

**THE UNIVERSITY OF HOUSTON**  
**4800 CALHOUN ROAD, HOUSTON, TEXAS 77004**

**FIRST MONITORING REPORT**

**Prepared for**

**Commission on Colleges, Southern Association of Colleges and Schools**  
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**DATES OF SACS COC COMMITTEE VISIT: APRIL 7 – 9, 2008**

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## SUMMARY, AND RECOMMENDATION ADDRESSED

### Recommendation addressed: CS 3.5.1 (College-Level Competencies) Recommendation 2

*The assessment of core competencies is well planned by the institution; however, many of the activities have not yet been implemented. The institution should document the assessment of college-level competencies as described in the document, "Core Competency: Assessment Plan and Progress Report," submitted to SACS on September 10, 2008.*

Implementing the assessments described in our 2008 report has engaged faculty across the entire campus in discussions and activities, including assessment of a comprehensive university-wide sample of student work. This narrative documents those activities. First, a summary:

**Critical Thinking:** In 2009, a multi-disciplinary faculty group assessed the critical thinking displayed in an extensive, representative, campus-wide sample of student work, using the rubric developed by the faculty to articulate the UH expectations and standards for the undergraduates' critical thinking. Their findings are presented in this report. In addition, as promised in the 2008 report, a nationally-normed test of critical thinking has been selected by a subcommittee of the Faculty Senate: The Collegiate Learning Assessment will be administered to representative samples of students in the 2009-10 school year: in October (freshmen) and in March (seniors).

**Communication:** In 2009, our Writing rubric, modified after its use in the 2006 campus-wide writing assessment, was used by a multi-disciplinary faculty group to

assess the writing skills displayed in the university-wide representative sample of student work. Their findings are presented in this report.

Our QEP program, Learning through Discovery, enhances undergraduates' opportunities for research both on and off campus, and provides training in associated skills, including communication. Setting standards and expectations for assessment of public speaking through the QEP program has engaged discipline-specific teams as well as cross-disciplinary groups. Students' communications about their research have been assessed using discipline-specific rubrics developed and reviewed by these teams. These data for Spring and Summer, 2009, are presented in this report.

**Information literacy:** The information literacy assessment underway on campus is groundbreaking, in that it examines both product and process. A faculty committee in 2008-09 surveyed 174 UH faculty in order to modify the five standards of the American College and Research Libraries (ACRL) to align with core competencies for general education at UH in light of faculty priorities. Descriptors, representing expectations for UH undergraduate students focused on those standards, were developed by a team of faculty members and librarians; the resulting rubric is being pilot tested Fall, 2009 with a subset of the student work assessed for Critical Thinking and for Writing. Utilizing the rubric with these work samples will allow us to investigate associations among Information Literacy, Critical Thinking, and Writing as evidenced in these items of student work.

Information Literacy includes knowing how to use the appropriate sources to find needed information, so its assessment must include process as well as product. A team

of library and assessment personnel applied for and received a grant from university library funds to support a research project which will videotape and analyze students' information-seeking behavior at the library, working on research questions in their own fields. This study is funded for the 2009-10 academic year.

**Quantitative reasoning:** A major assessment of the work of 4,271 students in UH mathematics courses in 2008 examined students' performance with respect to four quantitative reasoning objectives. The assessment used an item analysis methodology to examine student performance on embedded test items identified as addressing each of the four objectives, rating the performance with respect to standards defined by mathematics faculty. The assessment found satisfactory performance overall for each of the four objectives.

The item analysis methodology employed in that assessment provided highly useful information about student performance. Seeing the power of that approach, and the utility of the information developed through its use, mathematics faculty have subsequently applied item analysis methodology to assist their pedagogy, and the methodology is currently being evaluated for a more sensitive approach to the entire mathematics placement function. In addition to its usefulness for placement and pedagogy, item analysis methodology led to a cooperative project with the College of Education, in which audio-visual materials were produced that were targeted to meet student needs as evidenced through item analysis. As student performance data related to these activities become available, their impact will be examined.

## **ASSESSMENT AT UH: FACULTY MEMBERS ARE THE KEY**

Assessment in which faculty are engaged is more likely to result in improved teaching and learning. With over 3,000 faculty teaching approximately 36,000 students, building genuine faculty engagement requires not only time, but also real commitment. The assessment described in this report reflects that commitment. Faculty identified the learning outcomes expected for the students, and the standards expected for each outcome. Faculty participated actively in rubric development, including defining the identifiers for unacceptable, acceptable, and exemplary performance for each outcome. The university-wide sampling described in this report required a high level of faculty participation across the university: over 90% of instructors of selected students participated in that conversation and gathering of student work. The high level of participation in the collection process, together with careful adherence to the principles of random sampling, permitted a high degree of confidence that the university-wide sample provides an accurate representation of student work. Cross-disciplinary teams of faculty performed the assessments of the university-wide samples of work. Conversations with faculty about these assessments are ongoing; faculty interest and commitment are high. Findings will be reported to the Undergraduate Council, the academic governance committee charged with advising the Office of the Senior Vice President for Academic Affairs and Provost about the qualitative development of undergraduate programs and activities. After that, summary reports will be disbursed to departments and faculty for discussion and feedback.

## **UNIVERSITY-WIDE SAMPLE OF STUDENT WORK: CRITICAL THINKING AND WRITING**

To assess the cumulative impact of their UH education on the Critical Thinking and Writing skills of our students, we took a comprehensive university-wide sample of the work of graduating seniors. The following narrative describes the identification, selection, collection, and preparation of that sample of student work.

### **Embedded work**

Authenticity is one of the principles of UH assessment. For this reason, we sampled embedded work, written in response to course assignments from faculty. Chairpersons from each academic department in the university were sent a listing of the senior-level courses offered in Spring, 2009 in their departments, and asked to identify those in which student products would be expected to show critical thinking and writing skills.

All departments responded to this request. Using these responses, we prepared a list of all students enrolled in any of those courses who had applied for graduation in Spring, 2009. Our sampling unit was a student-course: not simply a graduating student, not simply a senior-level course, but the unit of a graduating student enrolled in a course identified by the department chair as having the expectation that the students' work would demonstrate critical thinking and writing skills. A total of 1,773 student-course units meeting these qualifications were identified.

From these, using the Excel random number function, we drew a random sample of 350 student-course pairs. We eliminated duplicate students (the same student selected in more than one course) but not duplicate courses (more than one student selected

from a course). Our random sample included students from 113 different courses having 112 different instructors (some instructors taught more than one course from which students were selected; some courses had students selected from more than one section of the course).

Each instructor having a student selected from the sample was contacted with a description of the assessment and its purposes, and a request for the instructor to select a piece of written work by this student from a course assignment which called for the demonstration of critical thinking and writing skills. The assignment could be from any point in the semester. Where possible, ungraded copies of the work were solicited, but graded or ungraded work was accepted. For each piece of work, a copy of the assignment was also requested. Because this work was gathered for internal assessment purposes, student consent was not required; however, a number of faculty members chose to notify students that their work would be included in the assessment.

More than 90% of faculty responded to this request. Some instructors reported no appropriate work available from their class, or otherwise declined to participate. A total of 262 pieces of embedded student work were collected for assessment. The high level of participation in the collection process, together with our careful adherence to the principles of random sampling, permitted a high degree of confidence that the university-wide sample provided an accurate representation of student work.

### **Preparation of student work samples**

The collected student work and assignment descriptions were prepared for assessment by faculty. All information identifying the student or the faculty member



was removed. For work samples which had been graded or which bore comments by the instructor, those grades and comments were removed. Some work, including some papers in Business, Psychology, Hotel and Restaurant Management, and Psychology, had identifying information about other people; this was removed. Identification codes were affixed to each piece of student work and its corresponding assignment description.

The assessment of the samples for Critical Thinking, for Writing, and later, for Information Literacy, is described in the following sections.

## **CRITICAL THINKING**

### **The rubric**

Using as a starting point nationally-available rubrics representing best practices, a multidisciplinary group of UH faculty defined the standards for critical thinking for UH undergraduate students. The rubric developed and piloted in this process articulates the characteristics of critical thinking that are common across all disciplines. The UH Critical Thinking rubric, which may be seen in Appendix A, was forwarded to all colleges in academic year 2008-09 for distribution to all faculty teaching core courses. With a shared understanding of faculty expectations established, we set out to assess the performance of our students in Critical Thinking, using the collected sample works.

During June, 2009, faculty members met for rubric review, benchmarking, and norming before beginning assessment of the work samples. To the rubric which had

been developed, reviewed, and piloted by faculty was added an open-ended question to capture each reviewer's on-the-spot reactions to the piece of student work.

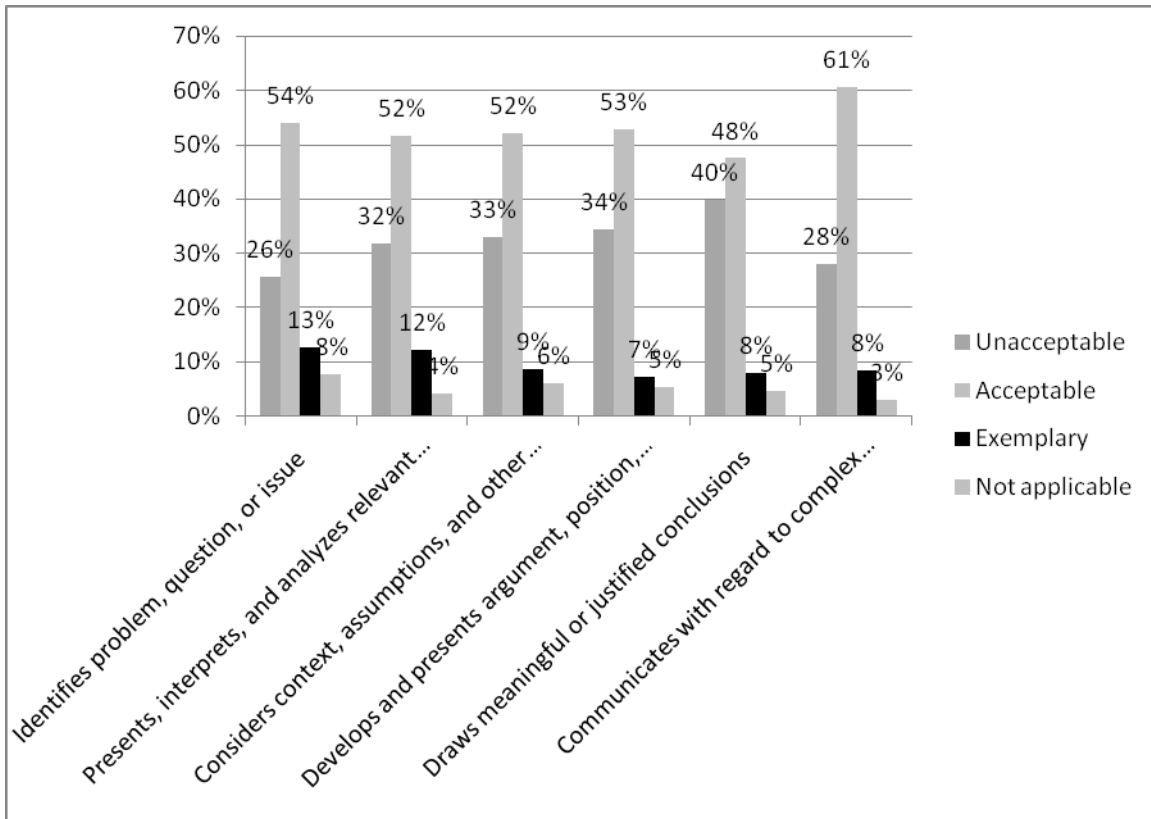
After the benchmarking and norming process was complete, faculty used the rubric to assess each piece of work. More than half the pieces of work were assessed independently by two different faculty members, to allow for tests of inter-rater agreement.

Near the end of the faculty assessments, the faculty rating groups were assembled for a debriefing. They were surveyed, and a group interview was conducted and recorded, in order to discover any difficulties with the instrument and its use, the training, logistics of handling data and submitted scores, or any other problem. These responses will be a part of the further analysis of Critical Thinking performance and assessment on the campus.

### **Critical Thinking Findings**

Analysis of the rich findings is underway. A full analysis of raters' comments, both about specific pieces of work and in the group meeting, will add perspective to these findings. Areas of inter-rater agreement and disagreement will be explored in depth to understand more about faculty expectations in each of these areas. Continued faculty discussions of these findings over time will clarify our expectations: Is there an acceptable proportion of "unacceptable" ratings? Does this differ from one criterion to another? What is a satisfactory balance between "acceptable" and "exemplary" ratings? The initial findings themselves, however, are interesting and informative, and are presented here.

**Figure 1: Faculty Ratings of Critical Thinking Performance in Sampled UH Student Work**



For each of five of the six criteria of critical thinking, the majority of students' work samples were deemed acceptable. However, the large numbers of samples rated unacceptable, and the small numbers rated exemplary, show work to be done in critical thinking with undergraduates. In particular, about 40% of sampled work demonstrated unacceptable performance in drawing meaningful or justified conclusions. Furthermore, in each of the tested criteria, one-quarter or more of the sampled pieces were rated unacceptable.

Analysis of these findings continues, including relating the findings on Critical Thinking to those on Writing and later, to those on Information Literacy. It is expected

that faculty comments about the work will be helpful. Some examples of those comments:

*Organized and thoughtful*

*No consideration of alternate theories, and no criticism or evaluation of the presented theory.*

*Describes a novel concept and its attempted implementation, with good evaluation of successes and failures integrated into conclusions and implications.*

*Does not use evidence to link employee benefits to employee satisfaction or lower turnover, although this is their main claim/argument.*

*Most evidence presented is from the author's direct observations, but it is used and interpreted very effectively.*

*Conclusion is present, but vague and weakly stated. No evidence is presented outside the case scenario.*

*Case is well written and student projects several ideas associated with each element of the case. Reader is excited about reading further as student has definite (but not rigid) ideas to offer.*

Findings from this assessment are already causing us to look again at the curriculum map to consider where our students are developing their critical thinking skills.

