

**TH!NK** Higher-order Skills  
in **Critical** and **Creative** Thinking



# TH!NK Annual Report | 2015

Submitted by Dr. Sue Carson, Director  
<http://qep.ncsu.edu>

## Overview

The focus of the NC State Quality Enhancement Plan, TH!NK, is to improve students' higher-order thinking competencies, including critical evaluation, creative thinking, and reflection on their own thinking. The incorporation of an explicit common language of intellectual standards in courses across disciplines, combined with discipline-specific activities that emphasize the critical and creative thinking process throughout each TH!NK course will carry us toward this goal.

The TH!NK initiative addresses several of the **NC State strategic plan goals**. First and foremost, we aim to enhance the success of our students through the educational innovation and high-impact teaching strategies. The initiative enhances scholarship by investing in faculty through focused faculty development and the creation of a vibrant learning community. Because the TH!NK initiative is being implemented across disciplines, the learning community will bring faculty together, increasing the potential for interdisciplinary collaboration.

## Impact Summary

### Faculty and Student Engagement

- Fall 2014 implementation – 15 TH!NK Faculty
  - 371 students directly impacted in TH!NK courses (302 first-year students)
- 93% of TH!NK Faculty reported participation impacting their other courses
  - Many additional students indirectly impacted
- Implementation team facilitated numerous workshops in the OFD over the Fall and Spring semesters, impacting many additional faculty and students outside of the QEP
  - Many additional students impacted
- Fall 2015 implementation – over 40 TH!NK Faculty (inclusive of Cohorts 1 and 2)

### Student Learning Outcomes

- Students are learning the intellectual standards in classes.
- Based on self-reported data, students are making gains in using intellectual standards in evaluating their thinking and making decisions. This is one indication of becoming more metacognitive.
- Students met or exceeded the pre-determined expectations on activities that were scored with the common rubric.
- We see pockets of increased skills in the CAT data; it does not seem to be dependent on size of course enrollment or discipline-related clusters.
  - In courses that had significant, large impact gains in CAT overall, there were significant gains in 1-3 items. Those instructors indicated emphasizing a few specific skills over and over with feedback loops.
- None of the assessment tools paint the whole picture. We need to consider CAT, rubric, and self-reflection.

## Personnel

The core members of the implementation team are listed below (Table 1).

Name	Role in QEP	Faculty Appointment
Sue Carson, PhD	QEP Director	Assoc. Professor, Plant & Microbial Biology
Deb Moore	Asst. Director of Assessment	N/A
Yvette Thompson	Admin. Support Specialist	N/A
Maxine Atkinson, PhD	Faculty Fellow	Professor, Sociology
Anne Auten	Faculty Fellow	Lecturer, English
*Anita Vila-Parrish, PhD	Faculty Fellow	Teaching Assistant Professor, Industrial & Systems Engineering
*Sara Glee Queen	Faculty Fellow	Assistant Professor, Architecture
Diane Chapman, PhD	OFD Director, Assessment of Faculty Development	Teaching Associate Professor of Leadership Policy & Adult & Higher Education

*Table 1: Implementation Team*

\*Anita Vila-Parrish and Sara Glee Queen were recruited this year and began participation in January 2015 because Santiago Piedrefita left the university and Jason Flores was unable to continue participation as a Fellow.

The first cohort of TH!NK Faculty began implementation in their courses Fall 2014 and will continue in Fall 2015. Cohort 1 TH!NK Faculty and their courses are listed in Table 2.

