February 19, 2016

CAAC Report for Mathematics

Committee Members: Melissa Hardeman (chair), Dr. Annie Childers, Dr. Eric Kaufmann, Marvelyn Tapp

The Department of Mathematics and Statistics offers eight core mathematics courses: College Algebra, Quantitative and Mathematical Reasoning, Pre-Calculus, Trigonometry, Business Calculus, Applied Calculus, Calculus I, and Intro to Statistics. Student artifacts were collected from all eight courses in the Fall 2015 semester. The CAAC committee members from the Department of Mathematics and Statistics are Dr. Annie Childers, Melissa Hardeman, Dr. Eric Kaufmann, and Marvelyn Tapp. This committee scored the artifacts in Feb. 2016 using the common rubric developed for this task.

Selecting the courses, selecting and scoring the artifacts:

The CAAC committee met initially to discuss how we would go about selecting and scoring the artifacts to ensure that each submission was randomly chosen and then graded by two members. Since there are eight courses to be assessed, we decided to give every member of the 4 member committee two courses to score. The committee made sure that none of the members were evaluating their own class.

The course sections that were chosen for this initial trial were not 100% randomly selected. We determined it would be best to choose courses from experienced full-time faculty who may have some experience with the assessment process. In several cases, we offered only one section of the course making it impossible to do a random selection. For the most part, faculty members turned in 5 folders, one folder for each grade level: A, B, C, D, F, where each folder contained several artifacts for that grade level. The faculty member also included a “secret code” that identified which folder contained which grade-level.

The CAAC member randomly chose one artifact from each of the 5 folders, scored the 5 artifacts using the rubric, recorded these results in a modified spreadsheet, and then labeled each artifact with a number (1-5) for identification and comparison purposes. The scorer was instructed not to replace the artifacts back into the folders because the next person scoring this course would need to score the same set of papers. After all courses were scored once, the committee then switched courses with each other for the second scoring. Care was taken to make sure no member scored their own submissions. We found an error in our process that involved identifying which folder the scored artifact came from. So, besides placing the number 1-5 on the document for identification purposes, it was also necessary to state which folder it came from for comparison purposes.

The team determined that it took approximately 8-10 minutes to score one artifact. Each paper was scored based on 3 different learning outcomes.

Did the Rubric work?

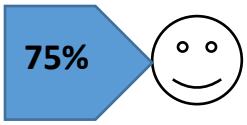
Firstly, the committee devised a scale that could be used to compare the rubric score to the teacher grade for that artifact (see below). We were interested to see if there was consistency with the rubric score and the teacher's grade.

Rubric total	Teacher's Grade
8-9	A
6-8	B
3-6	C
1-3	D
0-1	F

There were 36 total artifacts that were each scored twice which equates to a total of 72 scorings. Of the 72 scorings, there were 13 discrepancies between the rubric score and the teacher's grade. Given that this discrepancy occurred on approximately 18% of the artifacts, we feel that the rubric score did a fairly decent job of correlating to the teacher's grade.

With respect to the comparison between the CAAC member's scores, we found the following.

Rubric scores were the Exact same on an objective	**13 out of 36**	**36%**
Rubric scores were within 1 point of each other on an objective	**14 out of 36**	**39%**
Rubric scores differed by 2 or more points	**9 out of 36**	**25%**



The CAAC members scores were the exact same or within 1 point of each other 75% of the time. There were major discrepancies 25% of the time. This indicates that there was some consistency among the graders.

After some conversations among the CAAC committee members, the following is a list of why we think some of these discrepancies occurred.

- Determining which part of the problem being graded corresponded to which learning outcome.
- The set-up of the problem.
- Rubric wording.

