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Self-reported gains and engagement

The HEDS senior survey, conducted each year beginning in 2002, includes a set of items that ask students to indicate the extent to which they perceive that they have "enhanced their abilities" in the following 26 areas:

Table 1. Self-reported gain items, HEDS Senior Survey

Acquire new skills and knowledge on my own	Lead and supervise tasks and groups of people
Appreciate art, literature, music, drama	Write effectively
Communicate well orally	Understand moral and ethical issues
Develop awareness of social problems	Plan and execute complex projects
Develop self-esteem	Read or speak a foreign language
Engage in the pursuit of knowledge and truth	Work under pressure
Establish a course of action to accomplish goals	Think analytically and logically
Evaluate and choose between alternative courses or action	Place current problems in historical/cultural/philosophical perspective
Evaluate the role of science and technology in society	Relate well to people of different races, nations, and religions
Understand myself; abilities, interest, limitations and personality	Understand the process of science and experimentation
Formulate creative/original ideas and solutions	Use quantitative tools (e.g. statistics, graphs)
Function effectively as a member of a team	Use technology
Function independently, without supervision	Gain in-depth knowledge of a subject area

For most of these items, self-reported gains have been declining over the 5-year 2002-2006 period. In addition, Colby seniors now exhibit significant gaps in self-reported gains as compared to graduating seniors at peer institutions. This report reviews preliminary work undertaken to explore the correlates of these self-reported gains.

Factor analysis of self-reported gains scores

The analysis began with an effort to identify the broad aptitudes underlying the 26 items in Table 1. One way to approach this is to simply look at the items and group them semantically. For example, one might group "understand the process of science" with the "evaluate role of science" together into a broader, "science outcomes" factor.

How would one go about demonstrating the validity of this factor? If, in fact, there is some higher-level "science outcomes" factor of which these two items are but two related aspects, then one would have to assert that students reporting strong outcomes on one item would also report strong outcomes on the

other. If most students reporting strong gains in one item reported weak gains in the other area, however, that would call the validity of that factor into question.

This is the logic of the statistical technique known as factor analysis. The procedure "looks for" items that tend to *co-vary,* that is, items on which students tend to respond similarly – it is a purely a mechanical, mathematical procedure. The human element enters after the mathematical search for covarying sets of items, to try to *interpret* what the factors underlying this covariation might be.

There are certain statistical guidelines for determining the appropriate *number* of factors and the *"fit"* of the final solution that are not important to this discussion, except to say that following these guidelines produced an unusually "clean" and interpretable solution. It is presented in Table 2. Importantly, the "factor labels" represent this authors' own subjective interpretation of the groupings or factors that were mechanically generated by the factor analysis procedure – other factor labels might better capture the meaning of the items contained within them.

Table 2. Factor analysis of self-reported gains items

Item loadings less than +/- .40 not shown

		Component					
Factor Labels		1	2	3	4	5	6
Social Justice / Ethical Understanding	Develop Awareness of Social Problems	0.82					
	Place Problems in Historical Perspective	0.78					
	Understand Moral and Ethical Issues	0.75					
	Relate to People of Different Races, Nations, or Religions	0.68					
	Engage in Pursuit of Knowledge and Truth	0.55					
Critical Thinking / Creativity	Think Analytically and Logically		0.73				
	Formulate Creative Ideas and Solutions		0.71				
	Acquire New Skills and Knowledge		0.62				
	Write Effectively		0.56				
	Evaluate and Choose Alternatives		0.56				
	Plan and Execute Projects		0.48				
	Gain In-Depth Knowledge of a Subject		0.44				
Self-Reliance	Function Independently			0.77			
	Establish Course of Action			0.69			
	Develop Self-Esteem			0.63			
	Understand Myself			0.63			
	Work Under Pressure			0.62			
Scientific Thinking	Understand Process of Science				0.82		
	Use Quantitative Tools				0.78		
	Use Technology				0.76		
	Evaluate Role of Science and Technology in Society				0.72		
Leadership & Communication	Lead and Supervise Groups					0.73	
	Function Effectively as Team Member					0.68	
	Communicate Well Orally					0.66	
Expressive Skills	Read or Speak Foreign Language						0.80
	Appreciate Art						0.69

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

The numbers in the table (item loadings) indicate the extent to which each item is representative of the overall factor – items with higher loadings (up to a maximum of 1.0) are more central to the factor and should be accorded higher weight in the subjective labeling of that factor.

What this analysis says is that there are six well-defined areas of gains that underlie the 26 more specific abilities. It is reassuring that the "blind" mathematical procedure produced factors that are readily interpretable and, most likely, fairly close to what an effort based purely on semantics would have yielded.

The advantage of this effort is that now, instead of having to analyze variation in all 26 items and link it back to variables of interest such as academic major, gender, financial aid status and so on, we can do this with just six "factor scores" that are comprised of the items within each factor, and feel comfortable that we are losing a minimum of information in doing so.

Factor analysis of "engagement" items

The HEDS senior survey contains a number of participation items related to specific activities that are either directly or indirectly related to "engagement" in the academic program. An analogous factor analysis of these items yielded the following "solution." Again, the factor labels are subjectively defined.