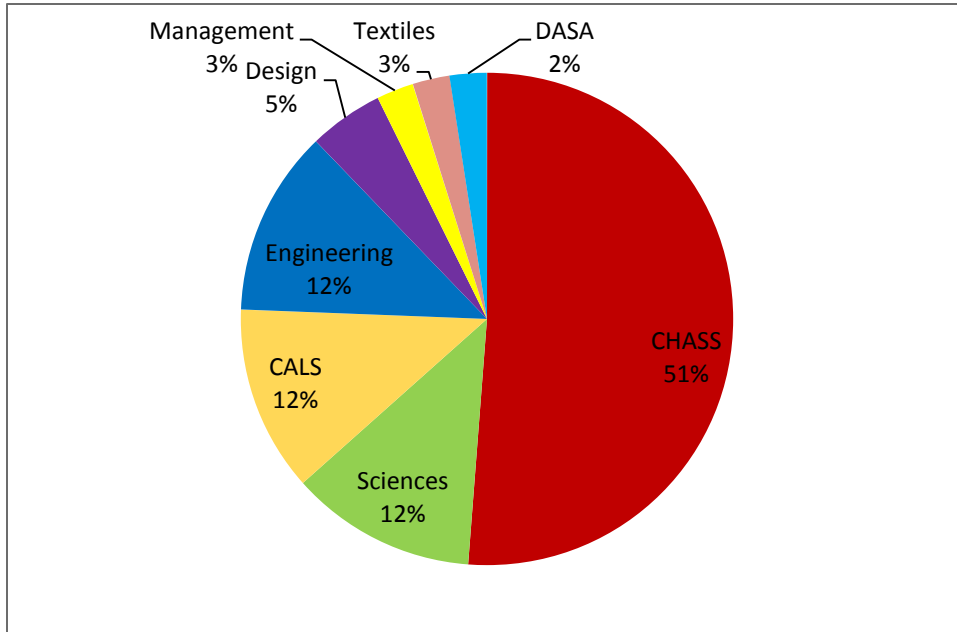
Last	First	Course #	Course Name
Auten	Anne	ENG 101	Academic Writing and Research
Bottomley	Laura	E 101	Intro to Engineering and Problem Solving
Brown	Deb	MIE 201	Intro to Business Processes
Cochran	Stacey	ENG 101	Academic Writing and Research
Cornett	Sheryl	ENG 101	Academic Writing and Research
Darling	Judith	ENG 101	Academic Writing and Research
Hall	Megan	ENG 100	Reading and Writing Rhetorically (formerly ENG 101) Introduction to Academic Writing)
Hayes	Holly	ENG 101	Academic Writing and Research
Lewald	Carol Ann	WGS 200	Intro to women and gender studies
Mainland	Catherine	ENG 220	Gt Works of Western Lit
Murray	D. Seth	IS 200	Intro to International studies
Nelson	Elizabeth	COM 110	Public Speaking
Parks	Lisa	LSC 101	Critical Thinking in Life Sciences
Patterson	Bob	STS 323	World population and food prospects
Severin	Laura	ENG 251	Major British Writers

*Table 2: Cohort 1 TH!NK Faculty*

TH!NK Cohort 2 Faculty were recruited and participated in the TH!NK workshop May 11-15, 2015. They will begin TH!NK integration into their courses Fall 2015 and 2016. Cohort 2 TH!NK Faculty and their courses are listed in Table 3.

