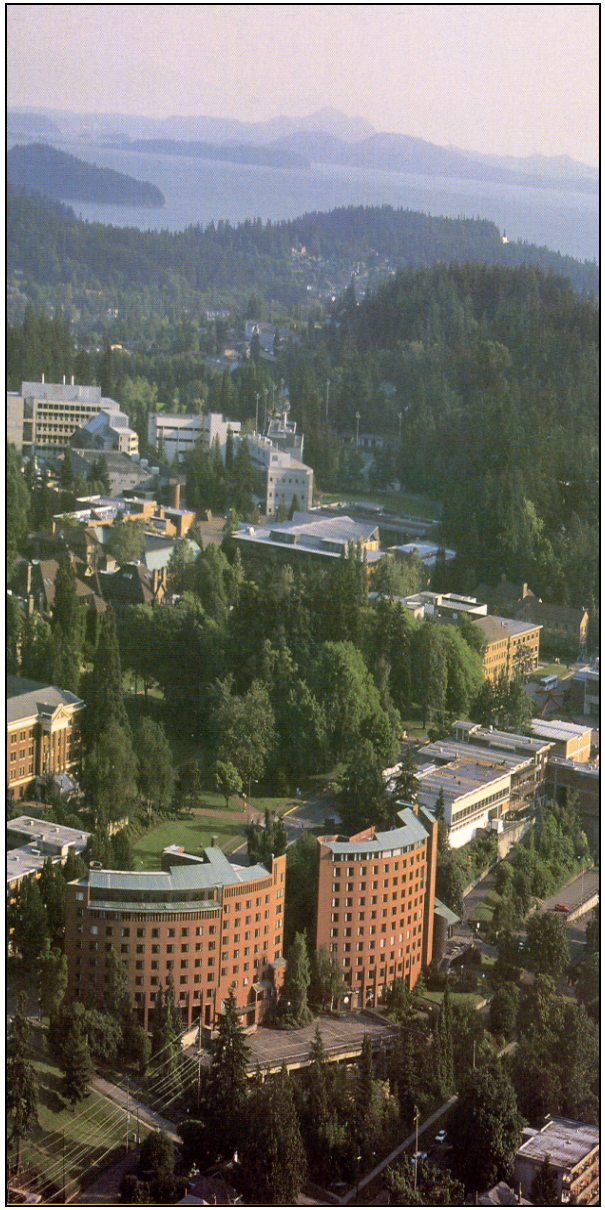

Preparing Teachers for Tomorrow's Schools

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Science, Mathematics, & Technology Education

WESTERN
WASHINGTON UNIVERSITY

Washington State Academy of Sciences
September 22, 2011

A Little Science Cred

Astron. Astrophys. 65, 223—227 (1978)

ASTRONOMY
AND
ASTROPHYSICS

A Line Driven Rayleigh-Taylor-Type Instability in Hot Stars

George Driver Nelson* and A. G. Hearn
Sterrekundig Instituut, Sterrewacht "Sonnenborgh", Servaasbolwerk 13, Utrecht, The Netherlands

Received October 20, 1977

Summary. The existence of a Rayleigh-Taylor-type instability in the atmospheres of hot stars, driven by the radiative force associated with impurity ion resonance lines, is demonstrated. In a hot star with an effective temperature of 50000 K, the instability will grow exponentially with a time scale of approximately 50 s in the layers where the stellar wind velocity is 5% of the thermal velocity of the ion. As a result metric stellar winds driven by resonanc forces will break up in small horizonta The energy fed into the instability pro source of mechanical heating in the at chromosphere or corona.

Key words: hot stars — Rayleigh-Taylor – radiation driven instability — mecha

I. Introduction

The existence of Rayleigh-Taylor inst atmospheres of hot stars has been sugg Mihalas (1969) based on model atmosph of hot stars by Underhill (1949). Unde in some model atmospheres the outward resulting from the transfer of momentun tinuum radiation to the outer layers of exceed the inward force due to gravity. suggested that an inverted density dist result which would be unstable against R instabilities. Wentzel (1970) showed tha since measured with respect to the effec density distribution is normal.

In the present paper a radiation dr Taylor-type instability is demonstrated This instability depends on the rapid in the momentum transfer from the radiati mosphere by absorption in the resonanc impurity ions.

The importance of the radiative forc with the impurity ion resonance lines wa by Lucy and Solomon (1970) who sugges

Protein Crystal Growth in Microgravity

LAWRENCE J. DELUCAS, CRAIG D. SMITH, H. WILSON SMITH, SENADHI VIJAY-KUMAR, SHOBHA E. SENADHI, STEVEN E. EALICK, DANIEL C. CARTER, ROBERT S. SNYDER, PATRICIA C. WEBER, F. RAYMOND SALEMME, D. H. OHLENDORF, H. M. EINSPAHR, L. L. CLANCY, MANUEL A. NAVIA, BRIAN M. MCKEEVER, T. L. NAGABHUSHAN, GEORGE NELSON, A. MCPHERSON, S. KOSZELAK, G. TAYLOR, D. STAMMERS, K. POWELL, G. DARBY, CHARLES E. BUGG

The crystals of most proteins or other biological macromolecules are poorly ordered and diffract to lower resolutions than those observed for most crystals of simple organic and inorganic compounds. Crystallization in the microgravity environment of

tions were loaa launch. Once in activated by extı the tip of the syı protein solution achieved by repe truding the solut let was then allov surrounding solu The protein dro after activation during the 3-day the solutions an withdrawn into t for return to Ear

Control experi formed in equipr shuttle ats wer nded; t ical load ies were in the S rol exp n proto before re comp liffractic ative eva The resu with th ensiona area det of dif phs is hi ident o ended p for cc wn crys y data

