Mathematics Program Assessment Plan

Our Vision

The Center for Math & Science is a world-class center teaching our students how to use knowledge in the areas of Science, Technology, Engineering, and Mathematics (STEM) for ongoing participation in the workforce, transfer studies, and the world at large.

Our Mission

CCD's Center for Math & Science prepares intellectually confident students to apply STEM concepts in the global community. We provide a rich academic foundation in a supportive setting, including accessible, highly qualified faculty and state of the art learning environments. Rigorous, affordable, convenient: start here to go anywhere.

Introduction

The CCD mathematics faculty designed an assessment plan which is best suited for a young degree program in a growing institution improving student learning outcomes.

The assessment team used resources from the Mathematics Association of America (MAA) and the American Mathematical Society (AMS). The MAA focuses primarily on undergraduate mathematics education in the United States and has organized in depth studies on assessment of undergraduate mathematics programs. Many mathematics programs in US colleges and universities have implemented assessment practices based on the research of MAA and AMS affiliated committees; the advice given by assessment teams from such programs stress designing assessment methods around the needs of the program in question.

The assessment procedure addresses the two functions served by the mathematics program: 1) service courses, and 2) the mathematics Associate of Science (A.S.) program.

Service Courses: The mathematics faculty will continue to discuss the relevance of course content, the coordination of multi-section courses, student abilities and preparedness, as well as *course assessment practices* at the end of each semester. Service courses include: MAT 120, MAT 121, MAT 122, MAT 123, MAT 125 and MAT 135

The mathematics assessment team will use data from the CCD Office of Institutional Research (IR) so we can continuously improve student learning outcomes in the Service Courses. As a result, we will better serve the needs of other disciplines within CCD. The Assessment Team, program faculty, and CCD IR staff will analyze the data, which may include:

- Enrollment in math courses
- Student success rates
- The distribution of programs of students registering for each course and their relative success rates (as percentages)
- Distributions of how students meet the prerequisite(s) for courses, if possible

Additionally, faculty from Math and other disciplines will collaboratively analyze quantitative data to assess effectiveness of mathematics courses which are prerequisites of courses in other disciplines. Math faculty will interpret periodic reviews of current professional literature for trends in service type courses.

Mathematics A.S. Program:

Courses required for the mathematics A.S. program are Calculus 1, 2, and 3, Physics 1 and 2.

A breakdown of target areas of *assessment* and proposed *tools* are listed below. These have been compiled, and will be kept current, according to recommendations provided in the CCD Curriculum Guide and other such publications. As suggested by the guide and individuals recognized within the mathematics community as experts on program assessment at the undergraduate level, answers to questions appropriate only to CCD and the needs of the CCD mathematics program are sought.

Summary of Assessment Plan

The Math Assessment Team will continuously assess learning outcomes for students enrolled in the Mathematics A.S. program. This report includes:

- The Proposed Assessment Cycle
- A description of Program Student Learning Outcomes.

Proposed Assessment Cycle

The mathematics program assessment cycle will comprise of *Annual Reports* and three-yearly *Self-Studies*.

Annual Reports, along with supporting material where applicable, will be performed at the end of each academic year. These reports may include, as appropriate:

a. Observations on current trends and areas of possible further investigation.

b. Recommendations and/or proposals agreed upon by the mathematics faculty.

c. Justifications for the above recommendations and/or proposals from the literature, or based on observations from annual program or CCD statistics.

d. Implementation time-line of proposed changes, if applicable.

Methods of Measuring Assessment Data

a. Collect artifacts correlating to each PSLO. Each PSLO will be assessed every cycle.

b. Population of students: students in MAT 201, 202, 204 courses

c. Sample size for each assessment will be 12 to 15 student artifacts, pulled randomly from the population of students in a given course.

d. The raters will encompass full-time faculty and adjunct instructors, and will include both individuals that teach MAT 201, 202, and 204 and individuals that do not.

e. **The norming session:** A group of four to five raters and a facilitator will meet for 1 – 2 hours. Ideally the facilitator will identify at least three samples of student work to be used with a range of student work quality (i.e., high-performance, mid-

level performance and low performance) prior to the meeting. This will give faculty members a chance to understand each other's perspectives about what constitutes strong performance. If the program has "anchor" artifacts (clear examples of what different scores or levels of performance look like) from previous years, the process will be adjusted. Faculty raters and the facilitator will come together to:

i. Practice using the rubric on several samples of student artifacts

(a) Raters should take some time to get to know the rubric. The facilitator will clarify if the ratings will be holistic (one score for the entire rubric) or analytic (one score for each element of the rubric).

