

University Reports

AUGUST 2015

REPORT ON THE ASSESSMENT OF STUDENT LEARNING

INSTITUTION: *Emporia State University*

AREA ASSESSED: Mathematics and Analytical Reasoning

Assessment Instrument(s):

The instrument used to assess student works from college algebra course assignments was the AAC&U Quantitative Literacy VALUE Rubric. This rubric is used to rate students abilities to explain information presented in mathematical forms (Intrepretation), abilities to convert relevant information into various mathematical forms (Representation), abilities to make judgments and draw appropriate conclusions based on the quantitative analysis of data (Application/Analysis), and abilities to calculate mathematical equations (Calculation).

Assessment Results:

In Spring 2015, a base-line collection of student work from 8 sections of college algebra was used to evaluate the rubric dimensions: Intrepretation, Representation, Application, and Calculation skills. The mean (average) scores for the dimensions were as follows: Representation 2.1, Calculation 2.6, Intrepretation 2.6, and Application 2.9. Representation was the lowest rating of the four dimensions and new learning strategies will be implemented as a first priority in the fall of 2015.

Explain how your institution makes use of the assessment results:

ESU uses assessment findings to make both curricular and pedagogical (teaching) changes. The following changes have been made to improve student learning:

Related to "Representation" skills: Assignments are modified to focus on the student's ability to convert written word to mathematical language. Both assignments allow for greater repetition of highlighting the necessary information to form the correct equation. These changes will be implemented in all college algebra course sections beginning in the fall of 2015.

Related to "Calculation" skills: Currently various exam review strategies are being employed with mixed results. Faculty will collaborate to fine tune these strategies and present a more consistent approach to assisting students in preparing for examinations.

Related to "Intrepretation" skills: An improvement in graphical interpretation will positively affect overall learning in the course. The assessment findings were used to identify those strategies that worked well in Exam 1 where students scored the highest. These skills seemed to become less refined as the course progressed. Using more visuals in both the course worksheets and lab assignments using a common theme called "test and chart" will be implemented throughout the course. This skill will then be reassessed to determine if the strategies were effective.

Comments:

ESU has been assessing the college algebra curriculum and instruction over the past few years using a variety of mechanisms including a faculty sabbatical reasearch project, standardized testing using the Collegiage Assessment of Academic Proficiency and ACT/CAAP Linkage Studies. This past year it was determined that assessment of course embedded student works using the AAC&U VALUE Rubric as an assessment instrument would more directly measure student learning. Likewise, using course embedded assessments positions the mathematics faculty to make immediate adjustments to curriculum and pedagogies. Since this was the first year using the rubric, this year's metrics serve to establish the baseline.

AUGUST 2015

REPORT ON THE ASSESSMENT OF STUDENT LEARNING

INSTITUTION: *Fort Hays State University*

AREA ASSESSED: Mathematics and Analytical Reasoning

Assessment Instrument(s):

The general education course MATH 110 College Algebra outcomes are defined by the Kansas Core Outcomes for College Algebra (KCOCA). The fourteen outcomes given in the KCOCA come from an articulated agreement between twenty-six post-secondary Kansas institutions of higher learning. To determine achievement of these core outcomes in MATH 110, a direct measure of student performance is necessary.

As is widely recognized, there is a need for appropriate placement in college level mathematics courses for newly matriculating students, whether this student is coming directly from their senior year in high school or is coming from some other situation well removed from formal academic settings. Each student enrolled in MATH 110 College Algebra is required to take a placement (Pre-test) exam. This exam is adapted from a past MAA Placement Test design. This exam consists of twenty-five multiple choice questions and is used to determine whether or not a student has certain pre-requisite skills at the time of entry into the MATH 110 course. The exam is taken by each student at the beginning of the semester in which the student is enrolled in MATH 110 for the departmental data collection. The content of this exam includes basic number calculations (such as order of operations and signed numbers) and basic algebraic concepts (such as simplifying algebraic expressions, applying basic factoring concepts, solving basic linear and quadratic equations, and basic linear function analysis.) Students who correctly answer at least fifteen of the twenty-five questions are determined to have sufficient background knowledge and skills to begin the content of the MATH 110 course.

The Mathematics Department at FHSU also designs a common final post-test exam for all sections. The exam includes problems that directly measure students' ability to perform each of the core outcomes. This final exam, constructed by a departmental committee and tied to the common core outcomes, consists of thirty multiple-choice questions and ten open-ended questions for a total of forty points. Every student within a section of MATH 110 is required to take this common final exam and each student's score is included in the analysis of the core outcomes. The final exam results are then analyzed across all sections and all instructional methods for this course.

Assessment Results:

The following table represents the average pre-test and post-test scores across all sections of MATH110 for each semester.

Semester	Pre-test	Post-test
S2006	15.13	30.90
E2006	13.94	27.04
S2007	15.30	31.68
F2007	15.17	28.79
S2008	14.96	29.71
F2008	13.94	27.04
S2009	13.32	29.18

F2009	11.90	22.30
S2010	13.25	28.27
F2010	14.20	33.80
S2011	13.67	28.89
F2011	13.69	28.89
S2012	13.04	31.66
F2012	14.38	31.00
S2013	12.72	27.53
F2013	16.25	33.40
S2014	12.28	25.39

Explain how your institution makes use of the assessment results:

Assessment results, like this pre-test/post-test model are useful in various ways. First, this model gives the department great insight into possible individual differences in pedagogy so adjustments in teaching can be made. Not all mathematics faculty are well suited to teach this important foundational course. If particular sections demonstrate that a faculty member has difficulty in producing a value-added outcome in student learning, then faculty can be re-deployed to assure greater student performance.