THE ASTROPHYSICAL JOURNAL, 238:659-666, 1980 June 1

GRANULATION IN A MAIN-SEQUENCE F-TYPE STAR

GEORGE DRIVER NELSON
Joint Institute for Laboratory Astrophysics
University of Colorado and National Bureau of Standards
Received 1978 June 2; accepted 1979 December 11

ABSTRACT

The modal approach developed by Nelson and Musman is used to investigate convection in an F-type main-sequence star ($T_{\rm eff} = 7300$ K, $g = 10^4$ cm s^{-2}). The convective velocities and

Higher Education Collaborators

Physics: Jim Stewart[1], Andrew Boudreaux[1,], George Nelson[1], Sara Julin[2], Ann Zukoski[3], Linda Zuvich[4], Ted Williams[5]

Biology: Deb Donovan[1], Carolyn Landel[1], Alejandro Acevedo[1], John Rousseau[2], Val Mullen[3], Rene Kratz[4], Pam Pape-Lindstrom[4], Adib Jamshedi[5]

Geology: Scott Linneman[1], Sue DeBari[1], Bob Mitchell[1], Bernie Dugan[2], Brad Smith[3], Ben Fackler-Adams[3], Steve Grupp[4], Terri Plake[5]

Chemistry: Steve Gammon[1], Emily Borda[1], Paul Frazey[2,3]

Science Education: Chris Ohana[1], Jacob Blickenstaff[1](Physics), Liesl Hohenshell[1] (Biology), Don Burgess[1](Biology), Molly Lawrence[1]

Evaluation:, Dan Hanley[1], Jim Minstrell[6], Ruth Anderson[6], Phil Buly[1], Many Graduate Students[1]

[1] Western Washington U, [2] Whatcom CC, [3] Skagit Valley C, [4] Everett CC, [5] Northwest Indian College, [6] FacetInnovations Inc.

My Start as a University Professor

Teaching is hard.

Teaching so your students learn—and you know that they have learned—is really hard.

How do we think about teaching?

What helps children learn?

- Effective teaching in the classroom every year, which involves much more than just good teachers
- Sufficient, appropriate, consistent, individual support for students—all the time

"….teacher effectiveness is the single biggest factor influencing gains in achievement, an influence bigger than race, poverty, parent's education, or any of the other factors that are often thought to doom children to failure."

-Thinking K-16
Education Trust, Winter 2004

Effective Teaching/Teachers

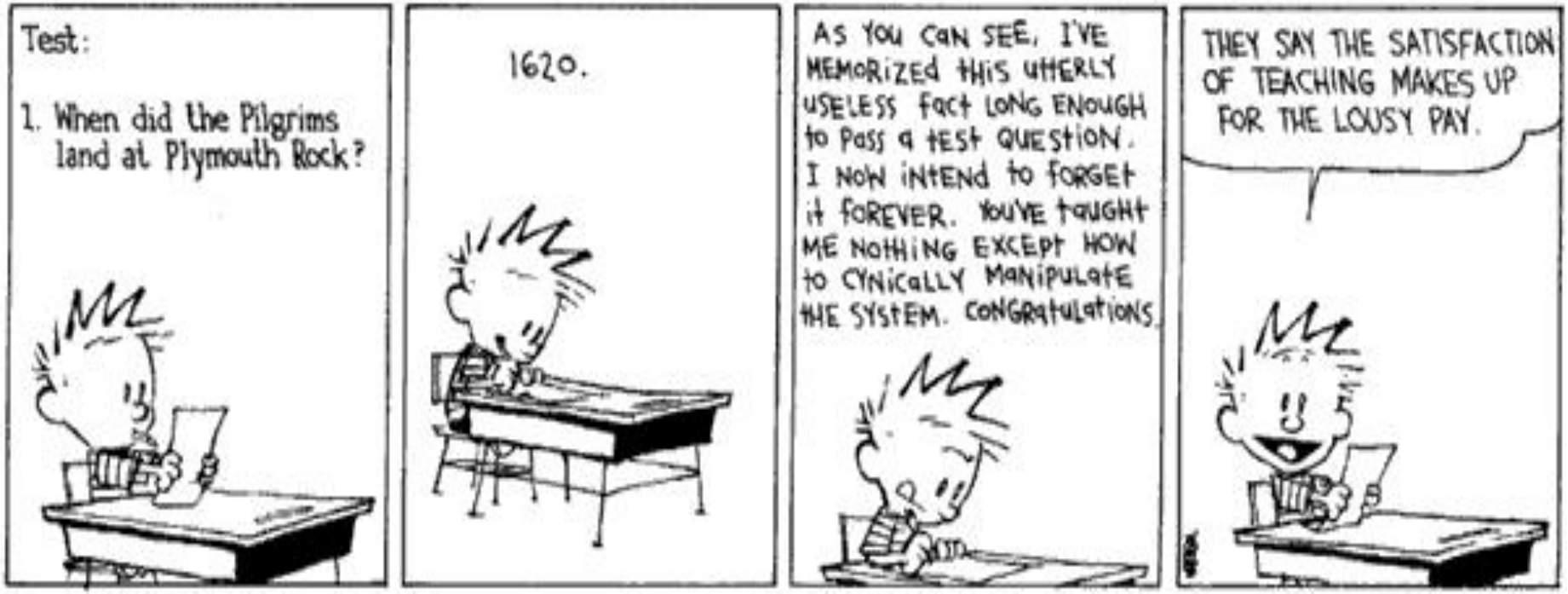
- Effective Teachers have:
  - **Shared beliefs** (All students can learn, it is our moral responsibility, no excuses)
  - **Research knowledge** (HPL, FA, etc.)
  - **Deep content knowledge**
  - **Knowledge and skills to teach specific content** (PCK)
  - **Practical knowledge and skills** (Management, formative assessment processes, relationships)
  - **Collaborative knowledge and skills** (Continued growth through professional teamwork)
  - **Experience** (Excellent training and mentoring during internship and early career)

