WASHINGTON STUDENT ACHIEVEMENT COUNCIL
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Title	Aligning Education Supply with Workforce Demand
Staff lead	Randy Spaulding
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Synopsis	Staff will provide background and a progress update on the revised approach for the Skilled and Educated Workforce Report. The report, developed jointly with the State Board for Community and Technical Colleges and the Workforce Training and Education Coordinating Board, has been published four times since 2006. It is being revised this year based on feedback from national experts and is due to be completed in the fall of 2015. The update will be followed by a presentation on new research conducted by staff from the Education Research and Data Center, which looks at wage premiums for graduates with a bachelor's degrees in STEM fields and considers differences by gender and race.
Guiding questions	• How has the purpose and scope of the Skilled and Educated Workforce Report evolved? • How are staff from the three agencies integrating recommended methodological improvements in the report? • How can earnings data inform system planning and improve our understanding of employer demand? • What are some key challenges we face in STEM fields?
Possible council action	☒ Information/Discussion ☐ Approve/Adopt ☐ Other _____
Documents and attachments	☒ Brief/Report ☒ PowerPoint ☒ Third-party materials ☐ Other

WASHINGTON STUDENT ACHIEVEMENT COUNCIL

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Skilled and Educated Workforce

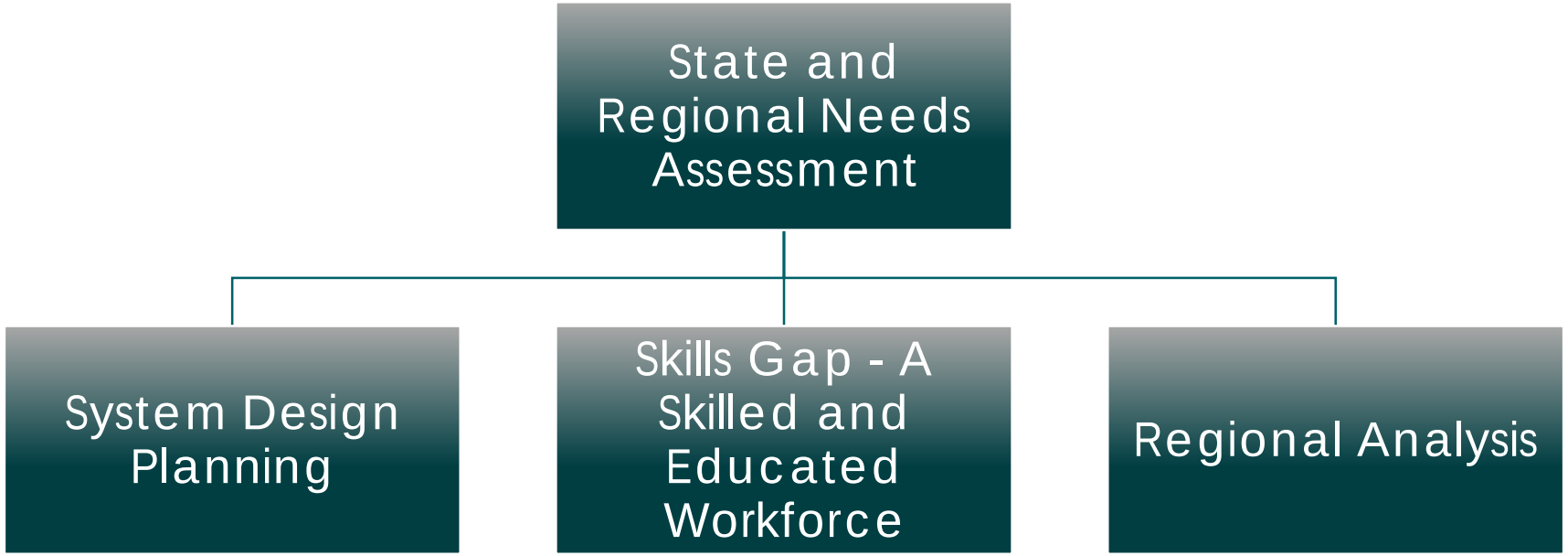
Progress Report

Randy Spaulding, Ph.D.
Director of Academic Affairs and Policy

Our work today

- Provide background and history of the report
- Discuss challenges in developing the report
- Provide preliminary look at new version of the analysis

Background


State and Regional Needs Assessment
System Design Planning
Skills Gap - A Skilled and Educated Workforce
Regional Analysis

