparatory School) in select course materials (Math, English/Grammar/Reading, Science, etc) for recruits in conjunction with their entry onto active duty or between completion of basic military training and the beginning of their technical specialty training

- T.2. The services may need to provide early (no penalty) Armed Services Vocational Aptitude Battery (ASVAB) assessment, perhaps as early as grade 9, to identify students' weaknesses or gaps early enough to allow them to take necessary corrective action during their high school years

Personnel:

- Per.1. Conscription could become necessary as a way to locate and "hire" the necessary talent to operate a modern force beyond 2020

- Per.2. Invest in secondary-school STEM education, through the Junior Reserve Officers' Training Corps (JROTC), Air Force Association "CyberPatriot" competition, and similar programs.

- Per.3. In order to compete with the private sector in pay/wages/benefits to recruit members with the necessary knowledge, skills, and abilities to operate the force; services may need to develop new compensation/incentive structure(s).

Policy:

- Pol.1. Services may need to consider job specialty-unique entrance qualifications to allow those who may not currently qualify physically (weight, fitness, etc) for active duty under the current one-size-fits-all standards to serve in information related specialties. Network administrators, cyberspace operators, MISO planners, and others may benefit from this type of flexible entrance standard.

- Pol.2. An alternative to considering alternate physical standards for active duty military would be to modify current laws (e.g. Title 10 vs Title 5) or policies in order to expand the roles available to civilian military employees (e.g. such as cyber "trigger pullers").

References

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4. American high school students slip in global education rankings
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