Table 3. Factor analysis of items related to student engagement / disengagement

Item loadings less than +/- .30 not shown

		Component					
Factor Labels		1	2	3	4	5	6
Academic Engagement: Within the Classroom	Studying/Preparing for Class	0.76					
	Attending Class or Labs	0.62					
	Using Computer for Academics	0.61	0.43				
	Working With Peers on Classwork	0.57					
	Talking or Meeting With Faculty	0.50					0.39
Recreational Computing	Using Computer for Recreation		0.87				
	Using Computer for Communication		0.84				
	Watching TV/Playing Video Games		0.48			0.38	
Academic Engagement: Beyond the Classroom	Academic Discussions With Students			0.76			
	Disscussions With Students of Different Beliefs			0.76			
	Cultural Events			0.63			
	Guest in Faculty Member's Home			0.34			
Teamwork and Communication	Group Projects				0.83		
	Class Presentations				0.78		
	Multimedia Presentations				0.72		
Partying and Athletics	Partying					0.83	
	Other Socializing With Friends					0.71	
	Participating in Athletics					0.47	
Social Justice	Volunteering						0.69
	Participating in Clubs or Organized Groups						0.65
	Organized Demonstrations						0.47
	Religious Services						0.45

Regression analysis: What are the key drivers of self-reported gains?

Regression analysis is a technique that among other things allows one to identify, from a range of possible characteristics, those that covary the most with an outcome variable of interest. To the extent that covariation is one of the most important criteria of *cause*, regression analysis is a way of identifying the most likely candidates for the true cause from a list of possible causes.

The list of possible characteristics that might impact self-reported gain scores is, theoretically, infinite. Only some of these characteristics have themselves been measured, which limits the possibilities somewhat. From the list of measured characteristics, then, a list of important variables were identified, as shown in Table 4, along with the results of the analysis. For this analysis, the average self-reported gain

score was used (average of all 26 items for each respondent). The items were entered in "blocks" as outlined in Table 5.

In order to gauge the relative power of each variable in the prediction of average self-reported gain, compare the *Beta* or *t* columns. The extent to which values in these columns deviate from 0 significantly indicates the power of that characteristic to predict average gains. Negative values are inversely related to average gains score, but are still "predictive" in that sense.

So, for the non-statistician, what is important here?

First, by far the best predictors of average gains are the set of "student engagement" factors described in Table 3. The top 4 predictors, in order, are the *Academic Engagement: Beyond the Classroom, Academic Engagement: Within the Classroom, Teamwork and Communication*, and *Social Justice* factors (review Table 3 for the specific items that comprise each factor). This block of six variables, when it is added to the regression model, *more than doubles* the predictive power of the model.

This is a dramatic finding, because it also means that the explanatory power of these four "engagement" factors *cannot be explained with reference to any of the other characteristics within the model.* In other words, the explanatory power of these variables is not merely

Table 4. Regression analysis: Predicting average gain score

Statistically significant predictors of average gain score are shaded.

	B	Std. Error	Beta	t	Sig.
(Constant)	3.42	0.30		11.29	0.00
Cumulative GPA	**0.11**	**0.04**	**0.08**	**2.94**	**0.00**
SAT Verbal Score	**0.00**	**0.00**	**-0.15**	**-5.00**	**0.00**
SAT Math Score	0.00	0.00	-0.03	-1.17	0.24
Dean's Academic Rating	0.01	0.02	0.01	0.41	0.68
Dean's "Social" Rating	-0.02	0.01	-0.03	-1.08	0.28
Female (reference: male)	**0.08**	**0.02**	**0.09**	**3.43**	**0.00**
Legacy (reference: non-legacy)	-0.02	0.04	-0.01	-0.44	0.66
African-American	-0.11	0.09	-0.03	-1.19	0.23
Latino	-0.08	0.08	-0.02	-1.01	0.31
Native American	-0.40	0.23	-0.04	-1.72	0.08
Asian-American	0.00	0.05	0.00	-0.05	0.96
International	0.00	0.06	0.00	-0.01	0.99
Enrolled Early Decision	**0.06**	**0.02**	**0.07**	**2.79**	**0.01**
Applied for aid; no aid received	**0.07**	**0.03**	**0.05**	**2.10**	**0.04**
Aided 0-20% Expenses	0.01	0.05	0.01	0.24	0.81
Aided 20-40% Expenses	-0.03	0.05	-0.02	-0.71	0.48
Aided 40-60% Expenses	0.04	0.04	0.02	1.01	0.31
Aided 60-80% Expenses	-0.02	0.04	-0.01	-0.52	0.61
Aided 80-100% Expenses	-0.01	0.04	-0.01	-0.26	0.80
Intramural athlete	-0.01	0.02	-0.01	-0.50	0.62
Intercollegiate athlete	0.02	0.02	0.02	0.70	0.48
Administrative Science	0.10	0.22	0.01	0.45	0.65
American Studies	0.02	0.16	0.01	0.13	0.90
Anthropology	-0.01	0.16	0.00	-0.07	0.94
Art	0.00	0.16	0.00	-0.01	0.99
Biology	-0.04	0.15	-0.03	-0.27	0.78
Chemistry	0.03	0.16	0.01	0.21	0.84
Classics	-0.07	0.18	-0.02	-0.40	0.69
Computer Science	-0.13	0.17	-0.04	-0.78	0.43
East Asian Studies	-0.26	0.19	-0.05	-1.38	0.17
Economics	0.02	0.16	0.01	0.14	0.88
English	-0.12	0.15	-0.09	-0.79	0.43
French & Italian	0.06	0.18	0.01	0.31	0.76
Geology	0.04	0.18	0.01	0.24	0.81
German & Russian	-0.10	0.21	-0.02	-0.48	0.63
Government	-0.08	0.15	-0.05	-0.54	0.59
History	0.03	0.16	0.01	0.17	0.87
Mathematics	0.06	0.16	0.03	0.39	0.70
Music	0.03	0.18	0.01	0.17	0.87
Philosophy	-0.08	0.17	-0.03	-0.47	0.64
Physics	-0.03	0.17	-0.01	-0.18	0.86
Psychology	-0.13	0.16	-0.07	-0.84	0.40
Religious Studies	0.03	0.19	0.01	0.15	0.88
Sociology	0.01	0.16	0.01	0.08	0.93
Spanish	-0.02	0.17	-0.01	-0.13	0.90
Theater	0.01	0.20	0.00	0.08	0.94
Education	-0.08	0.18	-0.02	-0.45	0.65
Environmental Studies	-0.07	0.16	-0.02	-0.40	0.69
Independent Major	0.01	0.18	0.00	0.07	0.95
International Studies	-0.01	0.16	-0.01	-0.06	0.95
Latin American Studies	0.05	0.19	0.01	0.28	0.78
Women's / Gender / Sex Studies	-0.16	0.27	-0.02	-0.58	0.56
Academic Engagement: Within Class	**0.10**	**0.01**	**0.21**	**8.73**	**0.00**
Recreational Computing	0.00	0.01	-0.01	-0.43	0.67
Academic Engagement: Beyond Class	**0.11**	**0.01**	**0.25**	**10.30**	**0.00**
Teamwork & Communication	**0.10**	**0.01**	**0.23**	**9.44**	**0.00**
Partying and Athletics	0.02	0.01	0.04	1.55	0.12
Social Justice	**0.07**	**0.01**	**0.15**	**6.40**	**0.00**

