Mathematics General Education Summary Report

Fall 2018

A. The Mathematics General Education offerings starting with Math 110 and above (up to Math 151, per recommendation of the General Education Committee) have all been assessed using a common assessment tool for the three semesters Spring 2017, Fall 2017 and Spring 2018. The Reports containing the Assessment Methods and the Findings have all been uploaded in the General Education Assessment Online Repository.

B. For the preceding three semesters our Target Criterion has been reaching an average grade of 2.0 in a scale of 3.0. According to the Rubric developed by the School of Mathematics and Computer Science and approved by the General Education Committee, a 2.0 grade is deemed as Proficient in the analytical skills needed to successfully cope with the Mathematics General Education Objective, i.e., to ``analyze situations symbolically and quantitatively in order to make decisions and solve problems".

   Regarding this Target Criterion, we note the following:

   a. In the Spring 2017 semester, when this common Mathematics General Education Assessment tool was instituted, the questions were almost exclusively of quantitative character. The General Education Committee pointed out this shortcoming, which it felt it fell short of assessing the full scope of the Objective, and directed the School of Mathematics and Computer Science to revise the contents of the Assessment Tool in order to standardize it further and to align it more faithfully to the Mathematics General Education Objective. These changes were implemented starting with the Fall 2017 Quiz.

   b. In the Fall of 2018, the School of Mathematics and Computer Science was advised by the Administration that the Target Criterion of attaining an average Grade of 2.0 out of 3.0 in the Assessment tool was insufficient. It was pointed out that what was needed was a percentage target for students achieving ``Proficiency" (2.0 out of 3.0 score) and a percentage target for students achieving the ``Very Proficient" level (3.0 out of 3.0 score). Complying with this request (despite some reservations) the School of Mathematics and Computer Science set a target of 15% for students having a score of 3.0 and 60% having a score of 2.0, giving an overall 75% of students attaining a level of ``Proficient" or higher in the Assessment tool. This Target Criterion will be used starting with the Fall 2018 Semester.

C. Neither the School of Mathematics and Computer Science nor the General Education Committee has noticed any deficiencies or raised any issues concerning the rubric that has been used to assess the General Education Mathematics Objective. So no changes has been instituted nor are any planned for the Fall 2018 Semester.

   The rubric has been appended at the end of this Summary Report.

D. The Findings across all courses in which the General Education Mathematics Objective has been assessed using the common assessment tool during the Spring 2017, Fall 2017, and Spring 2018 Semesters were included in Semester Reports uploaded to the General Education Repository. The main conclusion drawn was that ***students at L.S.S.U. are better prepared to handle quantitative reasoning problems than are problems involving more abstract analytical and symbolic reasoning skills***. Accordingly, instructors in General Education approved courses were advised to emphasize material and to work more thoroughly (to the extent possible subject to existing time constraints) with students on problems pertaining to more abstract analytical skills and requiring symbolic and/or algebraic manipulation skills. The outcome, if any, of this emphasis and special attention will be monitored in upcoming semesters.

   The Semester Reports detailing the Assessment Tools and the Finding for the Spring 2017, Fall 2017 and Spring 2018 Semesters are appended at the end of this Summary Report.

E. No additional observations are deemed necessary at this time. Monitoring of tools, of results and proposing and adopting necessary actions concerning the Assessment Tool, the Target Criteria and the Students' Performance will continue by both the School of Mathematics and Computer Science and the Mathematics Subcommittee of the General Education Committee and progress will be reported periodically to the plenum of the General Education Committee. This has been done in a semester cycle so far and the input of the Committee has guided the work of both the School and the Subcommittee for which both are appreciative and grateful.

School of Mathematics and Computer Science Meeting October 18, 2017

Revision of the Proposal Adopted by the School of Mathematics and Computer Science on

The Assessment of the General Education Mathematics Objective

The School of Mathematics and Computer Science:

1. **Acknowledging the discussion that took place in the General Education Committee meeting of October 11, 2017 on the questions administered and the data produced in the Spring 2017 Assessment of the Mathematics General Education Objective;**
2. **Appreciating the overall positive response of the General Education Committee regarding the Mathematics initiatives in the context of new methods for evaluating the General Education Objectives and the encouragement that the Committee provided; and**
3. **Taking into account the recommendations put forward by the General Education Committee after reviewing the questions and the data on the first Assessment of the Mathematics General Education Objective;**

has decided to adopt the following Revised Form of the Proposal that was initially adopted on April 3rd 2017.

