Course Title: **MAT109 (3 Credits) INRO TO STATS**

Date: **12/15/15**

Course Team: **Tom Crawford**, **Joseph Mason, Richard Campbell**

STUDENT LEARNING OUTCOMES:
General Education/Program/Course Outcomes:
Upon successful completion of this course, students will learn how to:

G1. Apply mathematical methods involving arithmetic, algebra, geometry, and graphs to solve problems.

G2. Represent mathematical information and communicate mathematical reasoning symbolically and verbally.

G3. Interpret and analyze numerical data, mathematical concepts, and identify patterns to formulate and validate reasoning.

P/C1. Use computational techniques and algebraic skills essential for success in an academic, personal, or workplace setting. (Computational and Algebraic Skills)

P/C2. Use visualization, special reasoning, as well as geometric properties and strategies to model and solve problems. (Geometric Skills)

P/C3. Collect, organize, and display data as well as use appropriate statistical methods to analyze data and make inferences and predictions. (Statistical Skills)

P/C4. Critically analyze and construct mathematical arguments. (Proof and Reasoning)

P/C5. Use technology, where appropriate, to enhance and facilitate mathematical understanding, as well as an aid in solving problems and presenting solutions. (Technological Skills)

P/C6. Communicate and Understand mathematical statements, ideas and results, both verbally and in writing, with the correct use of mathematical definitions, terminology and symbolism. (Communication Skills)

P/C7. Work collaboratively with peers and instructors to acquire mathematical understanding and to formulate and solve problems and present solutions. (Collaborative Skills)

Assessment:
1. A common assessment (CA) is delivered to all students across all sections and delivery modes. This common tool was first used at the conclusion of the Fall 2012 semester.
2. The CA consists of 19 MC questions selected from AP Stats and Praxis Exams.
3. The assessment is delivered in the classroom or Academic Testing Center at the conclusion of the course.

Validation:

1. All previous and currently available assessment data has been entered into the "Mathy" database.
2. CA results are evaluated only after final course grades have been assigned by the instructor.
3. Correlation between students' course grade and composite CA score will be determined each semester.
4. Correlation between students' final exam score and composite CA score will be determined each semester.
5. Grade distribution and mean CA score by letter grade assigned will be used compare on campus to off campus (HS) course offerings.
6. CA question results that differ significantly (alpha=.05) from HCC historical values will establish content areas in need of corrective action and those where previous efforts have proven successful.
7. CA question results that differ significantly (alpha = .05) from nationally normed exam results will establish content areas to be studied for systemic strength or weakness.

Results:

1. A correlation between CA results and student letter grades is present at alpha =.01 (overall r=.37, SU14 r=.36, FA14 r=.36, SP15 r=.43).
2. A correlation between CA results and final exam score is present at alpha =.01 (overall r=.37, SU14 r=.42, FA14 r=.37, SP15 r=.38).
3. During the SP15 semester 57% of all HS students earning credit were assigned letter grade of "A" and 43% were assigned a "B". The proportions compare to 23% and 32% respectively for traditional "On Campus" students. The mean CA scores for these students were 12.1, 10.4, 9.6, and 7.8 respectively.
4. During SU14, FA14, and SP15 there were no CA items significantly higher than HCC historical values. Success rate of FA14 students on item 12 (Central Limit Theorem) was significantly lower than the HCC historical proportion.
5. When collective HCC results (8 semesters) are compared to national results the proportion of HCC students answering each CA question correctly is significantly lower than the national norm. This is true for all but two CA questions. HCC students seem to outperform the national results on item #5 (t-test degrees of freedom). There is not a significant difference in performance on item #3 (t-test vs. z-test). Item #13 (inference from distribution shape) seems to be an area of significant shortfall as compared to national results.

Follow-up:
1. None
2. None
3. Based upon the CA scores the letter grades assigned to "Off-Campus" students may well reflect the level of course mastery. Currently the CA is the only HCC assessment these students complete. More information would be helpful in evaluating the degree to which "Off-Campus" grading is correlated with "On-Campus" grading.
4. HCC results are remarkably consistent. Effort to address specific weaknesses are not currently indicated.
5. If the assessment tool has been well selected, HCC results are not sufficient and efforts to address systemic weakness should be undertaken.
   a. Discussion with the MD State-wide Math Group indicates that the successful Intro to Stats college student should be able to achieve a measure of success when presented with the types of questions comprising the AP-Stats and Praxis Math Content Area statistics questions.

Closing the Loop:
1. Current curriculum materials, delivery methods, and performance expectations are not developing the depth of understanding and statistical thinking required for HCC students to successfully negotiate these types of assessment questions.
2. Fall 2016 will bring with it the first group of "College Ready" freshman as determined by PARCC assessment of the Common Core Learning Standards.
3. Absent PARCC certification students will be placed into developmental transition courses so as to achieve "College Ready" status.
4. Calculating and interpreting summary statistics, creating, reading, and using statistical graphics, and translating English mathematical and probability statements into mathematical symbols are Common Core items for which the "College Ready" freshman will have a demonstrated proficiency.
5. The course content of the newly revised MHEC Introductory to Statistics syllabus does not include the content items mentioned in #4 above. MD State-wide Math Group believe this course is only appropriate for H&SS students and that a more rigorous course should be required of STEM students.
   a. At this time HCC does not have a sufficient demand to support two distinct courses of Introductory Statistics.
6. The Dana Center's NMW Statistical Reasoning has the items mentioned in #4 above listed as "Readiness Competencies".
7. There are 12 MD colleges participating in The First in The World (FITW) grant project administered by The U.S. Dept. of Education. The objective of this project is the creation of a Pre-Stats developmental course that would shorten the path to credit Introductory Statistics. This Pre-Stats course would include the content mentioned in #4 above.
8. MAT109 will be revised for FA16 in the following ways;
   a. Content in #4 will be removed
   b. Emphasis will be placed on "Embedded Activities" and "Active Learning" to build deeper conceptual understanding.