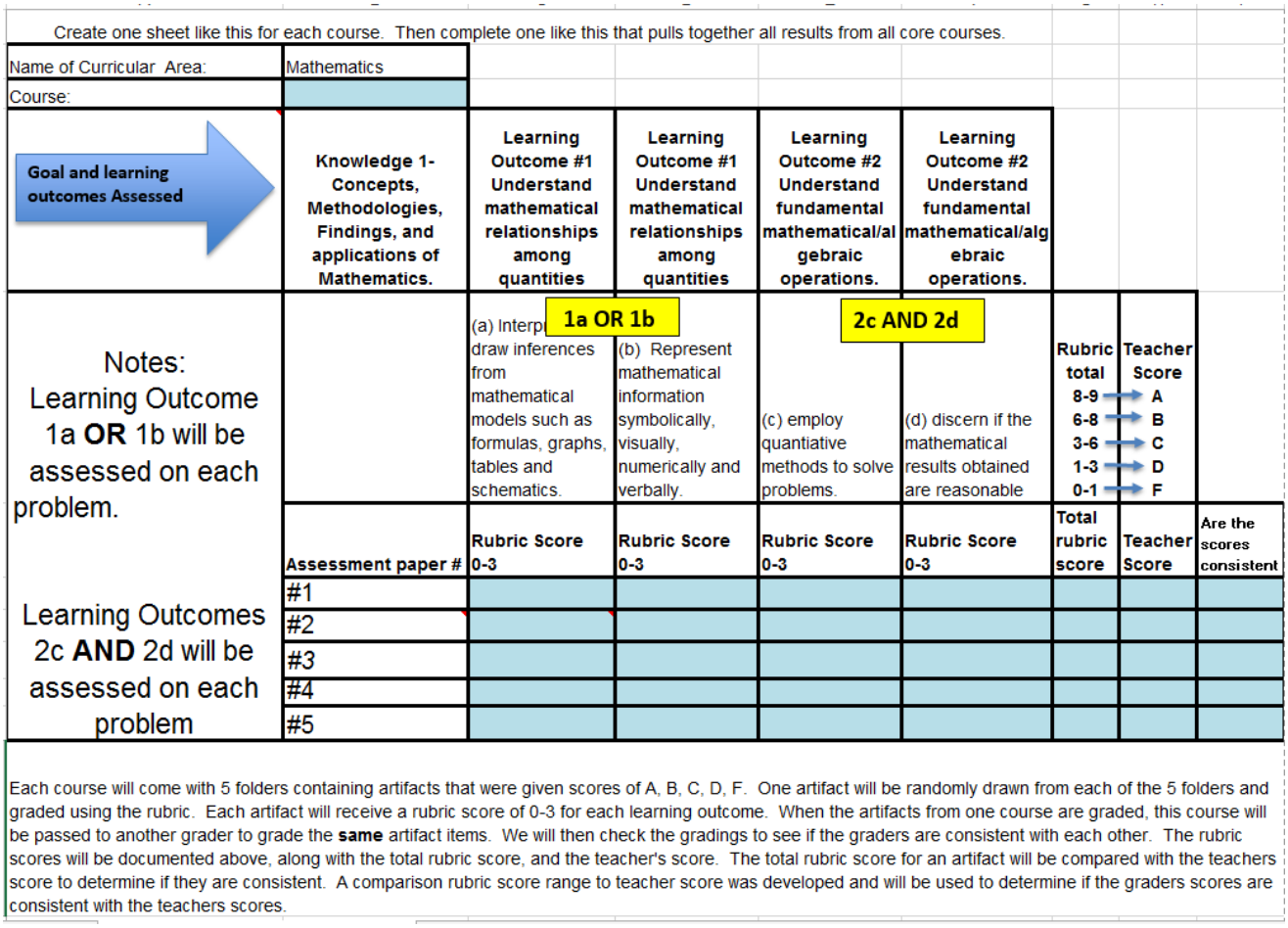
The following is a list of actions we can take to help minimize the discrepancies listed above.

- Have the teacher designate which part of the problem corresponds to which learning outcome.
- Create a detailed handout on how the problem should be set-up for faculty. Make sure the teachers adhere to this desired format.
- Change the wording on a couple of the rubric items.

As the committee members were grading the artifacts, they made notes on the rubric regarding which statements seemed to be key in determining the difference between giving a score of 0 or 1, or a score of 1 or 2, etc. The committee shared this information with each other as we met to look over the results.

Spreadsheet:

The spreadsheet was modified to fit our needs. See the screenshot below.



Create one sheet like this for each course. Then complete one like this that pulls together all results from all core courses.

Name of Curricular Area:	Mathematics							
Course:								
Goal and learning outcomes Assessed	Knowledge 1- Concepts, Methodologies, Findings, and applications of Mathematics.	Learning Outcome #1 Understand mathematical relationships among quantities	Learning Outcome #1 Understand mathematical relationships among quantities	Learning Outcome #2 Understand fundamental mathematical/algebraic operations.	Learning Outcome #2 Understand fundamental mathematical/algebraic operations.			
Notes: Learning Outcome 1a **OR** 1b will be assessed on each problem.		(a) Interp… draw inferences from mathematical models such as formulas, graphs, tables and schematics. **1a OR 1b**	(b) Represent mathematical information symbolically, visually, numerically and verbally.	(c) employ quantiative methods to solve problems. **2c AND 2d**	(d) discern if the mathematical results obtained are reasonable	Rubric total 8-9 → A, 6-8 → B, 3-6 → C, 1-3 → D, 0-1 → F	Teacher Score	
Learning Outcomes 2c **AND** 2d will be assessed on each problem	Assessment paper #	Rubric Score 0-3	Rubric Score 0-3	Rubric Score 0-3	Rubric Score 0-3	Total rubric score	Teacher Score	Are the scores consistent
	#1							
	#2							
	#3							
	#4							
	#5							

