

# Spring Term 2011: Assessment of the Learning Outcomes

The Washington and Lee University Quality Enhancement Plan:

“Revitalizing the Spring Term”

Report after Second Year of the Revitalized Spring Term

Submitted 5 April 2012

**Overview:** In the second running of the Revitalized Spring Term in the spring of 2011, we offered a total of 114 academic courses, 44 of which were repeat courses from spring 2010 (when we ran 119 courses) and 70 of which were new courses that had been conceived, proposed to the Courses and Degrees committee, and approved over the past 3 years. The four-week format once again proved to be intense, challenging, exhilarating—and at times exhausting for both students and faculty. Once again assessment shows that students and faculty produced some of their best work in the intensive teaching and learning format. Although challenges remain, as we indicate below, nevertheless the progress made on this initiative even in its first two years is substantial and impressive. As in 2010, we see that the Spring Term carries many aspects with it, but our main focus continues to be on **our central learning objective for the Spring Term: *to enhance our students’ critical and creative thinking skills.*** This is at the very heart of our Spring Term mission, and all of our assessment efforts associated with the Spring Term focus on this key issue.

We repeated from 2010 a range of assessment strategies in our efforts to learn about this particular Spring Term and also to begin comparing multiple spring term experiences over time. As before, we seek to assess in some cases the particulars of each given course, and in other cases the overall experience of the Spring Term; some tools target students’ perceptions of and reactions to the Spring Term, some target faculty; some seek a quantitative measure of the Spring Term experience, some a qualitative or affective measure. With each approach, our goal is to see to what extent the Spring Term experience affects students’ abilities in critical and creative thinking. As we state in the Quality Enhancement Plan proposal, “Revitalizing the Spring Term,” “Critical and creative thinking constitutes the essence of the liberal arts educational ideal.” The “Liberal Education and America’s Promise” (LEAP) initiative, sponsored by the Association of American Colleges and Universities, establishes the premise that “critical and creative thinking” is the central “Intellectual and Practical Skill” to be found under the category of “Essential Learning Outcomes” to be derived from the educational efforts of a Liberal Arts institution. Consequently we established the following guiding principle for the Spring Term: “*Every course taught in the spring term will seek to enhance our students’ critical and/or creative thinking skills.*” The following assessment strategies were all developed with this aim in mind.

## Main methods of assessment

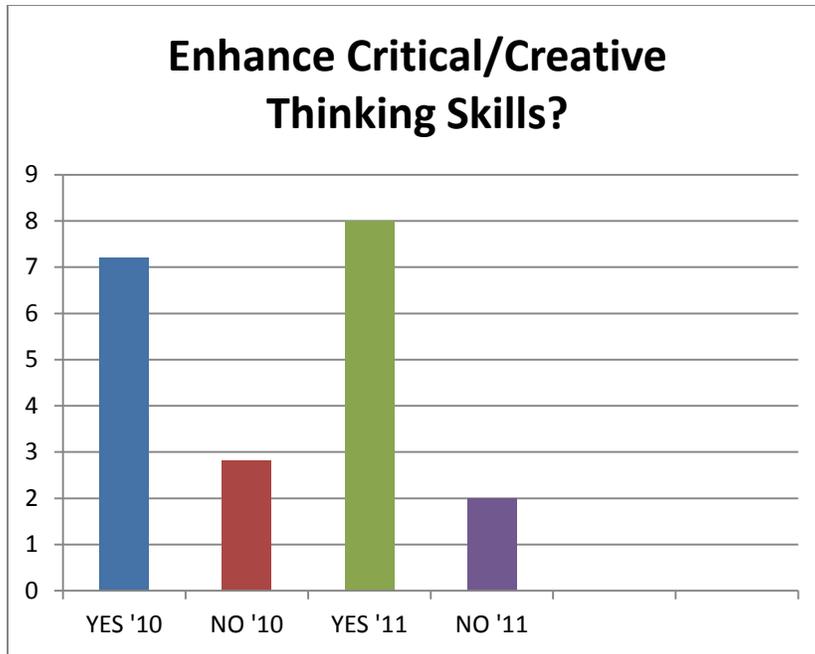
**I. The Student experience survey:** We repeated the 28-question student experience survey from 2010, administering this to all students enrolled in a Spring Term course near the end of the term. 622 students replied to the survey (total enrollment in the Spring Term = 1,525), for a 40.8% response rate—certainly a statistically significant response. The questions focused on the student learning experience, particularly the teaching methods employed in their classes, the kinds of work

and assignments given, the extent of student engagement in the course, and how well the course enhanced their critical and/or creative thinking abilities. Once again the overall portrait of the student experience shows an impressive success in the academic aims of the Spring Term.

- **What sorts of pedagogies did this course employ?** Nearly 73% of the students checked “lecture” and over 67% checked “seminar-style discussion,” and 64% checked “small group work.” Compared to 2010, we see a slight drop in seminar teaching (73% to 67%) and an increase in small group work (from 59% to 64%). Although these traditional teaching methods remain the dominant modes of Spring Term pedagogy, many other innovative methods were used, including lab work, problem solving, rehearsal and performance, and the use or creation of web-based tools. When students described any “other methods” used in their learning, they listed such intriguing approaches as “legal briefs,” “shadowing doctors,” “service learning,” “sculpture creation,” and even “built a satellite!” While we do not have comparative data with our 12-week terms, it seems fair to say that there is significant innovative teaching going on in the Spring Term, along with substantial use of the more traditional teaching methods.
- We continue to focus on **the teaching of writing** as a key element in the teaching of critical thinking in any discipline. We asked students “in what ways did this course emphasize the teaching of writing?” and overall we see an increase in writing engagement from Spring Term 2010. Nearly 64% of the classes employed essays reviewed and graded by the professor (up from 60% in 2010); 38.2% included a research essay (up from 37%); 55% had short essay assignments of some sort (up from 50%); and multiple other writing strategies were employed, including writing conferences, revision, wikis and blogs, power points, written proofs, and lab reports. A number of courses employed some sort of journal assignment. The increased presence of writing in the spring term signals the commitment to rigor and engaged learning.

**Response/Action Items:** We presented a “Faculty Academy” training session on 14 December 2011 that focused specifically on “Using the Journal as a Teaching Tool.” Four faculty from different disciplines—Marc Conner in the English department, Erich Uffelman in Chemistry, Deborah Miranda in Creative Writing, and John Lambeth in Romance Languages—delivered presentations on the effective ways to use, evaluate, and grade journal assignments. The aim was to show faculty the many ways in which the journal can be used effectively, since it is clearly a writing tool that many courses are employing. This was part of our ongoing efforts to help faculty find new ways to teach writing in the intensive term, as well as to expand our conversation about intensive pedagogies and learning strategies in general.

