

2014 PKAL Augsburg Proposal 1

**Augsburg PKAL-TIDES
Initial Proposal [Draft!]**

**Teaching to
Increase Diversity
in STEM**

Proposal by
Dr. Milo Schield,
Management Information Systems Coordinator

**AACU-PKAL issue a
Call for Proposals**

Goal: to increase the “participation, retention and graduation of underrepresented groups in STEM.” “to reach nearly 100,000 students”

Objective: “(Re)Design of multi-disciplinary curriculum that will enhance underrepresented student interest, competencies and retention in the computer/information sciences and related STEM disciplines.”

www.aacu.org/pkal/tides/cfp.cfm

**Funded by the
Helmsley Trust**

“In postsecondary education, the Trust is primarily interested in increasing the number of Science, Technology, Engineering and Mathematics (STEM) graduates who can participate in high growth sectors of the economy.”

“The Trust also focuses on policy levers that improve postsecondary completion, particularly for underrepresented populations.”

www.aacu.org/pkal/tides/cfp.cfm

**Minority Population Growing;
4 million+ in 2008**

US Four-Year College Enrollment (In thousands)

	1990	2000	2005	2008
White (NonH)	6,768	6,658	7,497	7,987
Black	723	995	1,313	1,565
Hispanic	358	618	901	1,092
Am. Indian	48	77	96	109
Asian/Pacific	357	576	700	823
Other	324	440	493	556
Total	8,578	9,364	11,000	12,132
Non-White	1,810	2,706	3,503	4,145

Source: Table 275 2011 US Statistical Abstract

**Individual Multi-Million Dollar
Awards by NSF**

- *Effects of College Degree Program Culture on Female and Minority Student STEM Participation:* #0525408; 2005; **\$1,328,310.**
- *Greater Minority STEM Participation Through Academic Opportunity and Institutional Change:* #0450339; 2005; **\$8,780,323.**
- *Sustainability of best practices for minority STEM student retention and success:* #0342041 2003; **\$2,500,000.**

**STEM Graduation Problem:
Minorities**

Percentage of Freshmen at four-year colleges intending to major in STEM who graduate with STEM majors:

STEM MAJORS	Amer.			Non-Hisp	
	Black	Indian	Hispanic	White	Asian
5-yr Grad Rate	18%	19%	22%	33%	42%
Comparison with White rate	-45%	-42%	-33%	0%	27%

Percent lower than white Higher

Source: www.insidehighered.com/news/2010/02/17/stem

7

Most under-represented: Women!

Over-represented: blacks, Asians, Other
Under-represented: women, Hispanics, whites.

US Bachelor's Degrees: 2009-2010							
STEM	# Degrees	White	Black	Hispanic	Asian	Other	Female
Computer Sc.	39,589	67%	12%	7%	9%	5%	18%
Engineering	72,654	69%	4%	7%	12%	7%	18%
Mathematics	16,030	72%	5%	6%	10%	6%	43%
Physical Sc.	23,379	74%	6%	5%	11%	5%	41%
SUB-TOTAL	151,652	70%	7%	7%	11%	6%	24%
College-wide	1,167,499	71%	10%	9%	7%	4%	57%

Source: 2011 Digest of Education Statistics, Table 301, National Center for Education Statistics
Source: www.directemployers.org/2012/08/16/the-college-class-of-2013-current-demographics/

8

AAC&U-PKAL APPROACH

A very different approach is required for PKAL to do more than the NSF with much less.

But the AAC&U brings a different approach:

- focuses just on computer/information science
- focuses on both 2-year and 4-year colleges
- 100,000 increase in CS/IS graduates
- allow course development from *any discipline*
- focuses on AAC&U learning outcomes.*

* www.aacu.org/leap/vision.cfm

9

Computer Science "Dropout" Problem

Left STEM: ~50,000/year
Total Loss: 300,000 in 6 years.
Cutting the yearly loss by a third seems doable

US Computer Science Majors			
	2000	2005	2008
Graduated with BS/BA	38,000	54,111	38,000
Left STEM	57,000	81,000	57,000

Source for 4 year BS/BA: Table 298 2011 US Statistical Abstract
Recall: 40% of 1st year intending STEM majors graduate in STEM.
Assume this is true for Computer. Science.majors.
#Drop = (Drop% / Grad%) times #Graduate

10

Augsburg's Proposal

Augsburg's proposal involves a very different approach to the problem. We argue that it is:

1. Compatible with AAC&U LEAP outcomes
2. Based on \$500k W. M. Keck grant
3. Key part field-tested by ~1,000 students
4. Designed to be rapidly scalable.
5. Lead by a seasoned PI.
6. Readily adoptable by 2 & 4 year colleges

11

STEM Shortage: Underlying Causes

Carnegie (Quantway & Statway) is targeting group D.
Augsburg's proposal is targeting groups B and C.

