

Spring 2010 CURE Report

A Collaborative Project Funded by HHMI

The CURE survey offers a comparison of learning benefits between course experiences and undergraduate research experiences. The pre-course survey collects student data based upon demographic questions, reasons for taking the course, level of experience on various course elements, science attitudes, and learning style. The post-course survey parallels the pre-course survey and includes additional questions that focus on student estimates of learning gains in specified course elements, estimates of learning benefits that parallel questions in the SURE surveys, overall evaluation of the experience, and science attitudes.

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Summary for **Washington & Jefferson College** (CHEM 270 All)

	Your Students		All Students*	
	PreCourse	PostCourse	PreCourse	PostCourse
N**	46	61	1359	987

* The data from "all students" in this report was obtained from the CURE Survey between January 12 - June, 2010.

** N represents the total number of respondents. Note that not every respondent answered each question in the survey, resulting in Ns smaller than the total (participation) postcourse N. In such instances, the total is represented by a lower case n.

Demographics

	Your Students		All Students		Gender
	PreCourse	PostCourse	PreCourse	PostCourse	
	31	40	582	361	Male
	14	20	754	604	Female
n	45	60	1336	965	

	Your Students		All Students		Ethnicity
	PreCourse	PostCourse	PreCourse	PostCourse	
	0	0	0	0	Alaskan Native
	0	0	5	5	American Indian
	3	3	181	81	Asian American
	0	1	62	91	Black or African American
	0	0	10	5	Filipino
	0	0	17	10	Foreign National
	0	0	0	1	Hawaiian
	1	0	101	78	Hispanic/Latino
	0	0	2	0	Pacific Islander
	39	54	831	607	White
	0	1	54	33	Two or more races
	1	2	33	25	Other
n	44	61	1296	936	

Your Students		All Students		Current Status
PreCourse	PostCourse	PreCourse	PostCourse	
0	0	1	0	High School
0	0	517	305	First-year college student
38	51	349	275	Second-year college student
6	10	255	169	Third-year college student
1	0	191	198	Fourth-year college student
0	0	25	20	Graduate or medical student
0	0	8	13	Other
n	45	61	1346	980

Academic Information

Your Students		All Students		Declared Major
PreCourse	PostCourse	PreCourse	PostCourse	
38	60	1083	793	Yes
7	1	267	189	No
n	45	61	1350	982

Your Students		All Students		Considering Science Major <i>(excludes those already science majors)</i>
PreCourse	PostCourse	PreCourse	PostCourse	
6	1	128	91	Definitely yes
0	0	68	57	It is likely
0	0	33	10	I'm not sure
1	0	19	14	It is unlikely
0	0	16	15	Definitely no
n	7	1	264	187

PreCourse Survey: Post-Graduate Plans

Your Students	All Students	%
4	149	11.4%
2	42	3.2%
0	57	4.4%
2	44	3.4%
0	91	7.0%
0	24	1.8%
0	14	1.1%
23	387	29.6%
7	219	16.8%
8	148	11.3%
0	59	4.5%
0	72	5.5%
n	46	1306

Grad school for Ph.D. in biology field
Grad school for Ph.D. in physical science field
Grad school for Masters in life science
Grad school for Masters in physical science
Grad School for Ph.D. or Masters in social science
Grad school for Ph.D. or Masters in humanities or fine arts
Earn certification or degree to qualify for teaching
Go to school for a medical degree (M.D.)
Go to school for an M.D./PhD.
Go to school for other health professions
Go to grad school for professional degree other than above (such as law)
No graduate education in near future

PostCourse Survey: Post-Graduate Plans

Your Students	All Students	%
2	73	8.5%
0	15	1.8%
3	182	21.2%
9	172	20.1%
0	60	7.0%
1	20	2.3%
44	313	36.5%
0	22	2.6%
n	59	857

I have not considered post-graduate education
I now plan NOT to pursue post-graduate education
I now plan to pursue a Master's degree in science field
I now plan to pursue a Doctoral degree in science field
I now plan to pursue a Master's degree in non-science field
I now plan to pursue a Doctoral degree in non-science field
I now plan to pursue a medical degree
I now plan to pursue a law, architectural, or other degree