- **AND….**

Effective Teaching/Systems

- Effective systems (buildings, districts, communities, state) have:
  - **Shared beliefs** (All students can learn, it is our moral responsibility, no excuses)
  - **Clear Learning Goals** (standards and beyond)
  - **Excellent, balanced curricula and assessments**
  - **Sufficient resources** ($$, staff, IT, labs, equipment)
  - **High expectations and support from leaders**
  - **Coherent community support** (parents, social services, higher education, business…)
  - **Low Noise**

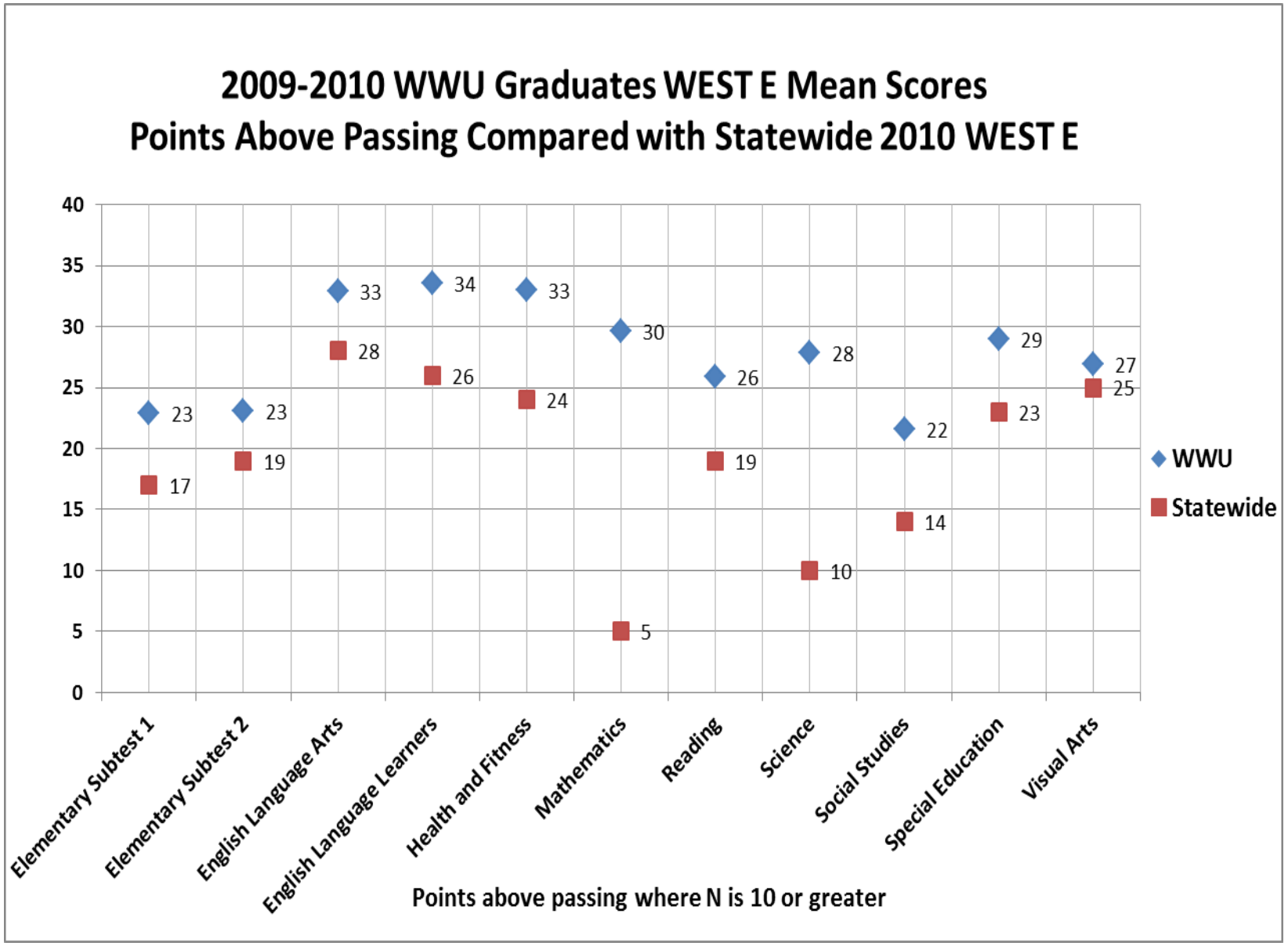
Who doesn't want to be a teacher?



How do we prepare new teachers?