Skilled and Educated Workforce Report

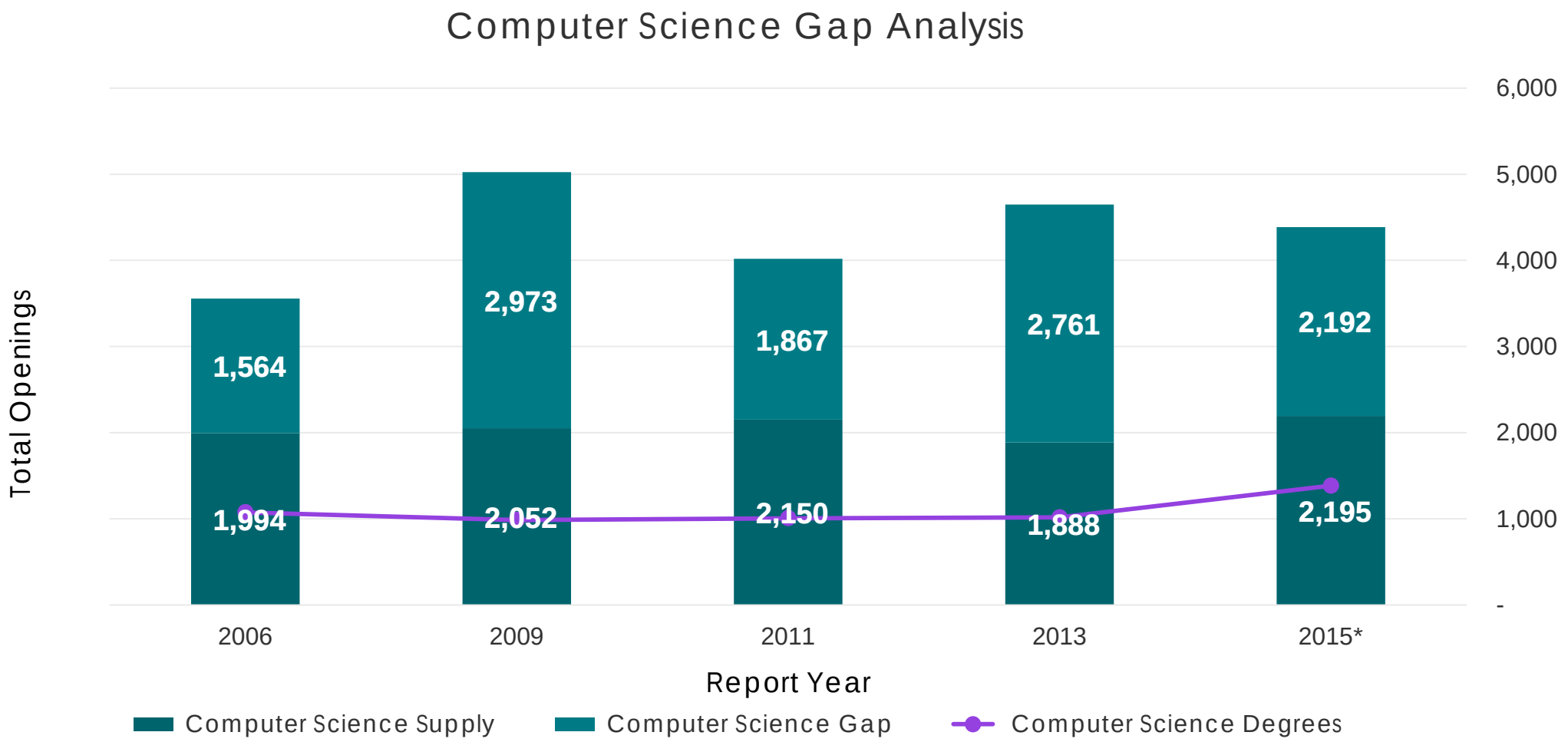
Three agencies contribute to the report's production.

Updates for 2015

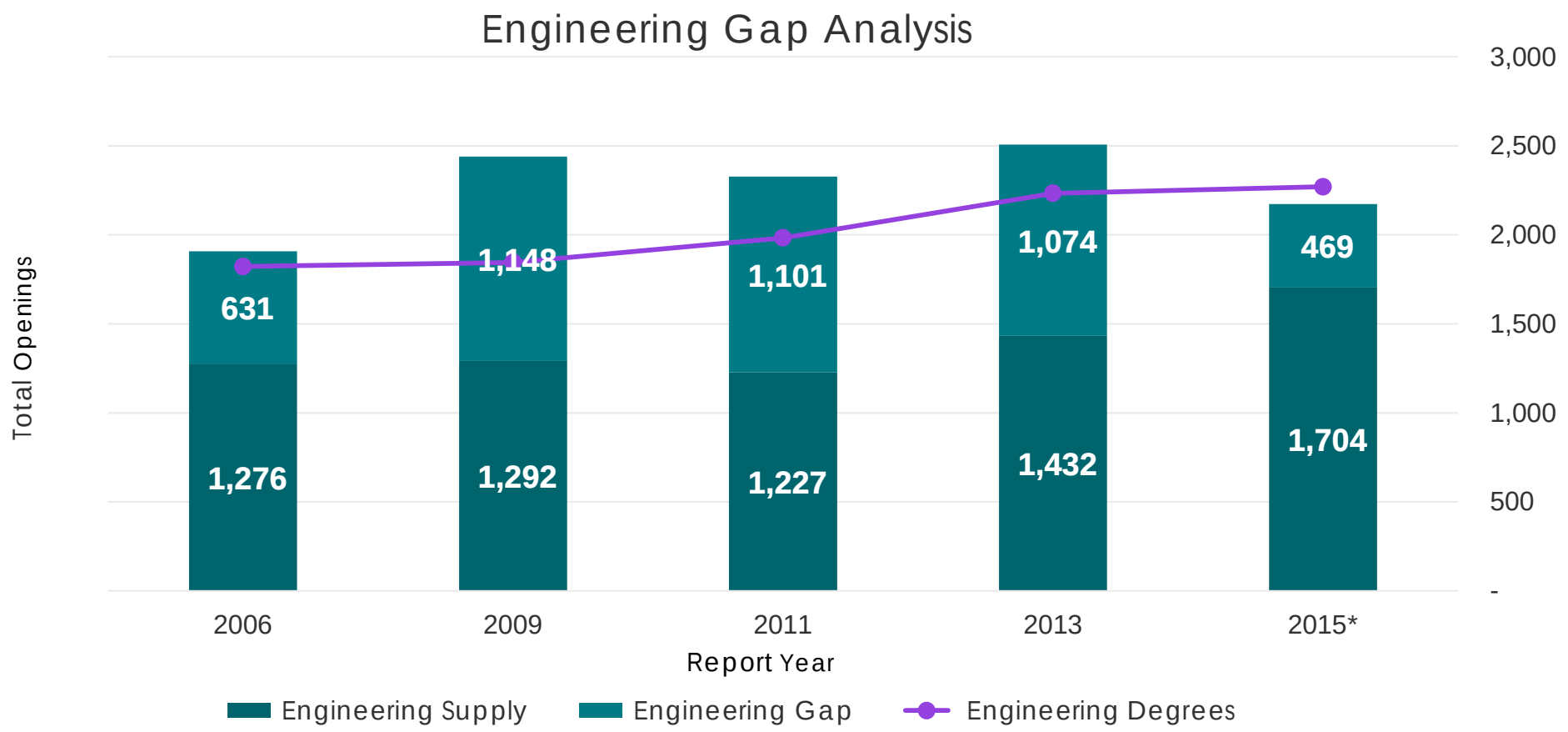
W.E. Upjohn Institute for Employment Research