PreCourse Survey: Reasons for Taking Course
10 reasons for taking a course

1 = Not important, 3 = very important

Your Students				
Level of Importance				
Not	Moderate	Very	N*	
6	14	22	42	To fill a distribution requirement
4	6	34	44	To fill a requirement for my major
4	10	30	44	I need it for graduate or professional school
3	15	27	45	I need it for my desired employment after college
9	24	13	46	Interest in the subject matter
5	24	17	46	To learn lab techniques
4	20	22	46	To learn about science and the research process
3	17	25	45	To get hands-on research experience
20	14	9	43	It fit in my schedule
15	21	8	44	The course and/or the instructor has a good reputation

** Each student was asked to rate each reason for taking the course.*

Course Elements**25 items about course elements**

On the pre-course survey, students were asked to assess their prior experience on each element. They were asked to rate their experience on a scale where 1 means no experience or that the student feels inexperienced and 5 means much experience or that the student feels that she or he has mastered the element. These data are most useful, first, descriptively, and second, as covariates that aid in the interpretation of other data. On the post-course survey, the students were asked to "rate the gains you may have made as a result of taking this course." The 5-point scale, where 1 = no or very small gain to 5 = very large gain, is consistent with the scale used to rate other learning gains. Means are used to represent the data.

Your Students		All Students		
PreCourse Experience	PostCourse Gain	PreCourse Experience	PostCourse Gain	
3.91	3.25	3.52	3.26	Scripted lab or project where students know outcome
3.35	3.32	3.30	3.41	Lab or project where only instructor knows outcome
2.40	3.11	2.37	3.43	Lab or project where no one knows the outcome
3.56	3.58	3.57	3.66	A least one project assigned and structured by instructor
2.93	3.34	2.80	3.85	A project where students have input into process or topic
2.13	2.59	2.32	3.64	A project entirely of student design
3.72	3.30	3.70	3.50	Work individually
2.76	3.11	2.92	3.26	Work as a whole class
3.61	3.57	3.73	3.83	Work in small groups
3.48	3.70	3.71	3.89	Become responsible for a part of the project
3.42	3.25	3.07	3.64	Read primary scientific literature
2.31	2.89	2.31	3.49	Write a research proposal
4.00	3.88	3.73	3.93	Collect data
3.76	3.93	3.62	4.05	Analyze data
2.74	3.44	3.01	3.62	Present results orally
3.48	3.75	3.52	3.87	Present results in written papers or reports
2.31	3.57	2.76	3.17	Present posters
2.74	2.78	2.71	3.25	Critique work of other students
3.91	3.10	4.15	3.64	Listen to lectures
3.91	3.14	4.17	3.21	Read a textbook
3.76	3.24	3.92	3.36	Work on problem sets
3.89	2.77	4.23	3.37	Take tests in class
3.52	2.85	3.91	3.55	Discuss reading materials in class
4.11	3.40	3.75	3.38	Maintain lab notebook
2.83	2.91	2.34	3.22	Computer modeling