Second, these assessment results obviously provide trend analysis allowing the Mathematics Department to understand longitudinal changes in student abilities. While the curriculum of MATH 110 is determined largely by our participation in the Core Outcomes Group, the Department takes great pride in evolving the pedagogy over time to create a more meaningful learning experience for students with a wide range of abilities.

Third, these assessment results provide important assurance to the campus community that students are learning essential quantitative skills in this foundation course. Other faculty can be assured that pre-requisite learning is sound so advanced learning can occur in the program curriculum.

Comments:

While the department currently places great emphasis on assessment of MATH 110, there is an understandable need to expand this model into other less populated general education classes like intermediate Algebra and Elements of Statistics. As FHSU embarks on a new general education program, the MATH 110 assessment results will drive the discussion about the most appropriate courses accepted for general education credit. Expansion of general education options for students is widely desirable, but such decisions will need to rest on sound assessment practices.

For the purpose of this report, the institution selected the most common assessment available. Several programs also assess quantitative and analytic reasoning at various points during a student's program of study. These assessments provide rich data to help programs improve, but the applicability across the institution is not substantial or comprehensive enough to be judged a better measure of mathematic skills than the MATH 110 pre-test/post-test approach.

AUGUST 2015

REPORT ON THE ASSESSMENT OF STUDENT LEARNING

INSTITUTION: *Kansas State University*

AREA ASSESSED: Mathematics and Analytical Reasoning

Assessment Instrument(s):

Direct assessment: Percent of students taking College Algebra during AY 2015 who received a grade of C or better

Multiple Indirect Assessments:

1. Percent of students responding positively ("very much" or "quite a bit") to National Survey of Student Engagement (NSSE) item pertaining to learning gains on "analyzing numerical and statistical information"
2. Percent of senior students responding positively ("quite a bit", "a lot" or "some") to items pertaining to the area of Quantitative Reasoning on our Senior Survey, which includes an internal assessment of seniors' learning gains in the eight areas within our General Education program. The specific items for this report are:
 - a. Applying observation, experimentation, and/or quantitative concepts and skills to solve real-world problems
 - b. Learning to gather and evaluate information to make decisions

Assessment Results:

Direct Assessment - Of 1879 College Algebra students assessed, 75% (1406) earned a C or better

Indirect Assessments:

1. NSSE - 66% of students responding (1726/2621) answered "very much" or "quite a bit" when asked about their learning gains in "analyzing numeric and statistical information".
2. Items from the Senior Survey
 - a. Applying observation, experimentation, and/or quantitative concepts and skills to solve real-world problems: 67% of senior students responded 'quite a bit' and 'a lot'; an additional 20% of senior students responded 'some'
 - b. Learning to gather and evaluate information to make decisions: 71% of senior students responded 'quite a bit' and 'a lot'; an additional 19% of senior students responded 'some'

Explain how your institution makes use of the assessment results:

Direct Assessment:

The Department of Mathematics uses the results to continue to improve the way College Algebra is taught

Indirect Assessments:

NSSE - We compare our results for the NSSE to previous years results to determine whether improvement is occurring.

Internal Assessments: These results are shared with the entire campus, and the full senior survey report is posted on the Office of Assessment website. The results are used by our Office

of Undergraduate Studies and the general education steering committee to determine whether changes need to be made to our general education program.

Comments:

Direct Assessment:

College Algebra is a basic math course that is either a requirement or pre-requisite for all undergraduate majors in Agriculture and Business, most STEM and social science majors, and aeronautical and technology programs, and many other degree programs. It is one of the most critical courses for many of our students. The Department of Mathematics has developed methods for teaching this course that increase student learning, and they continue to seek ways to improve the teaching of the course.

Indirect Assessments:

NSSE - We participate in NSSE in order to gather a broad set of data on our programs. The items do not reflect specific assessments of our student learning outcomes, but offer another view.

Our internal assessments of the 8 General Education areas began in 2013, and the current results reflect initial data. These data and the internal assessment survey will continue to be improved and administered to graduating seniors to provide an indirect assessment of learning across all 8 areas of General Education at K-State.

AUGUST 2015

REPORT ON THE ASSESSMENT OF STUDENT LEARNING

INSTITUTION: *Pittsburg State University*

AREA ASSESSED: Mathematics and Analytical Reasoning

Assessment Instrument(s):

Pittsburg State University's assessment procedures observe the field's Best Practices by valuing student learning as the focus. Using a variety of measures that provide both direct and indirect evidence, decision making is supported by both quantitative and qualitative data.