- The fundamental question we asked was, “Did this course enhance or improve your ‘critical thinking abilities,’ defined as your abilities to reason and problem-solve according to the framework of the course’s specific discipline?”—in short, the centerpiece of the Spring Term. Student responses were certainly encouraging, with 79.8% answering “yes” and only 20.2% answering “no,” which reveals an impressive increase from 2010 (a 10.8% increase in a single year!):



*(The vertical axis represents percentages ranging from 0% to 90%)*

- This significant improvement in our primary learning objective is highly gratifying. We were already pleased with the success in 2010, and a near-11% increase in success the next year is quite encouraging. Certainly room for improvement remains, and we learned much from the follow-up question—“What specifically did this course do to enhance or improve your ‘critical thinking abilities?’”—which was answered by 380 of the respondents, signaling an increased awareness of this concept. Seminal responses included the following:
  - “Challenged me to design a problem or manipulate a problem into a solution on the computer.”
  - “Immersed me in a culture and taught me how to act and think in a new environment.”
  - “To perform and learn through the viewpoint of an actor for the first time.”
  - “How to analyze a problem by looking at all of the contributing factors and how many causes affect a result.”
  - “I used real life skills of critically thinking as a physician would.”
  - “Requiring me to think in 3-D and process that into 2-D as well as use critical mapping skills.”
  - “Daily analysis and summaries of readings with heavy discussion expected.”

**Response/Action Item:** Ongoing education of faculty and students in the meanings of “critical/creative thinking” and how our courses aim to enhance this, by again expanding the faculty focus groups who do intensive assessment on the spring term, and also working to connect this concept to the students’ sense of what they are doing intellectually.

- We asked a range of questions about what sorts of projects students completed or produced as part of their spring term class, and the array of work accomplished was highly impressive: group projects, podcasts, mappings, documentary creations, interviews, herbarium

construction, and much more. We followed up this question by asking **how well the course enhanced students' abilities to perform each particular project or assignment.** The average negative response—"not at all"—arose in just over 9% of the respondents, meaning we attained a success rate of between marginal and exceptional enhancement of students' abilities in these various projects of just under 91%.

- We asked if a given course focused more on breadth of topic or on depth; 73.4% of the students indicated a depth-oriented academic experience, which fits with our goal of creating courses that follow specific intellectual paths into depth of study, as opposed to broad-ranging courses that treat subjects only in breadth. (In 2010 the depth response was 72.4%.)
- Our last focus in the Student Experience Survey asks students to estimate the amount of time they spent *in class* (our guideline for faculty was to aim for 8-10 hours of in-class time per week) and the amount of time they spent *outside of class* on course-related work (our guideline here was 20-25 hours per week). In 2010, students reported devoting significantly more in-class time than we had aimed for—fully 50% of the students felt they exceeded the goal of 6-10 hours per week in class. But the time spent outside of class fell short of the aim of 20-25 hours per week—61% of students reported 14 or fewer hours per week spent outside of class working on the course, with only 24% reporting 18+ hours per week. In 2011, the perception of class time was even more extreme: 37.5% of students felt they spent fewer than 10 hours per week in class; 62.6% felt they spent more than 10, and a full 27.5% felt they spent more than 14 hours per week in class. For time devoted to course work outside of class, only 18.7% of students felt they put in more than 18 hours per week; 37.7% reported between 10-18 hours; and a remarkable 43.6% reported spending fewer than 10 hours per week on their Spring Term course outside of class time. In sum, assuming student reporting is accurate, **the students are spending more time in class, and less time outside of class, than our best practices recommend.**

**Response/Action items:** in our ongoing pedagogical training sessions with faculty, we will continue to emphasize the aim of engaging students for 8-10 hours each week, and then setting up an additional 20-25 hours of work outside of class for them each week. The key here seems to be to help faculty think creatively of innovative pedagogy strategies that will engage the students in meaningful ways without necessarily involving the faculty in every step of the way. We held two important Faculty Pedagogy sessions, one in March of 2011 titled "Building the Spring Term Syllabus," a session devoted to the structures, activities, and expectations recommended for a Spring Term course (this session was videotaped and the program made available to the entire faculty); and another titled "How to Teach in the Spring Term Without Killing Yourself" in August of 2011 that focuses on ways to engage the students in meaningful ways without a corresponding over-burden on the faculty. We will also communicate these survey results to department heads as the Spring Term 2012 approaches, to encourage faculty to fully engage their students.

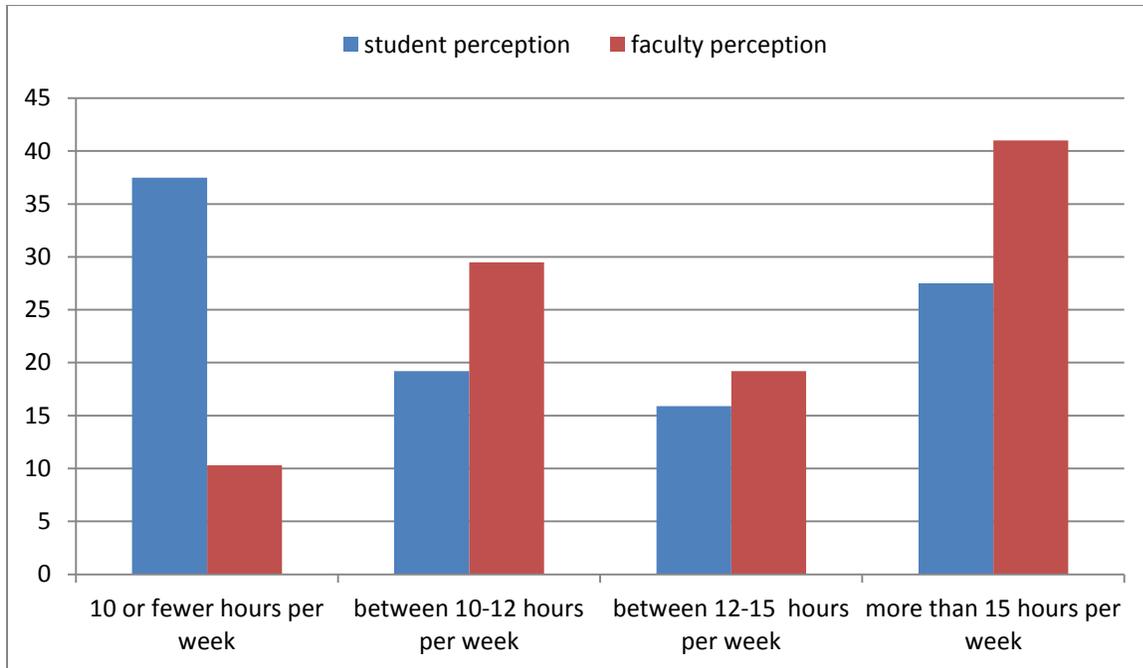
Finally, the last part of the survey asked students to "share any comments you might have about this Spring Term." Of the 622 respondents to the entire survey, 113 included a positive comment about

the Spring Term experience, and 125 included a negative comment. Of the negative comments, there are four that arose with sufficient frequency to merit a closer look:

1. There is an uneven work load across the courses (e.g., “my course was really hard and time-consuming, but my friend had a course that was really easy and took little time”). RESPONSE: continue educating faculty about good practices to engage the students fully. (At the same time, we recognize that this may well be a **perception** issue only: in our next survey, we will slightly adjust the questions to make sure both students and faculty are counting time spent learning with the professor as “in-class” time.)
2. Bring back the old six-week Spring Term. (RESPONSE: as senior classes graduate, the student memory of the old six-week term will vanish. Returning to that model is not an option, and this complaint will likely fade when this generation of students moves on.)
3. Complaints about registration, especially the practice of letting first-year students choose a course before juniors and sophomores. (RESPONSE: First-year students traditionally had the hardest time finding good spring term courses, and they are the only class required to take a spring term course. So we will continue giving them an advantage in registration. But curiously, though many students expressed outrage over this registration system, when we asked students if they were “happy with the course” they eventually registered for, even if it was not their first choice, a resounding 98.3% said they were indeed happy with the course they got. So it is difficult to reconcile this common complaint about registration with actual student satisfaction with the courses.)
4. Spring Term courses are demanding, they’re a lot of work, they’re hard. (RESPONSE: Encourage precisely this experience!)

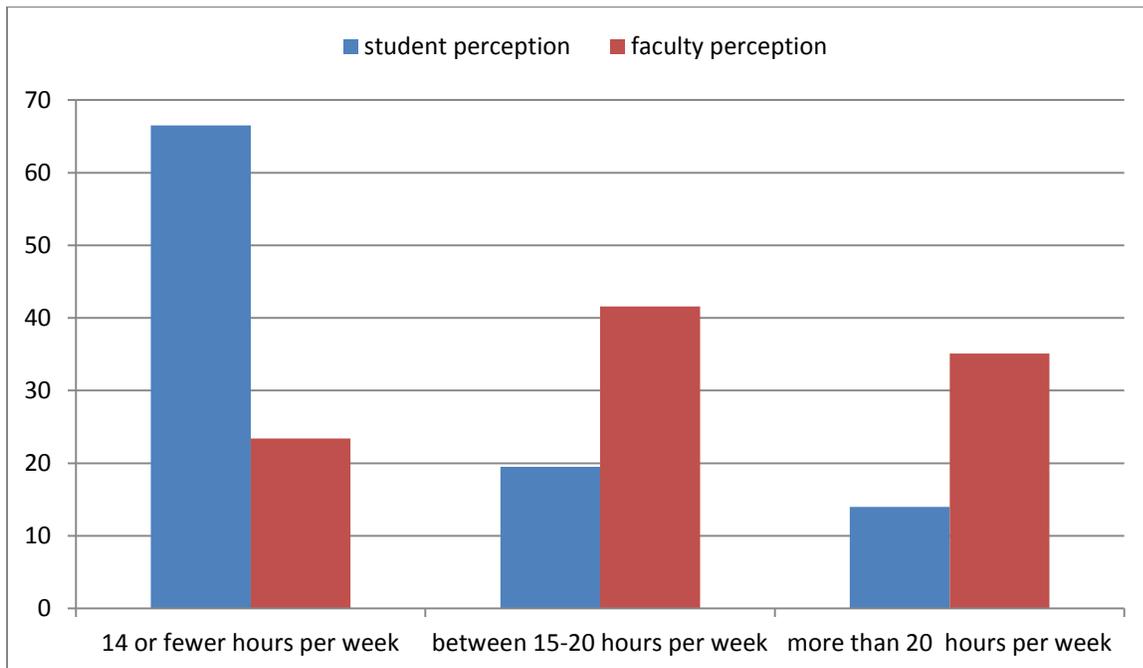
We also administered the same **Faculty experience survey** that mirrored the student survey in many ways. The faculty and student perceptions of the Spring Term have much in common and also diverge in intriguing ways.

- As in 2010, in 2011 the faculty response to contact time, both within the classroom and outside of the classroom, contrasts with the student experience. Faculty reported spending much more ***time per week in the classroom*** than did the students:



This indicates that 37.5% of the students felt they put in less than the aimed-for amount of hours per week, whereas 41% of the faculty perceived they were actually exceeding 15 hours per week of in-class time. It is difficult to know why there is this contrast in perception—after all, the amount of time spent in class ought to be fairly obvious and consistent, one would think.

- Similarly, the faculty felt the students put in on average more *time per week outside of the class* than the students did:



Here too we need to educate the faculty in this area: the students do NOT perceive themselves as working as hard or putting in as much time as the faculty estimate they are. It is worth noting that over 73% of the faculty felt the amount of time they spent *with the students* was “just the right amount,” but just under 40% felt the amount of time they spent *outside* of the classroom was “just the right amount,” and over 60% felt it was “too much.” (These figures are almost identical to the faculty perceptions from 2010.) This apparent discrepancy in intensity of time will be discussed in the fall Faculty Meetings and also in the follow-up sessions on pedagogy and teaching strategies in the fall and winter Faculty Academies. But at the same time, we have never been satisfied with measuring intensity, quality, and immersion extent of these learning experiences solely in terms of hours within or without the classroom. Transformative learning is not merely a result of time devoted, although a certain devotion of time is surely important.