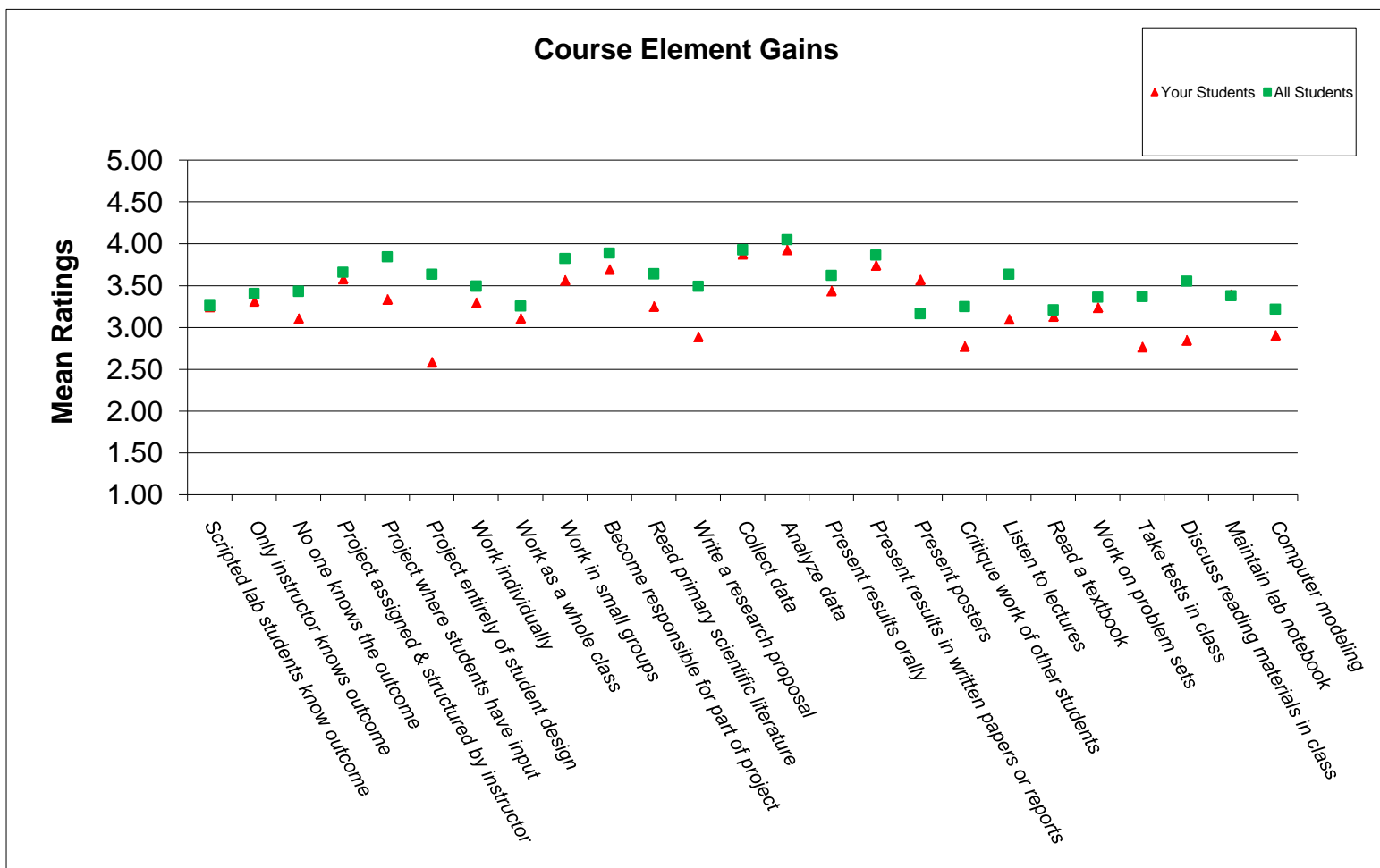


Figure 1. The figure illustrates the mean ratings by students of gains in 25 areas corresponding to the course elements above.

PostCourse Survey: Benefits
21 items about learning gains

The learning gain items below are the same as a list of gains students assess when they complete the SURE survey, an assessment of summer undergraduate research experiences. The parallel between the two surveys permits an analysis of how well the course experience emulates the gains of a research experience. A consistent result is that CURE means on most items, except for writing and ethics, are lower than SURE means. In addition, courses with a research-like component yield means higher than courses with no research-like component. The means shown for the benchmark on the right are for all CURE participants, regardless of course. The scale is 1 to 5, with 5 being the largest gain. These items appear only on the post-course survey. *Means are used to represent the data.*

Your Students	All Students	SD	
n≤60	n≤952		
2.91	3.00	1.28	Clarification of a career path
3.42	3.56	1.00	Skill in interpretation of results
3.40	3.54	1.05	Tolerance for obstacles faced in the research process
3.27	3.51	1.04	Readiness for more demanding research
3.38	3.50	1.01	Understanding how knowledge is constructed
3.38	3.59	1.05	Understanding the research process
3.44	3.57	1.00	Ability to integrate theory and practice
3.33	3.60	1.07	Understanding how scientists work on real problems
3.50	3.64	1.05	Understanding that scientific assertions require supporting evidence
3.60	3.76	0.97	Ability to analyze data and other information
3.37	3.57	1.09	Understanding science
2.88	3.27	1.22	Learning ethical conduct
3.65	3.71	1.10	Learning laboratory techniques
3.21	3.47	1.11	Ability to read and understand primary literature
3.12	3.28	1.24	Skill in how to give an effective oral presentation
3.53	3.51	1.10	Skill in science writing
3.22	3.35	1.22	Self-confidence
3.27	3.43	1.11	Understanding how scientists think
3.35	3.38	1.14	Learning to work independently
3.41	3.51	1.09	Becoming part of a learning community
2.89	3.05	1.30	Confidence in my potential as a teacher