- Validated much of the previous work
- Provided tools and recommendations to improve the report – particularly around two key areas:
  - Determination of education level required for given occupations
  - Improved crosswalks to compare completions to openings

Computer science exhibits a persistent skills gap



Gaps in engineering have also persisted



Graduates find employment in a diverse occupations

	Business/ Sales	Compute r Science	Engineeri ng/Arch.	Life Science \ Agrc	Physical Sciences	Social Sciences	Technicia ns	Human Protectiv e Service	Legal	Admin./ Clerical	Educator s	Editors, Writers, Performer s	Health Professio ns	Service occupati ons	Productio n and Trades	Total
Life Science/Agrc	32.40%	3.20%	1.80%	7.20%	3.20%	0.60%	2.80%	3.50%	0.40%	7.90%	5.40%	1.70%	14.20%	7.70%	8.00%	100.00%
Business/Mgment	63.60%	4.80%	1.30%	0.20%	0.00%	0.10%	0.10%	2.40%	0.40%	11.20%	2.30%	1.20%	1.90%	4.20%	6.20%	100.00%
Computer Science	21.70%	61.70%	2.70%	0.30%	0.20%	0.00%	0.00%	0.80%	0.10%	4.40%	0.90%	1.20%	0.60%	1.40%	4.20%	100.00%
Education	19.90%	1.30%	1.20%	0.40%	0.10%	0.00%	0.00%	3.20%	0.60%	9.10%	44.80%	2.20%	3.60%	8.10%	5.40%	100.00%
Engineering	25.20%	16.20%	36.60%	0.20%	0.40%	0.30%	0.40%	0.80%	0.20%	3.10%	1.60%	2.70%	1.10%	2.30%	8.90%	100.00%
Fam./Cons. Science	31.60%	1.90%	0.40%	0.90%	0.10%	0.00%	0.00%	5.50%	0.60%	17.00%	17.80%	2.20%	5.80%	11.90%	4.20%	100.00%
Health	13.50%	1.00%	0.40%	0.40%	0.30%	0.00%	0.10%	3.00%	0.00%	6.10%	2.70%	1.20%	63.30%	5.60%	2.10%	100.00%
Humanities & Comm.	35.90%	4.50%	0.70%	0.30%	0.20%	0.10%	0.20%	5.10%	1.20%	13.90%	7.30%	11.40%	3.80%	8.20%	7.40%	100.00%
Legal	22.30%	8.20%	0.00%	0.00%	0.00%	0.00%	0.00%	9.60%	24.10%	4.80%	0.00%	4.20%	0.00%	9.80%	16.90%	100.00%
Math	29.60%	32.40%	5.40%	0.00%	0.50%	0.20%	0.00%	2.10%	0.10%	7.50%	8.70%	0.80%	1.80%	3.70%	7.30%	100.00%
Physical Science	31.90%	10.70%	7.90%	1.40%	8.30%	0.00%	0.40%	3.00%	0.70%	7.40%	4.00%	2.00%	7.40%	5.50%	9.70%	100.00%
Social Science	39.60%	3.60%	1.40%	0.20%	0.30%	0.20%	0.20%	13.70%	2.20%	14.10%	5.00%	1.80%	4.40%	6.90%	6.40%	100.00%
Voc Tech	41.80%	1.60%	8.10%	0.10%	0.00%	0.00%	0.00%	1.20%	0.40%	5.90%	2.10%	0.40%	1.90%	1.60%	35.00%	100.00%
Total	37.20%	8.00%	5.60%	0.70%	0.60%	0.10%	0.30%	4.70%	0.80%	10.10%	7.20%	3.90%	8.20%	5.80%	6.80%	100.00%