Direct Evidence:

PSU Math Rubric

The PSU Math Rubric is an internally developed evaluation instrument used to assess student work relative to Mathematics and Analytic Reasoning learning outcomes identified in the university's general education curriculum. The rubric measures achievement criteria for five objectives: Interpretation, Representation/Application, Calculation, Analysis/Synthesis, and Communication. A team of Math faculty and Math Assessment Coordinator review student work drawn from assignments embedded in the courses taken by the majority of students to meet their general education math requirement.

College Learning Assessment (CLA+)

The College Learning Assessment (CLA+), designed by the Council for Aid to Education, is a nationally normed, standardized test that provides a value added measurement for assessing students' higher-order thinking skills. The Scientific and Quantitative Reasoning subsection of this exam provides information relevant to Mathematics and Analytic Reasoning.

Indirect Evidence:

National Survey of Student Engagement (NSSE)

The National Survey of Student Engagement (NSSE) is a national, standardized inventory of students' perceptions of their engagement in and satisfaction with their educational experiences. Biennial administration of the NSSE at PSU allows for comparison to student feedback from chosen peer institutions (public, four-year universities in the geographic plains region for PSU peers) and to national results. PSU solicits feedback from a random sampling of freshmen and seniors.

The NSSE's Quantitative Reasoning Engagement Indicator, which was new on the 2013 iteration, reflects how often students, during their college courses, reached conclusions from their analysis of numerical information, used numerical information to examine a real-world problem, and evaluated others' conclusions from numerical information. This indicator provides the primary form of indirect assessment of student ability, specific to

their own perception of learning while at the university.

Targeted Course Completion

Successful completion of general education math courses offers indirect evidence of student acquisition of learning outcomes. Trend data monitoring relevant course grades supports the overall evaluation of general education goal fulfillment in the area of Mathematics and Analytic Reasoning.

Assessment Results:

Results from both the direct and indirect measures outlined above provide evidence that PSU is meeting or exceeding targets set for Mathematics and Analytic Reasoning and that students' abilities in this area have steadily increased over recent years.

PSU Math Rubric

The PSU Math Rubric is designed to assess student knowledge and skills in the interpretation, representation/application, calculation, analysis/synthesis and communication of numerical information. The range of scores designated on the rubric is 0 (no credit) to 3 (exceeds expectations). The averages in Table 1 reflect evaluation of student work on course embedded assessments in the three courses that are commonly taken for general education Math credit. Mean rubric scores indicate that student performance in quantitative reasoning has steadily increased over the past three years, with the mean score being well above the level equivalent to meets expectations.

Table 1. PSU Math Rubric Mean Scores

2011-12	2012-13	2013-14
2.25	2.33	2.48

The Math Rubric allows faculty to aggregate student performance in relation to targeted expectations. Math faculty set a target for 70% of students to meet or exceed expectations in the area of Mathematics and Analytical Reasoning based on pilot data, with the caveat that the targeted expectation would be reexamined on completion of the first three year rotation and data collection. Table 2 shows that, during the 2013-14 academic year, 85.35% of students met or exceeded expectations. In addition, rubric scores indicate a consistently increasing performance in quantitative reasoning, well above the goal of 70% of students meeting or exceeding expectations.

Table 2. PSU Math Rubric Achievement Relative to Expectations

	Below Expectations	Meets Expectations	Exceeds Expectations
2011-12	21.76%	27.76%	50.40%
2012-13	20.03%	18.08%	61.88%
2013-14	14.68%	16.92%	68.43%

College Learning Assessment (CLA+)

The Collegiate Learning Assessment (CLA+) tests students in a series of workplace critical skills such as analysis and problem solving, writing effectiveness, and quantitative reasoning. Each academic year, the CLA+ is administered to a sample of entering freshman and graduating senior students. This allows for comparison in scores to determine gains in abilities from freshman to senior students. Table 3 shows the value added data for the Scientific and Quantitative Reasoning subsection of the CLA+, with scores indicating significant gains in Quantitative Reasoning skills in seniors compared to freshmen. For example, during the 2014-15 academic year, seniors scored 43.34 qualitative points higher than their freshmen peers.

Table 3. CLA+ Scientific and Quantitative Reasoning Scores

	2013-14	2014-15
Freshmen	488.55	493.38
Seniors	546.47	536.72

National Survey of Student Engagement (NSSE)

The NSSE is administered on a biennial basis at PSU and 2015 results are not yet available from the Center for Postsecondary Research. Results from the previous administration of the NSSE indicate that PSU freshmen enter college with less confidence in their quantitative reasoning abilities but graduate expressing a greater “value-added” experience than students at peer institutions. Table 4 compares the Quantitative Reasoning mean score of PSU against stated categories of schools and shows that the increase in Quantitative Reasoning Engagement Indicator scores from freshmen to seniors is significantly higher for PSU than for all categories of comparison institutions.

Table 4. NSSE 2013 Results on Quantitative Reasoning Engagement Indicator

	Other Plains Institutions	Other Carnegie Classification	All Institutions Administering NSSE	PSU
Freshmen	27.2	27.0	27.3	25.3
Seniors	29.4	28.9	29.7	30.9
Increase	2.2	1.9	2.4	5.6

Table 5 depicts student feedback on the NSSE survey question asking, “How much has your experience at this institution contributed to your knowledge, skills and personal development in the following areas: Analyzing quantitative problems or analyzing numerical and statistical information?” Percentages shown illustrate responses of either “Very Much” or “Quite a bit.” It is worth noting that seniors consistently perceive positive growth in analytical skills as a result of their educational experience at PSU.