- Faculty were asked to describe their OWN experience, and also the STUDENTS’ experience, in the Spring Term. Of the 26 responses (out of a total of 78) to this question, the terms provided were roughly equal in terms of negative or positive. A common faculty complaint is that they have to work too hard to attain the goals of their courses—terms such as “unsustainable,” “overwhelming,” “exhausting,” and “excessive” seem to reflect this. At the same time, as many faculty report a contrary experience, using terms such as “rewarding,” “transformative,” “exhilarating,” and “fantastic.” Certainly in terms of the enormous time commitment of creating and then teaching these courses, we anticipate that as faculty repeat their courses (not having to create them out of whole cloth again) the time commitment for them will decrease.
- Successful Pedagogies, Inadequate Pedagogies, and Experimental Teaching Methods: The faculty were asked to state the different pedagogies they used in the spring term, and which ones worked well and which did not work well; as in 2010 the list generated is a virtual catalog of teaching methods in an intensive learning experience, and we will continue to circulate these methods in such pedagogy sessions as “Building the Spring Term Syllabus” and “How to Teach in the Spring Term Without Killing Yourself.”
- Scope and Satisfaction: 41.6% of faculty described their class as “in-depth/narrowly focused” (2010: 35%); 13% as “broadly focused” (2010: 19.7%); 45.5% as “neither one exclusively” (2010: also 45.5%). This reflects a trend towards greater depth of focus, at least over these first two Spring Terms. **60.5% of faculty said they were “able to accomplish all that you had planned for your Spring Term course”** (the figure in 2010 was higher: 66.7%). Finally, we gave them an open-text question, “Are you satisfied with what was accomplished in your Spring Term course.” 67 responses were sent in of varying length and detail, 60 of which gave a clear yes or no response. 50 of these responses were affirmative, and only 10 were negative. 52 responses said a version of “yes,” and 9 said “no.” **That translates to a success rate of 83%, which is an impressively strong result given the scope and demands of this project.** A few of the representative comments include:
  - “Absolutely. I am myself overwhelmed by the results. They are writing really well after the course.”
  - “Absolutely. It was all-engrossing, very engaging, exciting, loads of fun. The camaraderie in the class was great.”
  - “In many respects, it was the most rewarding course that I have ever taught.”

- “Yes, this has been the opportunity of a lifetime for me and for the students. I hope to be able to do it again in 2 years.”

**II. The Faculty Focus Group:** As in Spring Term 2010, the Faculty Focus Group assessment project proved extremely successful in offering a more penetrating and depth-oriented view of the Spring Term learning experience. In 2011 we had 12 new faculty perform this depth assessment of their courses.<sup>1</sup> As in 2010, the focus group performed detailed assessment to help us determine the extent to which their courses are meeting their departmental, discipline-specific learning objectives, as well as *the primary learning outcome of enhancing students' critical and creative thinking*. The group used the same **general template** for our assessment gathering and reporting as in 2010 (see below); at the conclusion of Spring Term 2011, each faculty member of the Focus Group wrote up the results of her or his assessment work and submitted it to the Director of the Spring Term and the Director of Institutional Effectiveness.

**Basic Template for Submitting Assessment Results for Spring  
Term 2010**

- 1. Please list your Learning Objectives for this course. (This can be a comprehensive list of all LO's your department has stipulated for this course, or just a selection of the ones you specifically assessed for this project.)**
- 2. Please describe briefly, in just a sentence or two each, how you have assessed these LO's in this Spring Term 2010 course.**
- 3. Please add here the specific results of your assessment work. This could include before/after quizzes, results from exams, comparative essays, minute papers, and much more. You can paste these materials directly into this document, or you may append them as hard copies, or you can send them electronically to Debbie Dailey.**
- 4. Please comment briefly—a short paragraph or even a few sentences would suffice—on how these assessment results will impact the way you might teach the course in the future. (The “close-the-loop” question—how might your assessment of your learning objectives alter your teaching next time?)**

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<sup>1</sup> 2011 participating faculty and courses included: Rebecca Benefiel, “CLAS 238: Daily Life in Ancient Pompeii,” Marc Conner, “ENGL 243: Performing Shakespeare,” Jenefer Davies, “DANC 390: Aerial Dance,” Ted Delaney, “HIST 397: The Freedom Ride,” Steve Desjardins, “CHEM 106: Disorder and Chaos,” Art Goldsmith, “ECON 233: Colorism,” Monica Gonzalez, “SPAN 270: The Contemporary Latin American Press,” Robert Humston, “ENV 212: Land Use & Aquatic Ecosystems in Chesapeake Watershed,” Krzysztof Jasiewicz, “SOC 225: Peoples of Central Europe Through Literature and Film,” Jacob Sielher, “MATH 353: Numerical Analysis,” Rob Straughan, “BUS 180: International Corporate social Responsibility & Sustainability,” and David Wiest, “ACCT 297: Accounting Distress.”

Overall results of the 2011 Faculty Focus Group:

As in 2010, this was a very productive assessment project, not least because it serves to further the culture of assessment throughout the faculty. As in 2010, we conducted a series of meetings with the Focus Group throughout the academic year to discuss and strengthen the assessment process and results, and to discuss a wide range of issues clustered about our spring term assessment work, as follows:

- Thursday, February 10, 2011: meeting to introduce participants to the assessment work required of the Spring Term project, to offer suggestions and tactics for effective, pragmatic assessment, and to begin conversations among the group about our hopes and aspirations for our spring term courses.
- Wednesday, March 23, 2011: meeting to discuss our own assessment plans for our courses, and to examine FFG assessment reports from 2010 as models for our own work this spring.

In these sessions we also discussed specific assessment strategies, such as “embedded assessment” and pre- and post-testing approaches, many of which were employed to good effect in our spring term 2011 courses. Each professor performed a range of assessment tools for their courses, and submitted a formal report to the Spring Term Director by the end of June, 2011. The Director reviewed the reports and compiled the following overall portrait of the assessment work:

- Of the 12 reports submitted, each reported overall success in attaining the primary objective of enhancing students’ critical and/or creative thinking—the **“success rate” for the primary learning objective in these select courses was 100%**. (2010 rate: 92%.)
- The assessment measures employed varied widely, ranging from quantitative exams or quizzes to various forms of essays to journals to performances, and much more. Faculty were able to pursue **their discipline-specific learning objectives** while also showing how those objectives correlate to **overall critical/creative thinking**.
- A number of professors employed pre- and post-assessment quizzes that were extremely effective in measuring the gain in knowledge, understanding, and content throughout the four-week course. For example, in Professor Benefiel’s “Classics 238: Daily Life in Ancient Pompeii,” students demonstrated an impressive improvement in the knowledge quiz on critical analysis of a city-block in Pompeii, improving from a mean score of 1.8 on the first day of the term to a mean score of 8.4 on the final exam—a remarkable improvement of 367%. Similarly, in Professor Wiest’s “Accounting 297: Accounting Distress,” students moved from an average grade on the initial knowledge assessment of 42.3% to an average grade on the end-of-term knowledge assessment of 86.6%, an improvement of 51%. These results support the increase in knowledge gained over the four-week course. Similarly, in Professor Goldsmith’s course, “Economics 233: Colorism,” the pre- and post- essay test showed an improvement in students’ “understanding of all facets of Colorism” of 63%, a remarkably strong improvement. And in Professor Conner’s “Performing Shakespeare” course, students scored an average of 2.39 on the initial knowledge exam on Shakespeare’s biography, history, stage, and context, compared to a final average score of 9.0, an improvement of 276.6%.

- Other particularly intriguing assessment results included a montage of videos from Professor Jenefer Davies’ “Dance 390: Aerial Dance” course, which can be viewed at: <http://www.youtube.com/watch?v=iandzxwxdPE>. Also, Professor Delaney’s “History 397: The Freedom Ride” course produced a blog that captures much of their experiential engagement with the history of the Freedom Ride movement throughout the American south, viewable at: <http://springtermafield.washingtonandlee.net/category/hist-397-freedom-ride/>. These sites offer excellent examples of intensive, transformative learning experiences in the spring term.