- Recruit the best possible students (from everywhere)
- Set high expectations
- Maintain professional standards
- Model effective teaching to help students gain the necessary knowledge and skills in the classroom and in the field
- Provide purposeful mentoring at every stage
- Help develop shared beliefs through positive (though not necessarily easy) experiences

- WWU Examples: We certify the most HS STEM and elementary teachers (who teach science and math) in the state


2009-2010 WWU Graduates WEST E Mean Scores
Points Above Passing Compared with Statewide 2010 WEST E
40
35
30
25
20
15
10
5
0
23
17
23
19
33
28
34
26
33
24
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5
26
19
28
10
22
14
29
23
27
25
Elementary Subtest 1
Elementary Subtest 2
English Language Arts
English Language Learners
Health and Fitness
Mathematics
Reading
Science
Social Studies
Special Education
Visual Arts
WWU
Statewide
Points above passing where N is 10 or greater

Western Washington University Secondary Preservice Students
2006-2007 WEST-E (Praxis II)
100% Pass Rate

Discipline	Passing Score	N (69)	Mean
• Biology	152	13	175
• Chemistry	152	9	172
• Earth Science	150	4	185
• Gen. Science	153	14	181
• Mathematics	134	21	167
• MS Math	152	2	190
• MS Science	145	2	168
• Physics	140	4	163

A Year-Long Course Sequence for Future Elementary Teachers

NORTH CASCADES AND OLYMPIC Science Partnership

- One quarter each of Physics, Geology, Biology
  - Chemistry and Astronomy come later
- Small Classes (24)
- Reduced content coverage, increased depth
- Based on principles in *How People Learn*
- Developed using *Understanding by Design*
- Learning Cycle Model (Physics and Everyday Thinking, SDSU)
  - Purpose
  - Initial Ideas
  - Collecting and Interpreting Evidence
  - Summarizing Questions (Reflection)

Sponsored by the National Science Foundation under Grant No. EHR-0315060

NORTH CASCADES AND OLYMPIC Science Partnership

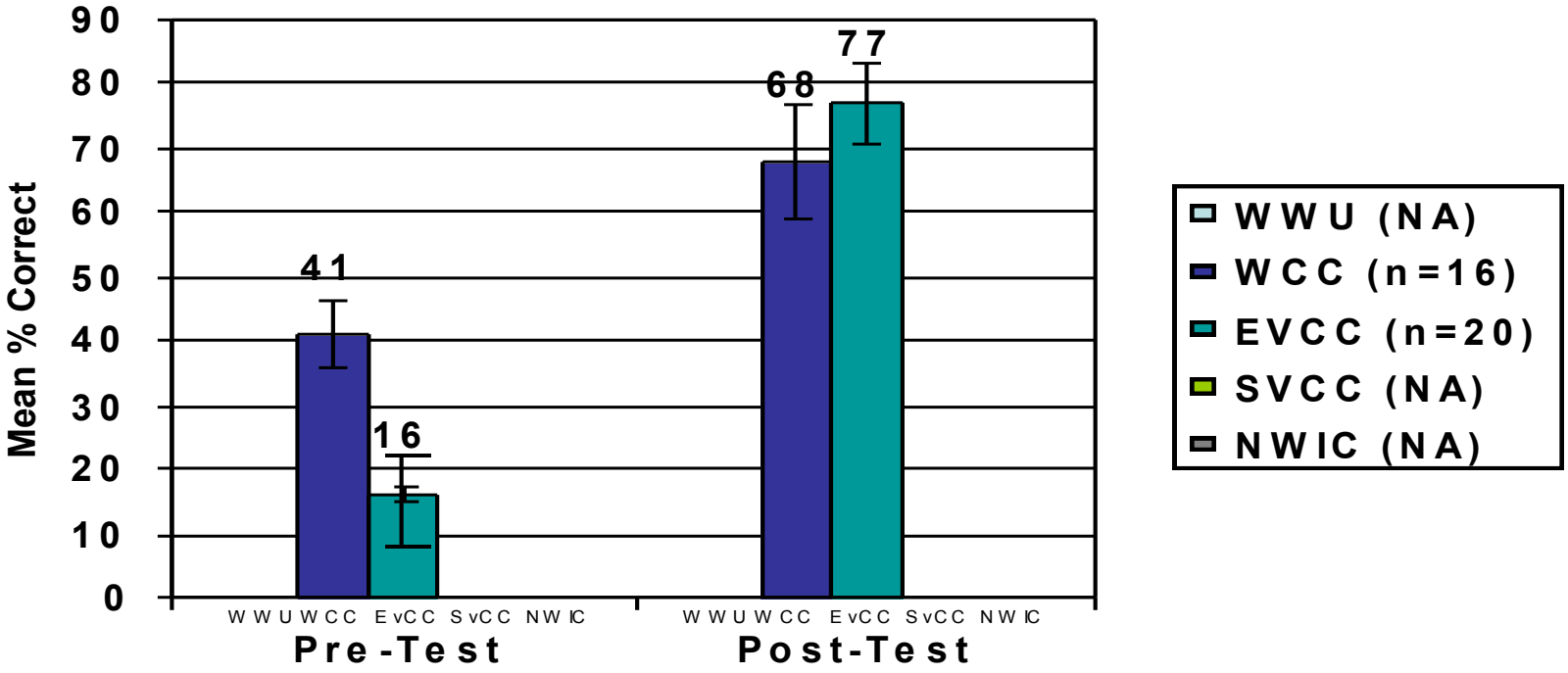
Results

- Courses are taught on five campuses
- Students are learning some physics, biology, and geology and pedagogy relevant to their teaching
- Students in elementary methods and practicum classes are different (research just starting)
- Practicing teachers that have taken the courses have improved student state test scores