### **National Test of Critical Thinking**

The findings from this assessment confirm the value of further information about the performance of our students in this essential area. The University of Houston has elected to participate in the Voluntary System of Accountability. We recognize the value of information from a nationally-normed and administered test in ensuring that our students are meeting wider expectations as well as our own expectations. A Faculty Senate subcommittee has chosen the Collegiate Learning Assessment (CLA) as our nationally-normed test of critical thinking. First administration of the CLA to samples of UH students is scheduled for October, 2009 (freshmen) and March, 2010 (seniors).

## COMMUNICATION

The University of Houston has been measuring student writing skills since the 1970s. A locally-developed Writing Proficiency Exam provided information on the skills of every degree-seeking undergraduate for over 35 years. A new rubric was developed for the writing assessment requested through the Undergraduate Council in 2004. That assessment identified three areas for development:

1. Help students understand more clearly and address more effectively what is expected of them on writing assignments
2. Help students develop knowledge and strategies for effective editing and improving writing quality
3. Help faculty communicate assignment expectations to students clearly

Another outcome of the assessment was a further refinement of the rubric. The revised rubric, which was used in the 2009 assessment, may be seen in Appendix B.

The same prepared samples of student work which had been used for the assessment of Critical Thinking were used for the 2009 Writing assessment. During summer, 2009, faculty members met for rubric review, benchmarking, and norming before beginning assessment of the work samples. To the rubric was added an open-ended question to capture the reviewers' contemporaneous reactions to each piece of student work.

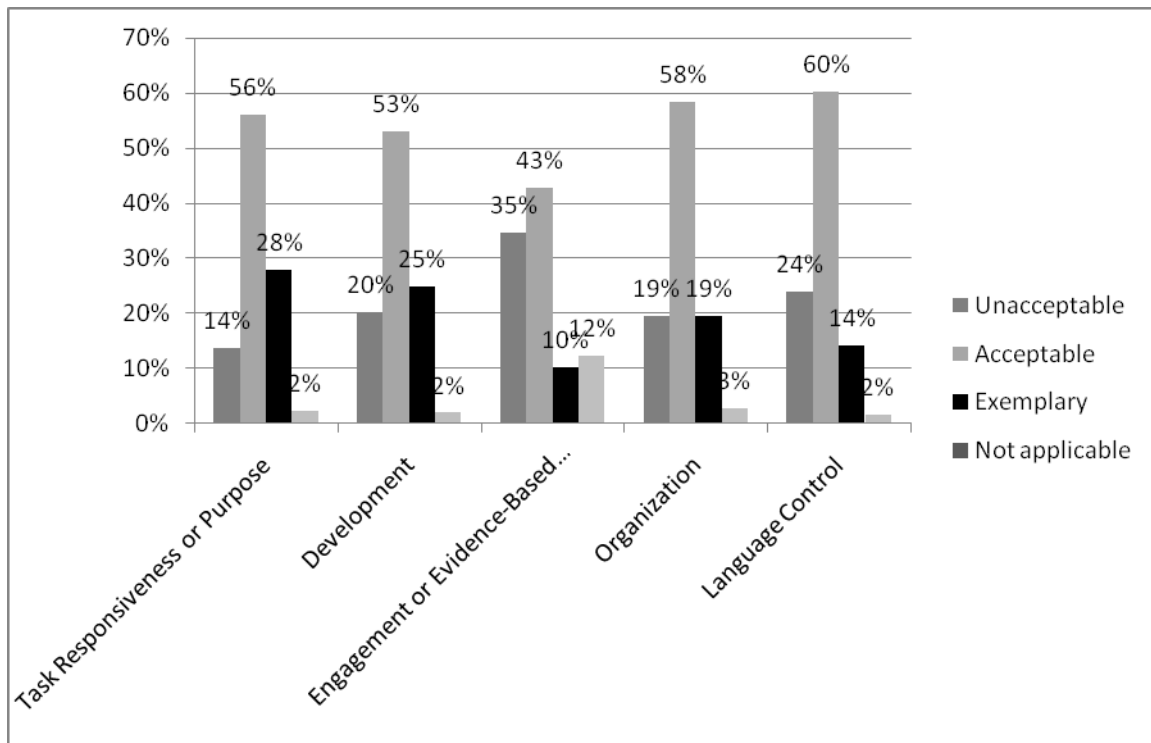
After the benchmarking and norming process was complete, faculty used the rubric to assess each piece of work. Faculty could choose whether they preferred to work with

electronic or paper samples. More than half the pieces of work were assessed independently by two different faculty members, to allow for tests of inter-rater agreement. Additional assessments for half the pieces of work were provided by advanced graduate students with experience in teaching writing composition courses.

Near the end of the faculty assessments, the faculty rating groups were assembled for a debriefing. They were surveyed, and a group interview was conducted and recorded, in order to discover any difficulties with the instrument and its use, the training, logistics of handling data and submitted scores, or any other problem. These responses will add to the analysis of Writing performance and assessment at UH.

### Findings on Writing Performance

**Figure 2: Faculty Ratings of Writing Performance in Sampled UH Student Work**



For each of four of the five writing criteria, the majority of students' work samples were deemed acceptable. The single exception was Engagement or Evidence-based Reasoning (the composition engages with sources, evidence, and/or data). Continued faculty discussions of these findings over time will clarify our expectations for these ratings: Is there an acceptable proportion of "unacceptable" ratings? Does this differ from one criterion to another? What is a satisfactory balance between "acceptable" and "exemplary" ratings?

Analysis of the rich findings is on-going. A full analysis of faculty comments, both about specific pieces of work and in the group meetings, will add perspective to these findings. Areas of inter-rater agreement and disagreement will be explored in depth to understand more about faculty expectations in each of these areas.

Examples of faculty comments follow.

*Author clearly establishes the purpose in the introduction. Good definition of terms and use of the definitions to support choice of economic indicators discussed.*

*A lot of statistics given but no references cited.*

*Piqued interest in reading these stories/tales*

*The purpose of the paper is never established.*

*The author provides too little information to allow the reader to understand the discussion points.*

*Engagement was uneven: some paragraphs contained no citations, others too many.*

*References are well-integrated into the text and support the development of the paper.*

With regard to the Evidence criterion, it is notable that a number of faculty raters remarked that the assignment did not specifically require evidence-based reasoning.

### **Speaking and listening**

Speaking and listening were assessed in conjunction with the Spring 2009 and Summer 2009 implementations of the Quality Enhancement Plan (QEP), which involves undergraduates in research opportunities which they present their research or problem-solving. Presentations may be spoken, written, or presented by another means, for instance, in the performing arts. Discipline-specific teams developed rubrics for assessing QEP projects in each of the following disciplines: Creative Arts; Science, Technology, Engineering and Mathematics; Social Sciences; Applied Sciences; Liberal Arts; and Professional Programs. Next, subcommittees for each of the six criteria examined the work of the academic-discipline subcommittees to ensure consistency across disciplines while maintaining the standards developed by the individual discipline committees. Finally the revised rubrics were reviewed by the full QEP Assessment Task Force and forwarded to faculty with QEP grants for their use in assessment. The six completed rubrics may be seen in Appendix C.

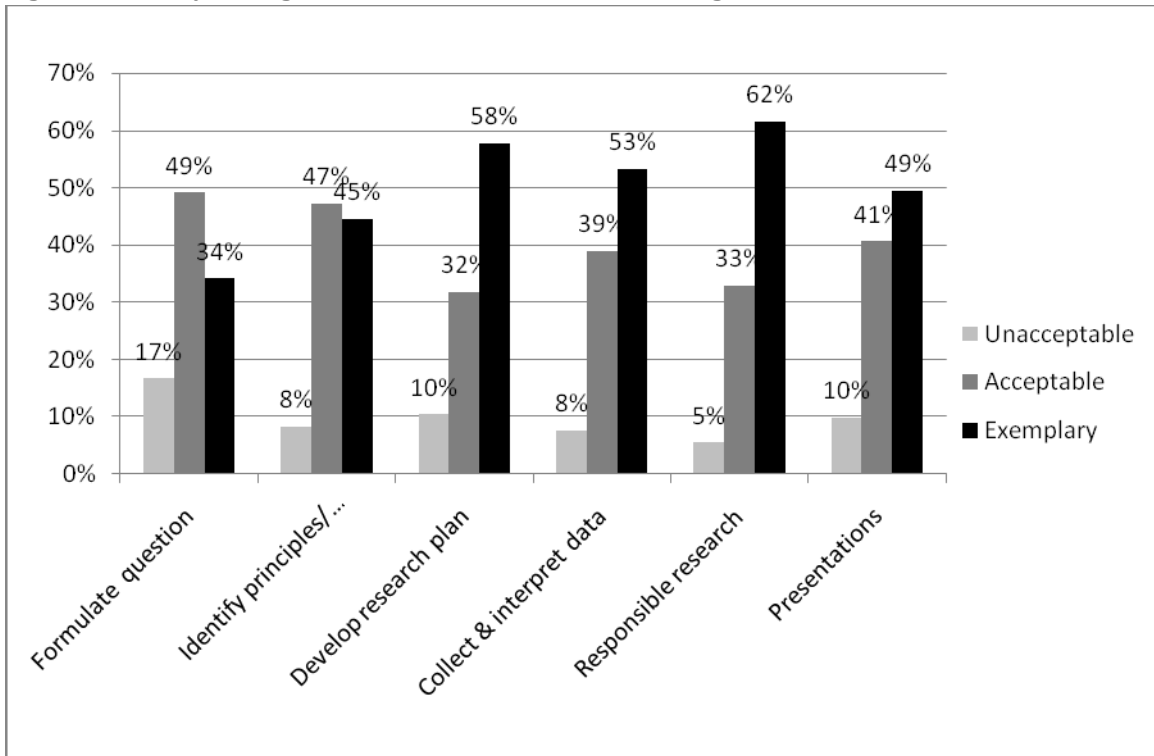
Each of the rubrics includes assessment of the communication demonstrated by the students, as appropriate for that discipline. The rubric in each of the six disciplinary areas includes this outcome: *Students will be able to articulate their research findings through written, performance, and/or oral presentations.* The descriptors provided differ among the disciplines, providing specificity for each area while maintaining comparability across areas.

Using these rubrics, student performance in Spring and Summer, 2009 QEP-funded programs were assessed by the faculty serving as principal investigators and/or



instructors for program classes. Communication skills of 182 participating students were assessed. Figure 3 shows the ratings by faculty.

**Figure 3: Faculty Ratings of Student Performance Including Presentations in QEP Courses**



“Exemplary” was the most frequent rating for four of the six outcomes, including Communication. Discussion around these findings will focus attention on the need to work with students on their formulation of research questions and problems.

### INFORMATION LITERACY

The assessment of Information Literacy is broad and multifaceted, reflecting the complexity of the field. Both faculty and library staff members are involved, and both student products and their approaches to acquiring information are examined. The “process” approach, funded by a UH Library grant for 2009-10, is breaking new ground in the assessment of Information Literacy. The following chart displays the skills and assessment of Information Literacy skills for UH.

**Assessment of Core Information Literacy Skills  
for University of Houston students**

<b>Information Literacy Skill</b>	<b>Assessed by</b>	<b>Source of information</b>
Determines the nature and extent of the information needed	Faculty	Critical thinking rubric: Identifies problem, question, or issue
Identifies and selects resources .....  and research tools	Library staff  Library staff	Resources: from student work products  Research tools: by observation
Finds and accesses needed information effectively and efficiently	Library staff	Observation
Critically evaluates information ....  and its sources	Faculty  Library staff	Critical thinking rating: Presents, interprets, and analyzes relevant information, data, or evidence.  Sources: Library staff from student work products
Understands the ethical and/or legal aspects of information use	Library staff	Student work products
Life-long learning: Understands how to apply information-seeking skills in their careers and throughout their lives	Faculty and library staff (imputed from observations and student work)	Student work products and observation

Sources of identified skills: ACRL Information Literacy Competency Standards; 2008 UH faculty survey

## **2008 faculty survey**

The skills outlined above were derived from the standards and outcomes defined for undergraduate students by the Association of College and Research Libraries (ACRL), and tailored for our campus through a 2008 survey of UH faculty. One hundred seventy-four faculty members participated in the survey, which asked them to indicate the importance to them of the ACRL standards and outcomes. The findings from that survey may be seen in Appendix D.

## **Assessing student products for information literacy**

Information Literacy goals that can be assessed by looking at student products include some to be assessed by faculty (determination of the information needed, and critical evaluation of the information procured) and some to be assessed by library staff (identifying resources, accessing information, and employing citation correctly). The Information Literacy goals assessed by faculty are addressed in the university-wide assessment of Critical Thinking. For those Information Literacy skills which are to be assessed by library staff, a joint committee of faculty and subject librarians developed a rubric including anchor descriptions consistent with faculty expectations for the students; the rubric may be seen in Appendix E. This Fall, the rubric is being pilot tested with a sample of the student work collected for the university-wide assessments of Critical Thinking and Writing. The findings related to Information Literacy will be informed by the findings of the Critical Thinking and Writing assessments of the same works.

## **Assessing the processes students use in seeking information**

Whether student products include appropriate and sufficient information, and whether that information is used effectively and cited appropriately, can be observed by assessing student products. However, while assessment of student products is, in our view, necessary, it is not sufficient. We consider the quality and expediency of the search for information to be a component of information literacy, and this aspect cannot be deduced from reviewing student products.

We decided that a comprehensive assessment of students' Information Literacy must consider the procedures students follow in seeking information. A proposal for research to investigate how students undertake information research has been funded by a micro-grant from the UH Library System. Through this grant we will investigate how students search for information when given a real-world problem to solve.

Data will be collected in three formats:

1. Videotape: Undergraduate students will be given a real-world problem/situation and their research process will be videotaped by library staff as they work in the library on a research problem in their major field.

2. Interview: Students will be interviewed to learn how they make decisions when it comes to searching for information, why they choose specific resources, and how they decide whether the information found can be used to solve their problem.

3. Questionnaire: Students will also be asked to complete a questionnaire which will include questions related to their experience using library services (e.g. reference and instruction services)

Funding was awarded in August, 2009, for this project. The project will be conducted and reported during the 2009-10 school year; the full proposal can be seen in Appendix F.