Employers rely on graduates from several fields

	Business/ Sales	Computer Science	Engineering/Arch.	Life Science \Agrc	Physical Sciences	Social Sciences	Technicians	Human Protective Service	Legal	Admin./ Clerical	Educators	Editors, Writers, Performers	Health Professions	Service occupations	Production and Trades	Total
Life Science/Agrc	0.051	0.023	0.019	0.62	0.336	0.226	0.507	0.044	0.025	0.046	0.044	0.026	0.102	0.077	0.068	0.058
Business/Mgment	35.50%	12.40%	4.90%	5.50%	1.40%	12.80%	8.50%	10.50%	9.90%	22.90%	6.60%	6.60%	4.90%	15.00%	18.70%	20.70%
Computer Science	2.40%	31.80%	2.00%	2.00%	1.60%	0.00%	0.00%	0.70%	0.30%	1.80%	0.50%	1.30%	0.30%	1.00%	2.50%	4.10%
Education	3.90%	1.20%	1.50%	4.10%	1.00%	0.00%	0.80%	5.00%	5.40%	6.50%	45.10%	4.20%	3.20%	10.10%	5.80%	7.30%
Engineering	7.90%	23.40%	76.60%	4.10%	7.40%	23.60%	15.40%	1.90%	2.30%	3.60%	2.60%	8.20%	1.60%	4.50%	15.20%	11.70%
Fam./Cons. Science	0.70%	0.20%	0.10%	1.10%	0.10%	0.00%	0.00%	1.00%	0.60%	1.40%	2.00%	0.50%	0.60%	1.70%	0.50%	0.80%
Health	2.70%	0.90%	0.50%	4.40%	4.30%	1.70%	2.00%	4.80%	0.40%	4.50%	2.80%	2.40%	57.90%	7.20%	2.30%	7.50%
Humanities & Comm.	21.40%	12.30%	2.60%	8.20%	6.20%	15.80%	11.80%	24.20%	32.20%	30.30%	22.30%	65.30%	10.40%	31.20%	24.00%	22.10%
Legal	0.10%	0.10%	0.00%	0.00%	0.00%	0.00%	0.00%	0.20%	3.40%	0.10%	0.00%	0.10%	0.00%	0.20%	0.30%	0.10%
Math	1.00%	5.10%	1.20%	0.00%	1.00%	1.70%	0.00%	0.60%	0.10%	0.90%	1.50%	0.30%	0.30%	0.80%	1.30%	1.30%
Physical Science	2.00%	3.20%	3.40%	4.70%	35.80%	0.00%	2.70%	1.50%	2.00%	1.70%	1.30%	1.20%	2.10%	2.20%	3.40%	2.40%
Social Science	16.20%	6.90%	3.80%	3.80%	7.60%	21.80%	8.10%	44.90%	40.50%	21.20%	10.50%	7.30%	8.20%	18.10%	14.20%	15.20%
Voc Tech	1.10%	0.20%	1.40%	0.20%	0.00%	0.00%	0.00%	0.20%	0.40%	0.60%	0.30%	0.10%	0.20%	0.30%	4.90%	1.00%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Questions?

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WDQI Research Report: Studies in Gender and the Returns to Education

Toby Paterson and Greg Weeks

Forecasting Division

Office of Financial Management

June 17 2015

Education Research & Data Center

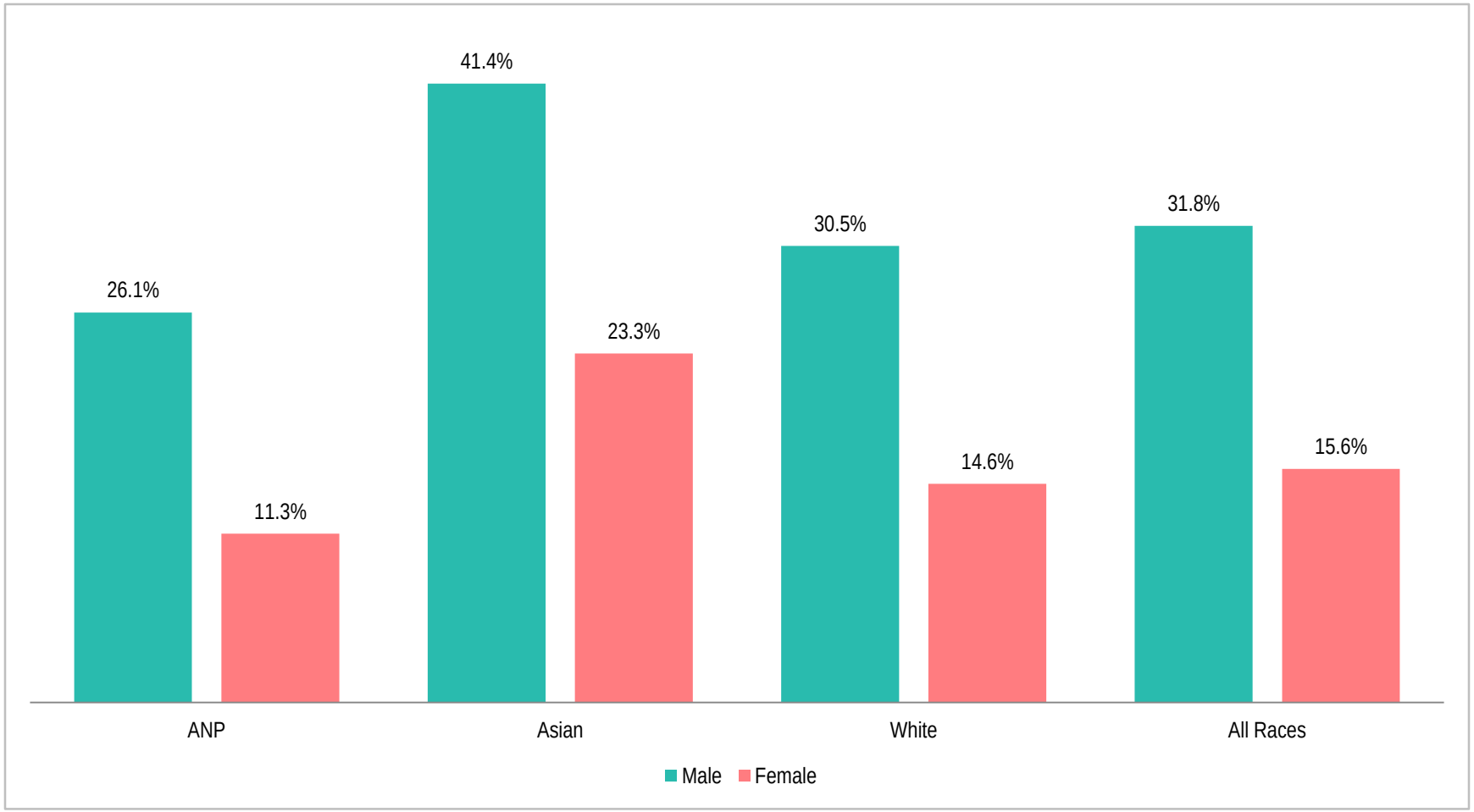
- **ERDC created in 2007 to:**
  - Assemble, link and analyze education and workforce data
  - Provide research focusing on student transitions
  - Make data available to the education agencies and institutions
- **Located in Governor's budget agency** (Office of Financial Management)
- **Work closely with State Education Agencies**
- **WDQI grant** (ends June 30)
  - Research and reporting projects
  - Integration of workforce and Education data

ERDC
Education Research & Data Center

WDQI has funded **three** studies on the economic returns to post-secondary education using PSM

- The returns to a bachelor's degree compared to high school diploma only, by gender.
- The returns to an associate degree (no transfer), compared to high school diploma, by gender
- The returns to STEM (Science, Technology, Engineering and Mathematics) degrees, compared to non-STEM degrees by gender and race categories.