Last	First	Course #	Course Name
Acker	Debbie	SLC 250	Critical and Creative Decision Making Models
Allen	Tania	D 100	Design Thinking
Ashwell	Chris	PO 295	Poultry and People: How the chicken conquered the world
Atkinson	Maxine	SOC 202	Principles of Sociology
Ballard	Tameshia	E 101	Intro to Engineering
Battestilli	Lina	CSC 113	Introduction to Computing - MATLAB
Clayton	Jacob	ENG 101	Academic Writing and Research
Crane-Seeber	Jesse	HSS 120	Intro to Humanities & Social Sciences
DeSoucey	Michaela	SOC 202	Introduction to Sociology
Ferzli	Miriam	BIO 181	Introductory Biology: Ecology, Evolution and Biodiversity
Ford	Ericka	TMS 211	Intro to Fiber Science
Fyfe	Paul	HON 296	Interpretive Machines
*Gonzalez	Julia	ENG 332	Communication for Business and finance
Graves	Alex	USC 110D	Freshman Advancement Seminar
Kuo	Kenny	LSC 101	Critical and Creative Thinking in the Life Sciences
Lupton	Daniel	ENG 101	Academic Writing and Research
McGill	Alicia	HI 298	Special Topics in History
Nelson	Zak	ENG 101	Academic Writing and Research
Neyhart	Greg	CH 101	Chemistry - A Molecular Science
Petrovich	Lori	CH 101	Chemistry - A Molecular Science
Petters	Bob	MUS 180	Intro to Musical Experiences
Queen	Sara	D 104	First Year Studio I
Queen	Hailey	E 101	Intro to Engineering & Problem Solving
* Rabah	Ghada	CH 454	Advanced Measurement Techniques II
Schmidt	Jessica Young	CSC 116	Intro to Computing - Java
Simon	Maggie	ENG 261	English Literature I
Mickle	James	BIO 181	Introductory Biology: Ecology, Evolution and Biodiversity

Table 3: Cohort 2 TH!NK Faculty. \*recruited to teach first-year course but had teaching assignment changes just before the workshop began.



THINK Faculty (Cohorts 1 and 2) by college is displayed in Figure 1. Not surprisingly, the College of Humanities and Social Sciences is highly represented due to the focus on ENG 101 and FYI courses in Phase 1 of the QEP. I would like to achieve a wider distribution across colleges in future years.

Figure 1. THINK Faculty percentages by college.

## THINK –related Publications and Conference Proceedings

### Publications

Carson, S. Targeting critical thinking skills in a first-year undergraduate research course. Submitted to *JMBE*.

### National and international conference proceedings/published abstracts

Carson, S, C Zelna, D Moore. QEP Implementation at a Large Research-Intensive Institution: Transitioning from Design to Execution. SACS-COC General Meeting, December 2014, Nashville, TE.

Carson, S. Cultivating Critical and Creative Thinking in a First-year Undergraduate Research Course. Pre-ISSoTL CUR Symposium, October 2014, Quebec City.

Carson, S. Critical Thinking Scenarios Enhance Higher-order Cognitive Skills in a First-year Undergraduate Course. American Society for Microbiology Conference on Undergraduate Education. May 2015, Austin, TX.

## Faculty Development

Faculty members in Cohort 1 reported a substantial increase in the use of teaching strategies that focus on higher-order thinking. Table 4 shows self-reported use of a number of teaching strategies from a survey issued by the Office of Faculty Development shortly after the Fall 2014 semester. A common theme that emerged in the open-ended responses by Cohort 1 faculty was that they struggled some with the new teaching approaches in the first part of the semester, but became comfortable by the end of the semester. Almost all faculty members indicated that changes to their course had a positive impact on student learning and have a strong plan going into next fall.

Strategy	Use Fall 2014					Prior Use	
	None	1-2	3-4	5+	Mean	Yes	No
Analytical writing	0	0	6	8	3.57	12	2
Case studies	3	4	5	2	2.43	7	7
Concept mapping	4	4	3	3	2.36	4	10
Content analysis	1	1	4	8	3.36	9	5
Critical thinking scenarios	3	4	4	3	2.50	2	12
Data Analysis	3	5	4	2	2.36	8	6
Fundamental & Powerful Concepts	4	1	4	5	2.71	5	9
Data visualizations	2	5	4	3	2.57	6	8
Integrating Intellectual Standards	0	1	3	10	3.64	1	13
Peer review	1	3	7	3	2.86	9	5
Rhetorical analysis	4	0	5	5	2.79	8	6
SEE-I	4	7	2	1	2.00	0	14
Self-reflection/Metacognition	0	3	6	5	3.14	5	9

*Table 4. Faculty self-reported use of various teaching strategies before and after THINK training.*

The faculty development structure was similar this year to last. Again, we held an intensive May workshop, but stretched it from 3 full days to 5 shorter days. Faculty seemed to absorb more from the workshop in this slightly more spread out format.