Percentage of School Seniors taking the ACT who are:			
Interested in STEM but not Proficient in Math	C 15%	A	Interested in STEM and proficient in Math
Not interested in STEM and not proficient in Math	D 42%	B	Proficient in Math but not interested in STEM

Source: ACT and Business Higher-Education Forum (BHEF) at
www.nccu-cu.org/downloads/BHEF_STEM.pdf

12

Augsburg's Proposal: Overview

1. Create Data Analytics minor in CS, IS or MIS for **Group B (often Social Studies and professions) and Group C (often liberal arts and minorities)**
2. Focus: analyzing/presenting information
3. Focus: charts, graphs, Geographic systems
4. Focus: Big Data -- challenges/difficulties
5. Focus: Data analytics using multivariate statistics
6. Use Excel as the computer tool
7. Information Science helps non-profits

13

**Augsburg's Proposal:
Designed for math-phobic**

1. Focus on Quantitative Literacy and Excel instead of algebra and calculus.
2. Focus on statistical literacy for analysts instead of traditional research statistics.
3. English is the primary means of describing or comparing statistics instead of Algebra.
4. Induction (practical reasoning) is the primary means of argument instead of deduction.

14

**Statistical Literacy:
Designed for verbally-fluent**

1. focuses on the role of statistics as evidence in arguments (Quantitative Rhetoric).
2. treats statistics as more like words (influenced by context) than like pure numbers (Platonic).
3. studies where do statistics come from, how were things counted and measured, how were grouped combined, how were measurement categorized, and how statistics are compared and presented.

15

**Proposed Minor: 6 Courses.
Certificate after the first Three**

1. Excel: Logic/Stat, Pivot Tables, Chart/Trend
2. Statistical literacy* or traditional statistics with 15% Statistical Literacy*
3. Data Analytics*, Statistics II (data models*) or Data Communications*.

4. Info Sys. or Decision/Management Science
5. Logic, discrete/finite math or critical thinking
6. One other STEM/quantitative course: c.f., C/S, GIS, Liberal Arts Math, Q/R, Probability

* Excel-based with confounder focus.

16

**Students value this focus:
Data modeling and Excel**

Students recognize that

- Excel is commonly used for analyzing data
- knowing Excel is a valuable job skill
- analyzing data is a valuable job skill
- analyzing data that is real and relevant can be interesting – and even exciting
- data may support more than one right answer
- this minor can complement many majors

17

Desired Outcomes

Those taking Data Analytics will take more:

- Statistics
- Computer Science/Information Science
- Health Science/Epidemiology

Those taking Data Analytics will have

- a more positive view of STEM majors
- see more value in quantitative reasoning

18

**Augsburg's PI: #1
Dr. Milo Schield**

- Elected member of International Statistical Institute
- world leader in statistical literacy with more than 60 papers. See: [Statistical Literacy and Liberal Education at Augsburg College, 2004 Peer Review](#)
- described as “the leader of the statistical literacy movement” by Dr. Joel Best.”
- has developed a unique Statistical Literacy textbook for students in non-quantitative majors.
- is webmaster of www.StatLit.org: largest statistical literacy website (over 180,000 visits in 2013).

19

**Augsburg's PI: #2
Dr. Milo Schield**

- Awarded a \$500,000 grant from the W. M. Keck Foundation for “the development of statistical literacy as an interdisciplinary curriculum.”
- Is “chair” of Management Information Systems
- Created the MIS major at Augsburg College
- Has taught courses in Computer Science dept.
- Has taught critical thinking for more than 10 years
- Has developed some unique Excel worksheets that demonstrate abstract statistical ideas and principles.

20

**Augsburg's PI: #3
Dr. Milo Schield**

- Is a leader in using a new online forum, Odyssey, to help students improve their understanding, analysis and expression of abstract ideas.
- Is a leader in providing guides to the use of ordinary English in expressing quantitative relationships – without using algebraic symbols.
- Has designed a unique online tutor that decodes ordinary English descriptions and comparisons and gives students helpful feedback on their mistakes.

www.augsburg.edu/faculty/schield/

21

Project Goals

1. Offer a Data Analytics minor at Augsburg with a PKAL Data-Analytics Certificate.
2. Completion by at least 15 students per year
3. Embedding PKAL Data-Analytics Certificate
 - in at least a dozen colleges by 2015.
 - In at least 2 dozen colleges by 2016
4. Design web site for adoptee communication
5. Create training materials for decision makers

22

Dissemination Plans

1. Field test on local faculty (2 & 4 year)
2. Run online faculty development courses
3. Face2Face two-day summer conferences
4. Design web site to disseminate all this.
5. Web videos on Statistical Literacy
6. Web videos on Information Literacy
7. Web videos on Information Science

23

Augsburg Qualifications

Augsburg is an institution with

- a moderate to low research infrastructure.
- a mainly undergraduate population (2,700 / 3,600)
- a minority serving institution (34% students of color)
- a long-term member of the AAC&U

Although Augsburg has ~ 2,700 undergraduates, Augsburg has pioneered some – and field tested all – of the elements in our proposal including monitoring student success and student satisfaction.

24

Institutional Team

Dr. Paul C. Pribbenow, President
 Dr. Karen Kaivola, Provost
 Dr. Amy Gort, Dean of Arts and Sciences
 Erica Swift, Director of Sponsored Programs

Dr. Rebekah Dupont, Director STEM Programs
 Dr. Kathy Schwalbe, Business/MIS
 Marc Isaacson, Business/MIS
 Dr. John Schmit, English
 Bonnie Tensen, E-Learning Specialist, IT.