an artifact of the fact that "engaged" students are those with higher SAT scores or higher cumulative GPAs at Colby. These variables are already in the model, which means that any "overlapping" explanatory power has largely been removed from the values shown in Table 4. Table 5 shows how much each "block" of variables incrementally adds to the accuracy of the overall regression model in predicting average gains. R^2 is commonly referred to as the "percent of variance explained", and ranges between a minimum of 0 to a maximum of 1.0.

Table 5. Incremental increase in explained variance for regression model in Table 4.

Model	*R*	*R Square*
Cumulative GPA	0.07	0.00
SAT Scores	0.22	0.05
Dean's Ratings	0.23	0.05
Gender, Ethnicity	0.27	0.08
Financial Aid Status	0.28	0.08
Athletic Participation	0.29	0.08
Student Major	0.33	0.11
Engagment Indices	0.52	0.27

Cumulative GPA and SAT scores both raise the predictive power of the model substantially, though it is worth highlighting that SAT scores are a *negative* predictor – meaning that the higher a graduating senior's SAT score at admission, the *lower* their self-reported gains.

Gender, ethnicity, financial aid status and athletic participation all make only marginal improvements to the model. Student major, however, adds small but noticeable predictive power to the model. But what is most striking and perhaps unexpected here is the dramatic improvement in the model's predictive capacity when the six engagement indices are added (see Table 3 for the composition of these factors in terms of specific aptitudes).

Table 6. Incremental increase in explained variance for regression model models for six gains factors

	GAINS FACTORS					
Block	***Social Justice***	***Critical Thinking***	***Leadership***	***Self-Reliance***	***Expressive Skills***	***Scientific Thinking***
Cumulative GPA	0.00	0.01	0.00	0.01	0.01	0.00
SAT Scores	0.04	0.04	0.04	0.04	0.02	0.05
Dean's Ratings	0.04	0.04	0.06	0.05	0.02	0.06
Gender, Ethnicity	0.06	0.05	0.07	0.09	0.05	0.07
Financial Aid Status	0.06	0.06	0.08	0.09	0.06	0.07
Athletic Participation	0.07	0.06	0.08	0.10	0.06	0.07
Student Major	0.15	0.09	0.11	0.12	0.21	0.40
Engagment Indices	0.24	0.22	0.23	0.20	0.25	0.44
Gain in Prediction for Engagement indicators:	***0.10***	***0.12***	***0.12***	***0.08***	***0.04***	***0.05***

Still, this analysis employs the variable "average gain" across all of the 26 items. Given the wide range of abilities assessed, it's quite possible that this analysis conceals meaningful relationships – particularly with academic major – for some of the more specific abilities.

Table 6 represents the incremental increases in R^2 values the same regression model shown in Table 4, but this time with each of the six specific gains factors (see Table 2), in six separate regression equations as the outcome (dependent) variable.

The data look virtually identical across the six gains factors as compared to the overall, "average gains" item up through the first six blocks of variables (through *Athletic Participation*), do a fairly poor job of predicting any one of the six gains factors.

But when the next block of variables – student majors – are entered, there are some significant differences across the six gains factors. Student major matters little to self-reported gains related to Critical Thinking, Leadership, and Self-Reliance, but matters moderately in relation to Social Justice, Expressive Skills, and especially Scientific Thinking outcomes.

Again, however, the indices of engagement matter in all six cases – generally these indices of engagement matter most in the areas where student major matter *least.* Table 7 shows the complete regression analyses for each of the six gains factors.