Sponsored by the National Science Foundation under Grant No. EHR-0315060

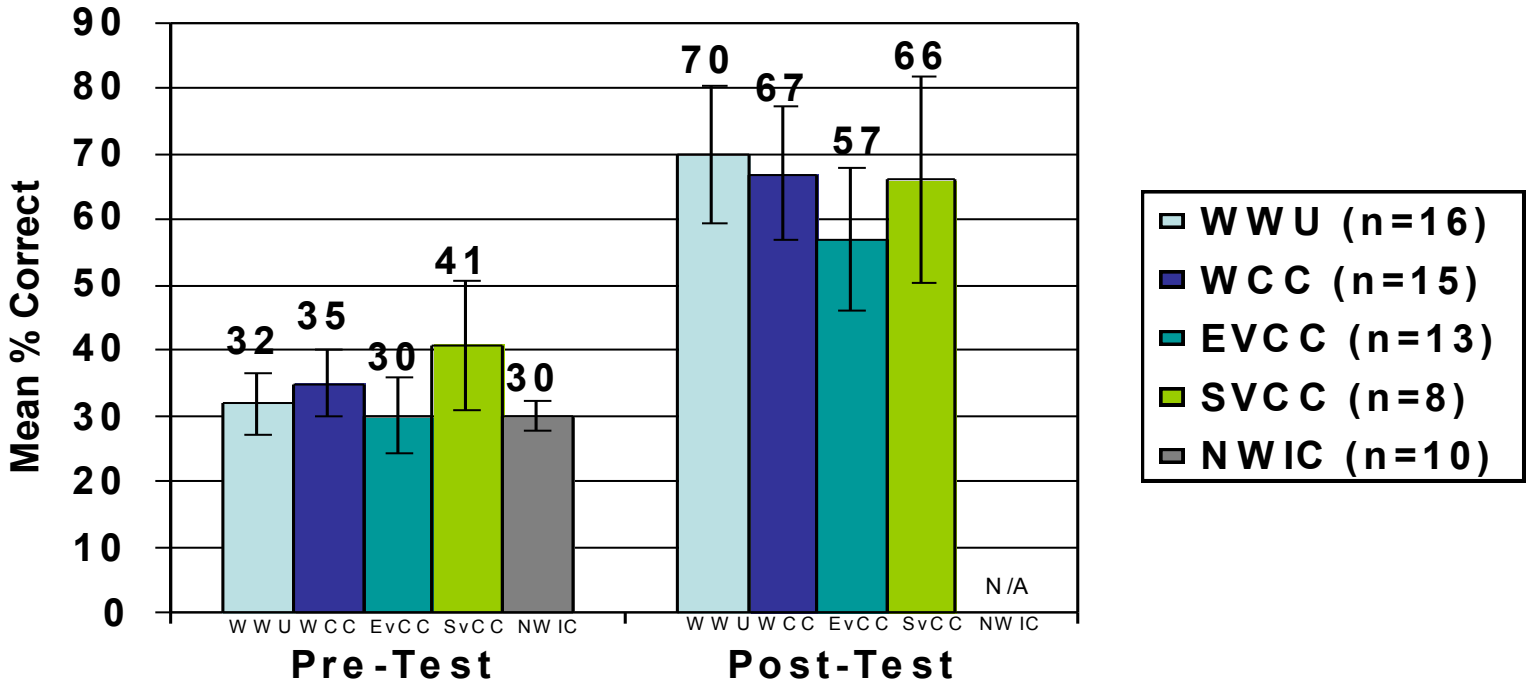
Pre-Post Scores Physics

Figure 28: Physical Science Content Assessments in Year 5



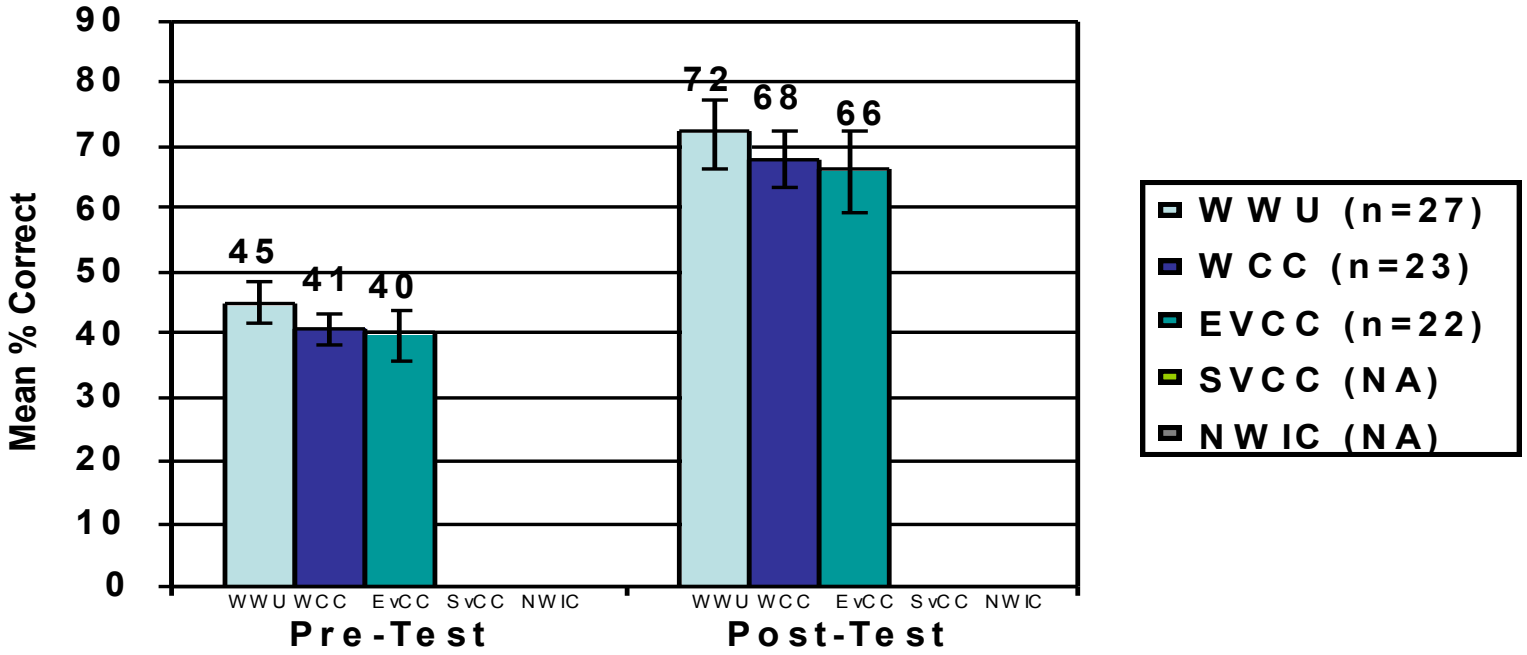
Pre-Post Scores: Biology

Figure X: Life Science Content Assessments in Year 5