Motivating Question:
Percentage in STEM majors by gender and race category
(ANP = African-American, Native American and Pacific Islander)



Top ten majors for male and female STEM bachelor's degree graduates

Female Major	Percent	Cumulative Percentage		Male Major	Percent	Cumulative Percentage
cell/cellular and molecular biology	15.7%	15.7%		mechanical engineering	8.1%	8.1%
biology/biological sciences, general	11.6%	27.3%		civil engineering, general	6.5%	14.6%
biochemistry	7.1%	34.4%		cell/cellular and molecular biology	6.0%	20.6%
environmental studies	5.0%	39.4%		electrical and electronics engineering	5.9%	26.5%
biological and physical sciences	5.0%	44.4%		biochemistry	5.7%	32.3%
environmental science	4.7%	49.1%		biology/biological sciences, general	5.2%	37.5%
chemistry, general	4.2%	53.3%		computer and information sciences, general	5.1%	42.6%
mathematics, general	3.2%	56.5%		computer science	4.8%	47.4%
civil engineering, general	2.8%	59.3%		management information systems general	4.7%	52.1%
zoology/animal biology	2.5%	61.8%		chemistry, general	3.4%	55.5%

Source: U.S. Census Bureau, American Community Survey

Top 10 occupations for workers with STEM degrees by gender

Male		Female	
Software developers, applications and system software	20.9%	Registered nurses	9.0%
Civil engineers	3.9%	No occupation	5.0%
Postsecondary teachers	3.3%	Customer service representatives	3.5%
Accountants and auditors	2.7%	Software developers, applications and system software	3.2%
Computer programmers	2.5%	Postsecondary teachers	3.2%
Computer support specialists	2.4%	Counselors	3.1%
Managers, all other	2.4%	Secretaries and administrative assistants	2.8%
Sailors and marine oilers	2.3%	Miscellaneous life, physical and social science technicians	2.5%
Mechanical engineers	2.2%	Managers, all other	2.4%
Carpenters	2.2%	Physical therapists	2.2%
Total top 10	44.8%	Total top 10	36.9%
Source: U.S. Census Bureau, American Community Survey			

Median occupational wage rates for top 10 occupations of workers with STEM degrees, by gender

Male		Female	
Software developers, applications and system software	$52.70	Registered nurses	$36.74
Civil engineers	$39.15	No occupation	
Postsecondary teachers	$39.09	Customer service representatives	$17.48
Accountants and auditors	$32.16	Software developers, applications and system software	$52.70
Computer programmers	$53.66	Postsecondary teachers	$39.09
Computer support specialists	$25.32	Counselors	$21.47
Managers, all other	$50.48	Secretaries and administrative assistants	$17.75
Sailors and marine oilers	$22.77	Miscellaneous life, physical and social science technicians	$30.25
Mechanical engineers	$42.68	Managers, all other	$50.48
Carpenters	$22.68	Physical therapists	$17.48
Weighted average hourly wage rate	$44.23	Weighted average hourly wage rate	$28.12
Source: U.S. Census Bureau, American Community Survey			

Selection Bias

- All three studies assume that college graduates (or STEM students) differ from high school graduates (or non-STEM students) in ways that affect the **likelihood of attending and completing college**, and also affect **earnings.**
- The difference between the treatment and comparison groups is sometimes called ability or selection bias.
- **Simple comparisons of earnings by educational attainment lead to biased (over-stated) estimates of the earnings premium associated with a college degree.**
- We utilize a propensity score matching approach to **correct for selection bias** in these studies.