We made some substantive changes based both on feedback from last year's faculty, as well as the ability to capitalize on the strengths of the new Faculty Fellows. Areas we greatly enhanced were in the realms of data visualization, divergent thinking, and most importantly, the critical and

creative thinking process. Central to the training of the critical and creative thinking process is a new animated video of a scenario that walks the viewer through the process, skills and behaviors of critical and creative thinkers. The animation requires a few changes and will be distributed widely once they are completed. The video draft is available at <https://vimeo.com/127930608>, password: TH!NK. Figure 2 displays a graphic representation of the critical and creative thinking process, integrated with intellectual standards.

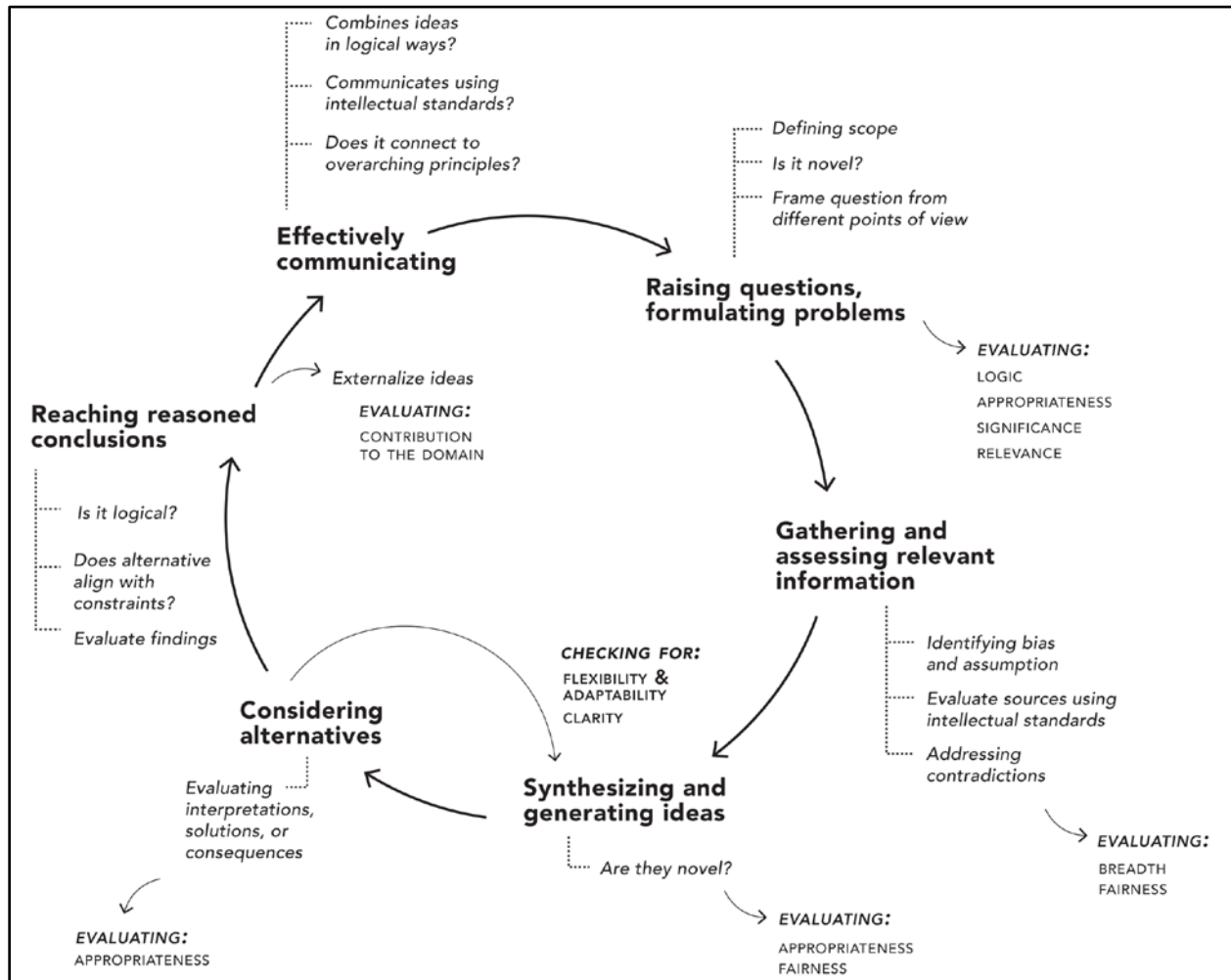


Figure 2. The critical and creative thinking process

## Student Learning Outcomes Assessment

### Outcomes measured by the Critical Thinking Assessment Test

Individual questions on the Critical Thinking Assessment Test (CAT) were mapped to the appropriate student learning outcomes defined in the QEP. Table 5 summarizes the statistically significant impact on student learning defined in the QEP as assessed by CAT. In summary, when mapped to our student learning outcomes, the CAT was able to detect statistically significant differences, in small and moderate effect size ranges, in the first year of implementation compared to baseline.

		Fall 2013 Baseline	Fall 2014 Cohort 1
<b>Outcomes Measured by the Critical Thinking Assessment Test (CAT)</b>		<b>Impact</b>	<b>Impact</b>
SLO-C1A	Raising Questions	Small	
SLO-C1B	Gathering/Assessing Relevant Information		Small
SLO-C1C	Reaching Reasoned Conclusions	Small	Moderate
SLO-C1D	Testing Conclusions Against Standards	Small	Moderate
SLO-C1E	Considering Alternatives/Points of View		
SLO-C1F	Effectively Communicating		
SLO-C2A	Analyzing & Evaluating		
SLO-C2E	Elaborating		
SLO-A	Explains Intellectual Standards		Small
SLO-B1	Uses Intellectual Standards		Small

*Table 5. Student learning outcomes based on pre/post CAT profiles*