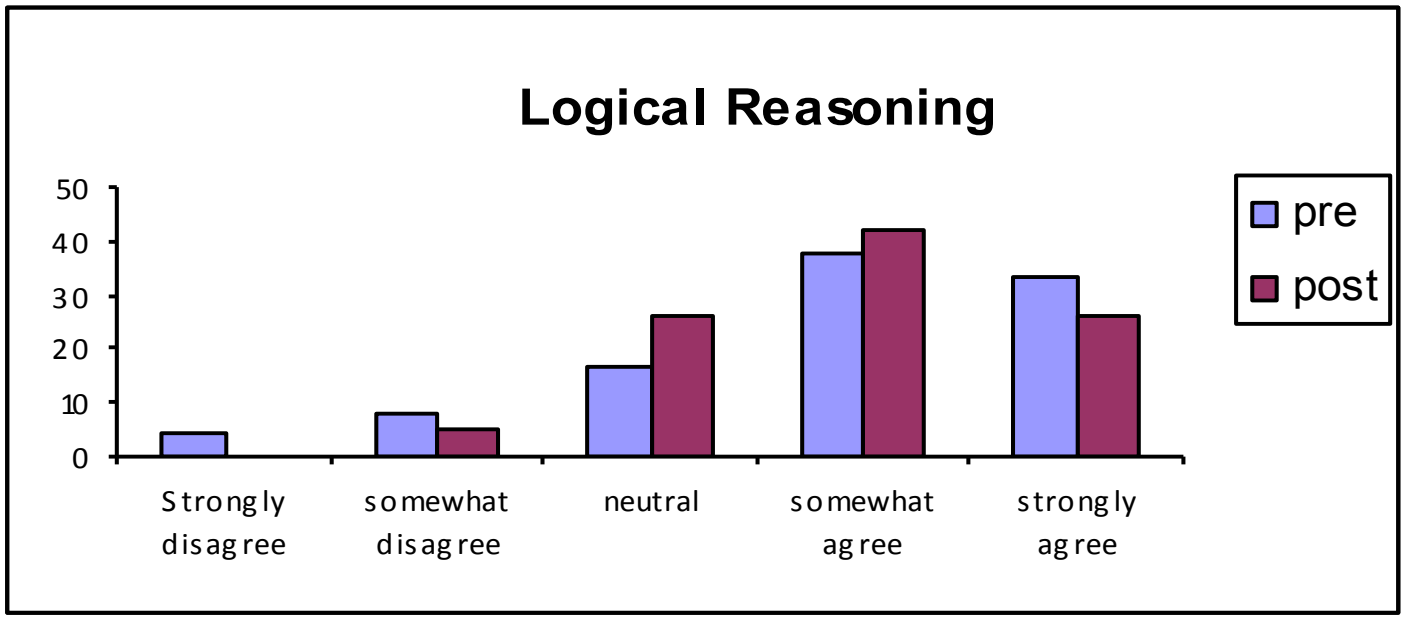
Pre-Post Scores: Geology

Figure 29: Earth Science Content Assessments in Year 5



Students' Views of the Nature of Science

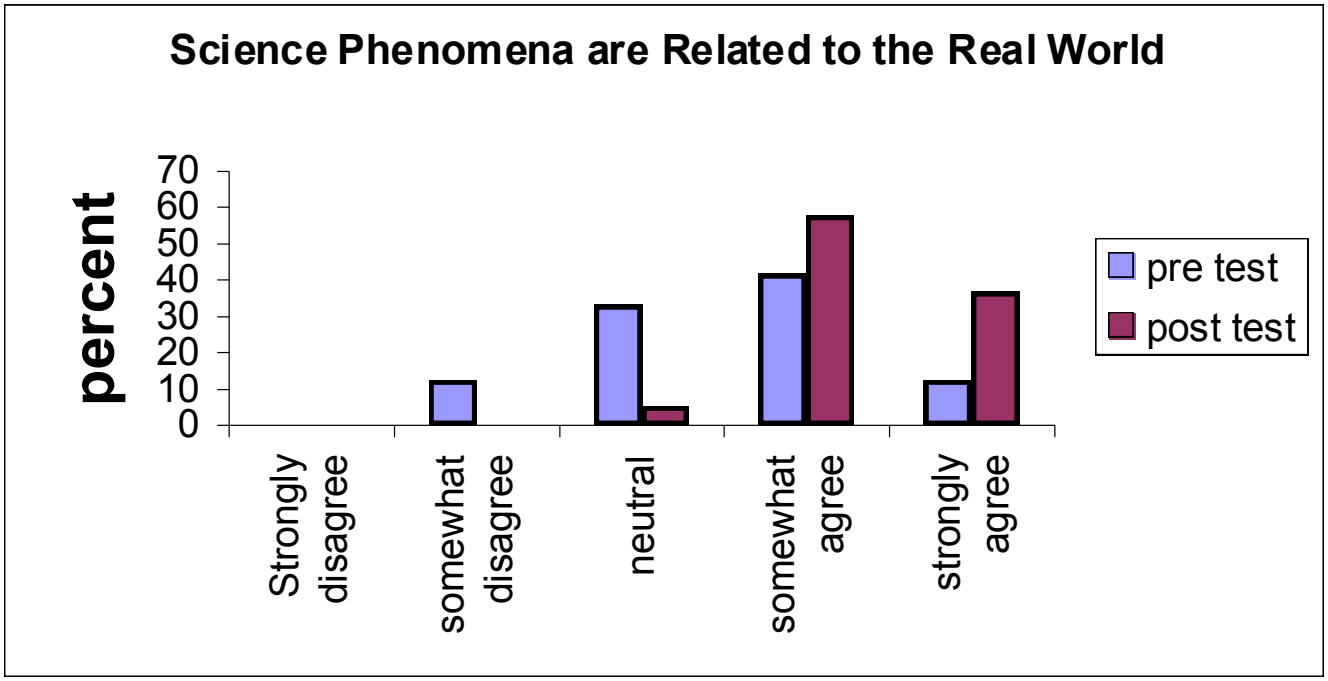
The main skill I expect to get out of this course is to learn how to reason logically about the physical world.