These exploratory studies are expected to provide the foundation for further assessment on a larger scale. Under consideration for the university-wide comprehensive assessment is a university-wide sample of student research papers and/or an Information Literacy content test administered to a stratified sample of students from all undergraduate colleges. The embedded work would be assessed by faculty and by librarians, using rubrics revised through the pilot testing. A content test would be expected to include questions requiring students to identify relevant databases, discriminate appropriate from inappropriate information sources, and use Boolean operators.

## **QUANTITATIVE LITERACY**

### **Assessment of multiple work samples from 4,271 students**

The assessment strategy for math competencies at the University of Houston reflects four general learning objectives adopted from the core curriculum guidelines

established by the Texas Higher Education Coordinating Board (THECB). Stated in terms of what students are expected to do, these objectives are:

- To apply arithmetic, algebraic, geometric, higher-order thinking, and statistical methods to modeling and solving real-world problems
- To represent and evaluate basic mathematical information verbally, numerically, graphically, and symbolically
- To expand mathematical reasoning skills and formal logic to develop convincing mathematical arguments
- To interpret mathematical models such as formulas, graphs, tables and schematics, and draw inferences from them

In order to assess student progress, the four learning objectives were mapped to four lower-division courses:

- MATH 1310: college Algebra
- MATH 1313: Finite Mathematics with Applications
- MATH 1314: Calculus for Business and the Life Sciences
- MATH 1330: Pre-calculus

The Mathematics Department collaborated with the Office of Institutional Effectiveness to identify specific data items appropriate for each of the four objectives, including both

multiple choice and free response items. Performance on each item was expressed in terms of four performance levels:

- Needs Improvement: Student is lacking the prerequisite skills necessary to take the first step toward solving the problem.
- Basic: Student has demonstrated that s/he has the pre-requisite skills to set up the problem and/or take the first step toward solving the problem.
- Acceptable: Student has demonstrated sufficient knowledge to solve the problem
- Exemplary: Student has completed every step required to solve the problem correctly and has reported the answer correctly.

The critical cut score is the point at which students are classified as “acceptable” since this represents the minimum math target outcome for these items. Performance standards were based on student outcome patterns in previous years. Analysis of the work of 4,271 students in the identified mathematics courses indicated that students were meeting the general education benchmarks for acceptable performance in mathematics. Outcome data for each objective suggest that students were able to demonstrate learning at a level consistent with the goals of the math problem. The full report may be seen in Appendix G.



This research has had direct impact on placement in, and delivery of, service courses and other lower-division courses in mathematics. The research employed an item analysis methodology for examination of student performance on specific test items, to measure achievement of the outcomes tested by those items. As a consequence of that research, mathematics faculty are extending the item-specific approach to an examination of performance on each test item for the team-taught lower-division mathematics courses, and to an item-performance based course placement for new students.

#### **Item analysis: Impact on service courses**

Service courses in mathematics are team-taught by instructors, using a calendar set up by the course coordinator and a shared bank of test items which feed computer-generated tests taken by students. There are ten forms for each of the fourteen question items, for a total of  $10^{14}$  total possible tests. The course coordinator now receives an item-by-item report after each test. When performance for an item is lower than expected, the course coordinator investigates the reason: Have students been given sufficient opportunity to practice this type item in homework assignments, pop quizzes, and the practice test? Dialogue with course instructors follows: How are you teaching this content? Did you notice reactions from your students when you taught this? Coordinators have these discussions with instructors by email or informal meetings.

#### **Item analysis: Impact on placement exam**

The item analysis approach is also being extended the current academic year to the mathematics placement exam taken by new students, making possible a movement from placement by overall score to placement by performance on items testing specific content. Presently, student performance on the exam is reported as a single score. Higher scores place the students into higher-level courses, regardless of the specific items on which a given student had been successful. In Fall, 2007, the Department of Mathematics took over administration of the mathematics placement test, formerly administered by the UH Testing Center. In 2008-2009, the Department of Mathematics completely revised the test, working for a balance of items. In conjunction with this revision, mathematics faculty mapped placement test items to content of lower-division course. Consideration is now being given to revising the policies for student placement, so that placements will be made in consideration of performance on specific test items rather than an overall score. It is considered possible that this more sensitive assignment of students to courses would enhance student success in these courses. Mathematics faculty will test this possibility by performing an analysis to compare pretest performance with subsequent performance in math classes.

### **Assessment leads to inter-college cooperation**

The focus on item-specific content resulted in a cooperative venture completed with the College of Education (COE). A COE graduate student produces content videos on specific topics, such as multiplying fractions, identified through item analysis methodology as being problematic for students. Students identified as requiring remediation in particular topics are directed to review the appropriate video and take

the corresponding test, after which the instructor is notified of successful remediation for that student. This benefit was a direct outcome of the assessment of the work of the 4,271 students in the sample.

## CONCLUDING COMMENTS

At UH, assessment is both ongoing and exciting. Faculty members have driven this process, have been kept informed at every step, and in some cases have let us know that their instruction has already benefited: for example, from the rubrics developed in this process. We have dispersed the rubrics for critical thinking and writing to all faculty, and a number have reported sharing these with students to let them know expectations, and adding these expectations to their instructional syllabi and content.

The scope of the university-wide sampling has necessarily engaged department chairs and faculty across the university. Every department responded to the request for identification of senior-level classes with appropriate products; in many cases, significant dialogue took place as cooperation was sought and gained. Similar discussions took place as faculty members were notified of the selection of one or several of their students in the sample. The request for the work of one or a few named students demonstrated the nature of the sample and piqued interest.

We understand that the most effective dispersion and discussion works through channels both formal and informal. The Undergraduate Council is the faculty governance committee charged with advising the Office of the Senior Vice President for Academic Affairs and Provost about the qualitative development of undergraduate programs and activities, and has been an active partner in assessment. Our reports to the Council have been important steps in making these findings known and discussed.

This assessment process has enhanced the sense of shared responsibility for student instruction. We are a stronger academic community with a greater sense of identity and

purpose, for all the activities and discussions around assessment. That shared purpose continues to grow as our effectiveness is examined and supported.

## **SUMMARY OF SIGNIFICANT OUTCOMES**

**Critical thinking:** A university-wide representative random sample of embedded senior-level student work was assessed by a cross-disciplinary group of faculty, using the rubric developed by faculty to articulate the UH expectations and standards for the undergraduates' critical thinking. Findings show significant progress in a number of areas, and work to be done in the drawing of meaningful or justified conclusions. The Collegiate Learning Assessment (CLA) has been selected to provide a nationally-normed assessment of our students' critical thinking skills. First administration of the CLA to samples of UH students is scheduled for October, 2009 (freshmen) and March, 2010 (seniors).

**Communication:** In 2009, a comprehensive assessment of writing was completed by a cross-disciplinary group of faculty; this was the second major assessment of writing in the past four years. The 2009 assessment, conducted using the university-wide random sample of embedded student work, indicated a need for improvement in engagement, or evidence-based reasoning. Further analysis of these data is on-going. Assessment of speaking skills conducted through the Quality Enhancement Plan; data for Spring and Summer 2009 show strong communication skills but work to be done in statement of the problem or research question.

**Information literacy:** Assessment in this area includes research, by videotape, of information-seeking behavior of UH undergraduates, funded for 2009-10 by a UH library grant. A faculty survey in 2008-09 served to focus the ACRL Information Literacy standards for UH in light of faculty priorities. Descriptors representing expectations for UH undergraduate students reflecting those standards were developed by a team of faculty and librarians; the resulting rubric will be pilot tested in Fall, 2009 with a subset of the student work assessed for Critical Thinking and for Writing.

**Quantitative literacy:** A major assessment of the work of 4,271 students in mathematics courses examined students' performance with respect to four quantitative reasoning objectives showed we are meeting our objectives in mathematics. Item analysis methodology used in this assessment has enhanced and focused pedagogy and placement in mathematics courses, and has led to cooperative work with College of Education.

**.Appendix A**

**University of Houston Rubric for Assessment of Critical Thinking**

## **University of Houston Critical Thinking Rubric**

<b>Identifies problem, question, or issue</b> (raises questions, formulated clearly and precisely)		
<i>Unacceptable</i>	<i>Acceptable</i>	<i>Exemplary</i>
<ul style="list-style-type: none"> <li>- Does not attempt to or fails to identify and summarize accurately.</li> </ul>	<ul style="list-style-type: none"> <li>- Summarizes issue, though some aspects are incorrect or confused. Nuances and key details are missing or glossed over.</li> </ul>	<ul style="list-style-type: none"> <li>- Clearly identifies the challenge and subsidiary, embedded, or implicit aspects of the issue.</li> </ul>
<b>Presents, interprets, and analyzes relevant information, data, or evidence</b> (gathers relevant information, using disciplinary concepts to interpret it effectively)		
<ul style="list-style-type: none"> <li>- Little or no evidence of search, selection or source evaluation skills.</li> <li>- Repeats information provided without question or dismisses evidence without adequate justification.</li> <li>- Data/evidence or sources are simplistic, inappropriate, or not related to topic.</li> </ul>	<ul style="list-style-type: none"> <li>- Demonstrates adequate skill in searching, selecting, and evaluating sources to meet the information need.</li> <li>- Use of evidence is qualified and selective.</li> <li>- Discerns fact from opinion and may recognize bias in evidence, although attribution is inappropriate.</li> </ul>	<ul style="list-style-type: none"> <li>- Evidence of proficient and effective search, selection, and source evaluation skills.</li> <li>- Examines evidence and its source; questions its accuracy, relevance, and completeness.</li> </ul>
<b>Considers context, assumptions, and other perspectives</b> (thinks open-mindedly, considering multiple sources and options, assessing the credibility and authority of sources)		
<ul style="list-style-type: none"> <li>- Approach to the issue is in egocentric or socio-centric terms.</li> <li>- Analysis is grounded in absolutes, with little acknowledgment of own biases.</li> <li>- Engages ideas that are obvious or agreeable. Avoids challenging or discomfoting ideas.</li> </ul>	<ul style="list-style-type: none"> <li>- Provides some recognition of context and consideration of assumptions and their implications.</li> <li>- Engages challenging ideas tentatively or in ways that overstate the conflict.</li> <li>- May dismiss alternative views hastily.</li> </ul>	<ul style="list-style-type: none"> <li>- Analysis acknowledges complexity and bias of vantage and values, although may elect to hold to bias in context.</li> <li>- Identifies influence of context and questions assumptions, addressing ethical dimensions underlying the issue.</li> <li>- Integrates own and others' ideas in a complex process of judgment and justification.</li> <li>- Clearly justifies own view while respecting views of others.</li> </ul>



<b>Develops and presents argument, position or hypothesis, with implications</b>		
<i>Unacceptable</i>	<i>Acceptable</i>	<i>Exemplary</i>
<ul style="list-style-type: none"> <li>- Argument, position, or hypothesis is clearly inherited or adopted with little original consideration.</li> <li>- Fails to present and justify or forward argument, position, or hypothesis.</li> <li>- Argument, position, or hypothesis is unclear or simplistic.</li> </ul>	<ul style="list-style-type: none"> <li>- Argument, position, or hypothesis includes some original thinking that acknowledges, refutes, synthesizes or extends other assertions, although some aspects may have been adopted.</li> </ul>	<ul style="list-style-type: none"> <li>- Presents and justifies clearly and in sufficient detail own argument, position, or hypothesis while qualifying or integrating contrary views or interpretations.</li> </ul>
<b>Draws meaningful or justified conclusions (comes to well-reasoned conclusions and solutions, tested against relevant criteria and standards)</b>		
<ul style="list-style-type: none"> <li>- Fails to identify conclusions, implications, and consequences, or conclusion is a simplistic summary.</li> <li>- Conclusions presented as absolute, and may attribute conclusion to external authority.</li> </ul>	<ul style="list-style-type: none"> <li>- Conclusions consider or provide evidence of consequences extending beyond a single discipline or issue. Presents implications that may impact other people or issues.</li> <li>- Presents conclusions as relative and only loosely related to consequences. Implications may include vague reference to conclusions.</li> </ul>	<ul style="list-style-type: none"> <li>- Identifies, discusses, and extends conclusions, implications, and consequences. Considers context, assumptions, data, and evidence. Qualifies own assertions with balance.</li> <li>- Conclusions are qualified as the best available evidence within the context.</li> <li>- Consequences are considered and integrated. Implications are clearly developed, and consider ambiguities.</li> </ul>
<b>Communicates with regard to complex problems (adapts communication to target audience and disciplinary conventions)</b>		
<ul style="list-style-type: none"> <li>- Grammar, syntax, or other errors are distracting or repeated. Little evidence of proofreading. Style is inconsistent or inappropriate.</li> <li>- Work is unfocused and poorly organized; lacks logical connection of ideas. Format is absent, inconsistent or distracting.</li> <li>- Few sources are cited or used correctly.</li> </ul>	<ul style="list-style-type: none"> <li>- Errors are not distracting or frequent, although there may be some problems with more difficult aspects of style and voice.</li> <li>- Basic organization is apparent; transitions connect ideas, although they may be mechanical. Format is appropriate although at times inconsistent.</li> <li>- Most sources are cited and used correctly.</li> </ul>	<ul style="list-style-type: none"> <li>- Errors are minimal. Style is appropriate for audience.</li> <li>- Organization is clear; transitions between ideas enhance presentation. Few problems with format or other components of presentation.</li> <li>- All sources are cited and used correctly, demonstrating understanding of economic, legal and social issues involved with the use of information.</li> </ul>

This rubric incorporates substantial portions of the Washington State University Scoring Guide for Critical and Integrative Thinking and outcomes identified for a well cultivated critical thinker by the National Council for Excellence in Critical Thinking Instruction.