A major presentation grew out of this assessment project. Titled “Assessment in the Spring Term: Pragmatic and Effective Approaches,” led by Professor Marc Conner in the English Department and Professor Steve Desjardins in the Chemistry Department, it has been given to both iterations of the Faculty Focus Group in 2010 and 2011, and serves as a template for effective assessment work. This presentation is now available at our Q.E.P. web site, at <http://www.wlu.edu/x56626.xml>, with the following description: *A 55-minute faculty presentation on how to conduct embedded assessment and pre- and post-assessment for Spring Term courses. Professor Conner discusses overall assessment strategies, as well as particular tools he uses in his Spring Term in Ireland program; Professor Desjardins discusses assessment strategies in the natural sciences, as well as particular tools he uses in his Chaos and Disorder course.* Interested faculty are able to view this and make use of its suggestions and practices—a further example of how the Spring Term project continues to spread the culture of assessment throughout the faculty.

Also, within each course in the Focus Group, faculty provided a summary of changes they will make to future offerings of the course, based on their assessment results and the experience of examining their teaching of the course. Three good examples of this follow-up to the assessment work follow:

**From CHEM 106: “Disorder and Chaos” / Proposed changes for next offering:**

- Since success in the course depends on mastering subject-specific terminology and precise wording of answers, we will continue to emphasize this aspect the next time this course is offered. Some students expressed frustration in being able to distinguish differences between two subtly different answers to multiple choice questions. At the next offering of this course, we will not only stress the importance of precise wording, but provide counter-examples to illustrate common student misconceptions and how imprecise wording can sometimes convey the exact opposite of an intended answer.
- Because test results and informal observation indicate students have trouble understanding and interpreting graphs, we will conduct specific lab or classroom sessions dedicated to this topic.
- Laboratory introductions will give more specific examples of valid scientific conclusions and how to relate them to the experimental data and classroom content.
- Both instructors noted that a lack of understanding of assumed mathematical basics (trigonometry, laws of powers and logarithms) greatly impeded students’ conceptual understanding. A suggestion for the next offering would be to conduct a very short math review class with supplemental reference material available on Sakai.

- Use of math modeling software proved confusing to students, and we acknowledge that either better instructions for computer labs need to be developed or some other software needs to be employed (VenSim instead of Maple, for example).

**From ACCT 297: “Accounting Distress” / Proposed changes for next offering:**

As a result of the assessments, especially the journal reports, I would plan several changes to the course in the future. In general it seems to have been reasonably successful in achieving the objectives, given that the course has been limited to sophomores with only introductory accounting courses and perhaps a corporate finance course in their background. I found the journal reports to be quite helpful in gauging the progress of the course and pointing out areas that might need more attention. I believe I will include this activity in the future.

The students also completed projects evaluating a company that experienced financial distress and any connection that accounting might have had to the distress. Although several of the projects displayed meaningful critical analysis, I felt, and several students stated in their course evaluations, that time limitations prevented the projects from being as useful as they might have been as exercises in critical and creative thinking. From the results of the midterm and the pre-post test, I believe I could cut back somewhat on coverage of the background material and move more quickly to the analysis and projects.

Also, both journal reports and student course evaluations indicated that many of them would have been interested in spending more time on the causes of the 2008 financial crash and on the underlying financial instruments. Based on their success on the quantitative assessments, it appears that they should be able to handle at least some more of this exceedingly complex material without completely eliminating the accounting content that might seem less interesting to some.

**From DANC 390: “Aerial Dance” / Proposed changes for next offering:**

I think the assessment results were fine. I believe, though, that my goals were slightly too adventurous for only four weeks. Because we had to create a fully produced concert, we never really had any experimentation time. We began on the first day of class creating a final production. In future I will make the production as well as its technical aspects smaller, possibly a ‘works in progress’ showing instead of a performance, in order to have the time to experientially explore the space, movement and new possibilities and allow the students to contribute to the ongoing national discussion and experimentation with this new technique.

As in 2010, we include **two particularly representative examples of FFG detailed assessment reports**, from Professors Humston and Siehler:

**Faculty Focus Group Assessment Example #1**  
**“Land Use and Aquatic Ecosystems in the Chesapeake Watershed”**  
**ENV 212 Spring Term 2011**

***Formative Assessment of Course Objectives and Student Learning***

**Course Synopsis:** This course is a mid-level course for majors in Environmental Studies and Biology. In the first week of the course, the students are introduced to foundational concepts in aquatic ecology (emphasis on stream / lotic systems) and learn sampling techniques for physical

(temperature, nutrient levels, etc.) and biological parameters (chlorophyll-a for algal biomass, macroinvertebrate and fish community composition). These data provide the common thread linking all natural habitats we visit throughout the course. Local, familiar waterways (Woods Creek, Maury River) provide the natural classrooms. By the second week, the emphasis shifts to an examination of anthropogenic alteration of these habitats through land use in the watershed. Visits to pristine and comparative degraded sites provide hands-on context and students collect physical and biological data at each site. In the third week, we embark on a journey to and around the Chesapeake Bay. Students experience freshwater and brackish tidal river habitats (knee-deep and hands-on) and visit research labs, advocacy and policy-development offices, sustainable agriculture initiatives and restoration sites, and historic “waterman” communities along the way. The goal is to demonstrate the ecological underpinnings of the issue while connecting these with the sociological drivers of the problem and its solutions.

**Assessment Format:** Course assessment had two primary components, both structured as pre- and post-course comparisons.

First, a pre-course quiz was distributed on the first day of class prior to presentation of any lecture material. This quiz consisted of five multiple choice questions and three short answer questions. These questions assessed students in three areas: a) knowledge of basic concepts related to the course; 2) simple problem-solving skills reflecting understanding of system dynamics; and, 3) critical thinking skills reflecting an understanding of historical and current ecological conditions in Chesapeake Bay, as well as the interaction between land use in the watershed and ecological dynamics of the estuary. The questions reappeared on mid-term or final exams (as appropriate) later in the course. At no time during the class did we explicitly discuss these questions or the students’ responses to them.

Second, a journal-entry assignment asked students to describe the physical nature of Woods Creek, a local and familiar water body, and explain how the physical structure of the system might influence or shape the biotic community within it. They completed this assignment during the first afternoon of class while sitting in a site of their choosing along the creek, following a 3-hour lecture in basic stream ecology and a 30 minute walk / discussion along the banks of the creek. On the last day of the course, they revisited this assignment and were told to return to the same place on the creek, re-read their entry from the first day, and write a new entry that addressed the same question but to ask themselves a simple follow-up: “Do you see the creek differently now?”