(b) Raters would all be given the same three samples (without the facilitator identifying the level of performance) and score it using the rubric on their own (without discussion from other participants).

ii. Discuss scores and develop a shared understanding of how to apply the criteria at the program level

(a) Scores are collected from all raters and the group looks for patterns, where scores align and where they differ. Participants should be prepared to talk about their ratings and why they see the ratings as appropriate.

iii. Develop consensus on scoring so that reliable data can be generated for program assessment

(a) Participants should talk through all questions and concerns. If individuals don't agree on a rating, they should attempt to meet a middle ground where all participants are confident they rate in the same way.

(b) If participants cannot come to a consensus, the rubric may need to be adjusted and should be discussed at this time.

iv. Repeat as needed until raters are consistent in rating for the same or similar reasons.

v. After the rubrics have been finalized and the participants are consistent on their scoring, raters will be given three new artifacts each from the sample. They can score the papers over a one-week period.

f. At the end of the one-week scoring process, a spreadsheet will be put together and raters will enter their raw data.

g. The group will meet to review and discuss the raw data.

h. An assessment report will be put together by the facilitator showing this data and its analysis and reviewed by the group.

i. The group will meet one last time to discuss the analysis and plan for improvement will follow and changes to classes/assessment for the next year will follow.

Mathematics A.S. Program Student Learning Outcomes (PSLOs)

PSLO 1: The graduate will analyze functions presented in a variety of formats:

- Algebraic
- Graphic
- numeric
- verbal

PSLO 2: The graduate will use appropriate technology to represent spatial visualization of shapes, structures and their properties.

PSLO 3: The graduate will use mathematical models to accurately calculate solutions to real world applications.

In alignment with CCD's Institutional Outcomes, the Center for Math & Science educates students who will become:

- Complex Thinkers
- Effective and Ethical Users of Technology
- Effective Communicators
- Globally Aware
- Personally Responsible
- Numeric Thinkers

Curriculum Map - Institutional Outcomes - CCD

	Gen Ed Requirements							Electives	Science Requirements		Required Mathematics Courses		
Courses	ENG 121 (3)	ENG 122 (3)	COM 115 or COM 125 (3)	CSC 160 (4)	Arts & Humanities Courses (9)	History Course (3)	Social & Behavioral Sciences (6)	Elective Courses (4-5)	PHY 211 (5)	PHY 212 (5)	MAT 201 (5)	MAT 202 (5)	MAT 203 or MAT 204 (4-5)
Numeric Thinker									x	x	x	x	x
Personally Responsible									x	x	x	x	x
Globally Aware													
Effective Communicator									x	x			x
Complex Thinker									x	x	x	x	x
Effective and Ethical User of Technology											x	x	x

Curriculum Map - Mathematics Program - CCD

	Gen Ed Requirements							Electives	Science Requirements		Required Mathematics Courses		
Courses	ENG 121 (3)	ENG 122 (3)	COM 115 or COM 125 (3)	CSC 160 (4)	Arts & Humanities Courses (9)	History Course (3)	Social & Behavioral Sciences (6)	Elective Courses (4-5)	PHY 211 (5)	PHY 212 (5)	MAT 201 (5)	MAT 202 (5)	MAT 203 or MAT 204 (4-5)
1. The student will analyze functions in a variety of formats, including algebraic, graphic, numeric, and verbal.											I	D	A
2. The student will use mathematical models to accurately calculate solutions to real world applications.									D	D	I, D	D	A
3. The student will use appropriate technology to represent spatial visualization of shapes, structures, and their properties.											I	I	D,A

I Introduced
D Developed
A Formally Assessed

Math Program Rubric

Program Student Learning Objective (PSLO)	Beginning	Developing	Competent
1. The student will analyze functions in a variety of formats, including algebraic, graphic, numeric, and verbal. Unable to be assessed ☐	Analysis is incorrect AND any conclusions are implausible.	Analysis is essentially correct OR the student makes conclusions that are implausible.	The student makes correct analysis of a function AND draws appropriate conclusions.
2. The student will use mathematical models to accurately calculate solutions to real world applications. Unable to be assessed ☐	Calculations are attempted but are both unsuccessful AND are not comprehensive.	Calculations are attempted and are either unsuccessful OR represent only a portion of the calculations required to comprehensively solve the problem.	Calculations attempted are essentially all successful AND sufficiently comprehensive to solve the problem.
3. The student will use appropriate technology to represent spatial visualization of shapes, structures, and their properties. Unable to be assessed ☐	Completes conversion of information but resulting mathematical portrayal is inappropriate or inaccurate AND demonstrates a misunderstanding of the technology tool.	Completes conversion of information but resulting mathematical portrayal is inappropriate or inaccurate OR demonstrates a misunderstanding of the technology tool.	Converts relevant information into an appropriate mathematical portrayal AND demonstrates a complete understanding of the technology tool.