## Appendix B

### Rubric for University-wide Writing Assessment 2 (UAW2)

Criteria	Unacceptable (1)	Acceptable (2)	Exemplary (3)
<p><b>Task Responsiveness or Purpose:</b></p> <p>the composition establishes purpose or responds to assignment task</p>	<p>Fails to establish and announce purpose or fails to explicitly respond to assignment task (may lack clear purpose statement).</p>	<p>Establishes purpose or responds to assignment purpose, but may not completely fulfill purpose or may fail to respond to minor aspects of the assignment task.</p>	<p>Clearly establishes and fulfills purpose or clearly responds fully to assignment task, and establishes significance of purpose or task in terms of larger context.</p>
<p><b>Development:</b></p> <p>the composition develops with regard to audience, genre, and/or conventions</p>	<p>No apparent awareness of reader's needs and expectations (<i>prediction and fulfillment, support, elaboration</i>).</p> <p>Fails to conform to genre conventions (<i>structure/sectioning, format, style</i>), making the presentation difficult to process or follow.</p> <p>Voice, tone, level of formality poorly controlled or inappropriate for audience or purpose.</p>	<p>Demonstrates some awareness of reader's needs and expectations (<i>prediction and fulfillment, support, elaboration</i>) but may not fully meet all needs and expectations.</p> <p>Generally conforms to genre conventions (<i>structure/sectioning, format, style</i>), with occasional minor lapses.</p> <p>Voice, tone, level of formality mostly appropriate for audience or purpose, with occasional minor lapses.</p>	<p>Anticipates and fully meets reader's needs and expectations (<i>prediction and fulfillment, support, elaboration</i>).</p> <p>Works in concert with genre conventions (<i>structure/sectioning, format, style</i>) to increase accessibility and clarity of presentation.</p> <p>Voice, tone, level of formality consistent and well-suited to audience or purpose.</p>
<p><b>Engagement or Evidence-Based Reasoning:</b></p> <p>the composition engages with sources, evidence, and/or data</p>	<p>Makes generalizations without support or cites irrelevant evidence.</p> <p>Repeats or summarizes source texts without analyzing or critiquing, and/or fails to integrate (<i>introduce, incorporate</i>) sources into the writing.</p> <p>In-text citations and end-of-text references are missing or not formatted according to an appropriate style.</p>	<p>Goes beyond repetition or summary of sources, but does not fully synthesize or refute the ideas of source texts.</p> <p>Sources are integrated (<i>introduced, incorporated</i>) into the writing, but some quotations, paraphrases, or references may lack fluency.</p> <p>Most in-text citations and end-of-text references are appropriately cited.</p>	<p>Presents and interprets evidence from sources and synthesizes or refutes the ideas of source texts.</p> <p>Quotations, paraphrases, and references are handled fluently and add to the authority of the writing.</p> <p>All in-text citations and end-of-text references are appropriately cited.</p>

<p><b>Organization:</b> the composition is organized to manage flow appropriate to genre</p>	<p>Composition fails to flow in predictable and logical sequences (lacks transitions between paragraphs and sections).  Patterns of exposition, analysis, and/or argument proceed without obvious connection to purpose of the composition or assignment task (lacks unity).  Paragraphs or sections do not cohere with topic ideas and supporting details, or lack topic ideas and supporting details.</p>	<p>Composition flows in predictable and logical sequences (makes transitions between most paragraphs and sections).  Patterns of exposition, analysis, and/or argument proceed according to purpose of the composition or assignment task (unified composition).  Paragraphs or sections generally cohere with topic ideas and supporting details.</p>	<p>Composition flows in satisfying, surprising, or compelling sequences that go beyond simple established forms.  Patterns of exposition, analysis, and/or argument are fully unified and proceed with authority and/or originality.  Paragraphs or sections fully realize their portion of topic ideas and supporting details.</p>
<p><b>Language Control:</b> the composition demonstrates control of academic language</p>	<p>Problems with grammar, syntax, and/or vocabulary distract reader and detract from overall presentation.  Sentences frequently unsound in construction and/or lacking economy, variety, and clarity.  Frequent major editing errors.</p>	<p>Occasional problems with grammar, syntax, and/or vocabulary, but language does not otherwise stand out to reader.  Sentences generally sound in construction, but may be uneven in their economy, variety, and clarity.  Occasional editing errors.</p>	<p>Language usage impresses reader (clear, concise, polished prose).  Sentences supple, varied, and clear.  Few noticeable editing errors.</p>

Appendix C

Rubrics for Assessment of QEP Projects, including Communication Skills

Rubric for Assessing QEP Projects

**CREATIVE ARTS**

<b>Outcome</b>	<b>Developing</b>	<b>Competent</b>	<b>Exemplary</b>
<b>1. Students will be able to formulate a research question or problem.</b>	The research question or problem requires more thorough development to contribute to existing research in the discipline.	Either the research question or problem is too broad or narrow in scope appropriate to contribute to existing research in the discipline.	The research question or problem is correctly and thoroughly developed to contribute to existing research in the discipline.
<b>2. Students will be able to identify basic principles and knowledge related to their research question or problem.</b>	The student's research or project plan requires significant development of critical knowledge and skills and conventions respective to the discipline.	The student's research or project plan reflects competency in critical knowledge and skills and conventions respective to the field.	The student's research or project plan reflects exemplary understanding and thorough development with critical knowledge and skills.

<p><b>3. Students will be able to develop a research plan to address or resolve a specific question or problem.</b></p>	<p>The process described does not suggest student is able to execute the product or instantiate the idea. There is no evidence of awareness of critical vocabulary and its application.</p>	<p>Student demonstrates some process of genesis and revision. Student understands the critical vocabulary appropriate to the product/project.</p>	<p>Student's process shows sustained thought and revision. Student can use the critical vocabulary.</p>
<p><b>4. Students will be able to collect and interpret data and information in an attempt to resolve the question or problem.</b></p>	<ul style="list-style-type: none"> <li>• <b>Information gathering.</b> Students lack the ability to consistently locate, evaluate, select, or make effective use of appropriate and credible information resources (databases, Internet, library catalogue, etc.) to understand the structure of their fields (reviews, biographies, criticism, etc.), discover source material for projects, or assess outlets/venues for their work</li> <li>▪ <b>Incorporation of Feedback.</b> The student's abilities require more development in decision-making, listening, and interpreting skills to enrich the artistic project and/or to increase the sum of knowledge in</li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>Information gathering.</b> Students are generally able to locate, evaluate, select, or make effective use of appropriate and credible information resources (databases, Internet, library catalogue, etc.) to understand the structure of their fields (reviews, biographies, criticism, etc.), discover source material for projects, or assess outlets/venues for their work</li> <li>▪ <b>Incorporation of Feedback.</b> The student exhibits competency in decision-making, listening, and interpreting skills to enrich the artistic project and/or to increase the sum of knowledge in the</li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>Information gathering.</b> Students fully and successfully locate, evaluate, select, and make effective use of appropriate and credible information resources (databases, Internet, library catalogue, etc.) to understand the structure of their fields (reviews, biographies, criticism, etc.), discover source material for projects, or assess outlets/venues for their work</li> <li>▪ <b>Incorporation of Feedback.</b> The student exhibits exemplary decision-making, listening, and interpreting skills to enrich the artistic project and/or to increase the sum of knowledge in the</li> </ul>

	the creative arts.	creative arts.	creative arts.
<b>5. Students will demonstrate awareness of the responsible conduct of research.</b>	Responsible work habits and techniques require more development, including the practice of academic honesty to contribute positively and fully in both individual and group efforts in the arts.	Responsible work habits and techniques are understood and can contribute positively and fully in both individual and group efforts in the arts.	Responsible work habits and techniques are demonstrated in an exemplary manner, including the ability to contribute positively and fully in both individual and group efforts in the arts.
<b>6. Students will be able to articulate their research findings through written, performance, and/or oral presentations.</b>	The written, performance, and/or oral presentation requires more development to integrate artistic training beyond the genre with a reflection upon self-knowledge in a disciplinary context.	The written, performance, and/or oral presentation attempts to integrate artistic training beyond the genre with a reflection upon self-knowledge in a disciplinary context.	The written, performance, and/or oral presentation integrates artistic training beyond the genre with a reflection upon self-knowledge in a disciplinary context.

**Rubric for QEP Assessment**  
**Science, Technology, Engineering, Mathematics**

Outcome	Developing-1	Competent-2	Exemplary-3
<b>1. Students will be able to formulate a research question or problem</b>	<ul style="list-style-type: none"> <li>• Research question or problem is not clear.</li> <li>• Research question cannot be feasibly investigated.</li> </ul>	<ul style="list-style-type: none"> <li>• Research question or problem requires more clarification.</li> <li>• Research question requires additional focus to be feasibly investigated.</li> </ul>	<ul style="list-style-type: none"> <li>• Research question or problem is clear.</li> <li>• Research question can be feasibly investigated.</li> </ul>
<b>2. Students will be able to identify basic principles and knowledge related to their research question or problem</b>	<ul style="list-style-type: none"> <li>• Student establishes a methodology that is not appropriate for the discipline.</li> <li>• The research shows a lack of knowledge of the literature in the field.</li> </ul>	<ul style="list-style-type: none"> <li>• Student establishes a methodology that is accepted within the discipline, although another methodology may be more effective.</li> <li>• The research shows a competent knowledge of the literature in the field.</li> </ul>	<ul style="list-style-type: none"> <li>• Student establishes a methodology that shows knowledge of the discipline.</li> <li>• The research shows in-depth knowledge of the literature in the field.</li> </ul>
<b>3. Students will be able to develop a research plan to address or resolve a specific question or problem.</b>	No coherent plan presented. It does not appear that appropriate literature and background have been consulted in development of plan.	The research plan is essentially valid; however, there are some issues with variables, errors, or proposed techniques that are inappropriate.	The research plan is logical and comprehensive. Potential sources of error have been identified and minimized. Appropriate literature and background have been consulted and included.

<p><b>4. Students will be able to collect and interpret data and information in an attempt to resolve the question or problem.</b></p>	<ul style="list-style-type: none"> <li>• Data collection. Data collected do not reflect a thorough or sound data collection process</li> <li>• Relevance of data to research question. Data collected are not sufficiently relevant to the research question, with too much extraneous material</li> <li>• Data interpretation. Interpretation of data is not accurate enough, or the student does not demonstrate effort to address bias in interpretation. There is insufficient description or use of validation procedures.</li> <li>• Relevance of interpretation to research question. There is no clear link between the interpretation of the data and the original research question or problem</li> <li>• Coding, Programming, and Computation skills. Student was lacking in skills required for debugging codes, and application of relevant theory</li> </ul>	<ul style="list-style-type: none"> <li>• Data collection. The collection process is generally sound.</li> <li>• Relevance of data to research question. Data collected are mostly relevant to the research question, with some extraneous material.</li> <li>• Data Interpretation. Interpretation of data is mostly accurate with some minor errors. There is some effort to minimize or address bias. Student attempts to use or describe validation procedures for data.</li> <li>• Relevance of interpretation to research question. The interpretation of the data is linked to the original research question or problem.</li> <li>• Coding, Programming, and Computation skills. Student was able to code adequately, draw relevant diagrams and figures to complete project.</li> </ul>	<ul style="list-style-type: none"> <li>• Data collection. Data collected reflect a thorough and sound data collection process.</li> <li>• Relevance of data to research question. Data collected directly address the research question, without extraneous material</li> <li>• Data interpretation. Interpretation of data is accurate. Student demonstrates effort to minimize or address bias. Student describes appropriate data validation procedures. Student presents caveats and results that may not agree with hypothesis.</li> <li>• Relevance of interpretation to research question. The interpretation of the data is clearly linked to the original research question or problem.</li> <li>• Coding, Programming, and Computation skills. Student's ability to code was elegant, successfully debugged program, and was meticulous in the computations.</li> </ul>
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<p><b>5. Students will demonstrate awareness of the responsible conduct of research.</b></p>	<ul style="list-style-type: none"> <li>• Research has been conducted in an unethical and illegal manner.</li> <li>• Student does not follow proper protocol.</li> </ul> <p>a) safety aspects: Research has been conducted in an unsafe manner.</p> <p>b) subjects issues Research has been conducted without consideration for the ethical treatment of animals and/or humans.</p> <ul style="list-style-type: none"> <li>• Research findings are not properly cited.</li> </ul>	<ul style="list-style-type: none"> <li>• Research has been conducted in a generally acceptable ethical and legal manner.</li> <li>• Student generally follows proper protocol.</li> </ul> <p>a) safety aspects Research appears to have been conducted in a safe fashion, but some questions about safe practices are not addressed.</p> <p>b) subjects issues Research appears to have been conducted in an appropriate fashion, but some guidelines are not followed or documentation is missing.</p> <ul style="list-style-type: none"> <li>• Research findings are generally cited.</li> </ul>	<ul style="list-style-type: none"> <li>• Research has been conducted in a fully acceptable ethical and legal manner.</li> <li>• Student follows proper protocol.</li> </ul> <p>a) safety aspects Student is aware of all issues surrounding ethics and safety of research, and addresses them fully in reports.</p> <p>b) subjects issues Animals and humans are treated in a safe manner, following relevant guidelines. Student has obtained all necessary release forms.</p> <ul style="list-style-type: none"> <li>• Research findings are properly cited.</li> </ul>
<p><b>6. Students will be able to articulate their research findings through written, performance, and/or oral presentations.</b></p>	<p>a) oral presentation</p> <ul style="list-style-type: none"> <li>• Oral presentation fails to follow the appropriate genre for the discipline and fail to reflect technical competency in the subject area.</li> <li>• Presentation fails to answer the research question and does not provide analysis of the research, leaving most questions</li> </ul>	<p>a) oral presentation</p> <ul style="list-style-type: none"> <li>• Oral presentation follows the appropriate genre for the discipline and reflects technical competency in the subject area.</li> <li>• Presentation answers the research question and provides analysis of the research, though</li> </ul>	<p>a) oral presentation</p> <ul style="list-style-type: none"> <li>• Oral presentation follows the appropriate genre for the discipline and reflects technical expertise in the subject area.</li> <li>• Presentation fully answers the research question and provides in-depth analysis of the research.</li> </ul>