### **Pre- and Post-Course Comparison of Student Responses to “Exam” Style Questions**

For brevity, this summary only addresses those questions for which the initial (pre-course) success rate was less than 100%, as questions with 100% success rate on pre-course quizzes are uninformative. Three of the original questions are therefore omitted. No statistics are presented since the sample size (5 students) is not large enough for reasonable inference.

**Multiple Choice Question 1:** Which of the following does NOT directly affect the retention time of nutrients in streams?

- a) Stream flow velocity.
- b) Amount of primary production.
- c) The amount of streamside vegetation.
- d) Degree of connection with the hyporheic zone.
- e) All of these directly affect nutrient retention time.

*Explanation:* This question does not have a straightforward answer. It can be argued that either “E” or “C” are appropriate answers, depending on one’s perspective. However, given the wording of the question the most appropriate answer is “C” as riparian vegetation does not *directly* influence retention time per se. This question was intended to determine familiarity with basic concepts and definitions (hyporheic zone, retention time, etc.) and ability to reason out the answer based on these.

*Pre-Course Performance:* **0 of 5 students answered this question correctly** on the pre-course assessment. All chose “E,” likely because they know that streamside vegetation plays a key role in preventing nutrients from entering streams. However, this is not the same process as retention of nutrients in streams.

*Post-Course Performance:* This question reappeared on the mid-term exam (after 1 week of lecture / field trips). On the mid-term, **4 of 5 students answered it correctly**. When given the opportunity to correct mistakes on this exam, the remaining student correctly reasoned out the appropriate answer.

*Improvement:* **Original success rate: 0%. Final success rate: 80%**

**Multiple Choice Question 3:** The three main pollutants from the watershed that negatively impact the health of the Chesapeake Bay ecosystem are:

- a) Nitrogen, phosphorus, and sediment
- b) Nitrogen, chlorophyll, and mercury
- c) Fecal coliform bacteria, iron, and polychlorinated biphenyls (PCB’s)
- d) Acid rain, arsenic, and mercury

*Explanation:* This question queried basic awareness of the specific stressors affecting Chesapeake Bay.

*Pre-Course Performance:* **4 of 5 students answered the question correctly** on the pre-course assessment.

*Post-Course Performance:* This question reappeared on the mid-term exam (after 1 week of lecture / field trips). On the mid-term, **5 of 5 students answered it correctly**.

*Improvement:* **Original success rate: 80%. Final success rate: 100%**

**Short Answer Question #1:** Dams can affect aquatic ecosystems by creating barriers to migratory fish movement, altering natural flow regimes, changing average stream temperature, and reducing downstream sediment transport. There are numerous dams on the major Chesapeake tributaries; which of the above has had the greatest impact on the Chesapeake Bay ecosystem and why?

*Explanation:* This question does not have a clear answer. Instead, it could be argued that either of the first two options are the correct answer. However, the last three are less likely based on an understanding of how dams change stream systems and the nature of the decline in Chesapeake health. I looked for students to select one of these two and offer a reasonable explanation why this would be the case.

*Pre-course Performance:* **0 of 5 students offered correct and well-reasoned explanations for their answer.**

*Post-course Performance:* This question reappeared on the final exam in the course. **5 of 5 students provided correct and well-reasoned explanations for their answer.**

*Improvement:* **Original success rate: 0%. Final success rate: 100%**

**Short Answer Question #2:** Explain the difference between point-source and nonpoint-source pollution. Which is easier to regulate and why?

*Explanation:* This question queries basic understanding of the nature of pollution sources and their regulation.

*Pre-Course Performance:* **3 of 5 students correctly answered this question on the pre-course assessment.**

*Post-Course Assessment.* This question reappeared on the final exam. **3 of 5 students correctly answered this question on the final exam, while the remaining 2 students received 4 out of 5 possible points for their answers.**

*Improvement:* **Original success rate: 60% Final Success Rate: 92% (based on awarding of partial credit for answers)**

**Short Answer Question #3:** Describe four different sources for nitrogen additions to Chesapeake Bay.

*Explanation:* This question queries basic understanding of the nature of nitrogen pollution in Chesapeake Bay and sources of loading from the watershed.

*Pre-Course Performance:* **0 of 5 students were able to correctly identify four sources of nitrogen additions on the pre-course exam. However, 3 of 5 students correctly identified at least one source. Only 1 of 5 students was able to identify more than one source.**

*Post-Course Assessment.* This question reappeared on the final exam. **5 of 5 students were able to correctly identify four sources of nitrogen additions on the final exam.**

*Improvement:* **Original success rate: 0% Final Success Rate: 100%.**

**If based on awarding of partial credit: Original success rate: 20% Final Success Rate: 100%**

### **Pre- and Post-Course Comparison of Student Responses to Reflective Writing Assignment**

Comparison of such open-ended writing assignments is difficult. However, it is clear that at the end of the course students were much more aware of human impacts to Woods Creek and how these shape the physical and biological characteristics of the stream. Their initial writings reflected a basic understanding of aquatic environments and associated biota (often focused on concepts covered in the first lecture). By comparison, their post-course essays demonstrated a much broader understanding of the connection between the stream and its watershed. Since this watershed is variably impacted by agricultural and residential land use practices, their perspective on the stream's physical and biological condition included an understanding of these impacts. They described more than just the piece of water in front of them in their final essays. They were able to consider how this small piece of water is connected to upstream habitats, and how upstream conditions are influenced by upland watershed health. Overall, their writing demonstrated a much deeper understanding of connectivity among aquatic-terrestrial ecosystems as well as how the functioning of these respective systems is influenced by human activities.

### **Faculty Focus Group Assessment Example #2**

**Math 353, Numerical Analysis**

**Jacob Siehler**

**Spring 2011**

#### **I. Objectives**

I have concentrated on two of our departmental learning objectives, which I describe here along with their course-specific interpretation:

1. "Acquire critical-thinking and problem-solving skills necessary to mathematical investigations, from their beginning stages in which experimentation and pattern analysis are likely to play a role, to their final stages, in which mathematical discoveries are precisely formulated and formally proven to be correct."

In this course specifically, I attempt to assess: *The ability to use computers and mathematical software to aid the experimentation and pattern analysis stages of problem solving.*

2. "Be prepared to achieve success in mathematics-related careers or graduate study."