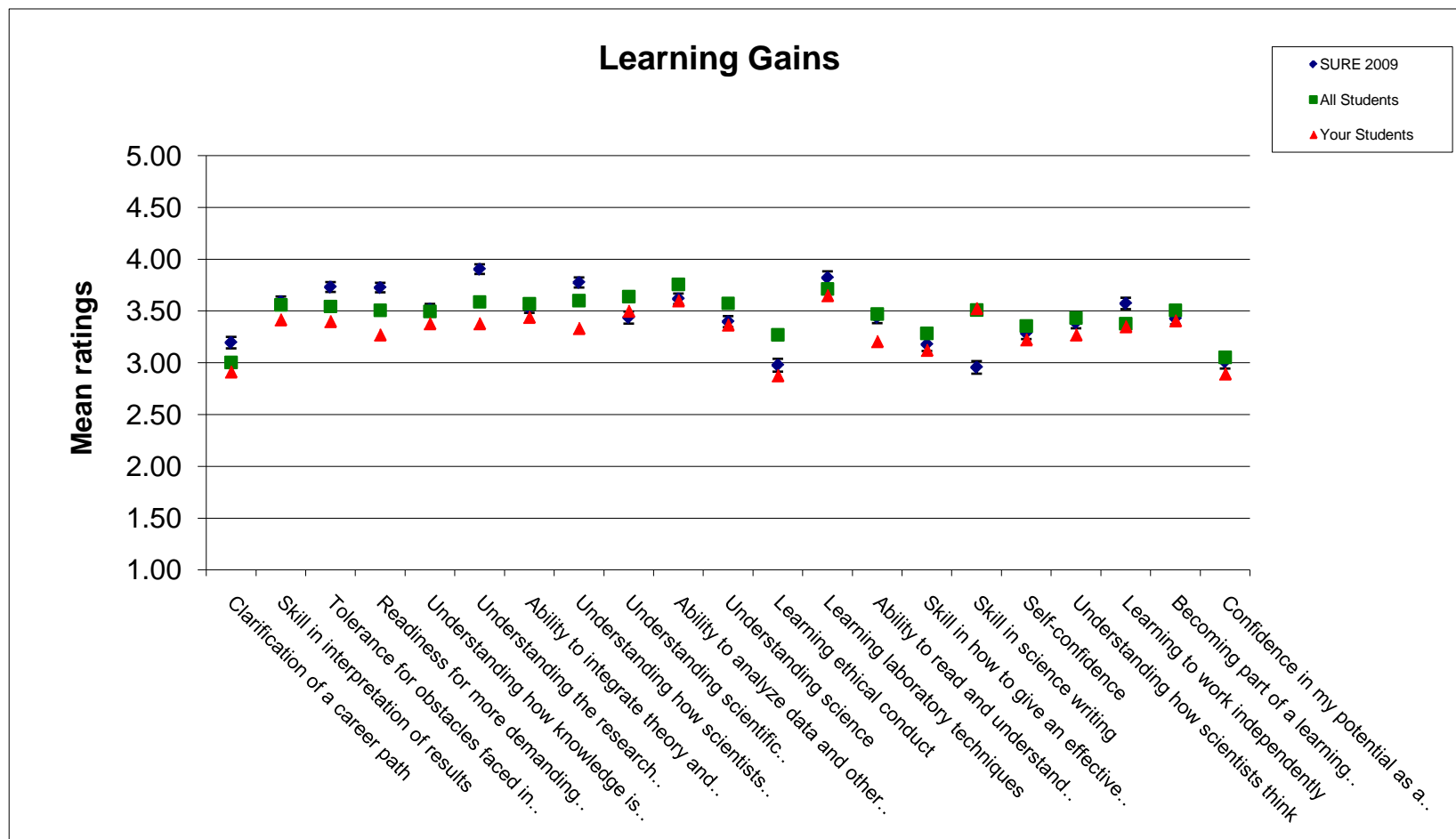


Figure 2. The figure illustrates the mean ratings by students of gains in 21 areas, corresponding to the areas above. As these same items are evaluated by students who participate in summer undergraduate research, the recent results of the Summer Undergraduate Research Experience (SURE) survey are presented for reference. Also presented (green squares) are the overall mean ratings by the reference cohort of students who completed the CURE survey in the spring of 2010. The vertical lines around the SURE means represent 2 standard errors above and below. *Note:* Data from students who completed the pre-course survey and those who did not are indistinguishable.

Attitudes about Science**22 questions about science**

These items appear on both the pre-course survey and the post-course survey. The scale is 1 (strongly disagree) to 5 (strongly agree). We have not found large changes from pre- to post-course survey. Note that 5 items are printed in italics. In exploratory factor analysis these 5 items load on a factor that we have named "engagement". Engagement scores, whether pre-course or post-course, have correlated in our first findings with higher reported learning gains and a greater likelihood to declare a science major. *Means are used to represent the data.*

Your Students		All Students		
PreCourse	PostCourse	PreCourse	PostCourse	
4.13	3.74	4.14	4.15	<i>Even if I forget the facts, I'll still be able to use thinking skills learned in science</i>
3.18	3.27	3.24	3.24	You can rely on scientific results to be true and correct
3.66	3.63	3.91	3.98	<i>The process of writing in science is helpful for understanding scientific ideas</i>
3.05	3.30	3.03	3.15	When scientific results conflict with my personal experience, I follow my experience in making choices
2.22	2.70	2.18	2.40	Students who do not major/concentrate in science should not have to take science courses
3.02	2.95	2.84	2.75	I wish science instructors would just tell us what we need to know so we can learn it
1.96	2.64	1.87	2.07	Creativity does not play a role in science
1.82	2.62	1.93	2.10	Science is not connected to non-science fields such as history, literature, economics, or art
2.67	3.02	2.92	2.98	When experts disagree on a science question, it's because they don't know all the facts yet