Table 7. Incremental increase in explained variance for regression model models for six gains factors

Statistically significant relationships are shaded (p < .10)

		SELF-REPORTED GAINS FACTORS											
		Social Justice		Critical Thinking		Science_Math		Leadership		Self-Reliance		Expressiveness	
BLOCK	PREDICTOR VARIABLE	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.
GPA	Cumulative GPA	0.03	0.29	**0.11**	**0.00**	**-0.05**	**0.04**	**0.09**	**0.00**	**0.13**	**0.00**	0.01	0.74
ADMISSIONS	SAT Verbal Score	**-0.10**	**0.00**	**-0.10**	**0.00**	**-0.07**	**0.01**	**-0.11**	**0.00**	**-0.14**	**0.00**	**-0.08**	**0.01**
	SAT Math Score	-0.03	0.23	**-0.05**	**0.09**	0.03	0.24	-0.03	0.26	-0.01	0.62	-0.04	0.14
	Dean's Academic Rating	-0.02	0.50	0.04	0.25	-0.03	0.39	0.05	0.19	0.04	0.28	-0.03	0.39
	Dean's "Social" Rating	-0.02	0.41	-0.03	0.28	0.01	0.51	**-0.06**	**0.02**	-0.03	0.22	-0.01	0.83
DEMOGRAPHIC	Female (reference: male)	**0.08**	**0.00**	0.04	0.14	-0.04	0.12	**0.08**	**0.01**	**0.14**	**0.00**	**0.08**	**0.00**
	Legacy (reference: non-legacy)	0.00	0.91	0.00	0.94	-0.01	0.66	-0.01	0.75	-0.02	0.31	0.00	1.00
	African-American	-0.04	0.14	0.01	0.66	-0.02	0.28	-0.02	0.41	-0.01	0.61	**-0.06**	**0.02**
	Latino	-0.02	0.43	0.00	0.96	-0.01	0.62	-0.03	0.20	-0.03	0.16	-0.01	0.60
	Native American	-0.01	0.64	**-0.05**	**0.04**	-0.03	0.13	-0.02	0.34	**-0.05**	**0.04**	0.02	0.38
	Asian-American	-0.02	0.46	0.02	0.54	-0.03	0.18	-0.01	0.71	0.02	0.38	0.02	0.34
	International	0.02	0.53	0.01	0.66	-0.02	0.34	0.00	0.88	-0.01	0.82	-0.02	0.59
	Enrolled Early Decision	**0.06**	**0.02**	**0.06**	**0.01**	-0.02	0.25	**0.07**	**0.00**	**0.10**	**0.00**	-0.02	0.43
FINANCIAL AID STATUS	Applied for aid; no aid received	0.03	0.25	**0.07**	**0.00**	0.00	0.96	**0.04**	**0.09**	**0.04**	**0.08**	0.01	0.57
	Aided 0-20% Expenses	-0.01	0.64	0.00	0.94	**0.04**	**0.06**	-0.01	0.65	0.00	0.91	0.01	0.83
	Aided 20-40% Expenses	-0.01	0.66	-0.02	0.34	0.00	0.90	0.01	0.64	-0.02	0.42	-0.03	0.23
	Aided 40-60% Expenses	0.03	0.14	0.03	0.17	0.02	0.25	0.01	0.69	-0.01	0.71	0.01	0.64
	Aided 60-80% Expenses	-0.01	0.65	-0.02	0.54	0.02	0.43	0.00	0.93	**-0.04**	**0.09**	0.01	0.59
	Aided 80-100% Expenses	-0.01	0.77	-0.03	0.32	0.04	0.15	0.01	0.86	-0.03	0.27	0.02	0.59
ATHLETE	Intramural athlete	-0.01	0.65	-0.01	0.67	-0.01	0.77	-0.03	0.15	0.01	0.64	-0.01	0.54
	Intercollegiate athlete	-0.03	0.25	0.00	0.89	0.02	0.41	**0.08**	**0.00**	0.04	0.15	-0.04	0.16
MAJOR	Administrative Science	-0.01	0.78	0.00	0.90	0.01	0.62	0.03	0.33	0.01	0.87	0.03	0.32
	American Studies	0.06	0.32	0.03	0.66	**-0.08**	**0.09**	0.06	0.34	-0.02	0.73	0.00	0.97
	Anthropology	0.09	0.15	0.04	0.53	**-0.09**	**0.09**	0.01	0.87	-0.10	0.13	0.05	0.41
	Art	-0.02	0.77	0.04	0.63	-0.09	0.14	0.04	0.62	-0.06	0.46	**0.20**	**0.01**
	Biology	-0.17	0.14	-0.03	0.81	**0.26**	**0.01**	0.03	0.83	-0.19	0.11	0.01	0.90
	Chemistry	-0.08	0.22	0.02	0.77	**0.20**	**0.00**	0.03	0.62	-0.09	0.20	-0.02	0.80
	Classics	-0.04	0.40	-0.01	0.77	-0.04	0.27	0.01	0.88	-0.03	0.48	**0.11**	**0.01**
	Computer Science	**-0.10**	**0.04**	-0.01	0.78	0.05	0.23	0.02	0.65	**-0.10**	**0.06**	0.02	0.69
	East Asian Studies	-0.01	0.74	**-0.06**	**0.10**	**-0.06**	**0.04**	-0.03	0.37	-0.06	0.12	**0.08**	**0.02**
	Economics	-0.10	0.29	0.09	0.39	0.05	0.58	0.12	0.22	-0.06	0.56	-0.01	0.91
	English	-0.09	0.45	0.03	0.77	**-0.22**	**0.02**	0.03	0.77	-0.16	0.17	**0.19**	**0.08**
	French & Italian	-0.01	0.86	0.01	0.78	-0.02	0.51	0.02	0.65	-0.02	0.65	**0.14**	**0.00**
	Geology	-0.06	0.16	0.03	0.51	**0.11**	**0.01**	0.01	0.75	-0.03	0.49	-0.02	0.65
	German & Russian	0.00	0.93	-0.02	0.64	-0.02	0.39	-0.01	0.82	**-0.07**	**0.04**	**0.10**	**0.00**
	Government	-0.05	0.60	0.02	0.87	-0.07	0.42	0.04	0.66	-0.14	0.17	0.04	0.69
	History	0.03	0.77	0.08	0.35	-0.07	0.33	0.07	0.45	-0.07	0.45	0.06	0.47
	Mathematics	-0.08	0.21	0.05	0.46	**0.11**	**0.05**	0.05	0.41	-0.06	0.38	0.08	0.21
	Music	-0.04	0.33	0.03	0.43	-0.01	0.70	0.02	0.56	-0.03	0.54	**0.11**	**0.01**
	Philosophy	-0.01	0.87	0.00	0.94	-0.06	0.24	0.02	0.77	-0.05	0.36	0.02	0.78
	Physics	-0.08	0.12	0.00	1.00	**0.09**	**0.03**	0.02	0.73	-0.06	0.27	0.00	0.95
	Psychology	-0.06	0.44	-0.05	0.57	0.00	0.95	-0.03	0.72	-0.12	0.16	0.00	0.99
	Religious Studies	0.05	0.21	0.03	0.41	**-0.05**	**0.09**	0.01	0.85	-0.03	0.50	0.02	0.50
	Sociology	0.06	0.32	0.03	0.58	-0.05	0.38	0.04	0.52	-0.07	0.25	0.02	0.74
	Spanish	-0.03	0.58	0.01	0.83	-0.04	0.36	0.01	0.85	-0.05	0.33	**0.15**	**0.00**
	Theater	-0.03	0.38	0.04	0.31	-0.04	0.16	**0.06**	**0.07**	-0.01	0.72	0.02	0.59
	Education	0.03	0.45	-0.02	0.68	-0.05	0.20	0.00	0.93	-0.05	0.25	0.02	0.63
	Environmental Studies	-0.05	0.39	-0.01	0.91	0.07	0.16	0.01	0.86	-0.10	0.12	-0.01	0.81
	Independent Major	-0.01	0.87	0.01	0.77	0.01	0.72	0.03	0.47	-0.04	0.35	0.04	0.42
	International Studies	0.00	0.99	0.03	0.73	-0.09	0.19	0.05	0.53	-0.10	0.26	**0.20**	**0.01**
	Latin American Studies	0.02	0.62	0.02	0.58	-0.03	0.37	0.02	0.64	-0.03	0.38	**0.09**	**0.01**
	Women's / Gender / Sex Studies	0.01	0.68	0.00	0.91	**-0.05**	**0.03**	-0.01	0.73	-0.01	0.79	0.01	0.77
ENGAGEMENT	Academic Engagement: Within Class	**0.07**	**0.00**	**0.23**	**0.00**	**0.16**	**0.00**	**0.14**	**0.00**	**0.17**	**0.00**	**0.06**	**0.01**
	Recreational Computing	-0.01	0.64	-0.02	0.37	-0.01	0.75	0.01	0.76	0.01	0.65	-0.03	0.28
	Academic Engagement: Beyond Class	**0.27**	**0.00**	**0.22**	**0.00**	**0.05**	**0.02**	**0.10**	**0.00**	**0.18**	**0.00**	**0.15**	**0.00**
	Teamwork & Communication	**0.10**	**0.00**	**0.18**	**0.00**	**0.15**	**0.00**	**0.29**	**0.00**	**0.16**	**0.00**	**0.08**	**0.00**
	Partying and Athletics	0.01	0.74	**0.05**	**0.05**	-0.02	0.41	**0.07**	**0.01**	**0.07**	**0.00**	-0.03	0.25
	Social Justice	**0.14**	**0.00**	**0.09**	**0.00**	**0.09**	**0.00**	**0.16**	**0.00**	0.04	0.13	**0.12**	**0.00**