### Outcomes measured by the common rubric

The Common Rubric provides information on some outcome skills and behaviors that are not measured by the CAT. It is used to score an end-of-semester assignment. Without this measure, gaps in the THINK student learning outcomes assessment would exist.

Anticipating the need to provide an interpretation of the results of this assessment, a group consisting of the implementation team and some members of the QEP writing team set benchmarks (standards) for first-year students for expected achievement at the end of their THINK course. These expectations were set prior to implementation of the program in fall 2014. Students, on average, met or exceeded expectations in all of the skills and behaviors assessed by the common rubric (Table 6).



Outcomes Measured by the Common Rubric	N	Mean	Std. Deviation	Median	Mode	Standard Expected by THINK Team	Outcome
CR A. Does the student articulate the scope of the issue at hand?	284	2.66	.913	3	3	3	Met
<b>Features expected to reach a standard of 2 are ordered from high to low based on the mean value.</b>							
CR E. Does the student combine ideas in coherent and logical ways?	283	2.75	.840	3	3	2	Above
CR M. How does the student explain ideas to others?	247	2.65	.865	3	3	2	Above
CR B. Does the student evaluate evidence with respect to the issue at hand?	284	2.65	.934	3	2	2	Above
CR G. Does the student generate multiple potential ideas about the issue at hand?	284	2.53	.949	2	2	2	Met
CR H. How does the student make judgments about benefits and drawbacks of various ideas about the issue at hand?	284	2.53	.949	2	2	2	Met
CR C. Does the student identify assumptions and the relevance of evidence to the issue context?	284	2.44	.921	2	2	2	Met
CR I. Does the student predict consequences of an approach to the issue at hand?	249	2.41	.943	2	2	2	Met
CR J. How does the student respond to new information?	249	2.41	.943	2	2	2	Met
CR L. Is the student able to elaborate on overarching ideas or principles that support her/his response to the issue?	265	2.41	.892	2	2	2	Met
CR F. Does the student demonstrate originality?	265	2.30	.992	2	2	2	Met
CR K. Does the student take intellectual or creative risks in the generation and selection of approaches?	282	2.26	.935	2	2	2	Met
CR D. When appropriate, does the student address contradictory evidence or perspectives?	266	2.25	.903	2	2	2	Met