In this course specifically, I attempt to assess: *Whether students have the technical skills to analyze and implement mathematical algorithms.*

## II. Assessments

To assess these objectives, I considered several activities which spanned the entire term, and tallied students' performance into categories indicating complete success, satisfactory results, or underperforming results that would indicate some problems I need to investigate more carefully. I also used my end-of-term course evaluation to gather some information about students' perceptions. Here's what I considered for the purpose of assessing our objectives:

1. Code Analysis: On exams, students were given short *Mathematica* programs and asked to determine the output (without recourse to a computer, of course). Producing a correct answer requires an understanding of the *Mathematica* syntax in particular, as well as general algorithmic concepts such as looping and recursion which are common to all programming languages. It is a clear test of critical thinking ("What is the purpose of this unfamiliar code?") as well as technical skills (fluency in a specific language). I recorded the results for two of these problems; there were six in all. One (involving recursion) I considered to be of medium difficulty and one (involving nested looping) I thought was considerably more difficult than average.

2. Algorithm Implementation: Over the course of the term, students built a library of functions in *Mathematica* which implemented algorithms discussed theoretically in the lectures - for example, conversion of real numbers to and from IEEE double-precision floating-point format, or Newton's Method for finding roots. At (approximately) weekly checkpoints, students submitted their library, which I applied to assorted test data, checking to see that their programs returned correct results. Students received a report of any functions that failed any of their checks, and they had one opportunity to revise and resubmit their library for a second inspection. In all, there were 56 checks to be passed. Success here, as with the Code Analysis component, indicates fulfillment of both learning objectives.

3. Project Euler Problems: One component of the course which I tracked was the solution of problems from the *Project Euler* repository. These are mathematical problems which are designed to be solvable with computer assistance; carrying out such an exercise involves designing an original algorithm which brings the problem within the realm of practical computing power, and then implementing the algorithm and obtaining a result. That is, there is a creative, problem-solving stage

followed by a practical stage which requires technique. The students had access to the entire database of more than 300 problems and were able to choose which ones they wanted to solve, so there was also an important "filtering" stage where they decided which problems looked tractable with the tools at their disposal. This is an element of problem solving which I feel is underexamined, but quite important to develop for future researchers.

4. Course Evaluations and Perceptions: Students' own confidence and self-perception are important for success in graduate and professional work. It is quite possible to design a very rigorous course which develops students' technical skills considerably but leaves them unconvinced of their own abilities (this can be due to insufficient feedback, for example). I include this as part of the assessment partly to provide some control for the other components.

### Results: Code Analysis

(The problems used for this component are included below, just as they appeared on the exam.) Here, I tallied responses in three categories: (1) a complete, correct answer which reflects an understanding of the syntax and algorithmic structures, (2) an incorrect answer (say, due to an arithmetic error) with supporting work that indicates an understanding of the algorithmic structure, or (3) a completely misguided answer. Although I did not use any sort of pretesting strategy in this class, students entering the class had, uniformly, zero experience with *Mathematica*, so any ability to read programs in this language reflects a gain during the term.

1. Recursive list-processing function	
Complete, correct solution:	8
Wrong answer, good understanding:	5
Failure to understand:	1
2. Nested-loop sorting algorithm	
Complete, correct solution:	4
Wrong answer, good understanding:	7
Failure to understand:	3

### Results: Algorithm Implementation

Students' completed libraries included twenty-seven functions which were ultimately subjected to fifty-six checks for correct output. Since there were opportunities for revision, any more than a few failures would indicate a problem—perhaps inadequate preparation or unclear expectations. There was no such indication here; the results were very good.

All checks passed	3
One to three failures	11
Failed more than three checks	0

### Results: Project Euler problems

Students were expected to complete thirty problems during the four-week term (with a checkpoint at midterm). The problems vary in difficulty, and students learn to find the relatively easy ones, and automatically pace their own advancement as they proceed. Completing fewer than 80% of the problems would indicate insufficient development of technical and/or problem-solving skills.

At least thirty problems solved	12
At least 24 problems solved (80%)	2
Below 80% completion	0

### Results: Student Perceptions

1. "I am better prepared to use mathematical software for research and problem-solving."

3 (Yes! Totally)	14
2 (Maybe / A little bit)	0
1 (No, not really)	0
  
2. "I can turn textbook descriptions of algorithms into working implementations."

3 (Yes! Totally)	7
2 (Maybe / A little bit)	7 (including one "2.5" that was written in)
1 (No, not really)	0
  
3. "I can see practical applications for the material in this course."

3 (Yes! Totally)	9
2 (Maybe / A little bit)	5 (including one "2.5" that was written in)
1 (No, not really)	0

### Future Implications

The quantitative results of this assessment are in line with my subjective end-of-term feeling that I was achieving my objectives for the course. Entering the term, I was not sure how high to set the bar for completion of Project Euler problems and I see from the results that I can raise the expected number of problems to be completed. It's also clear that there's a bit of a gap between the actual gain in technical proficiency (as measured by the nearly perfect completion of the algorithm implementation exercises—which exceeded my expectations) and the perceived gain (measured by the second of the evaluation questions). This needs to be corrected, but I think that can be achieved with a little extra feedback after the last assignment. Students, in the busy end days of the term, may not have had a good opportunity to look back over the totality of their work and appreciated their advances. I will consider ways to provide this opportunity and improve my feedback as well.

**Response/Action items:** We will continue this excellent assessment project with a fresh group of faculty from other departments and programs in the spring term of 2012.

**III. Spring Term Scholars:** As explained in our 2010 report, this is our primary long-range, "First-Year-to-Senior-Year" Assessment Tool, aiming to measure the impact of the Spring Term experience on a student over her four years at W&L. Eighteen students are participating in the program, submitting into an electronic archive a portfolio of all of their formal academic work for their spring term courses each year. (We define "formal academic work" as any work that will receive a grade from their professor.) After collecting literally hundreds of documents and assignments from Spring Term 2010, we faced the challenge of how to organize, categorize, and effectively assess this electronic archive (some of which amounted to scores of pages representing a huge range of assignments). This year our working subcommittee on assessment (Professors Conner, Desjardins, Kuehner, and Murdock) devoted a half-day (March 8, 2011) to a retreat dedicated to **determining the most effective way to assess this material**. We had two overarching questions to resolve:

1. How well did the assignment improve that student's critical thinking abilities?
2. How can we use this assessment to improve future learning?

We first determined that, rather than attempting to assess the entire body of work a student produced during her spring term course (in some cases this numbered well into the hundreds of pages), instead **we would choose one assignment that best suited the overarching learning goal of the Spring Term** (we asked, "which assignment best shows the course's effort to enhance critical/creative thinking?"). We asked the students to select this assignment and send it to us.

We then had to determine our assessment method on this work. After discussing and evaluating a range of possible strategies for assessing this wide variety of student work (assignments included class presentations, final exams, grant proposals of research, papers/essays, journals, storyboards (image/video + text/essay), lab reports, oral quizzes, and much more), **we determined to employ the AACU Critical Thinking and Creative Thinking VALUE Rubrics** to assess the spring term work. These have the advantages of being a nationally vetted assessment tool, having a breadth that would allow work from many disciplines to be assessed in common, and offering a good comparative between quite different kinds of student work.