"… a lot of the things that I just take for granted I had to question and then realize that I was wrong on a lot of the things I thought and the good thing is that because we did experiments… we had to figure out how to learn it ourselves and the teacher didn't just tell us how to think, it counteracted what I thought what was wrong so it forced me to realize what was wrong and not go back to what I was thinking before".

-WWU student

Learning science made me change some of my ideas about how scientific phenomena can be used to understand the world around me.

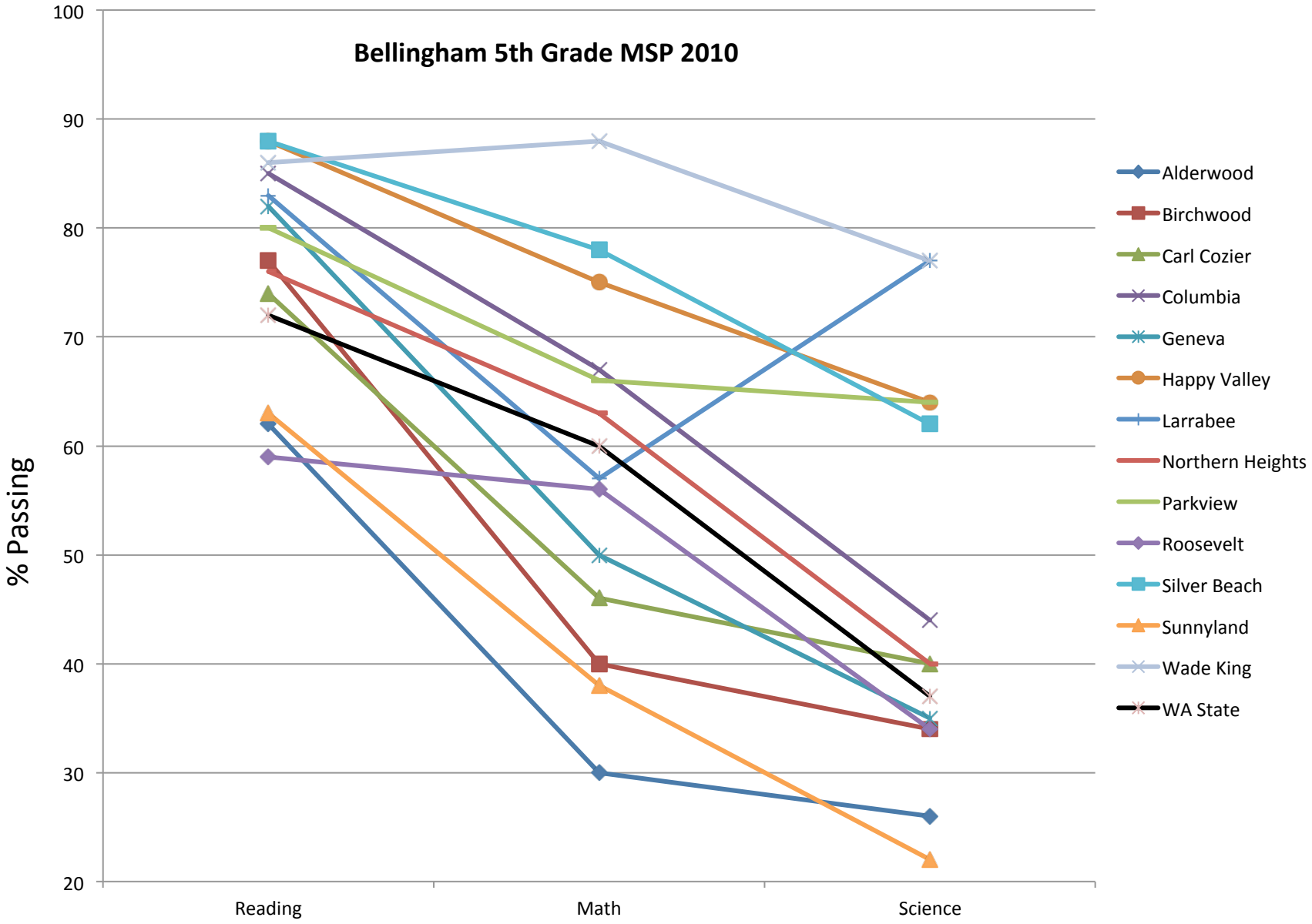


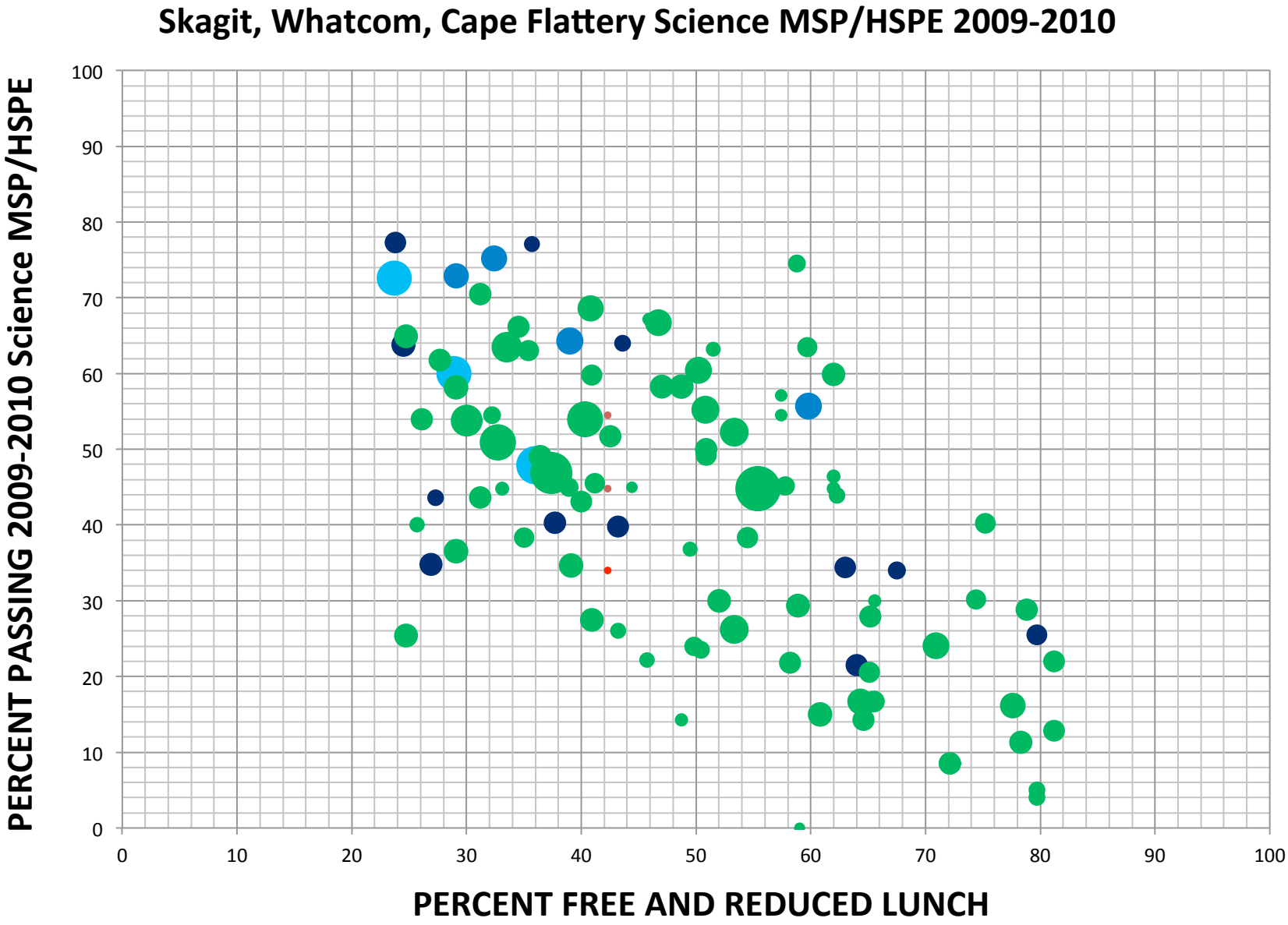
Final Reflection (Geology)

Earth science had never made so much sense to me before. Walking away from the final exam this quarter I felt accomplished and confident in my knowledge of how matter and energy in earth systems work(s). But how did I get to that feeling? Through active participation and constant questioning I gained a solid understanding of the material.

Concurrent K-12 and HE reform is critical

- Teachers learn to teach in the classroom where they can be supported to apply new knowledge and develop new skills
- Mentor teachers should be demonstrably effective as both teachers and mentors