Proposal Adopted by the School of Mathematics and Computer Science on 10-18-2017

The Assessment of the General Education Mathematics Objective

- **The Assessment will be based on measuring performance in only six courses across all sections offered every semester: Math 110, Math 111, Math 131, Math 207, Math 112 and Math 151.**
- **For comparison purposes the same Assessment Instrument will be administered in Math 087, Math 088 and Math 102 sections.**
- **The Assessment will be carried out every semester on the first meeting day of the last week of classes by administering across all sections of all six courses listed above a quiz, consisting of three multiple choice questions, with the goal of maintaining a uniform difficulty level as much as possible across semesters for reliability purposes. The General Education Quiz will consist of:**
    - **One question that primarily tests quantitative skills;**
    - **One question that primarily tests symbolic and/or qualitative skills;**
    - **One question that primarily tests logical and/or decision making skills.**
- **The following is the Mathematics General Education Objective:**
    - Analyze situations symbolically and quantitatively in order to make decisions and solve problems.

  The following Rubric will be used to assess success in fulfilling the ability reflected in the objective, which will be referred to below as ``specific ability".

	3. Very Proficient	2. Proficient	1. Moderate Ability	0. Poor Ability
Math Objective	Shows very good handling of information and is very proficient in the specific ability.	Shows good analytical skills and is proficient in the specific ability.	Shows moderate skills in fulfilling the specific ability.	Shows very poor, underdeveloped skills in the specific ability.

- **The Mathematics and Computer Science Representative to the General Education Committee will be responsible for:**
  - **writing the quiz;**
  - **grading the quiz;**
  - **compiling the data;**
  - **reporting the results.**

  (S)he shall be assisted, as necessary and/or requested, by the chairperson and/or other members of the department.

As a guideline, the School of Mathematics and Computer Science provides the following sample questions reflecting the types that were referred to in the itemized list above:

- **(Quantitative Skills)** It is estimated that 65% of American families have at least one pet. If we randomly select 400 American families, how many would we expect to have at least one pet?

  (a) 260 (b) 615 (c) 240 (d) 160

- **(Symbolic/Qualitative Skills)** A right triangle with area equal to A square feet has a base measuring b=0.5 feet. Find the length h of the height corresponding to the base b.

  (a) h=1/4A ft. (b) h=1/2A ft. (c) h=A ft. (d) h=4A ft.

- **(Logic/Decision Making Skills)** A company analysis indicates that if the company expands and the company diversifies then its market share will increase. A year later data showed that, even though the company did expand, the company's market share was reduced. Did the company diversify?

  (a) Yes (b) No (c) Inconclusive

- **(Logic/Decision Making Skills)** A nurse interviewing the director of a hospice in which a medical emergency occurred learned that out of a total of 40 patients 15 were taking heart medication and 10 were suffering from asthma. If 5 patients on heart medication were also suffering from asthma, how many patients were neither suffering from asthma nor taking heart medication?

  (a) 10 (b) 15 (c) 20 (d) 25

Mathematics General Education Assessment Report Spring 2017

The table below summarizes the data collected during the Spring Semester of 2017.

Dictionary of Terms: The official LSSU score is based on data collected at the Math 110 level and above as authorized by the General Education Committee in its mandate. It is based on the average score (0-3) that students obtained on the General Education Quiz that was prepared by the School of Mathematics and administered to the students during the last week of classes of Spring 2017. This score is further broken down into a Precalculus level score, attained by the students from Math 110 - Math 207 (in numerical order) and a Calculus level score attained by the students in Math 112 and Math 151. Only students in the courses up to Math 151 were tested, as was explicitly authorized by the General Education Committee during relevant discussions.

Explanation of the Data: Purely for comparison purposes, students in Developmental mathematics courses, Math 087 - Math 102, were also tested. As can be seen from the table attached below, their ability ranked at 1.22, those of Precalculus students at 1.71, whereas those of Calculus level students was 2.27. The highest proficiency was attained by the Students in Math 151 (as expected) who scored 2.5 in the test, a score between Proficient (2) and Very Proficient (3). The overall LSSU score attained was 1.84, between Moderate (1) and Proficient (2), closer to the Proficient level.