A "strong" test of the predictive power of the engagement indicators

It is worth noting that most of the variables in the regression model are measured surreptitiously or, better, really just categories of students. The only attitudinal items in the regression model are the learning outcomes themselves and the indicators of "engagement". It is possible that there is some uniform response bias in the survey itself that may underpin the apparent predictive power of the engagement indicators in the prediction of gains. Perhaps students simply are bored with the survey and simply check "agree" to everything. Or perhaps they have a general sense of favorability or negativity about their experience that pervades all their responses, and this is what produces the apparent correspondence between engagement and learning gains, rather than any purported causal or *"if…then"* relationship between engagement and learning.

We may with some confidence rule out the first possibility, that students merely "agree" with every item. Average intensities of agreement vary considerably across the specific learning gains, for one thing (as shown in an earlier report, *Methodology and Interpretive Context)* on trends and peer differences in student outcomes. Also, the clear and interpretable factor analyses shown in Table 2 and 3 strongly support the view that students' responses actually reflect their own *disparate* strengths and weaknesses across the various dimensions of gains and of engagement.

This latter point also clearly suggests that, while there may be an underlying favorability or negativity bias that influences responses to all the items in a favorable or negative direction,[1] it is equally clear that student responses are sensitive to the question being asked. Individual students vary dramatically in the extent to which they report gains or satisfaction across various areas of their experience.

That said, a "strong" test of the ability of the engagement indicators to predict learning gains would involve entering some other key items from the survey *ahead of* the engagement indicators in the regression model. Ideally these key items would comprehensively assess student "mood" or generalized sense of favorability toward Colby. If the engagement indicators fail to explain any additional proportion of the variation in the learning gains scores in the presence of these "mood" or "general satisfaction" indicators, then that would weaken the argument that engagement is a strong predictor of outcomes.