Table 6. Skills and behaviors of critical and creative thinkers assessed by the common rubric

## Student Reflections on THINK

At the end of the Fall 2014 semesters, students received a web survey asking them to reflect on their thinking habits. The survey with the aggregated responses is displayed in Tables 7A and 7B. In summary, on average, students reported *moderate gains* in their metacognitive habits, but still have room to grow (Table 7A). Also promising are responses indicating THINK students are *sometimes* applying these thinking skills and behaviors in multiple settings, suggesting they beginning to internalize them (Table 7B).

**7a. Instructions to Items 1-7:** Please reflect on your thinking behaviors both before the start of the semester and now. Tell us the degree to which you made gains in incorporating these behaviors over the course of the semester. **Scale:** 1=No Gain, 2=Little Gain, 3=Moderate Gain, 4=Great Gain.

Perceived Gains	Fall 2014 (Cohort 1)		
	N	Mean	Standard Deviation
1. Before I begin a project, I define for myself the purpose and scope of the work.	206	2.82	0.80
2. When I gather information, I evaluate it for accuracy, relevance and bias.	212	3.13	0.78
3. In interpreting data or evidence, I check that my conclusions are logical and follow from the evidence.	202	3.08	0.79
4. I ask myself whether I have considered all options when solving a problem or addressing an issue.	212	2.97	0.83
5. I take time to think through the implications and consequences of selecting one alternative over another.	202	3.00	0.81
6. In considering a problem or issue, I question my assumptions.	216	2.90	0.84
7. In considering a problem or issue, I study or consider points of view that conflict with my own.	209	2.98	0.83

**7b. Instruction to Items 1-3:** indicate the frequency with which you apply the behavior. **Scale:** 1=Never, 2=Rarely, 3=Sometimes, 4=Often, 5=Almost Always

Perceived Use of THINK Skills/Behaviors	N	Mean	Standard Deviation
1. In preparing work for my THINK course(s), I use the relevant intellectual standards.	232	3.36	0.92
2. In preparing work for my other courses, I use the relevant intellectual standards.	232	3.11	0.97
3. In making decisions in my everyday life (e.g. major purchases, voting, deciding how to spend my time), I use the relevant intellectual standards.	232	3.13	1.05

*Table 7a and 7b. Student self-reflection of metacognitive gains.*

## Student Reflection Quotes

In addition to the survey questions above, students were also asked the open-ended question “Please describe the single most important assignment, strategy, or other course aspect that made a meaningful difference to your higher-order thinking abilities.” A qualitative analysis of the nearly 300 responses was completed, providing insights into high impact learning experiences across the program (Polson, Moore, Carson, 2015). Select student responses are quoted below.

- “The article reviews encouraged me to critically evaluate another person’s thinking. **I realized the blind trust I gave to authors, and how little I stopped to question their methods and logic.**”
- “Case studies in my life science first year class helped me **to think about real world problems** and think about **many solutions** to that problem.”
- “**Every day** walking into E101 [Engineering 101], I knew I’d be faced with either critical thinking problems, ethical issues to be pondered and discussed, or even tactical hands-on experiences. [Every activity] helped to add **a meaningful difference to my higher order thinking abilities.**”
- “My gender studies papers got me thinking about issues through a new lens and helped me **look at things from other perspectives** [...] which led to an improved higher thinking ability.”
- “All of the essays in English 101 have allowed me to think more clearly and form an opinion about various issues. **I question everything I learn now**, and want to know more about that information.”
- “By using the [intellectual] standards to evaluate [works of] others, I found myself trying to **think according to the standards** in order to eliminate the weak places in my conclusions and arguments.”