- Buildings should be part of an effective system
- **Not enough examples of these exist yet**


Bellingham 5th Grade MSP 2010
% Passing
100
90
80
70
60
50
40
30
20
Reading
Math
Science
Alderwood
Birchwood
Carl Cozier
Columbia
Geneva
Happy Valley
Larrabee
Northern Heights
Parkview
Roosevelt
Silver Beach
Sunnyland
Wade King
WA State


Skagit, Whatcom, Cape Flattery Science MSP/HSPE 2009-2010
PERCENT PASSING 2009-2010 Science MSP/HSPE
PERCENT FREE AND REDUCED LUNCH
0
10
20
30
40
50
60
70
80
90
100

Where would you place your student teachers?

School (population)	1 (403)	2 (398)	3 (262)	WA (80,000)
% Ethnicity				
White	84	73	68	61
Hispanic	4	18	25	19
% FRL (Poverty)	20	54	57	44
% Passing 2011 5th Grade Science MSP	81	86	95	56
Level 4	61	55	67	24
Level 3	20	31	28	32
Level 2	15 (9)	6 (4)	5 (2)	24
Level 1	4 (2)	8 (5)	0 (0)	20

Finally

- At WWU we are preparing teachers to be part of successful schools where every student is expected to learn and every teacher and leader is committed to making that happen—no excuses. We are not preparing teachers for today's schools
- We are helping today's schools become successful schools
- This is not easy work, but it is critical work and it is doable work. Join us!

Thank you