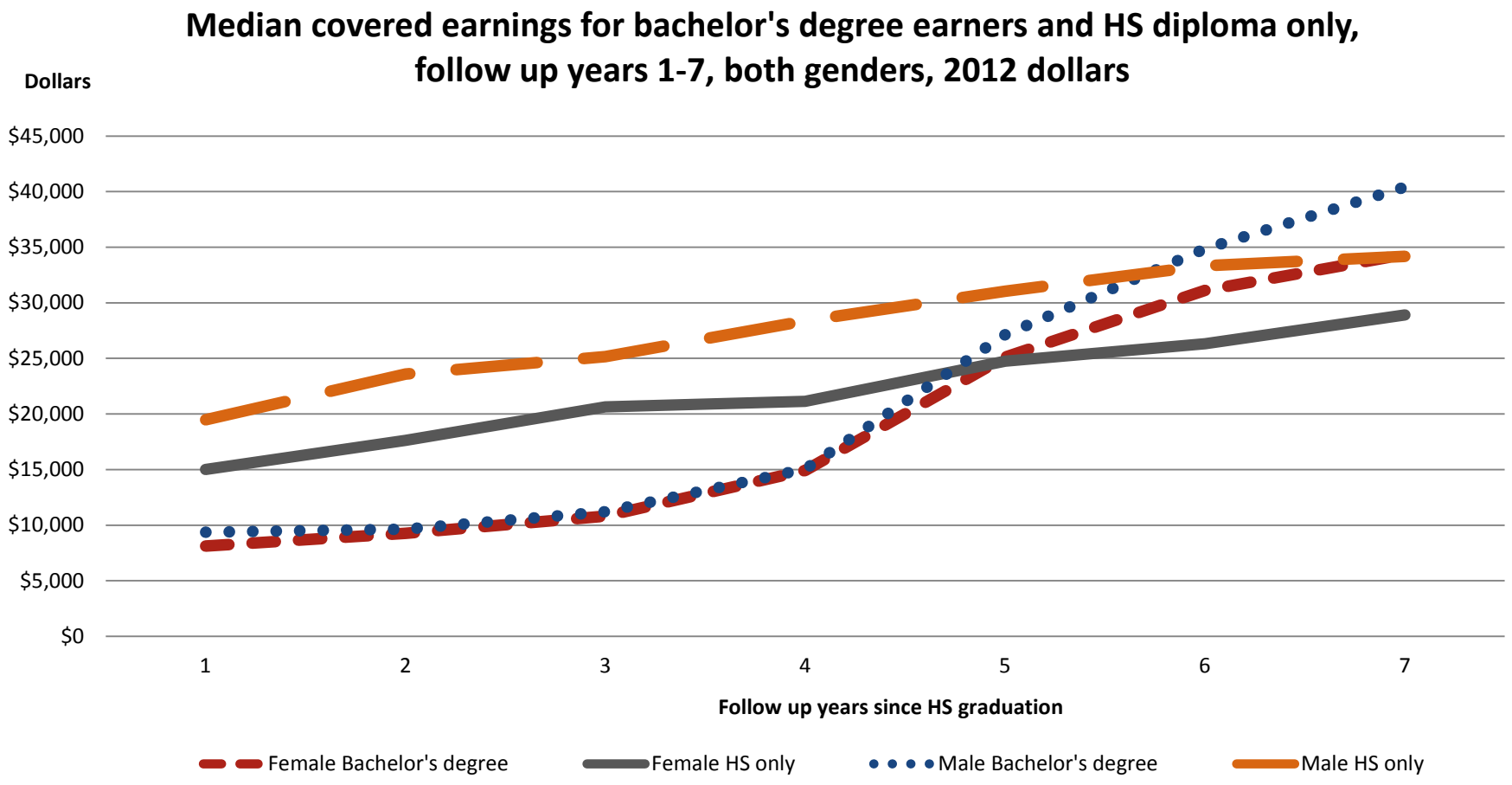
Propensity score matching (PSM)

- Propensity score matching is utilized to develop a closely matched comparison group and correct selection bias.
- A propensity score is the estimated probability that an individual from the treatment or comparison group will participate in the treatment.
- This single measure indexes all the variables in the characteristics vector and provides a selection corrected comparison of the outcomes between the two groups.
- Estimated propensity scores allow individual treatment group members to be matched with individual comparison group members.