4.24	3.88	4.29	4.19	<i>I get personal satisfaction when I solve a scientific problem by figuring it out myself</i>
2.29	2.56	2.48	2.65	Since nothing in science is known for certain, all theories are equally valid
2.91	2.98	2.98	3.04	Science is essentially an accumulation of facts, rules, and formulas
4.25	3.82	4.05	4.03	<i>I can do well in science courses</i>
3.09	3.30	3.05	3.22	Real scientists don't follow the scientific method in a straight line

Attitudes about Science (cont.)

<i>Your Students</i>		<i>All Students</i>		
PreCourse	PostCourse	PreCourse	PostCourse	
2.89	3.10	2.56	2.64	There is too much emphasis in science classes on figuring things out for yourself
2.33	2.46	2.36	2.49	Only scientific experts are qualified to make judgments on scientific issues
1.93	2.34	1.87	2.13	Scientists know what the results of their experiments will be before they start
4.11	3.93	4.14	4.09	<i>Explaining science ideas to others has helped me understand the ideas better</i>
3.02	3.27	3.28	3.41	Main job of the instructor is to structure the work so that we can learn it ourselves
2.27	2.85	2.84	2.88	Scientists play with statistics to support their own ideas
3.79	3.64	3.72	3.73	Lab experiments are used to confirm information studied in science class
1.76	2.18	1.75	1.96	If an experiment shows that something doesn't work, the experiment was a failure

Learning style items

10 pairs of statements

The pre-course survey included 10 self-descriptive items derived from a brief learning style survey published by Romero et al. Each item contained pairs of statements, and the student was to use a 1-6 scale to describe how closely one or the other statement described him or her. Two scales, one a dimension of concrete-abstract information preference and one a dimension of reflective-active learning preference were scored. The diagram below describes the names given to four kinds of learning styles and the majors typically associated with them. We are currently exploring the possible relations between this information and other information from the surveys. See Romero, Tepper, and Tetrault (1992). Development and validation of new scales to measure Kolb's learning style dimensions. *Educational and Psychological Measurement*, 52, 171-180.