Table 8. Correlation between "overall mood" items, engagement, and learning outcomes

Relive experience and overall satisfaction items are scored on five and four point scales, with higher values indicating strong agreement or higher satisfaction, respectively

Engagement Indicators	**Relive College Experience at Same Institution**	**Overall Satisfaction With Education**
Academic Engagement: Beyond Class	**0.14**	**0.16**
Academic Engagement: Within Class	**0.13**	**0.18**
Recreational Computing	0.00	-0.03
Teamwork & Communication	**0.12**	**0.10**
Partying and Athletics	**0.09**	**0.07**
Social Justice	**0.05**	**0.06**
Self-Reported Learning Gains		
Critical Thinking	**0.36**	**0.43**
Expressive Skills	**0.20**	**0.24**
Leadership	**0.31**	**0.31**
Scientific Thinking	**0.20**	**0.23**
Self-Reliance	**0.39**	**0.39**
Social Justice	**0.25**	**0.29**

This test is, *a priori,* particularly hostile to the hypothesis that engagement leads to gains in that the generalized mood or sense of favorability *also* is likely related to the engagement indicators. In regression analysis, such a situation makes it harder to either indicator to "claim" predictive power.

Table 8 shows the extent to which the two best "generalized satisfaction" indicators are related to engagement and learning gains. The two items are moderately, positively related to learning gains, and weakly, positively related to engagement. These correlations make the regression model including these items a strong test of whether engagement uniquely predicts gains.

[1] This author in fact does believe that these data do exhibit such a generalized pattern of response. The consistency of the peer differences and of the trends – almost all negative – suggest that there is some generalized "sense of experience" that students bring to their evaluations of all the specific elements assessed on the survey. As to whether this response patterning is evidence of a flawed instrument or research methodology, or rather of a "real" effect of student mood or emotional state influencing how they view Colby is a matter that cannot be answered directly with existing research. For what it is worth, this author is inclined to the view that students' "sense of belonging" and "overall satisfaction" with Colby, and vice versa, *does* in fact influence students' *actual* perceptions of the college, not merely which box they check on a survey instrument.

Table 9 essentially repeats the analyses conducted to produce re-estimates of the additional or incremental or "unique" predictive power of the engagement indices while controlling for the general satisfaction indicators in the model.

Table 9. Incremental increase in explained variance for regression model models for six gains factors, including "general satisfaction" variables

	GAINS FACTORS						
Variable Block	*Average Gain*	*Social Justice*	*Critical Thinking*	*Leadership*	*Self-Reliance*	*Expressive Skills*	*Scientific Thinking*
General Satisfaction	0.22	0.08	0.18	0.11	0.18	0.05	0.04
Cumulative GPA	0.22	0.08	0.18	0.11	0.18	0.05	0.04
SAT Scores	0.25	0.11	0.21	0.15	0.21	0.07	0.08
Dean's Ratings	0.26	0.11	0.21	0.17	0.22	0.07	0.11
Gender, Ethnicity	0.27	0.13	0.21	0.17	0.24	0.09	0.11
Financial Aid Status	0.27	0.13	0.22	0.17	0.24	0.10	0.12
Athletic Participation	0.27	0.13	0.22	0.18	0.24	0.10	0.12
Student Major	0.29	0.23	0.25	0.20	0.26	0.25	0.42
Engagment Indices	0.38	0.29	0.31	0.29	0.30	0.28	0.46
Gain in Prediction for Engagement indicators	***0.09***	***0.06***	***0.07***	***0.09***	***0.04***	***0.03***	***0.04***
Gain in Prediction for Engagement indicators from Table 6 (no general satisfaction variables)	***0.16***	***0.10***	***0.12***	***0.12***	***0.08***	***0.04***	***0.05***

The first fact to note here is the high degree of variability in the extent to which "general satisfaction" predicts the six learning outcomes. The highest relationship is in fact for the "average gains" item, which would lend credence to the theory that "general mood" does impact perceived self-reported gains.

But this patterning in the average gain statistic is diminished substantially when one considers gains in specific areas. Self-reported gains in Critical Thinking and Self-Reliance seem particularly sensitive to the generalized "mood" about Colby. Gains in areas related to Leadership and Social Justice are only weakly influenced by this generalized mood about the Colby experience, while Expressive Skills and Scientific Thinking skills are barely influenced at all.

But how does the introduction of the general satisfaction indicators into the model influence the unique relationship between engagement and gains? The short answer is: "slightly". That said, for the reasons noted above, this was a very strong test of that hypothesis, a deliberate attempt to falsify it. The finding that engagement is a uniquely strong predictor of gains is a robust one.

Table 10 shows the complete regression models for the six gains areas, including the generalized satisfaction variables.

Table 10. Incremental increase in explained variance for regression model models for six gains factors, including "general satisfaction" variables as controls

Statistically significant relationships are shaded (p < .10)