Table 5. NSSE Trend of Student Perception of Numerical Information Skills

{Reported as percentage of students responding as either "Very much" or "Quite a bit."}

	Freshmen	Seniors	Increase
2009	64%	77%	13%
2010	66%	79%	13%
2011	71%	80%	9%
2012	68%	73%	5%
2013	48%	65%	17%

Further analysis of individual NSSE questions associated with the Quantitative Reasoning Engagement Indicator suggest that PSU students have gained more confidence and experience in Quantitative Reasoning during their college experience than their peers, as shown in Table 6.

Table 6. NSSE 2013 Student Perception of Numerical Information Skills

During the current school year, about how often have you done the following?
 {Reported as percentage of students responding either "Very Often" or "Often".}

...Reached conclusions based on your own analysis of numerical information (numbers, graphs, statistics, etc.)?

	PSU	National
Freshmen	47	51
Seniors	62	54

...Used numerical information to examine a real world problem or issue (unemployment, climate change, public health, etc.)?

	PSU	National
Freshmen	30	38
Seniors	45	44

...Evaluated what others have concluded from numerical information?

	PSU	National
Freshmen	28	37
Seniors	45	44

Targeted Course Completion

Course grades and course completion are used as indirect evidence of student learning and support conclusions drawn through direct assessment measures. Table 7 shows the percentage of students who obtained a grade of "C" or higher in each of PSU's general education math courses. For the 2014-15 academic year, 78.7% of students obtained a

grade of “C” or higher, again indicating that we are exceeding our target of 70% of students meeting or exceeding expectations established based on pilot data.

Table 7. Course Grades Trend Data
Course Grades "C" or Better Percentages

	2010-11	2011-12	2012-13	2013-14	2014-15
Number of students enrolled	1161	1234	1337	1224	1205
Math 113 - College Algebra	80%	81%	91%	84%	80%
Math 133 - Quantitative Reasoning	69%	79%	75%	69%	78%
Math 143 - Elementary Statistics	81%	75%	78%	78%	78%

Explain how your institution makes use of the assessment results:

Use of results in the area of Mathematics and Quantitative Reasoning occurs primarily in the Department of Mathematics. Since the 2011-12 academic year, the department has followed a faculty-generated, formal plan for general education math assessment. This plan was developed through a campus-wide General Education Math Task Force. Data collected are used primarily to evaluate core objective 1.3 of our general education curriculum:

Goal #1: Students should be able to communicate effectively.

Objective #3: Demonstrate the ability to formulate and solve problems using the tools of mathematics.

To gather and evaluate baseline data, each of three general education math courses (Math 133: Quantitative Reasoning, Math 143: Elementary Statistics and Math 113: College Algebra) has been assessed for three consecutive years, with each being assessed every third year thereafter for a three-year frequency cycle. To date, Quantitative Reasoning and Elementary Statistics have been included in the annual reports provided by the department since the assessment plan’s adoption in 2011. During the 2014-15 academic year, student assessments embedded as course assignments in College Algebra were evaluated and scores will be included when the department assessment team meets again this coming fall to assess and report on student learning. Math faculty will also update targets for student success based on their review of assessment data for the past three years.

There is an identified Math Assessment Coordinator who works with the Director of Assessment to analyze assessment data and use findings to stimulate discussion around curriculum improvement for those faculty teaching general education courses that address quantitative reasoning. Results are also discussed with graduate assistants teaching relevant courses, with their mentor assisting them in using scores to inform course delivery.

More specifically, benchmarks for student performance in quantitative reasoning have been established and a team of faculty within the Math department annually evaluate student work, aggregating scores to confirm students are collectively attaining the

programmatic goal of 70% meeting and/or exceeding expectations. Analysis of data shows student performance exceeding that average or C-level target. However, more in depth analysis of rubric scores for the five previously identified achievement criteria has shown a pattern of highest performance in the area of Communication and lowest performance in the areas of Interpretation and Calculation. This feedback has been shared with faculty and graduate assistants teaching relevant math courses in order to modify course delivery to more effectively address Interpretation and Calculation aspects of the curriculum.

Each fall, the Math Assessment Coordinator generates a formal report reviewing results from the previous academic year. This report, along with other reports reviewing the assessment of student learning, is intentionally presented to the Provost for two primary reasons. First, evaluation of general education, including the quantitative reasoning component, is considered at the institutional level as well as at the department level. And, second, for the benefit of managerial decision making by academic administration.

An overview of CLA+ scores and NSSE is presented to the Faculty Senate annually to inform the faculty of the performance level of PSU graduates in comparison to their peers nationally. A more detailed breakdown addressing the areas related to the general education curriculum is provided to the Senate's General Education Committee. However, the focus remains on bringing the data and its implications back to teaching faculty who use data to inform curricular decisions to maximize student learning.