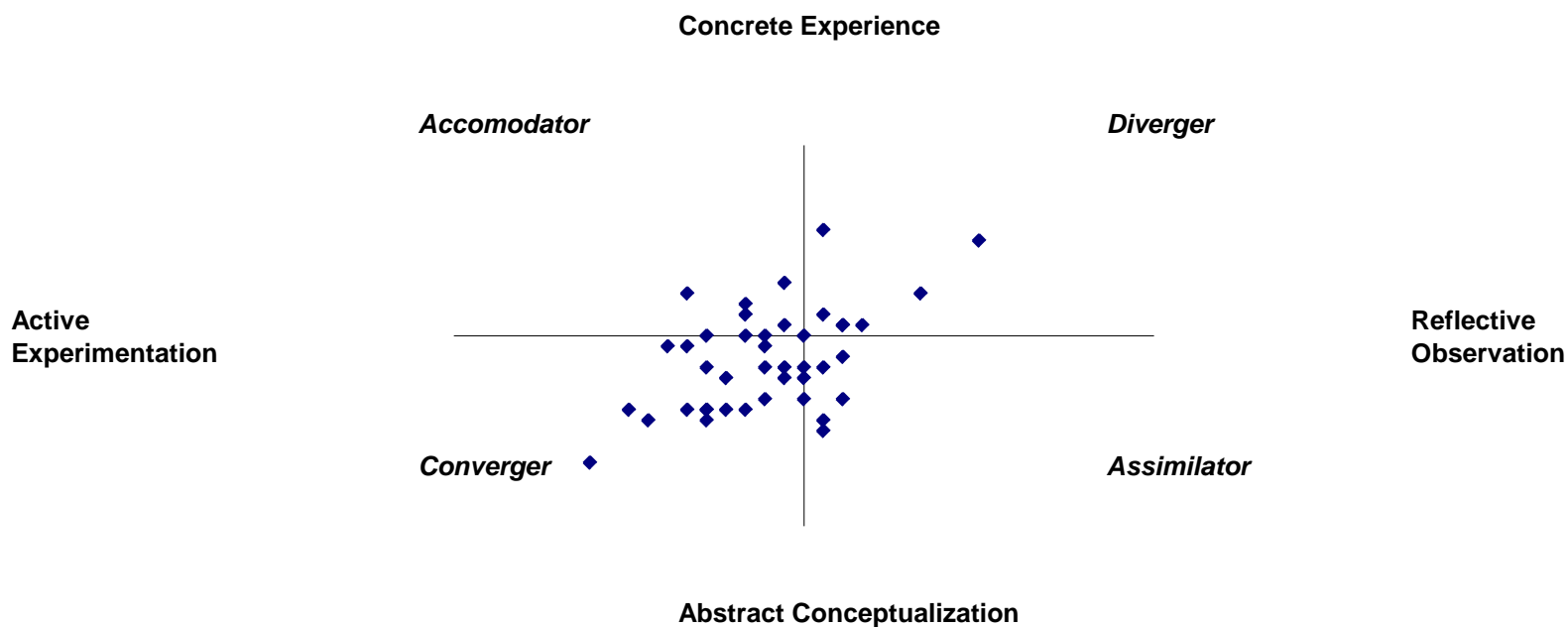


Figure 3. The two dimensions of learning style, with typical majors suggested by Romero, et al. In that report, science majors tended to score in the "Assimilator" or "Converger" quadrants.

Learning Style Quadrants

Your Students	All Students	%	
8	274	21.5%	Divergers
8	311	24.4%	Assimilators
18	437	34.4%	Convergers
8	250	19.7%	Accomodators
n 42	1272		

PostCourse Survey: Overall Assessment

These four questions serve as an overall assessment of the course. Note that the scale is 1 (strongly disagree) to 5 (strongly agree). The questions are on the post-course survey only. *Means are used to represent the data.*

Your Students	All Students	SD	
3.72	4.08	0.91	This course was a good way of learning about the subject
3.72	4.05	0.95	This course was a good way of learning about the process of scientific research
3.23	3.90	1.11	This course had a positive effect on my interest in science
3.55	4.15	0.94	I was able to ask questions in this class and get helpful responses

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