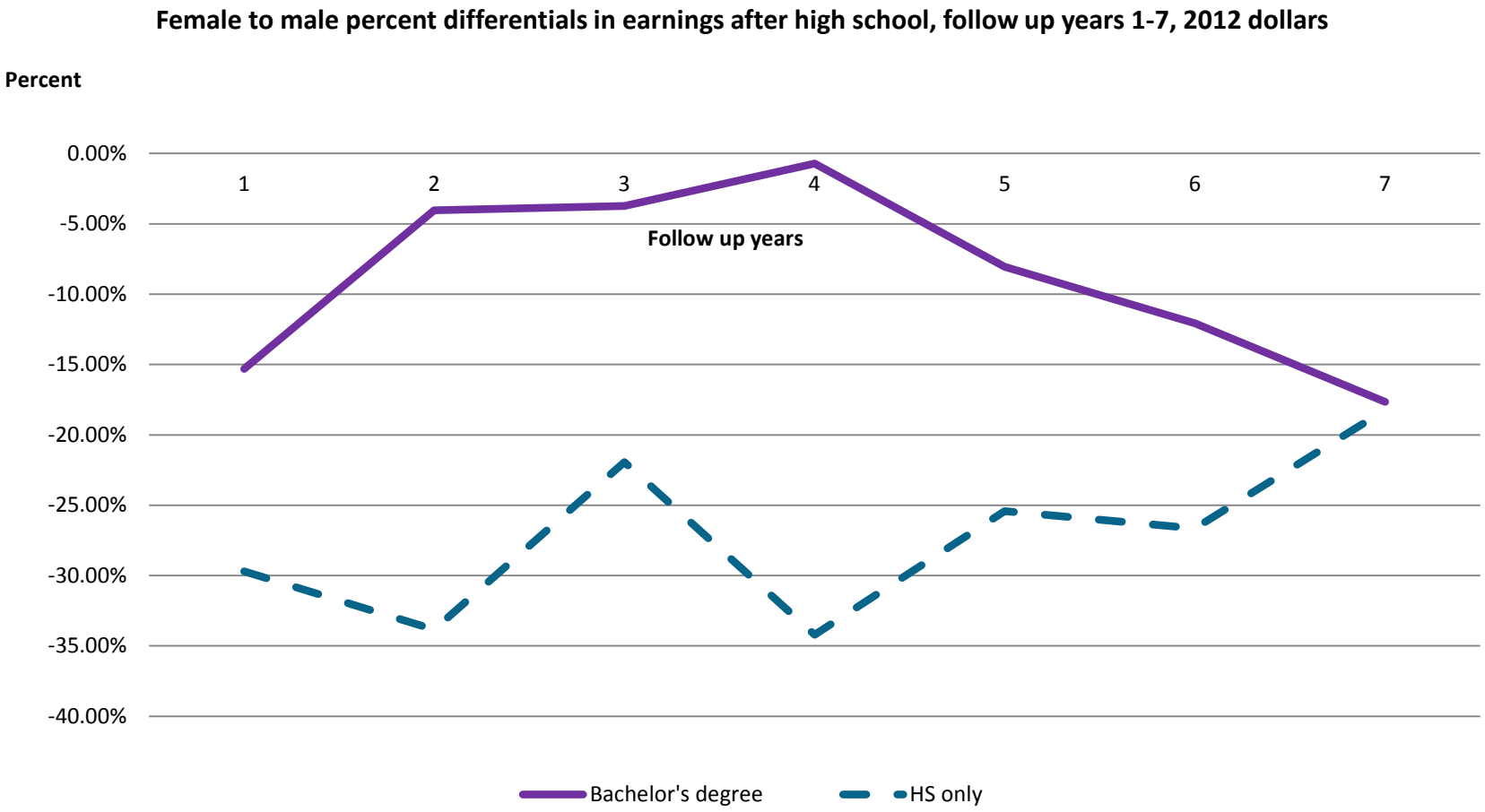
PSM- the counterfactual

- "PSM uses information from a pool of units that do not participate in the intervention to identify what would have happened to participating units in the absence of the intervention"
  - Heinrich, C., Maffioli, A. and Vazquez, G. "A Primer for Applying Propensity Score Matching". Office of Strategic Planning and Development Effectiveness. Inter-American development Bank. 2010. Retrieved from: http://publications.iadb.org/bitstream/handle/11319/1681/A%20Primer%20for%20Applying%20Propensity-Score%20Matching.pdf?sequence=1

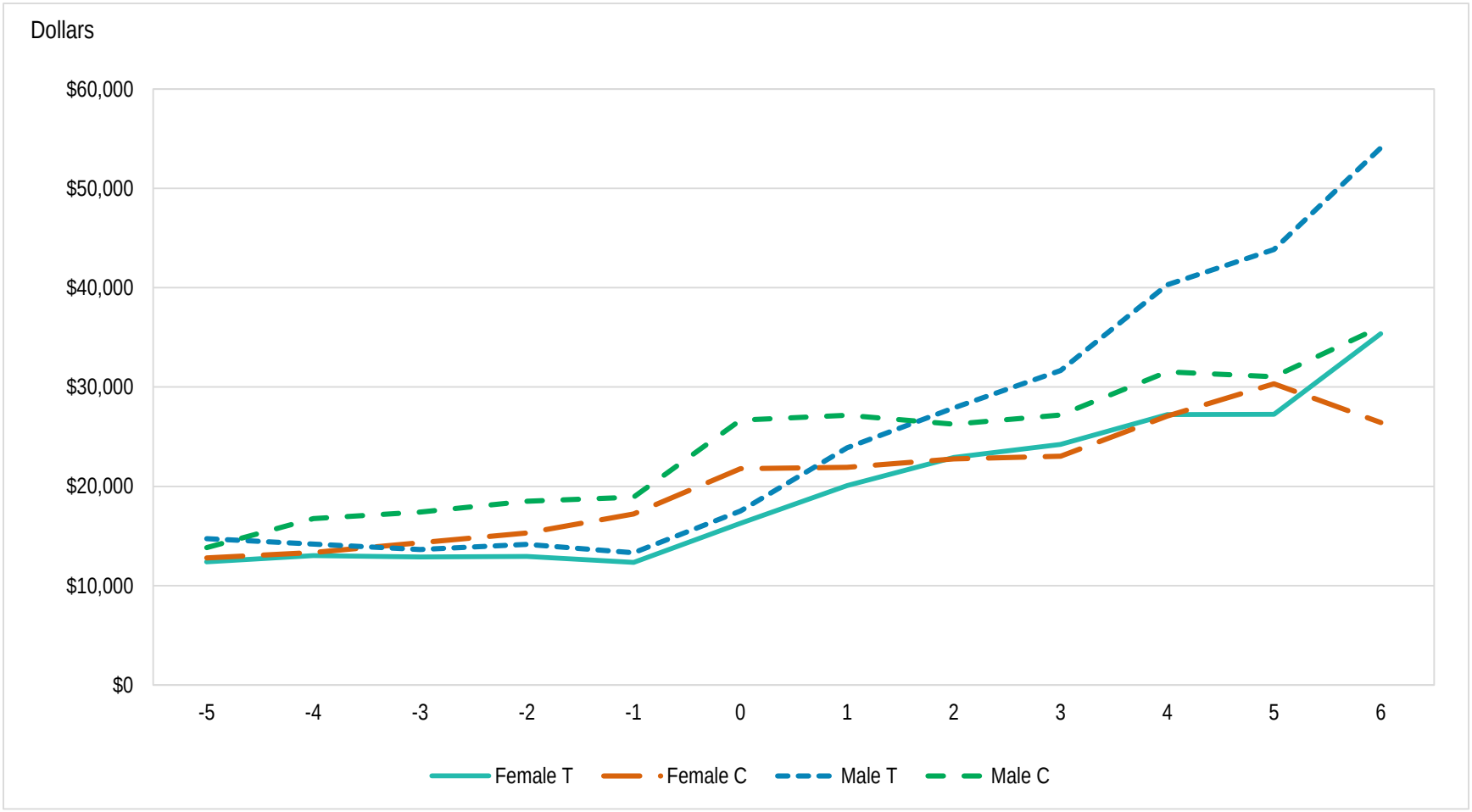
Female and male earnings trajectory, bachelor's degree and high school only, PSM, 2012 dollars, follow up years 1-7.