We then met a second time, for another half-day working retreat, on July 26, 2011, for our first effort at assessing, as a committee, the 18 assignments we had gathered from Spring Term 2010. The assessment work proved extremely fruitful, both for what it taught us about the spring term work students had accomplished, and for what it taught us about our assessment work itself. Our points of action and consideration included the following:

- We read through, discussed, and assessed (according to the AACU critical thinking value rubric) the assignments from 15 of the 18 spring term scholars' work from ST 2010.
- these assessment scores were tallied and the resulting data allows us to see each student's mark as well as the aggregate assessment for the entire group.
- 2 students produced work in a foreign language—we will pursue having a Wabash-connected professor assess these.
- We determined that for future assessment on this project, the student work will be completely anonymous: the Associate Provost and the Spring Term Director will collect the work and note the professor, class, and student, but will assign a number to the piece of work and that is all the committee as a whole will see. This should further reassure faculty that this project cannot be used for evaluative purposes, and is a good practice generally.
- We determined to give to the faculty who have a spring term scholar in their course the critical/creative thinking rubric in advance, so they will know the sorts of things we might be looking for and can enrich the campus-wide awareness of "critical thinking."
- We realized that the journal assignment is POTENTIALLY a fine tool for critical thinking, but that a faculty academy pedagogy session on this teaching tool would be quite helpful. Faculty need to see ways in which a journal can be turned into an appropriate critical thinking tool.

The assessment results for the 2010 Scholars' work reveal several very intriguing things. First, we realized that for this project, attaining the "benchmark" rating of "1" is good, a sign that critical thinking is going on, but at an appropriate (first-year) level. It would be quite surprising if the results showed students scoring 4's and 5's when they are just in their first year of college education.

Whether the scores will climb in their second, third, and fourth years remains to be seen, of course. But at this point, the AVERAGE scores across the 5 key categories of critical thinking seem in line with where first-year students ought to be hitting:

Explanation of issues	Evidence	Influence of context & assumptions	Student's position (perspective, thesis/hypothesis)	Conclusions and related outcomes (implications and consequences)	overall
1.38	1.23	1.25	1.25	1.20	6.5

We see at this stage that the students are strongest at offering explanation. Their uses of evidence are adequate, and the weakest area is in adjudicating the implications and consequences of their material.

Following this “assessment workshop” on the 2010 assignments, we then met once more on December 12, 2011, to perform our assessment on the Spring Term 2011 material. We successfully assessed 10 of the 13 examples of student work.<sup>2</sup> The comparisons between the students’ work in their first year and their sophomore year are intriguing:

	Explanation of issues	Evidence	Influence of context & assumptions	Student's position (perspective, thesis/hypothesis)	Conclusions & related outcomes (implications and consequences)	overall
2010	1.38	1.23	1.25	1.25	1.20	6.5
2011	1.82	1.85	1.63	1.23	1.25	7.35
% change	+ 32%	+ 50%	+ 30%	- 2%	+ 4%	+ 13%

We see that students’ skills at explanatory work continue to grow; their use of evidence also shows strong enhancement, as does their awareness of what impacts their views (“context and assumptions”). But in the more advanced metrics of critical thinking—development of their own perspective, the argumentation of thesis and hypothesis, the construction of conclusions, and the understanding of the implications and consequences of their ideas—students showed little appreciable gain. We speculate that these skills are the hardest to acquire and the ones that will be most enhanced through work accomplished in the junior and senior year, when students are much more aware of their disciplines and have gained appreciably in the advanced areas of critical thinking.

Other points of action and consideration from the December 13 2011 meeting include:

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<sup>2</sup> For 3 of the assignments, we determined to do the following: for #s 13 and 18, we determined that these must be assessed using the “Creative” rubric from AACU. We will do a one-hour assessment workshop at our next retreat, so that we can both talk about this rubric and also assess the assignments. For #14, we determined that it was comparable to a foreign language assignment, and that we were simply not qualified to read the work. We need to find an outside evaluator for this assignment, as for the 2 foreign language assignments from 2010.

- When we give faculty instruction for the Spring Term Scholar material this coming spring, we will emphasize the anonymity of the assessment; we will omit the numbers (4-3-2-1) corresponding to the different levels of critical thinking (capstone-milestone-benchmark) to clarify that these are not “scores” in ascending order so much as classifications; and we will provide the rubric at the outset of informing faculty of their ST scholar in their class.
  - We speculated that the 4-week, intensive spring term might not be conducive, on the whole, to capstone-order work. This would be a very intriguing conclusion to draw from the Spring Term experience, and we will continue to investigate this.
  - We saw with renewed emphasis that we must employ both the CRITICAL and the CREATIVE rubrics in assessing the Spring Term Scholars’ work.
  - We discussed the option of designating some assignments as “Not Applicable,” if they simply don’t match up with the AACU rubrics we are employing.
  - We realized that we must have the full assignment from faculty to go along with the actual student work. This is imperative for us to fully and effectively assess the work.
  - We discussed the idea of assessing how well the assignments fit the rubric, and also discussed the possibility of revising the AACU rubric to suit our own specific needs better.
- Response/Action items:** Overall the Spring Term Scholars assessment project is ambitious and complex, but it is leading to superb conversations about how to assess critical and creative thinking. It also is providing exactly the sort of portrait of student work in the spring term that we are seeking. As we continue to refine this tool, our understanding of the successes and challenges of the spring term is increased.

**IV. Spring Term Festival:** As in 2010, we concluded the Spring Term with a campus-wide Festival. Our aim here is both to celebrate the wonderful work accomplished during the term, and also to honor the efforts of students and faculty alike in this intensive learning model. We again provided a campus-wide BBQ luncheon, with live music from various student music groups. Attendance was superb, with over 1,400 people being served. The highlight was certainly the student poster show, which this year we moved into the first floor of the newly renovated Leyburn Library. Hundreds of students exhibited their work in multiple formats: traditional hard-copy posters, power point and projected displays, exhibits of created work, robotic models created in class, live performances of drama and dance projects, and much more. The entire campus community was able to tour the area and see the wide range of truly impressive student work. There was virtually unanimous praise for this aspect of the festival, as it called attention to the fine work our students and faculty are accomplishing in the spring term.

We could make use of the poster display as an ongoing assessment tool also. We can consider some sort of evaluation or study of the works produced. Certainly the “vetting” of so much student work in a public forum constitutes an impressive degree of finish to their multiple projects. A slide show of the festival featuring images from both 2010 and 2011 can be viewed at:

<http://vimeo.com/40013088>.