Actions: The School of Mathematics decided that the General Education Quiz approach was more informative for our purposes than the ETS administered test, given in the preceding years, and that it should be continued for the coming semesters. Since only a single semester's data are available, no action was deemed necessary for now. Adjustments and further deliberation will be carried out as necessary when more data become available in the coming semesters.

1. At a small college with 1000 students there are 13 Mathematics Majors and 25 History Majors. If 3 students are majoring in both Mathematics and History, how many students at the college are neither Mathematics nor History Majors?

   (a) 959 (b) 962 (c) 965 (d) 972

2. It is estimated that 65% of American families have at least one pet. If we randomly select 400 American families, how many would we expect to have at least one pet?

   (a) 260 (b) 615 (c) 240 (e) 160

3. A new vehicle depreciates by about 10% every year for the first three years. If its value a year after purchase is estimated to be \$21,600, how much was its purchase value?

   (a) \$23,760 (b) \$19,440 (c) \$24,400 (d) \$24,000

COURSE\QUESTION	Q1	Q2	Q3	Total	Pts		
Math 087	2	8	1	9	1.22		
Math 088	4	14	0	14	1.29		
Math 088	5	19	3	27	1		
Math 102	3	10	3	11	1.45		
Math 102	7	19	2	23	1.22	DEVELOP.	
Math 102	3	12	2	12	1.42	1.22	
Math 110	7	18	4	20	1.45		
Math 111	9	26	9	26	1.69		
Math 111	8	26	8	26	1.62		
Math 111	9	15	4	16	1.75		
Math 131	8	15	6	15	1.93		
Math 207	9	24	10	24	1.79		
Math 207	14	26	8	28	1.71	PRECALC	
Math 207	9	25	10	25	1.76	1.71	
Math 112	20	29	17	29	2.28		
Math 112	6	11	4	11	1.91	CALC	LSSU
Math 151	13	16	11	16	2.5	2.27	1.84
	0.41	0.94	0.31	332			

Mathematics General Education Assessment Report Fall 2017

We provide the Questions posed in the Mathematics General Education Quiz administered in the Fall 2017.

The accompanying table below summarizes the data collected during the Fall Semester of 2017, based on this Quiz.

Dictionary of Terms: The official LSSU score is based on data collected at the Math 110 level and above, as authorized by the General Education Committee in its mandate. It is based on the average score (0-3) that students obtained on the General Education Quiz that was prepared by the School of Mathematics and administered to the students during the last week of classes of Fall 2017. This score is further broken down into a Precalculus level score, attained by the students from Math 110 - Math 207 (in numerical order) and a Calculus level score attained by the students in Math 112 and Math 151. Only students in the courses up to Math 151 were tested, as was explicitly authorized by the General Education Committee during relevant discussions.

Explanation of the Data: Purely for comparison purposes, students in Developmental mathematics courses, Math 087 - Math 102, were also tested. As can be seen from the table attached below, their ability ranked at 1.14, those of Precalculus students at 1.69, whereas those of Calculus level students was 2.06. The highest proficiency was attained by the Students in Math 151 (as expected) who scored 2.11 in the test, a score between Proficient (2) and Very Proficient (3). The overall LSSU score attained was 1.80, between Moderate (1) and Proficient (2), closer to the Proficient level.

There was a slight decrease in the scores at all levels from those attained in the General Education Quiz administered in the Spring 2017 semester. However, the two tests were not directly comparable, since new guidelines were issued to the School of Mathematics by the General Education Committee as in the first feedback loop, in order to calibrate the test to better measure the Mathematics General Educational Outcome at LSSU. The decline can be explained by the inclusion of a question testing ``symbolic ability" (Question 2), which, as seen by the data, was the lowest scoring question.

Actions: The School of Mathematics decided that the General Education Quiz approach is fruitful and informative and that it should be continued for the coming semesters. Since only a two semesters' data are available, no action was deemed necessary for now, even though, particular attention should be directed to the study of how (a) symbolic and (b) decision making skills are incorporated and taught in our curriculum. Adjustments and further deliberation will be carried out as necessary when more data become available in the coming semesters.