      i. Instructors' previously incorporating flipped classroom and active learning expectations have confronted significant resistance and resentment from HCC students.

c. Student Learning Outcomes will remain consistent but will be restated in a way that makes clear the new emphasis on the development of Statistical Literacy, Statistical Reasoning, and Statistical Thinking.

      i. Increased rigor is likely to result is significant student dissatisfaction.

      ii. Substantial departure from previous expectations is, initially, likely to significantly alter grade distribution, completion and success rates.

d. Current CA will be administered for a period of time to assess the effectiveness of implemented course structural changes.

e. Future CA items will be consistent in form and substance to those experienced by students throughout the course.

f. Future CA items will be incorporated into the course Final Exam to facilitate administration and data collection.

g. Future CA items will be identified in a way the ties them directly to a specific learning outcome.

h. Offsite MAT109 students will be required to complete the new course FE to broaden the spectrum of assessment and increase the degree to which grading practices and student learning across institutions can be correlated.

Budget Justification:

    1. No extraordinary funding is required for this course at this time.

Course: MAT 109　　　　　　　　　　　　　　　　　　　　**Lead Faculty:　T. Crawford**

	SU 2010	FA 2010	SP 2011	SU 2011	FA 2011	SP 2012	FA 2012	SP 2013	SU 2013	FA 2013	SP 2014	SU 2014	FA 2014	SP 2015
# Active students	43	40	61	61	79	93	147	176	106	173	221	120	214	234
# Withdraw % Withdraw	2.3	12.5	9.8	9.8	8.9	5.4	22 15%	19 11%	8 7.5%	16 9.2%	25 11.3%	16 13.3%	22 10.3%	23 9.8%
# Walk-Away Fs* % Walk-Away Fs*							21 14%	23 13%	0 0%	15 8.7%	29 13.1%	9 7.5%	24 11.2%	25 10.7%
# Success (A,B,C) % Success (A,B,C)	79.1	75.0	78.7	77.0	65.4	79.3	91 62%	125 71%	87 82.1%	120 69.4%	152 68.8%	85 70.8%	125 58.4%	136 58.1%
Gen Ed SLOA							68%	70%	N/A	64.6%	63.3%	66.1%	64.4%	66%
Course SLOA		66.0	61.4				45.7%	43.2%	41.8%	43.8%	41.8%	43.3%	43.4%	43.1%
SLOA Item Analysis							S – 1, 14 W - 2	S - 12	S - 16	No Sig. Items	No Sig. Items	No Sig. Items	W - 12	No Sig. Items
Mean Course Grade	2.62	2.80	2.89	2.87	2.17	2.24	2.78	2.89	2.82	2.29	2.10	2.55	2.14	1.96

*Did not take the final exam and received a grade of F.

MAT109 COURSE SLOA RESULTS

	Course SLOA	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19
FA12	8.68 45.7%	0.80	0.29	0.65	0.43	0.93	0.54	0.73	0.31	0.40	0.30	0.42	0.33	0.08	0.61	0.30	0.41	0.30	0.34	0.54
SP13	8.22 43.2%	0.67	0.54	0.67	0.41	0.86	0.54	0.62	0.28	0.38	0.34	0.40	0.31	0.04	0.45	0.27	0.38	0.29	0.28	0.49
SU13	7.95 41.8%	0.68	0.42	0.68	0.37	0.79	0.58	0.68	0.21	0.37	0.26	0.37	0.16	0.00	0.58	0.16	0.63	0.16	0.42	0.42
FA13	8.33 43.8%	0.60	0.44	0.73	0.42	0.85	0.54	0.67	0.38	0.40	0.29	0.45	0.22	0.10	0.56	0.24	0.34	0.27	0.38	0.45
SP14	7.95 41.8%	0.59	0.41	0.66	0.31	0.81	0.57	0.70	0.35	0.48	0.28	0.40	0.24	0.08	0.46	0.19	0.34	0.28	0.28	0.51
SU14	8.23 43.3%	0.64	0.41	0.57	0.46	0.91	0.55	0.78	0.26	0.45	0.34	0.38	0.18	0.04	0.57	0.29	0.29	0.21	0.34	0.58
FA14	8.10 42.6%	0.57	0.54	0.73	0.39	0.84	0.55	0.71	0.30	0.39	0.31	0.46	0.14	0.07	0.46	0.25	0.35	0.20	0.30	0.54
SP15	8.18 43.1%	0.59	0.50	0.65	0.34	0.86	0.63	0.69	0.31	0.45	0.28	0.40	0.22	0.10	0.48	0.25	0.35	0.24	0.33	0.53
HCC Overall	8.20 43.1%	0.62	0.46	0.67	0.38	0.85	0.57	0.69	0.32	0.42	0.30	0.42	0.23	0.08	0.50	0.25	0.35	0.25	0.32	0.51
National		0.88	0.81	0.68	0.76	0.73	0.74	0.83	0.69	0.68	0.65	0.82	0.55	0.46	0.90	0.41	0.55	0.59	0.66	0.56

Noted differences are significant at alpha = .05

		A	B	C	D	F	
Off Campus	Proportion	23%	32%	30%	9%	5%	
	Mean CA Score	9.6	7.8	7	6.9	5.5	
On Campus	Proportion	57%	43%	0%	0%	0%	
	Mean CA Score	12.1	10.4				