	<p>unaddressed.</p> <ul style="list-style-type: none"> <li>• Presentation rambles and is not clear.</li> <li>• Voice, tone, and level of formality of the presentation are inappropriate for the setting.</li> <li>• Student does not address most questions of the audience in a coherent manner.</li> </ul> <p>b) written presentation</p> <ul style="list-style-type: none"> <li>• Composition fails to follow the appropriate genre for the discipline and does not reflect technical competency in the subject area.</li> <li>• Composition does not address the research question. Research lacks analysis and synthesis.</li> <li>• Composition lacks focus, coherency, and clarity</li> <li>• Quotation, attribution, and citation are improperly handled using the appropriate citation method.</li> <li>• The composition shows a lack of polish and editing; writing issues</li> </ul>	<p>some questions left unaddressed.</p> <ul style="list-style-type: none"> <li>• Presentation is for the most part focused, coherent and clear.</li> <li>• Voice, tone, and level of formality of the presentation are appropriate for the setting, although some slips may occur.</li> <li>• Student addresses most questions of the audience in a coherent manner.</li> </ul> <p>b) written presentation</p> <ul style="list-style-type: none"> <li>• Composition follows the appropriate genre for the discipline and reflects technical competency in the subject area.</li> <li>• Composition answers the question and provides analysis of the research; there may still be some questions left unaddressed.</li> <li>• Composition is focused, coherent and clear. Composition answers the research and clear.</li> <li>• Quotation, attribution, and citation are properly handled using the</li> </ul>	<ul style="list-style-type: none"> <li>• Presentation is focused, coherent and clear.</li> <li>• The presentation is polished and coherent, clear and concise.</li> <li>• Voice, tone, and level of formality of the presentation are appropriate for the setting.</li> <li>• Student addresses questions of the audience in a coherent manner.</li> </ul> <p>b) written presentation</p> <ul style="list-style-type: none"> <li>• Composition follows the appropriate genre for the discipline and reflects technical expertise in the subject area.</li> <li>• Composition fully answers the research question and provides in-depth analysis of the research.</li> <li>• Composition is focused, coherent and clear.</li> <li>• Quotation, attribution, and citation are properly handled using the appropriate citation method.</li> <li>• The composition presents polished</li> </ul>
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	<p>affect readability.</p> <ul style="list-style-type: none"> <li>• Voice, tone, and level of formality of the composition are inappropriate to the intended publication or audience.</li> <li>• Limited variety of primary and secondary sources in literature review and discussion.</li> </ul>	<p>appropriate citation method.</p> <ul style="list-style-type: none"> <li>• The composition presents prose that is edited, clear and concise.</li> <li>• Voice, tone, and level of formality of the composition are appropriate to the intended publication or audience.</li> <li>• Reasonable variety of primary and secondary sources in the literature review and discussion, but with some major omissions.</li> </ul>	<p>prose, carefully edited, clear and concise.</p> <ul style="list-style-type: none"> <li>• Voice, tone, and level of formality of the composition are appropriate to the intended publication or audience.</li> <li>• Literature review and discussion are appropriate, comprehensive, and includes primary and secondary sources.</li> </ul>
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**Rubric for QEP Assessment**  
**Science, Technology, Engineering, Mathematics**

Outcome	Developing-1	Competent-2	Exemplary-3
<b>1. Students will be able to formulate a research question or problem</b>	<ul style="list-style-type: none"> <li>• Research question or problem is not clear.</li> <li>• Research question cannot be feasibly investigated.</li> </ul>	<ul style="list-style-type: none"> <li>• Research question or problem requires more clarification.</li> <li>• Research question requires additional focus to be feasibly investigated.</li> </ul>	<ul style="list-style-type: none"> <li>• Research question or problem is clear.</li> <li>• Research question can be feasibly investigated.</li> </ul>
<b>2. Students will be able to identify basic principles and knowledge related to their research question or problem</b>	<ul style="list-style-type: none"> <li>• Student establishes a methodology that is not appropriate for the discipline.</li> <li>• The research shows a lack of knowledge of the literature in the field.</li> </ul>	<ul style="list-style-type: none"> <li>• Student establishes a methodology that is accepted within the discipline, although another methodology may be more effective.</li> <li>• The research shows a competent knowledge of the literature in the field.</li> </ul>	<ul style="list-style-type: none"> <li>• Student establishes a methodology that shows knowledge of the discipline.</li> <li>• The research shows in-depth knowledge of the literature in the field.</li> </ul>
<b>3. Students will be able to develop a research plan to address or resolve a specific question or problem.</b>	<p>No coherent plan presented. It does not appear that appropriate literature and background have been consulted in development of plan.</p>	<p>The research plan is essentially valid; however, there are some issues with variables, errors, or proposed techniques that are inappropriate.</p>	<p>The research plan is logical and comprehensive. Potential sources of error have been identified and minimized. Appropriate literature and background have been consulted and included.</p>

<p><b>4. Students will be able to collect and interpret data and information in an attempt to resolve the question or problem.</b></p>	<ul style="list-style-type: none"> <li>• Data collection. Data collected do not reflect a thorough or sound data collection process</li> <li>• Relevance of data to research question. Data collected are not sufficiently relevant to the research question, with too much extraneous material</li> <li>• Data interpretation. Interpretation of data is not accurate enough, or the student does not demonstrate effort to address bias in interpretation. There is insufficient description or use of validation procedures.</li> <li>• Relevance of interpretation to research question. There is no clear link between the interpretation of the data and the original research question or problem</li> <li>• Coding, Programming, and Computation skills. Student was lacking in skills required for debugging codes, and application of relevant theory</li> </ul>	<ul style="list-style-type: none"> <li>• Data collection. The collection process is generally sound.</li> <li>• Relevance of data to research question. Data collected are mostly relevant to the research question, with some extraneous material.</li> <li>• Data Interpretation. Interpretation of data is mostly accurate with some minor errors. There is some effort to minimize or address bias. Student attempts to use or describe validation procedures for data.</li> <li>• Relevance of interpretation to research question. The interpretation of the data is linked to the original research question or problem.</li> <li>• Coding, Programming, and Computation skills. Student was able to code adequately, draw relevant diagrams and figures to complete project.</li> </ul>	<ul style="list-style-type: none"> <li>• Data collection. Data collected reflect a thorough and sound data collection process.</li> <li>• Relevance of data to research question. Data collected directly address the research question, without extraneous material</li> <li>• Data interpretation. Interpretation of data is accurate. Student demonstrates effort to minimize or address bias. Student describes appropriate data validation procedures. Student presents caveats and results that may not agree with hypothesis.</li> <li>• Relevance of interpretation to research question. The interpretation of the data is clearly linked to the original research question or problem.</li> <li>• Coding, Programming, and Computation skills. Student's ability to code was elegant, successfully debugged program, and was meticulous in the computations.</li> </ul>
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<p><b>5. Students will demonstrate awareness of the responsible conduct of research.</b></p>	<ul style="list-style-type: none"> <li>• Research has been conducted in an unethical and illegal manner.</li> <li>• Student does not follow proper protocol.</li> </ul> <p>a) safety aspects: Research has been conducted in an unsafe manner.</p> <p>b) subjects issues Research has been conducted without consideration for the ethical treatment of animals and/or humans.</p> <ul style="list-style-type: none"> <li>• Research findings are not properly cited.</li> </ul>	<ul style="list-style-type: none"> <li>• Research has been conducted in a generally acceptable ethical and legal manner.</li> <li>• Student generally follows proper protocol.</li> </ul> <p>a) safety aspects Research appears to have been conducted in a safe fashion, but some questions about safe practices are not addressed.</p> <p>b) subjects issues Research appears to have been conducted in an appropriate fashion, but some guidelines are not followed or documentation is missing.</p> <ul style="list-style-type: none"> <li>• Research findings are generally cited.</li> </ul>	<ul style="list-style-type: none"> <li>• Research has been conducted in a fully acceptable ethical and legal manner.</li> <li>• Student follows proper protocol.</li> </ul> <p>c) safety aspects Student is aware of all issues surrounding ethics and safety of research, and addresses them fully in reports.</p> <p>d) subjects issues Animals and humans are treated in a safe manner, following relevant guidelines. Student has obtained all necessary release forms.</p> <ul style="list-style-type: none"> <li>• Research findings are properly cited.</li> </ul>
<p><b>6. Students will be able to articulate their research findings through written, performance, and/or oral presentations.</b></p>	<p>b) oral presentation</p> <ul style="list-style-type: none"> <li>• Oral presentation fails to follow the appropriate genre for the discipline and fail to reflect technical competency in the subject area.</li> <li>• Presentation fails to answer the research question and does not provide analysis of the research, leaving most questions</li> </ul>	<p>b) oral presentation</p> <ul style="list-style-type: none"> <li>• Oral presentation follows the appropriate genre for the discipline and reflects technical competency in the subject area.</li> <li>• Presentation answers the research question and provides analysis of the research, though</li> </ul>	<p>b) oral presentation</p> <ul style="list-style-type: none"> <li>• Oral presentation follows the appropriate genre for the discipline and reflects technical expertise in the subject area.</li> <li>• Presentation fully answers the research question and provides in-depth analysis of the research.</li> </ul>

	<p>unaddressed.</p> <ul style="list-style-type: none"> <li>• Presentation rambles and is not clear.</li> <li>• Voice, tone, and level of formality of the presentation are inappropriate for the setting.</li> <li>• Student does not address most questions of the audience in a coherent manner.</li> </ul> <p>c) written presentation</p> <ul style="list-style-type: none"> <li>• Composition fails to follow the appropriate genre for the discipline and does not reflect technical competency in the subject area.</li> <li>• Composition does not address the research question. Research lacks analysis and synthesis.</li> <li>• Composition lacks focus, coherency, and clarity</li> <li>• Quotation, attribution, and citation are improperly handled using the appropriate citation method.</li> <li>• The composition shows a lack of polish and editing; writing issues</li> </ul>	<p>some questions left unaddressed.</p> <ul style="list-style-type: none"> <li>• Presentation is for the most part focused, coherent and clear.</li> <li>• Voice, tone, and level of formality of the presentation are appropriate for the setting, although some slips may occur.</li> <li>• Student addresses most questions of the audience in a coherent manner.</li> </ul> <p>c) written presentation</p> <ul style="list-style-type: none"> <li>• Composition follows the appropriate genre for the discipline and reflects technical competency in the subject area.</li> <li>• Composition answers the question and provides analysis of the research; there may still be some questions left unaddressed.</li> <li>• Composition is focused, coherent and clear. Composition answers the research and clear.</li> <li>• Quotation, attribution, and citation are properly handled using the</li> </ul>	<ul style="list-style-type: none"> <li>• Presentation is focused, coherent and clear.</li> <li>• The presentation is polished and coherent, clear and concise.</li> <li>• Voice, tone, and level of formality of the presentation are appropriate for the setting.</li> <li>• Student addresses questions of the audience in a coherent manner.</li> </ul> <p>c) written presentation</p> <ul style="list-style-type: none"> <li>• Composition follows the appropriate genre for the discipline and reflects technical expertise in the subject area.</li> <li>• Composition fully answers the research question and provides in-depth analysis of the research.</li> <li>• Composition is focused, coherent and clear.</li> <li>• Quotation, attribution, and citation are properly handled using the appropriate citation method.</li> <li>• The composition presents polished</li> </ul>
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	<p>affect readability.</p> <ul style="list-style-type: none"> <li>• Voice, tone, and level of formality of the composition are inappropriate to the intended publication or audience.</li> <li>• Limited variety of primary and secondary sources in literature review and discussion.</li> </ul>	<p>appropriate citation method.</p> <ul style="list-style-type: none"> <li>• The composition presents prose that is edited, clear and concise.</li> <li>• Voice, tone, and level of formality of the composition are appropriate to the intended publication or audience.</li> <li>• Reasonable variety of primary and secondary sources in the literature review and discussion, but with some major omissions.</li> </ul>	<p>prose, carefully edited, clear and concise.</p> <ul style="list-style-type: none"> <li>• Voice, tone, and level of formality of the composition are appropriate to the intended publication or audience.</li> <li>• Literature review and discussion are appropriate, comprehensive, and includes primary and secondary sources.</li> </ul>
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**Rubric for Assessing QEP Projects**  
**APPLIED SCIENCES**

Outcome	Developing	Competent	Exemplary
<p><b>1. Students will be able to formulate a research question or problem</b></p>	<p>The research question or problem is neither testable nor manageable to contribute to existing research in the discipline.</p>	<p>The research question or problem is mostly testable, but requires refinement to become manageable to contribute to existing research in the discipline.</p>	<p>The research question or problem is articulated in a testable and evaluative approach to address a new to contribute to existing research in the discipline.</p>
<p><b>2. Students will be able to identify basic principles and knowledge related to their research question or problem</b></p> <p style="text-align: center;">--</p>	<ul style="list-style-type: none"> <li>• Principles and knowledge articulated by student are not relevant to the research question and/or are not accurately described or applied.</li> <li>• Student does not demonstrate functional knowledge of how to effectively use research databases, sources to support the research question.</li> </ul>	<ul style="list-style-type: none"> <li>• Relevant principles and knowledge that provide framework for the research question mostly accurate and applied somewhat consistently. There may be minor misunderstandings of specific knowledge or application.</li> <li>• Student mostly uses research databases judiciously. At this level, student also includes some peripherally related or irrelevant information.</li> </ul>	<ul style="list-style-type: none"> <li>• Relevant principles and knowledge that provide the framework for the research question are accurately described and applied.</li> <li>• Student is able to judiciously use research databases (e.g. library, internet) and relevant sources to inform the research question.</li> </ul>