## Student and Faculty StoryCorps Project Reflections

Undergraduate student, Seth Harrington and DASA Marketing Director, Justin Hammond produced a video of student and faculty reflections about their experiences in THINK courses: <https://www.youtube.com/watch?v=x3Wrp5l1YqQ&list=UUhC23ggD1x3bkJOnmmXOQoQ>

## Campus Outreach

We have engaged additional faculty outside of the scope of the QEP in pedagogical workshops through the Office of Faculty Development. In this reporting year, we delivered six 90-minute workshops that were open to all faculty and instructional staff in the campus community. These workshops were capped at 16 participants. Workshops included *Introduction to THINK and the intellectual standards* (multiple times), *Creating discipline-specific critical thinking scenarios*, *Metacognition*, and *Critical reading strategies* and *Writing to think*. We plan to increase the variety of offers in the next year.



We also held a half-day workshop with guest-speaker Dr. Keith Sawyer. Approximately 50 faculty and staff members from diverse disciplines and backgrounds participated in the special THINK workshop facilitated by Dr. Keith Sawyer. Dr. Sawyer walked faculty through the creative process and challenged participants with engaging creativity-building activities.

Dr. Sawyer is a professor of education at the University of North Carolina in Chapel Hill. After receiving his computer science degree from MIT in 1982, he began his career designing videogames for Atari. From 1984 to 1990, he was a principal at Kenan Systems Corporation, where he worked as a management consultant on innovation technologies. In 1990, Dr. Sawyer began his doctoral studies in psychology, where he studied creativity with Dr. Mihaly Csikszentmihalyi (author of best-selling books such as *Flow* and *Creativity*). Since receiving his Ph.D. in 1994, he has dedicated his career to research on creativity, collaboration, and learning.

## Changes to the Plan

### Modifications to assessment of student learning outcomes

1. We updated the common rubric. The original version was in great part modified from two AAC&U Value Rubrics (Critical Thinking and Creative Thinking). We reverted to the language used by the AAC&U because we found it to have more clarity and be more universal across disciplines. We also changed the format of the rubric back to a typical matrix design, rather than a multiple choice-like format.
2. We updated the intellectual standards quiz to a multiple choice quiz, rather than fill-in-the-blank. While we do lose something, many faculty members waited until the end of the semester to score these, losing the opportunity for formative feedback. By switching to multiple choice, we can score them rapidly and provide feedback to faculty. The definitions used in the new quiz are based on exemplary student responses from last year's students, rather than the Paul and Elder verbatim definitions.
3. As planned, we will begin sampling courses/students to take the CAT since we cannot test every student as the program grows.
4. We will use a student self-assessment of gains in self-reflection tool that we developed last year, along with an open-ended reflection question to assess student self-reflection. Some items on the common rubric directly measure self-reflection as part of the critical and creative thinking process.

### Modifications in faculty recruitment

The initial plan called for Cohort 2 to be comprised of 12 ENG 101 faculty members, 12 FYI faculty members, and 2-6 additional faculty members who teach courses that serve first-year students. The number of faculty members (as opposed to graduate students) teaching in ENG 101 and FYI was not high enough fill the slots, especially considering that 6 from each program were recruited in Cohort 1. Therefore, I chose to fill the remaining slots with faculty from diverse disciplines who teach courses that primarily serve first-year students. In two cases, faculty assignments were changed by departments after faculty members already began their training commitment. I chose to retain those faculty members because they were already invested and it would have been too late to recruit substitute faculty. In two additional cases, faculty members gave notification after the recruitment period had ended that they will be leaving the university prior to the fall semester.