Comments:

Data from both direct and indirect measures used to assess Mathematics and Analytic Reasoning show that PSU is effectively meeting this general education goal. Rubric data and course grades are above targets set by faculty. Data from nationally normed, standardized tests affirm a value added experience at PSU, with students making significant gains in analytic reasoning from the time they enter college until they become seniors. Although we experience success in meeting our general education goal related to Mathematics and Analytic Reasoning, faculty follow a formal assessment process and continue to make use of data to routinely inform discussions around the general education math curriculum to promote continuous improvement of student learning.

AUGUST 2015

REPORT ON THE ASSESSMENT OF STUDENT LEARNING

INSTITUTION: *University of Kansas*

AREA ASSESSED: Mathematics and Analytical Reasoning

Assessment Instrument(s):

1a. Rubric from Math 101 (College Algebra) on student performance on four essential learning outcomes: Computation, Methodology, Representation, Interpretation

1b. Examination of achievement levels of outcomes for calculus bound students vs. non-calculus bound students

2. Results of gateway exam with ten essential concepts for students progressing from Calculus I to Calculus II

Assessment Results:

1a. Assessment results from MATH 101 indicate that the majority of the students (nearly 70%) have achieved at least the basic competency in College Algebra, but had difficulty grasping the third concept, "Representation," where 45% of the students failed to achieve the expected learning outcomes.

1b. Non-calculus-bound students (i.e. who will take a statistics or a topics course as a second level math course) have more challenges in achieving the learning outcome, and are four times more likely to withdraw from the course than students who expect to take calculus.

2. Students in Calculus I must pass the gateway exam in order to progress to Calculus II. The exam tests ten concepts. We found that students had the most trouble with Concept 9: Compound Problems. Pass rates vary by modality of test (online or in class).

Explain how your institution makes use of the assessment results:

1. Our examination of performance on essential outcomes in College Algebra has led us to develop and pilot a data-driven College Algebra course. This course has the same essential learning outcomes, but takes a more data analytic approach to the material. We continue to analyze the success of this new approach to non-calculus bound students, but early signs are that students engage more with the material and succeed at a higher rate (77% attainment of skills in data driven sections vs. 64% attainment in traditional sections).

2. For the more difficult concepts in the calculus gateway exam, we are examining ways to provide more tutoring help and practice in compound problems. In addition, we are restructuring the calculus sequence to be a three-course sequence; this should help to provide the instruction that students need in these more complex areas in addition to being more in line with the calculus sequences in the state and across the country. Ultimately, this will help students be able to transfer in calculus courses and be successful as they progress through the sequence.

Comments:

The assessment of student learning reported here will allow us to adjust instruction in both Math 101 College Algebra and Math 121 Calculus I to emphasize the specific concepts that students have the most difficulty with. Additional practice opportunities, such as assignments and group

work, will be used to pinpoint students' learning barriers and offer students concrete feedback for improvement.

AUGUST 2015

REPORT ON THE ASSESSMENT OF STUDENT LEARNING

INSTITUTION: *Wichita State University*

AREA ASSESSED: Mathematics and Analytical Reasoning

Assessment Instrument(s): <ol style="list-style-type: none"> 1. Direct Measures <ul style="list-style-type: none"> • Collegiate Learning Assessment • Percent passing MATH 111 (algebra)/MATH 131 (contemporary mathematics) 2. Indirect Measure <ul style="list-style-type: none"> • Undergraduate perception of their numerical literacy competency 																																			
Assessment Results: <p>Collegiate Learning Assessment</p> <table border="1"> <thead> <tr> <th colspan="5">Scientific & Quantitative Reasoning</th> </tr> <tr> <th>Academic Year</th> <th>WSU Seniors</th> <th>WSU Freshmen</th> <th>All CLA Seniors</th> <th>All CLA Freshmen</th> </tr> </thead> <tbody> <tr> <td>2014-2015</td> <td>542 (n=72)</td> <td>546 (n=96)</td> <td>546</td> <td>499</td> </tr> </tbody> </table> <p>Percent Passing MATH 111/131</p> <table border="1"> <thead> <tr> <th>Academic Year</th> <th>n</th> <th>Percent Passing</th> <th>Target</th> </tr> </thead> <tbody> <tr> <td>2014-2015</td> <td>n=916</td> <td>61%</td> <td>76%</td> </tr> </tbody> </table> <p>Undergraduate's perception - numerical literacy competency on exit survey (scale 1-5, with 5 highest)</p> <table border="1"> <thead> <tr> <th>Academic Year</th> <th>n</th> <th>Percent 4 or higher</th> <th>Target</th> </tr> </thead> <tbody> <tr> <td>2014-2015</td> <td>n=3,126</td> <td>75.2%</td> <td>82.0%</td> </tr> </tbody> </table>					Scientific & Quantitative Reasoning					Academic Year	WSU Seniors	WSU Freshmen	All CLA Seniors	All CLA Freshmen	2014-2015	542 (n=72)	546 (n=96)	546	499	Academic Year	n	Percent Passing	Target	2014-2015	n=916	61%	76%	Academic Year	n	Percent 4 or higher	Target	2014-2015	n=3,126	75.2%	82.0%
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Explain how your institution makes use of the assessment results: <ul style="list-style-type: none"> • In the fall semester, WSU's General Education Committee gathers and assesses the data that has accumulated since the last review (i.e., learning outcomes, changes) and writes a report to the Faculty Senate. • In the spring semester, the report with any recommendations for change is presented to the Senate early in the semester so that the senate has the time for thorough consideration prior to taking the recommendations to the general faculty later in the semester. • Any changes approved by the faculty are instituted in the following version of the undergraduate catalog. • For the past three years, the WSU faculty have been engaged in evaluating all learning outcomes, not just mathematics and analytical reasoning. Although students are performing at expectations or higher, there is room for improvement especially in math content. Faculty are working on developing a required freshmen seminar course for all incoming freshmen, proposed to begin fall 2016. The freshmen seminar course will have the following features: <ul style="list-style-type: none"> ○ General education introductory, 3 hour course ○ Seminar style (25-30 students), 25 sections fall, 25 sections spring ○ Required for incoming freshmen to complete during their first year ○ Taught by tenured/tenure-track faculty ○ 1/3 of course will focus on freshmen transition issues either as standalone content or 																																			