<p><b>3. Students will be able to develop a research plan to address or resolve a specific question or problem.</b></p>	<ul style="list-style-type: none"> <li>• The research plan does not fully address the research question or problem.</li> <li>• There is a haphazard quality to the research plan.</li> </ul>	<ul style="list-style-type: none"> <li>• The research plan is mostly related to the research question or problem</li> <li>• There are some moderate inconsistencies or problems that are not addressed in the research plan.</li> </ul>	<ul style="list-style-type: none"> <li>• The research plan is logical and directly addresses the research question or problem.</li> <li>• The research plan reflects best research practices within the context of the discipline.</li> </ul>
<p><b>4. Students will be able to collect and interpret data and information in an attempt to resolve the question or problem.</b></p>	<ul style="list-style-type: none"> <li>• <b>Data collection.</b> Data collected do not reflect a thorough or sound data collection process</li> <li>• <b>Relevance of data to research question.</b> Data collected are not sufficiently relevant to the research question, with too much extraneous material</li> <li>• <b>Data interpretation.</b> Interpretation of data is not accurate enough, or the student does not demonstrate effort to address bias in interpretation. There is insufficient description or use of validation procedures.</li> <li>• <b>Relevance of interpretation to research question.</b> There is no clear link between the interpretation</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Data collection.</b> The collection process is generally sound.</li> <li>• <b>Relevance of data to research question.</b> Data collected are mostly relevant to the research question, with some extraneous material.</li> <li>• <b>Data Interpretation.</b> Interpretation of data is mostly accurate with some minor errors. There is some effort to minimize or address bias. Student attempts to use or describe validation procedures for data.</li> <li>• <b>Relevance of interpretation to research question.</b> The interpretation of the data is linked to the original research question</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Data collection.</b> Data collected reflect a thorough and sound data collection process.</li> <li>• <b>Relevance of data to research question.</b> Data collected directly address the research question, without extraneous material</li> <li>• <b>Data interpretation.</b> Interpretation of data is accurate. Student demonstrates effort to minimize or address bias. Student describes appropriate data validation procedures. Student presents caveats and results that may not agree with hypothesis.</li> <li>• <b>Relevance of interpretation to research question.</b> The interpretation of the data is clearly</li> </ul>

	<p>of the data and the original research question or problem</p> <ul style="list-style-type: none"> <li>• <b>Coding, Programming, and Computation skills.</b> Student was lacking in skills required for debugging codes, and application of relevant theory</li> </ul>	<p>or problem.</p> <ul style="list-style-type: none"> <li>• <b>Coding, Programming, and Computation skills.</b> Student was able to code adequately, draw relevant diagrams and figures to complete project.</li> </ul>	<p>linked to the original research question or problem.</p> <ul style="list-style-type: none"> <li>• <b>Coding, Programming, and Computation skills.</b> Students ability to code was elegant,, successfully debugged program, and was meticulous in the computations.</li> </ul>
<p><b>5. Students will demonstrate awareness of the responsible conduct of research.</b></p>	<ul style="list-style-type: none"> <li>• The student vaguely articulates awareness of activities necessary for responsible conduct of research. There is no evidence of application of appropriate procedures, protocols, and ethical guidelines. There is evidence of plagiarism and/or inappropriate use of others' work.</li> <li>• Where group work is involved, there is little or not evidence that the student contributed substantially to the team effort.</li> </ul>	<ul style="list-style-type: none"> <li>• The student articulates awareness of activities necessary for responsible conduct of research but does not follow through on application of discipline-specific procedures, protocols, and ethical guidelines. There may be minor oversights in terms of cited work.</li> <li>• Where group work is involved, there is some evidence that the student equitably contributes to team efforts.</li> </ul>	<ul style="list-style-type: none"> <li>• The student demonstrates adherence to the responsible conduct of research through appropriate application of relevant discipline-specific procedures, protocols, and ethical guidelines. There is no evidence of plagiarism and others' work is cited appropriately.</li> <li>• Where group work is involved, there is a preponderance of evidence that the student equitably contributes to team efforts.</li> </ul>

<p><b>6. Students will be able to articulate their research findings through written, performance, and/or oral presentations.</b></p>	<ul style="list-style-type: none"> <li>• Facts and examples were seriously lacking in detail, inaccurate, or inappropriate.</li> <li>• There is no clear connection between analyses, discussions, and examples, facts, and theories.</li> <li>• The model, design was lacking in performance as specified.</li> </ul>	<ul style="list-style-type: none"> <li>• Facts and examples were mostly detailed, accurate, and appropriate, but there were lapses.</li> <li>• The connection between analyses, discussions, and conclusions is evident or implied, but it is not explicitly linked to examples, facts, and theories.</li> <li>• The models and designs performed adequately.</li> </ul>	<ul style="list-style-type: none"> <li>• Facts and examples were detailed, accurate, and appropriate.</li> <li>• Analyses, discussions, and conclusions were explicitly linked to examples, facts, and theories.</li> <li>• Project/Model performed as specified in the original design</li> </ul>
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Rubric for Assessing QEP Programs  
Professional Programs

Student Learning Objectives	Exemplary - 3	Competent - 2	Developing - 1
<p><b>Students will be able to formulate a research question or problem</b></p>	<ul style="list-style-type: none"> <li>• The question demonstrates that the student understands the discipline</li> <li>• Resolution of the question contributes to existing research</li> <li>• The question is feasible regarding investigation within time period allotted</li> </ul>	<ul style="list-style-type: none"> <li>• The question demonstrates that the student does not have a complete command of the discipline</li> <li>• Resolution of the question partially contributes to existing research (i.e., new but not necessarily interesting)</li> <li>• The question may be feasible with modifications</li> </ul>	<ul style="list-style-type: none"> <li>• The question demonstrates that the student fails to understand the discipline</li> <li>• Resolution of the question replicates previous work</li> <li>• The question is not feasible regarding investigation within time period allotted.</li> </ul>

<p><b>Students will be able to identify basic principles and knowledge related to their research question or problem</b></p>	<ul style="list-style-type: none"> <li>• The information gathered is relevant, credible, and reliable</li> <li>• The information is accurately described</li> <li>• The information is applied appropriately.</li> </ul>	<ul style="list-style-type: none"> <li>• Some of the information gathered is not relevant, credible, and reliable</li> <li>• Some of the information is not accurately described</li> <li>• Some of the information is not applied appropriately.</li> </ul>	<ul style="list-style-type: none"> <li>• The information gathered is not relevant, credible, and reliable</li> <li>• The information is not accurately described</li> <li>• The information is not applied appropriately.</li> </ul>
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<p><b>Students will be able to develop a research plan to address or resolve a specific question or problem</b></p>	<ul style="list-style-type: none"> <li>• The research plan is clearly related to the research question or problem.</li> <li>• The research plan is feasible within the time allotted.</li> <li>• The research plan clearly articulates the research objectives.</li> <li>• The research plan reflects best research practices within the context of the discipline (i.e., research methodology is sound).</li> <li>• The research plan clearly identifies the appropriate data analysis techniques.</li> </ul>	<ul style="list-style-type: none"> <li>• The research plan is partially related to the research question or problem (some parts of the plan do not address portions of the question).</li> <li>• The research plan is feasible within the time allotted with modifications.</li> <li>• Some of the objectives are not clearly articulated.</li> <li>• The research plan reflects some aspects of best research practices within the context of the discipline, but may also include inappropriate strategies.</li> <li>• The research plan only identifies basic data analysis techniques that need further refinement.</li> </ul>	<ul style="list-style-type: none"> <li>• The research plan is not clearly related to the research question or problem.</li> <li>• The research plan is not feasible within the time allotted.</li> <li>• The research plan fails to articulate the research objectives.</li> <li>• The research plan does not fully reflect best research practices within the context of the discipline.</li> <li>• The research plan does not clearly identify the appropriate data analysis techniques.</li> </ul>
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<p><b>Students will collect and interpret data and information in an attempt to resolve the question or problem</b></p>	<ul style="list-style-type: none"> <li>• Data collected are relevant to the research question.</li> <li>• Data collected reflect a sound data collection process.</li> <li>• Data collected are interpreted accurately.</li> <li>• Data collected are appropriately linked to the research question or problem.</li> <li>• The research results address the research question in a meaningful way</li> </ul>	<ul style="list-style-type: none"> <li>• Data collected are loosely relevant to the research question.</li> <li>• Data collected reflect an elementary/unsophisticated data collection process.</li> <li>• Data collected are interpreted in an elementary/unsophisticated manner.</li> <li>• Data collected are partially linked to the research question or problem.</li> <li>• The research results address the research question in a simplistic way</li> </ul>	<ul style="list-style-type: none"> <li>• Data collected are not relevant to the research question.</li> <li>• Data collected do not reflect a sound data collection process.</li> <li>• Data collected are interpreted simplistically.</li> <li>• Data collected are not appropriately linked to the research question or problem.</li> <li>• The research results do not address the research question in a meaningful way</li> </ul>
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<p><b>Students will demonstrate awareness of the responsible conduct of research</b></p>	<ul style="list-style-type: none"> <li>• The research question can be investigated in an ethical manner (i.e., would pass IRB)</li> <li>• The student demonstrates adherence to the responsible conduct of research through appropriate application of relevant discipline-specific procedures, protocols, and ethical guidelines (i.e., appropriate citations, human subjects).</li> </ul>	<ul style="list-style-type: none"> <li>• It is questionable if the research question can be investigated in an ethical manner</li> <li>• The student loosely demonstrates adherence to the responsible conduct of research through appropriate application of relevant discipline-specific procedures, protocols, and ethical guidelines</li> </ul>	<ul style="list-style-type: none"> <li>• The research question cannot be investigated in an ethical manner</li> <li>• The student fails to demonstrate adherence to the responsible conduct of research through appropriate application of relevant discipline-specific procedures, protocols, and ethical guidelines (i.e., appropriate citations, human subjects).</li> </ul>
<p><b>Students will be able to articulate their research findings through written, performance, and/or oral presentations</b></p>	<ul style="list-style-type: none"> <li>• Facts and examples are detailed, accurate, and appropriate.</li> <li>• Analyses, discussions, and conclusions are appropriately linked to research results.</li> <li>• Students are able to articulate specific research limitations and identify future research direction.</li> </ul>	<ul style="list-style-type: none"> <li>• Facts and examples were mostly detailed, accurate, and appropriate, but there were lapses.</li> <li>• The connection between analyses, discussions, and conclusions is evident or implied, but it is not explicitly linked to the research results.</li> <li>• Students are able to generally articulate research limitations and identify future research direction.</li> </ul>	<ul style="list-style-type: none"> <li>• Facts and examples were seriously lacking in detail, inaccurate, or inappropriate.</li> <li>• There is no clear connection from analyses, discussion, and conclusions to research results.</li> <li>• Students are unable to articulate relevant research limitations and identify future research direction.</li> </ul>



**Rubric for Assessing QEP Programs  
LIBERAL ARTS**

Outcome	Developing	Competent	Exemplary
<b>1. Students will be able to formulate a research question or problem</b>	The scope or focus of research question or problem requires more thorough development to contribute to existing research in the discipline.	The scope or focus of the research question or problem is either too broad or too narrow to contribute to existing research in the discipline.	The research question or problem is correctly and thoroughly developed to contribute to existing research in the discipline.
<b>2. Students will be able to identify basic principles and knowledge related to their research question or problem</b>	The basic principles and knowledge necessary for the project are inadequately identified or demonstrated.	The basic principles and knowledge necessary for the project are generally well identified or demonstrated.	The basic principles and knowledge necessary for the project are skillfully (or thoroughly) identified or demonstrated.
<b>3. Students will be able to develop a research plan to address or resolve a specific question or problem.</b>	The procedures necessary for investigating the problem are inadequately identified and selected.	The procedures necessary for investigating the problem are generally well identified and selected.	The procedures necessary for investigating the problem are skillfully (or thoroughly) identified and selected.

<p><b>4. Students will be able to collect and interpret data and information in an attempt to resolve the question or problem.</b></p>	<ul style="list-style-type: none"> <li>• <b>Information Gathering.</b> Students lack the ability to consistently locate, evaluate, select, or make effective use of appropriate and credible information resources (databases, Internet, library catalog, etc.), cannot distinguish between various types of sources (primary, secondary, and tertiary) or identify the types most appropriate for the research question, and have difficulty translating their research plan into an adequate research process.</li> <li>• <b>Relevance of information to research question.</b> The research plan/process does not yield sufficient relevant information (e.g., databases, books and journal articles, legitimate internet resources, and other materials) to answer the research problem adequately, and includes too much extraneous material.</li> <li>• <b>Interpretation.</b> The interpretation of the sources and information does not resolve the research question or problem in a logical order and effective manner appropriate to the</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Information Gathering.</b> Students are generally able to locate, evaluate, and make effective use of appropriate and credible information resources (databases, Internet, library catalog, etc.), and can make some distinction between various types of sources (primary, secondary, and tertiary).</li> <li>• <b>Relevance of information to research question.</b> The research plan/process yields some relevant information (e.g., databases, books and journal articles, Internet resources, and other materials) appropriate to answering the research problem, but is not thorough, or includes some extraneous material.</li> <li>• <b>Interpretation.</b> The interpretation of the sources and information attempts to resolve the research question or problem in a logical order and effective manner appropriate to the discipline</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Information Gathering.</b> Students consistently locate, evaluate, select, and make effective use of the most appropriate and credible information resources (databases, Internet, library catalog, etc.), make effective use of the most appropriate types of sources (primary, secondary, and tertiary) for their research question, and translate their research plan into a thorough research process.</li> <li>• <b>Relevance of information to research question.</b> The research plan/process yields the most relevant information (e.g., databases, books and journal articles, legitimate Internet resources, and other materials) appropriate to successfully answering the research problem, without including any extraneous material.</li> <li>• <b>Interpretation.</b> The interpretation of the sources and information resolves the research question or problem in a logical order and effective manner appropriate to the</li> </ul>
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	discipline and/or project.	and/or project, but some parts are unclear or outside the scope of the original question or problem.	discipline and/or project.
<b>5. Students will demonstrate awareness of the responsible conduct of research.</b>	The assignment does not adequately observe the principles and/or protocols of data integrity (e.g., citing all sources and contributors according to ethical, legal, and professional standards; observing the correct and legal procedures for the treatment of human participants).	The assignment generally observes the principles and protocols of data integrity (e.g., citing all sources and contributors according to best ethical, legal, and professional standards; avoiding plagiarism; observing the correct and legal procedures for the treatment of human participants), but some refinement and/or clarification is needed.	The assignment fully observes the principles and protocols of data integrity (i.e., citing all sources and contributors according to best ethical, legal, and professional standards; observing the correct and legal procedures for the treatment of human participants) and can be made public in its current form.
<b>6. Students will be able to articulate their research findings through written, performance, and/or oral presentations.</b>	The project/presentation does not use discipline-appropriate language, media, and tools to communicate the research and its results. The project/presentation ineffectively articulates its results in relation to the initial research question because it is unfocused, disorganized, or lacks intellectual clarity.	The project/presentation attempts to use discipline-appropriate language, media, and tools to communicate its research and results. The project/presentation generally articulates its results in relation to the initial research question, and contains some degree of focus, organization, and intellectual clarity.	The project/presentation uses discipline-appropriate language, media, and tools to communicate all research and results. The project/presentation fully articulates its results in relation to the initial research question, and demonstrates focus, organization, and intellectual clarity.