Female to male earnings differential for Bachelor's degree earners falls to HS level in seventh year after HS graduation

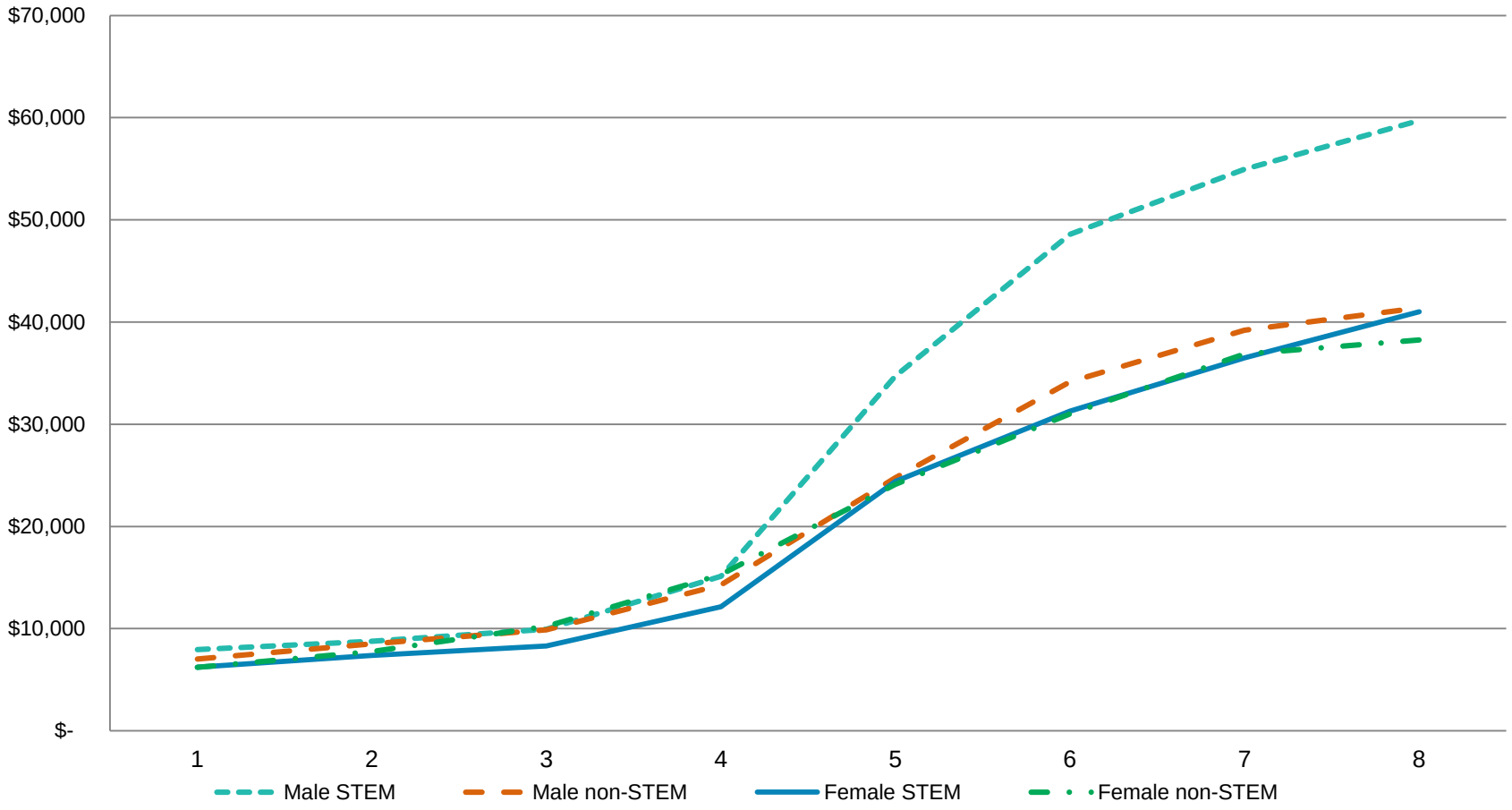


Female and male earnings: associate degree (T) compared to high school only (C), years since degree, 2013 dollars



Female to male earnings ratio: associate degree and high school only, years since high school, 2013 dollars

Median real earnings trajectories, STEM and non-STEM, by gender, 2013 dollars, years after HS



Male and female STEM earnings premiums in 2013 dollars, follow-up years 1-8.

The next step in this line of inquiry is to explore the reasons for the earnings gap. There are numerous possible explanations for the gender-based earnings gap, including:

- Gender-based discrimination in the educational system and labor market.
- A male-oriented culture in high technology organizations leading to less hiring and advancement for female job applicants and workers.
- Child bearing and family responsibilities requiring women to periodically withdraw from the workforce, leading to reduced job tenure, missed promotions and lower earnings over their careers.
- Tastes and preferences
  - Female students may select STEM fields that are less remunerative than male students (perhaps related to the first and second bullet above).
  - Female workers may select occupations that are less remunerative (perhaps related to the first and second bullet above).
- Combinations of any and all of these.

The differences between the STEM majors of females and males as well as the differences in the rates at which male and female students achieved bachelor's degrees in STEM fields may partly reflect a sorting process throughout the educational system in which girls are viewed by elementary school teachers as less skilled in mathematics than male students.

For a discussion of this issue, please see:

Riegle-Crumb, C. and Humphries, M. (2012). "Exploring Bias in Math Teachers' Perceptions of Students' Ability by Gender and Race/Ethnicity," *Gender & Society April 2012, 26: 290-322.*

“Given the importance of having talented men and women in education, health care and throughout the economy, it seems important to take a broader perspective on issues of gender equality. Perhaps it is time to ask a new question about gender representation in STEM: Would society be better off if men were more like women?”

(Penner, A., (2014) “Gender Inequality in Science. How Should a Better Gender Balance Be Achieved,” Science, 347, 6219, p 235.)

Questions?