infused throughout the course (e.g., study skills, library skills, getting connected, etc.) and 2/3 would focus on a topic determined by faculty in the divisions of:

- i. Fine arts and humanities
- ii. Social and behavioral sciences
- iii. Mathematics and natural sciences
- Each course would be designed to meet the general education expected outcomes:
 - i. Critical Thinking
 - ii. Problem Solving
 - iii. Analytical Reasoning
 - iv. Communication skills
 - v. Acquired knowledge in natural and social science, arts, and humanities
- The office of student success is reaching out to the math department to assist in developing tutoring programs for math content.

Comments:

AUGUST 2015

REPORT ON THE ASSESSMENT OF STUDENT LEARNING

INSTITUTION: *Washburn University*

AREA ASSESSED: Mathematics and Analytical Reasoning

Assessment Instrument(s):
ETS Proficiency Profile
Course-Embedded Assessment

Assessment Results:
ETS Proficiency Profile 2010-2013
Mathematics

	2010		2011		2012		2013	
	WU	Nation	WU	Nation	WU	Nation	WU	Nation
FR N	200.00	6985.00	214.00	9453.00	223.00	10506.00	230.00	21586.00
SR N	193.00	34387.00	334.00	44177.00	3220.00	44978.00	325.00	93135.00
FR Mean	111.54	111.20	111.99	111.20	112.41	111.30	112.76	112.10
SR Mean	113.63	113.30	113.72	113.50	113.40	113.70	114.02	114.20
Mean Diff	2.09	2.10	1.73	2.30	0.99	2.40	1.26	2.10
FR S.D.	5.56	5.90	6.11	5.80	5.66	5.70	5.35	6.00
SR S.D.	6.18	6.20	5.81	6.20	5.83	6.10	5.87	6.30
Test Value	3.53	26.02	3.33	33.10	1.97	36.75	2.58	44.52
P Value	0.0005	0.0001	0.0009	0.0001	0.049	0.0001	0.01	0.0001
C.I. Diff	.93, 3.26	1.94, 2.26	.71, 2.75	2.16, 2.44	.00, 1.98	2.27, 2.53	.30, 2.21	2.01, 2.19

Only the subcomponent Mathematics scores and a corresponding graph from 2010 through 2013 were included in this report since the national comparison data were not yet available for 2014.

On

the ETS Proficiency Profile, the mean mathematics subscores for seniors were compared with the mean mathematics subscores for first time freshmen and tested for statistical significance using

a .05 significance level. Statistical significance at the .05 level indicates the difference between the mean scores of freshmen and seniors is not a chance occurrence. Since 2010 Washburn's seniors scored higher than Washburn's freshmen on the ETS math test. Statistical tests show that these are real differences that are not due to chance. Nationally, seniors also performed better than freshmen on the ETS math test. In each year, Washburn's freshmen performed better than freshmen did nationally. Washburn's seniors performed better than the national average in 2010 and 2011 but below the national average in 2012 and 2013. However, Washburn senior exit scores have been remarkably close to the national average. The mean difference between Washburn's

seniors and its freshmen was identical to the national mean difference between seniors and freshmen in 2010, but Washburn's mean difference was below the national mean difference in 2011, 2012, and 2013 due to the Washburn freshman entrance scores were significantly higher than the national figures.

Course-Embedded Assessment - MA 112 Essential Mathematics and MA 116 College Algebra

MA 112

Student Learning Objectives:

- 1 Complete, correctly and concisely, all necessary computations to solve a problem.
- 2 Apply algebraic, geometric and statistical methods to solve applied problems.
- 3 Use appropriate technology e.g. graphics calculators, spreadsheets, to manipulate data sets.
- 4 Explain, in writing and orally, information represented analytically (equations), graphically and numerically.
- 5 Explain any assumptions made in the development of a model.
- 6 Develop and defend a position statement using appropriate quantitative information.
- 7 Communicate, in writing and orally, the conclusions of their investigations.