		SELF-REPORTED GAINS FACTORS											
		Social Justice		Critical Thinking		Science_Math		Leadership		Self-Reliance		Expressiveness	
BLOCK	PREDICTOR VARIABLE	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.
GENERAL SATISFACTION	Relive College at Same Institution	**0.10**	**0.00**	**0.16**	**0.00**	**0.07**	**0.00**	**0.16**	**0.00**	**0.23**	**0.00**	**0.09**	**0.00**
	Overall Satisfaction With Education	**0.17**	**0.00**	**0.23**	**0.00**	**0.09**	**0.00**	**0.12**	**0.00**	**0.16**	**0.00**	**0.13**	**0.00**
GPA	Cumulative GPA	0.00	0.90	**0.07**	**0.01**	**-0.07**	**0.00**	**0.07**	**0.01**	**0.10**	**0.00**	-0.01	0.62
ADMISSIONS	SAT Verbal Score	**-0.08**	**0.00**	**-0.07**	**0.02**	**-0.06**	**0.03**	**-0.09**	**0.00**	**-0.12**	**0.00**	**-0.06**	**0.04**
	SAT Math Score	**-0.05**	**0.10**	**-0.07**	**0.02**	0.02	0.43	-0.05	0.10	-0.03	0.30	**-0.05**	**0.06**
	Dean's Academic Rating	-0.02	0.45	0.04	0.28	-0.03	0.32	0.04	0.20	0.04	0.27	-0.03	0.32
	Dean's "Social" Rating	-0.02	0.52	-0.03	0.29	0.02	0.43	**-0.06**	**0.02**	-0.03	0.21	0.00	1.00
DEMOGRAPHIC	Female (reference: male)	**0.06**	**0.01**	0.01	0.82	**-0.05**	**0.03**	**0.05**	**0.07**	**0.10**	**0.00**	**0.06**	**0.01**
	Legacy (reference: non-legacy)	0.00	0.86	-0.01	0.64	-0.01	0.59	-0.02	0.48	-0.03	0.14	-0.01	0.63
	African-American	-0.03	0.24	0.03	0.29	-0.02	0.41	-0.01	0.73	0.01	0.83	**-0.05**	**0.04**
	Latino	-0.01	0.60	0.01	0.62	-0.01	0.75	-0.02	0.32	-0.02	0.32	-0.01	0.77
	Native American	-0.01	0.70	**-0.04**	**0.04**	-0.03	0.14	-0.02	0.37	**-0.05**	**0.04**	0.02	0.33
	Asian-American	-0.01	0.66	0.03	0.24	-0.03	0.17	0.00	0.99	0.03	0.15	0.02	0.34
	International	0.04	0.15	**0.05**	**0.09**	-0.01	0.74	0.03	0.31	0.03	0.35	0.00	0.90
	Enrolled Early Decision	**0.05**	**0.04**	**0.05**	**0.03**	-0.03	0.14	**0.06**	**0.01**	**0.08**	**0.00**	-0.03	0.25
FINANCIAL AID STATUS	Applied for aid; no aid received	0.02	0.45	**0.05**	**0.02**	0.00	0.82	0.03	0.19	0.03	0.24	0.00	0.86
	Aided 0-20% Expenses	-0.02	0.49	-0.01	0.68	**0.04**	**0.08**	-0.02	0.46	-0.01	0.79	0.00	0.90
	Aided 20-40% Expenses	0.00	0.86	-0.02	0.50	0.01	0.74	0.02	0.49	-0.01	0.57	-0.02	0.34
	Aided 40-60% Expenses	0.03	0.21	0.02	0.39	0.02	0.29	0.00	1.00	-0.02	0.46	0.01	0.76
	Aided 60-80% Expenses	-0.01	0.59	-0.02	0.41	0.02	0.44	0.00	0.96	**-0.05**	**0.05**	0.01	0.58
	Aided 80-100% Expenses	-0.01	0.70	-0.04	0.17	0.03	0.18	0.00	0.96	-0.05	0.11	0.01	0.70
ATHLETE	Intramural athlete	-0.02	0.34	-0.03	0.23	-0.01	0.47	**-0.05**	**0.03**	-0.01	0.72	-0.02	0.30
	Intercollegiate athlete	-0.03	0.20	-0.01	0.76	0.02	0.38	**0.07**	**0.00**	0.03	0.20	-0.04	0.11
MAJOR	Administrative Science	-0.01	0.77	0.00	0.88	0.01	0.61	0.03	0.27	0.01	0.75	0.03	0.31
	American Studies	0.06	0.33	0.02	0.69	**-0.09**	**0.08**	0.06	0.32	-0.02	0.73	0.00	1.00
	Anthropology	**0.10**	**0.08**	0.05	0.36	-0.08	0.10	0.02	0.70	-0.07	0.24	0.06	0.31
	Art	-0.03	0.66	0.02	0.75	-0.09	0.13	0.03	0.64	-0.06	0.42	**0.19**	**0.01**
	Biology	-0.18	0.11	-0.04	0.70	**0.25**	**0.01**	0.02	0.82	**-0.19**	**0.09**	0.00	0.97
	Chemistry	-0.10	0.15	0.01	0.93	**0.19**	**0.00**	0.03	0.67	-0.10	0.14	-0.03	0.71
	Classics	-0.03	0.47	0.00	0.93	-0.04	0.30	0.02	0.71	-0.02	0.65	**0.12**	**0.01**
	Computer Science	**-0.10**	**0.03**	-0.02	0.71	0.05	0.23	0.02	0.63	**-0.10**	**0.05**	0.02	0.70
	East Asian Studies	-0.01	0.88	-0.05	0.14	**-0.06**	**0.05**	-0.02	0.53	-0.04	0.21	**0.09**	**0.01**
	Economics	-0.13	0.18	0.05	0.56	0.03	0.69	0.11	0.27	-0.08	0.41	-0.03	0.76
	English	-0.09	0.39	0.03	0.81	**-0.22**	**0.02**	0.04	0.73	-0.15	0.15	**0.18**	**0.09**
	French & Italian	-0.02	0.69	0.00	0.99	-0.03	0.43	0.01	0.72	-0.02	0.55	**0.13**	**0.00**
	Geology	**-0.07**	**0.10**	0.02	0.69	**0.10**	**0.01**	0.01	0.84	-0.04	0.36	-0.03	0.52
	German & Russian	0.01	0.83	-0.01	0.76	-0.02	0.43	0.00	0.99	**-0.06**	**0.06**	**0.11**	**0.00**
	Government	-0.07	0.47	-0.01	0.93	-0.08	0.34	0.03	0.74	-0.15	0.11	0.02	0.80
	History	0.01	0.88	0.06	0.44	-0.08	0.26	0.06	0.49	-0.08	0.37	0.05	0.54
	Mathematics	-0.09	0.16	0.04	0.52	**0.11**	**0.06**	0.05	0.40	-0.06	0.35	0.08	0.23
	Music	-0.05	0.19	0.02	0.68	-0.02	0.55	0.01	0.74	-0.04	0.30	**0.10**	**0.01**
	Philosophy	-0.01	0.87	0.01	0.91	-0.06	0.23	0.02	0.67	-0.04	0.42	0.02	0.77
	Physics	**-0.09**	**0.08**	-0.01	0.82	**0.09**	**0.04**	0.01	0.79	-0.06	0.19	0.00	0.94
	Psychology	-0.06	0.47	-0.03	0.66	0.01	0.92	-0.01	0.87	-0.09	0.25	0.00	0.96
	Religious Studies	0.05	0.15	0.04	0.26	-0.05	0.11	0.02	0.67	-0.01	0.69	0.03	0.42
	Sociology	0.07	0.22	0.05	0.36	-0.04	0.44	0.06	0.34	-0.05	0.41	0.03	0.62
	Spanish	-0.03	0.50	0.00	0.92	-0.04	0.32	0.01	0.88	-0.05	0.28	**0.14**	**0.00**
	Theater	-0.03	0.36	0.04	0.28	-0.04	0.16	**0.07**	**0.05**	-0.01	0.78	0.02	0.59
	Education	0.02	0.54	-0.03	0.50	-0.05	0.16	0.00	0.96	-0.06	0.17	0.01	0.71
	Environmental Studies	-0.06	0.28	-0.02	0.73	0.07	0.19	0.00	0.93	**-0.10**	**0.08**	-0.02	0.69
	Independent Major	-0.01	0.79	0.01	0.84	0.01	0.76	0.03	0.44	-0.04	0.34	0.03	0.45
	International Studies	-0.01	0.86	0.01	0.90	-0.10	0.14	0.04	0.59	-0.10	0.19	**0.19**	**0.02**
	Latin American Studies	0.02	0.57	0.03	0.48	-0.03	0.39	0.02	0.54	-0.03	0.48	**0.10**	**0.01**
	Women's / Gender / Sex Studies	0.02	0.56	0.00	0.89	**-0.05**	**0.04**	0.00	0.95	0.00	0.89	0.01	0.67
ENGAGEMENT	Academic Engagement: Within Class	**0.04**	**0.07**	**0.19**	**0.00**	**0.15**	**0.00**	**0.11**	**0.00**	**0.13**	**0.00**	0.04	0.10
	Recreational Computing	-0.02	0.40	-0.03	0.19	-0.01	0.53	0.00	0.97	0.00	0.85	-0.03	0.16
	Academic Engagement: Beyond Class	**0.23**	**0.00**	**0.16**	**0.00**	0.03	0.21	**0.06**	**0.01**	**0.13**	**0.00**	**0.12**	**0.00**
	Teamwork & Communication	**0.07**	**0.00**	**0.14**	**0.00**	**0.13**	**0.00**	**0.26**	**0.00**	**0.12**	**0.00**	**0.06**	**0.02**
	Partying and Athletics	-0.01	0.55	0.02	0.46	-0.03	0.18	**0.05**	**0.05**	0.04	0.11	**-0.04**	**0.07**
	Social Justice	**0.13**	**0.00**	**0.08**	**0.00**	**0.08**	**0.00**	**0.15**	**0.00**	0.02	0.41	**0.11**	**0.00**