Each course will come with 5 folders containing artifacts that were given scores of A, B, C, D, F. One artifact will be randomly drawn from each of the 5 folders and graded using the rubric. Each artifact will receive a rubric score of 0-3 for each learning outcome. When the artifacts from one course are graded, this course will be passed to another grader to grade the **same** artifact items. We will then check the gradings to see if the graders are consistent with each other. The rubric scores will be documented above, along with the total rubric score, and the teacher's score. The total rubric score for an artifact will be compared with the teachers score to determine if they are consistent. A comparison rubric score range to teacher score was developed and will be used to determine if the graders scores are consistent with the teachers scores.

This format allowed us to track the rubric score for each learning outcome on each paper scored, and then easily determine a total rubric score. The total rubric score was then compared to the teacher's score to determine consistency. This format also allowed us to easily compare the rubric scores between the CAAC members.

DATA on Student perfomance.

Papers will be scored as defined by the rubric and success will be determined per outcome if 70% of participants score 2 or 3.

Name of Curricular Area:	Mathematics					
Goal assessed	Knowledge 1- Concepts, Methodologies, Findings, and applications of Mathematics.					
Rubric Score			0	1	2	3
Outcome 1	**Learning Outcome #1 Understand mathematical relationships among quantities**	**Median rubric score for each objective.**				
Learning Objective	(a) Interpret and draw inferences from mathematical models such as formulas, graphs, tables and schematics.	2	6%	17%	40%	37%
Learning Objective	(b) Represent mathematical information symbolically, visually, numerically and verbally.	2.5	10%	20%	20%	50%
Outcome 2	**Learning Outcome #2 Understand fundamental mathematical/algebraic operations.**					
Learning Objective	(c) employ quantiative methods to solve problems.	2	14%	17%	29%	40%
Learning Objective	(d) discern if the mathematical results obtained are reasonable	1	32%	22%	21%	25%

77% scored 2 or 3

70% scored 2 or 3

69% scored 2 or 3

46% scored 2 or 3

Based on the results in the previous table, did this process give us any insight into our students' ability to perform in these areas?

- It is encouraging to see that our students did well on **Learning Outcome #1: Understand mathematical relationships among quantities.** This is basically the "skills" area of the course.
- It appears that the students are struggling with **Learning Outcome #2: Understand fundamental mathematical/algebraic operations.** Specifically on part b where students are asked to discern if the mathematical results obtained are reasonable. This is the area where students are asked to synthesize their results.
- It would benefit every student if all faculty included this type of reasoning, in paper form, frequently throughout the semester (say, once a week) in order to advance the students' critical thinking ability. This suggestion will be made at the departmental meeting on 2/12/16.

Final thoughts:

The UALR Mathematics and Statistics Department will compile and keep percentages to determine changes that should be made to improve students' mastery of the outcomes. Analyses and recommended changes will be completed on the pilots as needed. The mathematics department will devise a plan of action that ensures changes have been implemented. The mathematics department will collectively continue to add to the pool of questions for assessment. Results will be disseminated to the faculty and appropriate administrators in a timely manner.

While we understand the importance of assessing every type of course delivery (live, online, concurrent...), we have concerns about being ready to go full-scale in the Fall 2016 semester. Our department is different from other departments in that we offer eight core mathematics courses, rather than one or two, and these courses are also offered concurrently. A full-scale implementation would increase the workload dramatically on the departmental committee members who grade the artifacts, thereby making it very burdensome. Since this fall was our first run on assessing all eight of our core courses, it would benefit us to run through this procedure one more time, with the inclusion of our online courses, before we incorporate the concurrent courses.

The decision to include six extra courses in the math core was not a departmental decision. We feel we could do a much more meaningful assessment of the core math courses if we went back to the two original core math courses: College Algebra and Quantitative and Mathematical Reasoning.

Personal time commitment for full implementation:

In the Fall 2016 semester, we will offer 56 core math courses at UALR and approximately 29 concurrent core math courses. **IF** full implementation involved assessing 20% of our core courses, we would end up assessing approximately 25 courses. Assessing these courses would require approximately 38 man hours (see below) of grading. These 38 hours do not include the time involved in coordinating the entire process of choosing the courses, gathering the artifacts, corresponding with concurrent faculty, analyzing the results, writing the report, etc.

25 courses x 5 papers for each course x 9 minutes per paper to score x 2 scorings per paper = 2250 minutes

We look forward to receiving any feedback from the Core Council regarding our assessment process, procedure, and findings to help guide us in our future efforts