Fall 2013	Face to Face		
Objectives	Assessed	Met Threshold	Percent Met Threshold
1	50	47	94%
2	50	45	90%
3	50	47	94%
4	50	50	100%
5	50	47	94%
6	49	46	94%
7	50	48	96%
SUM	50	48	96%

Spring 2014	Face to Face		
Objectives	Assessed	Met Threshold	Percent Met Threshold
1	53	47	89%
2	52	47	90%
3	52	46	88%
4	53	48	91%
5	53	49	92%
6	53	49	92%
7	53	49	92%
SUM	53	46	87%

Summer 2014	Online		
Objectives	Assessed	Met Threshold	Percent Met Threshold
1	15	11	73%
2	15	11	73%

3	15	11	73%
4	15	11	73%
5	15	11	73%
6	15	11	73%
7	15	11	73%
SUM	15	11	73%

Fall 2014	Face to Face		
Objectives	Assessed	Met Threshold	Percent Met Threshold
1	59	58	98%
2	60	57	95%
3	62	54	87%
4	60	59	98%
5	55	54	98%
6	57	55	96%
7	57	55	96%
SUM	60	54	90%

Spring 2015	Face to Face		
Objectives	Assessed	Met Threshold	Percent Met Threshold
1	38	36	95%
2	37	33	89%
3	38	36	95%
4	38	37	97%
5	37	34	92%
6	37	34	92%
7	37	34	92%
SUM	38	38	100%
Online			
1	18	18	100%
2	18	18	100%
3	19	19	100%
4	18	18	100%
5	18	18	100%
6	20	18	90%
7	18	18	100%
SUM	18	18	100%
All Students			
1	56	54	96%
2	55	51	93%
3	57	55	96%

4	56	55	98%
5	55	52	95%
6	57	52	91%
7	55	52	95%
SUM	56	56	100%

During the initial determination of the "met threshold," obtaining an average of 2 out of 4 or higher on the assessment assignments in MA 112 was considered "met." Overall, faculty report a high level of achievement of quantitative reasoning learning objectives for those students who complete the course. Based on the Summer 2014 assessment results, the course was refined prior to its offering in Summer 2015 with more extensive use of discussion posts, resulting in a much higher achievement level that summer. Additional emphasis on developing and defending a position statement using quantitative information will be included in future semesters.

MA 116

Student Learning Objectives:

- 1 Solve a variety of mathematical equations and inequalities.
- 2 Develop mathematical functions and/or equations to model a situation.
- 3 Identify characteristics and sketch various types of graphs.
- 4 Analyze a situation and solve problems using a formula or graph.

Fall 2013-Spring 2015 - Summary			
CEP	Assessed	Met Threshold	Percent Met Threshold
1	233	205	88%
2	224	182	81%
3	226	199	88%
4	231	189	82%
SUM	212	202	95%
Face-to-Face			
1	570	403	71%
2	542	322	59%
3	551	371	67%
4	557	330	59%
SUM	519	352	68%
Online			
1	48	34	71%
2	46	35	76%
3	46	32	70%
4	47	34	72%
SUM	42	30	71%

All Students			
1	837	626	75%
2	798	531	67%
3	809	588	73%
4	821	544	66%
SUM	519	501	97%
Fall 2013			
CEP	Assessed	Met Threshold	Percent Met Threshold
1	41	39	95%
2	36	36	100%
3	36	36	100%
4	36	34	94%
SUM	36	36	100%
Face-to-Face			
1	179	127	71%
2	172	92	53%
3	175	107	61%
4	176	90	51%
SUM	162	80	49%
All Students			
1	220	166	75%
2	208	128	62%
3	211	143	68%
4	212	124	58%
SUM	198	116	59%
Spring 2014			
Face-to-Face	Assessed	Met Threshold	Percent Met Threshold
1	113	82	73%
2	113	66	58%
3	112	70	63%
4	111	58	52%
SUM	114	76	67%
Online			
1	7	6	86%
2	7	6	86%
3	7	6	86%
4	7	6	86%
SUM	7	6	86%

All Students			
1	120	88	73%
2	120	72	60%
3	119	76	64%
4	118	64	54%
SUM	121	82	68%
Summer 2014			
Online	Assessed	Met Threshold	Percent Met Threshold
1	14	10	71%
2	14	12	86%
3	14	12	86%
4	14	12	86%
SUM	13	11	85%
Fall 2014			
CEP	Assessed	Met Threshold	Percent Met Threshold
1	74	73	99%
2	72	67	93%
3	74	71	96%
4	74	69	93%
SUM	74	72	97%
Face-to-Face			
1	147	112	76%
2	136	82	60%
3	139	100	72%
4	140	93	66%
SUM	146	110	75%
Online			
1	21	14	67%
2	22	14	64%
3	22	13	59%
4	21	13	62%
SUM	21	12	57%
All Students			
1	242	193	80%
2	230	167	73%
3	235	182	77%
4	235	178	76%
SUM	241	122	51%

Spring 2015			
CEP	Assessed	Met Threshold	Percent Met Threshold
1	118	93	79%
2	116	79	68%
3	116	92	79%
4	121	86	71%
SUM	102	94	92%
Face-to-Face			
1	131	82	63%
2	121	82	68%
3	125	94	75%
4	130	89	68%
SUM	97	86	89%
Online			
1	6	4	67%
2	3	3	100%
3	3	1	33%
4	5	3	60%
SUM	1	1	100%
All Students			
1	255	179	70%
2	240	164	68%
3	244	187	77%
4	256	178	70%
SUM	200	181	91%

During the initial determination of the "met threshold," obtaining an average of 2 out of 4 or higher on the assessment assignments in MA 116 was considered "met." In reviewing the data provided, for those students completing the course it appears students in the concurrent enrollment program (dual credit) are more successful in achieving the established quantitative reasoning learning objectives. This is most likely due to the fact that students in dual credit courses must have a high school GPA of at least 3.0 and they spend more time on the subject matter than students enrolled in a Washburn campus/online course. Additional emphasis on developing mathematical functions and/or equations to model a situation and on analyzing situations/solving problems using formulas or graphs will be included in future semesters.