Key Conclusions

In 75 words or less:

Grades, test scores, demographic background, chosen major are all inputs to the learning environment – and they *are* connected to one's sense of making significant academic gains while in that environment. But more than this, not surprisingly, what matters is *engagement* with Colby. These data are unambiguous on this point: a renewed commitment to *engaging* students – in the broadest possible sense of the term – with their academic program, will improve self-reported learning outcomes.

And in the traditional bullet points:

1. If you want to improve the self-reported learning outcomes from the HEDS Senior Survey, your best bet would be to deepen *engagement* with the academic program, as measured by the *Academic Engagement* indicators in Table 3. In particular, the two narrowly *academic* factors are most important, but of these, *Academic Engagement: Beyond the Classroom* factor is most important.

2. Cumulative GPA is a very weak predictor of any of the self-reported learning gains. Indeed, it is *negatively* related to Science / Math gains. This finding argues *against* a view that equates grades with (perceived) amount learned. In other words, students that perceive themselves to have made large gains are about as likely to have a low GPA as a high one.

3. SAT score, specifically SAT-Verbal score, is a *negative* predictor of self-reported gains. In combination with conclusion #2 above, this *may* suggest that Colby's highest aptitude students are not reaching their full potential. Either they are not pushed to do so, or they are making curricular choices that are insufficiently challenging, or some combination of these.

4. It is clear that strong self-reported learning gains are not merely the results of high grade point averages, of some generalized sense of belonging to Colby, or of satisfaction with social life. Rather, they are the result of concrete experiences of *engagement* with the course material, both within and outside the class room.