Appendix D

Responses of University of Houston Faculty  
To Information Literacy Survey 2008-09

**QEP Assessment Task Force Survey: a Focus on Information Literacy**

<b>1. Standard One: The information literate student determines the nature and extent of the information needed.</b>							
	<b>Very important</b>	<b>Important</b>	<b>Good to know</b>	<b>Not too important</b>	<b>Unimportant</b>	<b>Rating Average</b>	<b>Response Count</b>
Be able to define and articulate the need for information.	<b>66.7% (116)</b>	28.2% (49)	2.9% (5)	1.7% (3)	0.6% (1)	1.41	174
Can identify a variety of types and formats of potential sources for information.	<b>57.8% (100)</b>	30.1% (52)	9.8% (17)	1.7% (3)	0.6% (1)	1.57	173
Will consider the costs and benefits of acquiring the needed information.	19.2% (33)	<b>36.6% (63)</b>	36.0% (62)	6.4% (11)	1.7% (3)	2.35	172
Be able to reevaluate the nature and extent of the information need.	<b>45.1% (78)</b>	34.7% (60)	17.9% (31)	1.2% (2)	1.2% (2)	1.79	173
<b>answered question</b>							<b>174</b>
<b>skipped question</b>							<b>0</b>

<b>2. Standard Two: The information literate student accesses needed information effectively and efficiently.</b>							
	<b>Very important</b>	<b>Important</b>	<b>Good to know</b>	<b>Not too important</b>	<b>Unimportant</b>	<b>Rating Average</b>	<b>Response Count</b>
Be able to select the most appropriate investigative methods or information retrieval systems for accessing the needed information.	<b>60.1% (104)</b>	31.8% (55)	5.8% (10)	1.7% (3)	0.6% (1)	1.51	173
Can construct and implement effectively designed search strategies.	<b>45.1% (78)</b>	41.0% (71)	11.0% (19)	1.7% (3)	1.2% (2)	1.73	173

Know how to retrieve information online or in person using a variety of methods.	<b>64.2% (111)</b>	28.3% (49)	6.4% (11)	0.6% (1)	0.6% (1)	1.45	173
Be able to refine the search strategy if necessary.	<b>49.4% (85)</b>	40.1% (69)	8.7% (15)	0.6% (1)	1.2% (2)	1.64	172
Can extract, record, and manage the information and its sources.	<b>58.1% (100)</b>	28.5% (49)	9.9% (17)	2.3% (4)	1.2% (2)	1.60	172
<b>answered question</b>							<b>173</b>
<b>skipped question</b>							<b>1</b>

**3. Standard Three: The information literate student evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system.**

	Very important	Important	Good to know	Not too important	Unimportant	Rating Average	Response Count
Be able to summarize the main ideas to be extracted from the information gathered.	<b>77.2% (132)</b>	19.9% (34)	2.3% (4)	0.0% (0)	0.6% (1)	1.27	171
Can articulate and apply initial criteria for evaluating both the information and its sources.	<b>52.0% (90)</b>	40.5% (70)	5.8% (10)	1.2% (2)	0.6% (1)	1.58	173
Be able to synthesize main ideas to construct new concepts.	<b>64.2% (111)</b>	28.3% (49)	6.4% (11)	0.6% (1)	0.6% (1)	1.45	173
Be able to compare new knowledge with prior knowledge to determine the value added, contradictions, or other unique characteristics of the information.	<b>63.0% (109)</b>	29.5% (51)	5.8% (10)	1.2% (2)	0.6% (1)	1.47	173
Have the ability to determine whether the new knowledge has an impact on the individual's	32.6% (56)	<b>39.0% (67)</b>	21.5% (37)	4.7% (8)	2.3% (4)	2.05	172

value system and takes steps to reconcile differences.							
Be able to validate understanding and interpretation of the information through discourse with other individuals, subject-area experts, and/or practitioners.	<b>41.6% (72)</b>	39.3% (68)	16.8% (29)	1.7% (3)	0.6% (1)	1.80	173
Can determine whether the initial query should be revised.	<b>40.4% (69)</b>	39.8% (68)	16.4% (28)	2.3% (4)	1.2% (2)	1.84	171
<b>answered question</b>							<b>173</b>
<b>skipped question</b>							<b>1</b>

<b>4. Standard Four: The information literate student, individually or as a member of a group, uses information effectively to accomplish a specific purpose.</b>							
	<b>Very important</b>	<b>Important</b>	<b>Good to know</b>	<b>Not too important</b>	<b>Unimportant</b>	<b>Rating Average</b>	<b>Response Count</b>
Be able to apply new and prior information to the planning and creation of a particular product or performance.	<b>50.3% (87)</b>	34.7% (60)	13.3% (23)	1.2% (2)	0.6% (1)	1.67	173
Know how to revise the development process for the product or performance.	32.4% (56)	<b>43.4% (75)</b>	20.8% (36)	2.9% (5)	0.6% (1)	1.96	173
Can communicate the product or performance effectively to others.	<b>59.5% (103)</b>	26.0% (45)	12.1% (21)	1.7% (3)	0.6% (1)	1.58	173
<b>answered question</b>							<b>173</b>
<b>skipped question</b>							<b>1</b>

**5. Standard Five: The information literate student understands many of the economic, legal, and social issues surrounding the use of information and accesses and uses information ethically and legally.**

	Very important	Important	Good to know	Not too important	Unimportant	Rating Average	Response Count
Be able to understand many of the ethical, legal and socio-economic issues surrounding information and information technology	<b>41.5% (71)</b>	29.8% (51)	23.4% (40)	2.3% (4)	2.9% (5)	1.95	171
Be able to and will follow laws, regulations, institutional policies, and etiquette related to the access and use of information resources.	<b>53.2% (91)</b>	30.4% (52)	12.3% (21)	1.2% (2)	2.9% (5)	1.70	171
Be able to and will acknowledge the use of information sources in communicating the product or performance.	<b>65.1% (112)</b>	27.3% (47)	5.8% (10)	1.2% (2)	0.6% (1)	1.45	172
<b><i>answered question</i></b>							<b>172</b>
<b><i>skipped question</i></b>							<b>2</b>

**Appendix E**  
**Rubric for Assessing the Selection and Attribution of Information**

<b>Information Literacy Skill</b>	<b>Unacceptable</b>	<b>Acceptable</b>	<b>Exemplary</b>
<p>Selects appropriate resources            (Consider the subject, context and scope of the paper)</p>	<ul style="list-style-type: none"> <li>▪ Selection of resources suggests a lack of understanding of the nature of information needed for the topic/question at hand.</li> <li>▪ Sources cited are weak in timeliness, objectivity, authority, credibility and/or relevancy</li> <li>▪ Demonstrates lack of judgment in selecting sources</li> </ul>	<ul style="list-style-type: none"> <li>▪ Selection of resources shows a general understanding of the nature of information needed for the topic/question at hand.</li> <li>▪ Sources cited demonstrate timeliness, objectivity, authority, credibility and/or relevancy, however there is room for improvement</li> <li>▪ Demonstrates generally adequate judgment in selecting sources</li> </ul>	<ul style="list-style-type: none"> <li>▪ Selection of resources shows thorough understanding of the nature of information needed for the topic/question at hand.</li> <li>▪ Sources cited demonstrate high level of timeliness, objectivity, authority, credibility and/or relevancy</li> <li>▪ Selection of sources shows excellent understanding of context and the domain of the discipline</li> </ul>
<p>Uses resources of sufficient breadth            (Consider the subject, context and scope of the paper)</p>	<ul style="list-style-type: none"> <li>▪ Extent of information is inadequate for the topic/question at hand</li> <li>▪ Work cites only one type of resource (websites, journals, books, media resources) although several types of resources are available</li> <li>▪ Resources do not show appropriate breadth in time frame, point of view, and/or primary/secondary origin</li> </ul>	<ul style="list-style-type: none"> <li>▪ Extent of information is adequate for the topic/question at hand</li> <li>▪ Uses more than one type of resource, but not the full range of appropriate sources.</li> <li>▪ Resources show some variety in time frame, viewpoint, and/or primary/secondary origin, but less than full breadth</li> </ul>	<ul style="list-style-type: none"> <li>▪ Provides comprehensive information for the topic/question at hand</li> <li>▪ Uses the full range of resources appropriate for the topic.</li> <li>▪ Resources reflect the full appropriate breadth of time frame, viewpoint, and/or primary/secondary origin.</li> </ul>



Evaluates information sources critically	<ul style="list-style-type: none"> <li>▪ Demonstrates lack of judgment in weighing and using sources.</li> <li>▪ Sources used are biased, not evidence based</li> </ul>	<ul style="list-style-type: none"> <li>▪ Demonstrates generally adequate judgment in weighing and using sources</li> <li>▪ Primarily uses information that is based on evidence rather than emotion</li> </ul>	<ul style="list-style-type: none"> <li>▪ Use of sources shows understanding of context and the domain of the discipline.</li> <li>▪ Uses evidence-based information.</li> </ul>
Appropriate attribution	<ul style="list-style-type: none"> <li>▪ Fails to attribute</li> <li>▪ Plagiarizes</li> <li>▪ Inappropriate attribution (over-citing or under-citing)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Makes attributions, but with minor errors</li> </ul>	<ul style="list-style-type: none"> <li>▪ Fully and correctly attributed</li> </ul>
Citations are complete and consistent	<ul style="list-style-type: none"> <li>▪ No citations</li> <li>▪ Poor/inconsistent format</li> <li>▪ Writer demonstrates insufficient understanding of how to cite</li> </ul>	<ul style="list-style-type: none"> <li>▪ A few minor errors</li> </ul>	<ul style="list-style-type: none"> <li>▪ Correct in the style appropriate for the discipline</li> </ul>

How could this writer have better used information resources for this work?

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## Appendix F

### Funded Grant for Examining Information-seeking Behavior of Students

**Title:** Information seeking behavior of UH students: A videotape analysis

**Project leader:** Irene Ke, Program Director for Instruction and Information Literacy

#### **Project Team members:**

Mary Louise Ochoa, Director, Assessment and Accreditation Services

Lee A. Hilyer, Program Director for Research & Reference Services

Alex Simons, History, Political Science and Government Document Librarian

#### **Objectives**

The library invests an enormous amount of resources in providing information literacy training to our students. To further our service in this area, it is essential that we know how our students seek out information when they face a real-world problem, and that we are able to provide evidence indicating that our efforts have been effective. For that purpose, we have designed a research method to answer the following questions:

1. How do students search for information when given a real-world problem to solve?
2. How can we better assess students' information seeking behavior?

#### **Method**

Data will be collected in three formats:

1. Videotape: Students will be given a real-world problem/situation and their research process will be videotaped.
2. Interview: Students will be interviewed to learn how they make decisions when it comes to searching for information, why they choose specific resources, and how they decide if the information found can be used to solve their problem.
3. Questionnaire: Students will also be asked to fill out a questionnaire. The questionnaire will include questions related to their experience using library services (e.g. reference and instruction services)

This project can also serve as one component of the ongoing university-wide assessment of Information Literacy. Information Literacy is one of the General Education skills to which the university has committed. This particular skill will be assessed both by product and by process. The product assessment will begin by applying the Information Literacy rubric, developed as an outcome of our 2008 faculty survey, to the university-wide random sample of embedded student work.

While the student work products will illuminate the end product of information searches, by themselves they will not inform us about the process students went through. By observation with taping, and by interviews with the students afterward, we will learn the difficulties and knowledge gaps which we can then address in our work.

The project team will develop a set of research tasks, specific for each of the undergraduate colleges at UH. Senior-level students will be selected from each college and offered a gift card for participation in the study. All selected students will be in their senior year, because we are assessing the information literacy of students as they near the end of their undergraduate career.

Each student will be assigned a task appropriate for that student's field of study, and then videotaped as s/he investigates and conducts the needed research. Interviews and questionnaires will further illuminate students' experiences, difficulties and uncertainties as they attempt to use information resources.

Each videotape will be analyzed by at least two librarians on the team, who will observe the processes employed by the students. The project team will compile a report of findings, including problems, issues, and further questions to be addressed.

### **Implications**

One of the aims of the Libraries' Strategic Directions is to "become an integrated teaching and learning center." To help students learn, we need to know the information competency level of our students and whether our instructional interventions are effective in raising this level. The results of this project can provide insight to how our students find and use information. With a deeper understanding of our users' information-seeking behavior we can work with faculty on campus to plan for better ways to teach information literacy on the UH campus.

It is anticipated that this project will answer some questions and raise further questions which will warrant further research. We are committed to monitoring our students' effective use of our ever-expanding information resources.

### **Assessment**

The success of this project will be evident from the resultant report, which will describe students' successes and difficulties, both as observed by the team and as described by the student participants. Analysis of these findings will address current needs as well as successes in our preparation of students with regard to information literacy.

We hope to learn from the process for future planning and assessment, including data collection and assessment methods which we will be employing on a pilot basis. The team will document the process on how the work is carried out, lessons learned, and will make recommendations for future endeavors. The team will also report its findings to the RIS Department, to the Library Administration, and to the University Assessment and Accreditation Services.

**Time Frame:** August 2009 to March 2010

**Timeline**

August - September, 2009: Designing tasks, interview questions, and rubrics (for evaluating student's performance)

September - October, 2009: Identify and recruit subjects and schedule time for filming and interviews

October - November, 2009: interviewing and filming

December, 2009 – January 2009: Analysis of films. Coding and tabulation of interviews and questionnaires. Summarizing data

January – March 2010: Analysis and report development

**Budget**

We plan to select 10 senior level undergraduate students for participation. Each participant will receive a \$50 gift card.