Explain how your institution makes use of the assessment results:
The data obtained through these direct measurements in the ETS Proficiency Profile were compiled and disseminated to Washburn faculty along with the data regarding critical thinking, writing, and reading. After receiving the data, Washburn faculty engaged in a serious discussion of these results and developed a new set of five student learning outcomes which are emphasized through general education and major coursework, including one learning outcome emphasizing

Quantitative and Scientific Reasoning and Literacy. The revised general education program was implemented during the Fall 2013 semester.

One component of the newly adopted general education program requires each general education course to emphasize one of these five learning outcomes with at least a subset of the course learning outcomes dedicated to enhancing the chosen university learning outcome and defined course-embedded assessments of this subset of outcomes. At the end of each semester when final grades are submitted, faculty members teaching general education courses also enter data for each student regarding their level of achievement of the specified university learning outcome. This information is compiled into reports which are shared with various constituencies either in their aggregate form or by individual student at the major level. These reports are distributed at the end of both the fall and spring semesters each year so that departments can evaluate the effectiveness of the student learning occurring in these general education courses and implement changes as needed.

CHANGES UNDERTAKEN

Based on the results of the ETS Proficiency Profile and the course-embedded assessments, the following curricular modifications have been implemented in the core mathematics requirements by the Mathematics and Statistics Department.

*Core Requirement MA 116 – College Algebra Modifications

- Washburn's general education assessment of MA 116 now includes eight common assignments given throughout the semester on handouts and the common final exam.
- The MA 116 instructors have an informational meeting at the beginning of each semester.

This includes face-to-face campus instructors, Concurrent Enrollment Program instructors, and on-line instructors. At the meeting, the 116 instructors discuss results from the common final exam and the general education assessment assignments. Instructors have the opportunity to suggest changes.

- Mid-semester the on-campus 116 instructors meet to discuss the final exam for that term. Once written, the final is sent to the on-campus and on-line instructors for additional suggestions and comments.
- This spring, a Course Success Group consisting of four Math Department members focused on MA 116 College Algebra. The group examined College Algebra at several institutions across the United States, both in and out of Kansas. The group suggested some minor changes to College Algebra which will be made starting this fall. All changes will keep Washburn's College Algebra course consistent with the KBOR Common Competency List.

*Core Requirement MA 110 – Exploring Mathematics Changed to MA 112 – Essential Mathematics

- In considering the new General Education program, and Scientific and Quantitative Reasoning in particular, the Mathematics Department decided that the MA 110 Exploring

Mathematics course needed to be reworked from a course that took certain mathematical topics and applied them to real world situations, to a course which allowed real world applications to drive the mathematical content. To be able to do the units on probability and statistics, math of finance, basic set theory and so on, there is a treatment of algebraic content needed for those topics. The units the department chose to cover fit nicely with the mathematics concepts they feel

are needed for eventual college graduates to be “good citizens,” and they also fit well with the general education student learning outcome created by Washburn for assessment purposes.

*Supplemental Instruction Section of MA 116 College Algebra piloted – Now Offered Every Semester

- The special “3+2” College Algebra option arose from the Mathematics Department’s attempt to deal effectively with the high D-F-W rate in that course. The target audience was/is students who meet one of several possible criteria that make them candidates for the special course, but are high-risk for a regular section (i.e., 3 hour per week) of College Algebra. The philosophy of that course is to provide “just in time” review each day or several times per week on

Intermediate Algebra skills/concepts to make it easier for students to grasp the College Algebra concepts. Further, the face-to-face contact five days per week has been beneficial in that it keeps students immersed in doing mathematics regularly, and the extra practice helps them improve their overall skill level.

*The Mathematics Department will be increasing the average value of the threshold for meeting the quantitative reasoning objectives from 2 out of 4 to 2.5 out of 4 on assessment assignments beginning Fall 2015.

Comments:

During the FY14 academic year, faculty working groups were formed to investigate existing options for assessing graduating seniors’ level of achievement of the five university learning outcomes campus wide as well as their comparative achievement externally. The Madison Quantitative Reasoning Assessment Test was selected to assess the level of achievement in quantitative reasoning by Washburn seniors. This instrument, along with instruments for the remaining four university student learning outcomes, will be administered on a three-year rotation cycle and will replace the annual administration of the ETS Proficiency Profile. The ETS Proficiency Profile will now only be administered every third year to see what, if any, gains have been made when surveying Washburn freshmen and seniors. The first year of the administration of the Madison will be throughout the upcoming 2015-2016 academic year.

An extensive analysis of the assessment data gathered will be conducted and shared with Washburn faculty to determine if any changes need to be implemented to increase student achievement of the quantitative and scientific reasoning learning outcome.