10x \$50= \$500

**Appendix G**  
**General Education Assessment of Quantitative Reasoning**  
**at the**  
**University of Houston**

**Introduction**

Quantitative reasoning is an integral part of the core curriculum at the University of Houston and a key focus of the general education assessment effort. By choosing to add this institutionally designated option to the state mandated core curriculum, the university recognizes the importance of student learning in this area.

Quantitative reasoning is a multi-faceted construct which is owned by several disciplines housed on our university campus. While an assessment framework that encompasses more than one discipline is warranted, a decision was made to implement a pilot study of quantitative reasoning in one discipline to test an assessment protocol and to determine the feasibility of implementing this protocol on a larger scale. At the University of Houston, mathematics lends itself well to such a project in part because math reasoning is a good proxy for quantitative reasoning but also because math tends to have well-defined learning objectives and student performance data.

In mathematics, quantitative reasoning is entwined with student competencies. If one were to consider Bloom's taxonomy, students must acquire knowledge before they can *apply* knowledge. Similarly, reasoning in mathematics is possible only after students have attained pre-reasoning skills, which include axiomatic knowledge (i.e., math rules). Therefore, the pilot study examined student outcomes with respect to not only reasoning skills but also the foundational learning that enables reasoning as defined by the math curriculum.

The assessment strategy for math competencies at the University of Houston reflects four general learning objectives adopted from the core curriculum guidelines established by the Texas Higher Education Coordinating Board (THECB) (Texas Higher Education Coordinating Board, 2008). Stated in terms of what students are expected to do, these objectives are:

- To apply arithmetic, algebraic, geometric, higher-order thinking, and statistical methods to modeling and solving real world problems
- To represent and evaluate basic mathematical information verbally, numerically, graphically, and symbolically
- To expand mathematical reasoning skills and formal logic to develop convincing mathematical arguments.
- To interpret mathematical models such as formulas, graphs, tables and schematics, and draw inferences from them

These learning objectives are consistent with the University of Houston core curriculum reasoning requirement that includes “building students’ skills in mathematical and logical thinking” (University of Houston, 2008).

In order to assess student progress, the four learning objectives were mapped to four lower division courses.

- MATH 1310: College Algebra
- MATH 1313: Finite Mathematics with Applications
- MATH 1314: Calculus for Business and the Life Sciences
- MATH 1330: Pre-calculus

The rationale for choosing these particular courses is that a high proportion of undergraduates enroll in these classes as part of their degree plan. Thus, these courses provide the most appropriate data from which to study the acquisition of quantitative reasoning skills. (The reader is reminded that the quantitative reasoning construct is operationalized for the purposes of this pilot to be student work that reflects mathematical reasoning.)

## Assessment Structure and Definitions

In order to assess the extent of student learning in math, the Mathematics Department collaborated with the University of Houston - Office of Institutional Effectiveness to identify specific courses and data items appropriate for the task. These courses and items represent an initial “pilot” framework that will guide the long term assessment strategy in this area.

### I. Learning Objectives and Assessment Items

**Table 1** maps specific exam items in four undergraduate math courses against the general education objectives for math competency. The selected items were reviewed by the math department – in collaboration with institutional research and assessment personnel – for their relevance and appropriateness to the specified learning objectives. It is important to note that a single test item may address more than one objective. For example, in the Table 1 the column for MATH 1330 contains two references to Item 4 from Test 2, addressing Objective 2 and Objective 4.

**Table 1: Assessment Items by Course and Learning Objective\***

Learning Objectives	Course			
	MATH 1310	MATH 1313	MATH 1314	MATH 1330
<b>Objective 1:</b> To apply arithmetic, algebraic, geometric, higher-order thinking, and statistical methods to modeling and solving real world problems	Test 2: <b>15, 14</b>	Test 2: 6 Test 3: 2	Test 2: 2 Test 3: 4, <b>9</b> Test 4: 1, 7, 8	Test 3: 3 Test 4: 2, 9
<b>Objective 2:</b> To represent and evaluate basic mathematical information verbally, numerically, graphically, and symbolically	Test 4: 9, <b>10, 11</b>	Test 2: <b>13</b> Test 3: 1, 3	Test 3: 5 Test 4: 2	Test 2: 4, 10 Test 4: <b>13</b>
<b>Objective 3:</b> To expand mathematical reasoning skills and formal logic to develop convincing mathematical arguments	Test 3: 6 Final: 3		Test 3: <b>9</b>	Test 3: <b>14</b> Test 4: 5, 6, <b>13</b>
<b>Objective 4:</b> To interpret mathematical models such as formulas, graphs, tables and schematics, and draw inferences for them	Test 3: 8 Test 4: 7	Test 2: 5, <b>13</b> Test 3: 5, 12	Test 3: 3, <b>9</b>	Test 2: 4, <b>16</b> Test 3: 12 Test 4: 5, 6

\* Bold items represent free response questions

## II. Item Type and Performance Levels

Exams represent the majority of assessments utilized by instructors in lower division mathematics courses. Therefore, the assessment strategy described here utilizes two types of data items: multiple choice (MC) and free response.

### *Item Difficulty*

Math instructors and assessment staff routinely review the exams to evaluate the quality of the questions. Instructors also jointly determine item difficulty, which is rated on a three point scale of A, B, & C where “A” is most difficult and “C” is least difficult. In practical terms, an “A” level item requires “A” level understanding and skill, and a student earning an “A” in the class would be expected to answer the question correctly. A “B” level item requires “B” level comprehension and so on. Exams are constructed to have a mixture of A, B and C level questions so as to delineate differing levels of student understanding of concepts. As a result, interpretation of aggregate student performance on a given item must take item difficulty into account since the percentage of students answering a question correctly will likely vary depending on the difficulty of the questions. The item difficulty level is incorporated into the performance standards as illustrated in the following sections.

### *Performance Standards*

The performance standards for the mathematics exams are derived from patterns of student outcomes in these courses from the past year. In short, the expected performance benchmark for A, B and C level questions was set by the average percent of students receiving A’s, B’s and C’s in the respective math courses during the previous year. **Table 2** provides the benchmarks for student performance relative to test item difficulty.

**Table 2: Minimum Performance Benchmarks by Course and Item Difficulty**

Item Difficulty Level	Courses			
	Math 1310	Math 1313	Math 1314	Math 1330
A Level	22%	22%	21%	16%
B Level	44%	42%	44%	34%
C Level	60%	60%	59%	52%

In terms of multiple choice items, the figures above represent the minimum acceptable percentage correct for a given item difficulty. For example, if 61% of students in Math 1310 answer a “C” level item correctly, they will have met the standard of performance for that item.

The rationale for free response items is similar. In this case, the percentages from Table 2 indicate the minimum group performance expectation for each free response item defined as the proportion of responses that are “acceptable” or better. For instance, 42% of students in Math 1313 would be expected to provide an “acceptable” or “exemplary” answer to a “B” level free response item. In Math 1330, the group performance expectation would be 34% for the same item

#### *Performance Levels for Multiple Choice Items*

Performance standards for each type of item are slightly different and bear additional discussion. Standards for multiple choice items are applied to aggregate student results. Put simply, did students as a group do well enough on an item to demonstrate adequate learning at the program level? As mentioned previously, the performance standards are divided into three tiers to account for item difficulty. If an item represents “A” level content, then the percentage of students expected to answer that item correctly would be lower relative to the expectation for a “C” level question.

#### *Performance Levels for Free Response Items*

While multiple choice items primarily result in binary outcomes (correct vs. incorrect), free responses require a more complex grading system. Each free response item is composed of multiple parts and points are awarded cumulatively. In other words, success on later components of the problem is dependent on how well students perform on earlier stages. The more a student knows and understands the course material, the higher the likelihood of the student answering a given item accurately and completely. Points are assigned accordingly. Since the total point values for each question differ slightly depending on the number of item components, the math department has set specific performance cut points for each item. Regardless of the total number of points, performance on each item is expressed in terms of four performance levels. These are:

**Needs Improvement:** Student is lacking the prerequisite skills necessary to take the first step towards solving the problem.

**Basic:** Student has demonstrated that he/she has the pre-requisite skills to set up the problem and/or take the first step towards solving the problem.



**Acceptable:** Student has demonstrated sufficient knowledge to solve the problem.

**Exemplary:** Student has completed every step required to solve the problem correctly and has reported the answer correctly.

Although there are four possible student performance levels, the critical cut score is the point at which students are classified as “acceptable” since this represents the minimum math target outcome for these items. It is reasonable to assume that difficult items will have fewer students attaining acceptable status compared to less difficult items. Therefore, different cut points are set based on the three item difficulty levels (e.g. A, B, and C). The actual performance standards (i.e. minimum percentage needed for each performance level) are based on student outcome patterns in previous courses.

## Results

The results of the item analysis are organized by learning objective. This allows us to address individual objectives in terms of student performance on the appropriate items relative to the standards. The columns titled “% Correct” and “% Acceptable or higher” provide the actual student assessment results while a check in the “Met Standard” column indicates whether the overall aggregate results meet the threshold of acceptable performance as described in the previous section when factoring in item difficulty. Please note that item difficulty is indicated by a letter after each item in the tables (e.g. Test 2:15 (B)).

**Objective 1: To apply arithmetic, algebraic, geometric, higher-order thinking, and statistical methods to modeling and solving real world problems**

Course	MC Items	% Correct	Met Standard	Free Response Items	% Acceptable or higher	Met Standard
MATH 1310				Test 2: 15 (B)	81%	✓
				Test 2: 14 (A)	67%	✓
MATH 1313	Test 2: 6 (C)	93%	✓			
	Test 3: 2 (C)	49%	-			
MATH 1314	Test 2: 2 (B)	52%	✓			
	Test 3: 4 (C)	95%	✓			
	Test 4: 1 (B)	85%	✓	Test 3: 9 (A)	68%	✓
	Test 4: 7 (A)	60%	✓			
	Test 4: 8 (B)	62%	✓			
MATH 1330	Test 3: 3 (C)	65%	✓			
	Test 4: 2 (C)	43%	-			
	Test 4: 9 (A)	49%	✓			

**Objective 2: To represent and evaluate basic mathematical information verbally, numerically, graphically, and symbolically**

Course	MC Items	% Correct	Met Standard	Free Response Items	% Acceptable or higher	Met Standard
MATH 1310	Test 4: 9 (A)	66%	✓	Test 4: 10 (B)	51%	✓
				Test 4: 11 (B)	32%	-
MATH 1313	Test 3: 1 (C)	81%	✓	Test 2: 13 (B)	68%	✓
	Test 3: 3 (C)	74%	✓			

<b>MATH 1314</b>	Test 3: 5 (B)	46%	✓			
	Test 4: 2 (A)	96%	✓			
<b>MATH 1330</b>	Test 2: 4 (B)	56%	✓	Test 4: 13 (A)	24%	✓
	Test 2: 10 (A)	45%	✓			

**Objective 3: To expand mathematical reasoning skills and formal logic to develop convincing mathematical arguments.**

Course	MC Items	% Correct	Met Standard	Free Response Items	% Acceptable or higher	Met Standard
<b>MATH 1310</b>	Test 3: 6 (C)	81%	✓			
	Final: 3 (C)	93%				
<b>MATH 1314</b>				Test 3: 9 (A)	68%	✓
<b>MATH 1330</b>	Test 4: 5 (A)	54%	✓	Test 3: 14 (A)	52%	✓
	Test 4: 6 (A)	54%	✓	Test 4: 13 (A)	24%	✓

**Objective 4: To interpret mathematical models such as formulas, graphs, tables and schematics, and draw inferences for them**

Course	MC Items	% Correct	Met Standard	Free Response Items	% Acceptable or higher	Met Standard
<b>MATH 1310</b>	Test 3: 8 (B)	71%	✓			
	Test 4: 7 (C)	74%	✓			
<b>MATH 1313</b>	Test 2: 5 (C)	79%	✓	Test 2: 13 (B)	68%	✓
	Test 3: 5 (C)	87%	✓			
	Test 3: 12 (A)	39%	✓			
<b>MATH 1314</b>	Test 3: 3 (B)	46%	✓	Test 3: 9 (A)	68%	✓
<b>MATH 1330</b>	Test 2: 4 (B)	56%	✓	Test 2: 16 (B)	35%	✓
	Test 3: 12 (A)	78%	✓			
	Test 4: 5 (A)	54%	✓			
	Test 4: 6 (A)	54%	✓			

In sum, results indicate that students are meeting the general education benchmarks for acceptable performance in mathematics. Outcome data for each objective suggest that students are able to demonstrate learning at a level consistent with the goals of the math program. The range of item difficulty provides additional insight regarding the depth of knowledge acquired by students across the available courses.

## Discussion

The assessment process described in this report represents the first phase of a multi-year strategy to refine how the university evaluates student progress in quantitative reasoning skill acquisition. The results of this study will lead to a two-pronged assessment strategy. First, there will be continued development and refinement of the general math component of core curriculum assessment. Secondly, the university will expand the scope of quantitative reasoning assessment to include the other university disciplines that own the responsibility for teaching these skills. Each of these projects will be discussed in turn.

### *General Math Assessment – Next Steps*

Mathematics faculty will undertake a review of these objectives to determine whether these should be revised to better address our students' needs. The first stage of the review (FY 2008/2009) will utilize instructors from the four courses described in this report. However, the math department will continue to map exam items to the appropriate objectives for evaluative purposes only making changes when appropriate and consistent with the overall assessment approach.

In FY 2009-10, the scope of assessment will be expanded to incorporate additional courses. This will provide a wider net for gauging general student learning in math. It is likely that the first course to be added to this process is MATH 2311: Introduction to Probability and Statistics. The class provides foundational knowledge in an area of mathematics that permeates everyday life and is in keeping with mission of the university to create quantitatively literate graduates.

### *Quantitative Reasoning – Next Steps*

Within the framework of the university curriculum, mathematics and quantitative reasoning represent parallel learning paths. As discussed previously, quantitative reasoning is not owned by a single discipline. Quantitative reasoning skills may be learned in fields such as philosophy, computer science, and music. This pilot study provides a springboard for interdisciplinary discussions with respect to quantitative reasoning at the University of Houston. The ultimate goal is to develop a general education assessment protocol that incorporates the relevant skills and knowledge from each of these disciplines into a comprehensive continuous improvement plan.

## **References**

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