1. A nurse found that from 6:00 am to 7:00 am a patient's temperature rose by 0.4°F. From 7:00 am to 8:00 am, she found that the patient's temperature rose by 0.5°F. Then from 8:00 am to 9:00 am, the patient's temperature fell by 0.6°F, finally measuring 98.9°F. What was the patients temperature during the nurse's first visit at 6:00am?

   (a) 98.3°F (b) 98.6°F (c) 99.2°F (d) 100.4°F

2. A rectangle with perimeter P has length ℓ twice as big as its width. Which expression gives the length of the rectangle?

   (a) $\ell = \frac{P}{3}$ (b) $\ell = \frac{4}{P}$ (c) $\ell = \frac{P}{6}$ (d) $\ell = 6P$

3. A Fire Marshall interviewing the Director of a hospice, in which a fire emergency occurred, learned that out of a total of 45 patients residing there, 15 were taking heart medication and 7 were suffering from asthma. If 2 patients suffering from asthma were also taking heart medication, how many patients at the hospice were neither taking heart medication nor suffering from asthma?

   (a) 21 (b) 23 (c) 25 (d) 28

COURSE\QUESTION	Q1	Q2	Q3	Total	Pts/Std	
Math 087	10	3	2	21	0.71	
Math 087	3	0	2	15	0.33	
Math 088	12	3	12	26	1.04	
Math 088	25	3	14	36	1.17	
Math 102	14	4	12	19	1.58	
Math 102	17	3	10	21	1.43	DEVELOP.
Math 102	16	5	10	20	1.55	1.14
Math 110	13	4	12	17	1.71	
Math 111	18	4	15	23	1.61	
Math 111	29	12	17	32	1.81	
Math 111	6	4	7	13	1.31	
Math 111	16	2	13	25	1.24	
Math 131	13	12	11	15	2.40	
Math 207	16	3	16	19	1.84	
Math 207	6	2	7	8	1.88	
Math 207	16	7	8	23	1.35	PRECALC
Math 207	10	6	7	10	2.30	1.69
Math 112	11	5	9	12	2.08	
Math 112	24	12	20	28	2.00	
Math 151	27	13	19	28	2.11	CALC
Math 151	7	4	8	9	2.11	2.06
AVRGE/TOTAL	0.74	0.26	0.55	420		
AVRGE/DEVELOP.	0.71	0.13	0.39	158		LSSU
AVRGE/GEN.ED.	0.81	0.34	0.65	262		1.80

Mathematics General Education Assessment Report Spring 2018

The accompanying table summarizes the data collected during the Spring Semester of 2018, based on this Quiz.

Dictionary of Terms: The official LSSU score is based on data collected at the Math 110 level and above, as authorized by the General Education Committee in its mandate. It is based on the average score (0-3) that students obtained on the General Education Quiz that was prepared by the School of Mathematics and administered to the students during the last week of classes of Spring 2018. This score is further broken down into a Precalculus level score, attained by the students from Math 110 - Math 207 (in numerical order) and a Calculus level score attained by the students in Math 112 and Math 151. Only students in the courses up to Math 151 were tested, as was explicitly authorized by the General Education Committee during relevant discussions.

Explanation of the Data: Purely for comparison purposes, students in Developmental mathematics courses, Math 087 - Math 102, were also tested. As can be seen from the table attached below, their ability ranked at 0.85, those of Precalculus students at 1.42, whereas those of Calculus level students was 1.53. The highest proficiency was attained by the Students in Math 151 (as expected) who scored 1.75 in the test, a score between Moderate (1) and Proficient (2), closer to the Proficient level. The overall LSSU score attained was 1.45, between Moderate (1) and Proficient (2).

There was a significant decrease in the scores at all levels from those attained in the General Education Quiz administered in the Fall 2017 semester. This was, in part, due to the fact that the selection of the questions is still at an experimental phase (with this being only the third iteration phase of this new project). As a result, the two tests (as also the one administered in the Spring of 2017) were not directly comparable. Part of the reason for this experimentation are the relatively recent guidelines that were issued to the School of Mathematics by the General Education Committee after the first feedback loop, aimed at calibrating the test to better measure the Mathematics General Educational Outcome at LSSU. Despite this volatility, there are a couple of conclusions that may be firmly drawn:

1. L.S.S.U. students are better prepared to handle quantitative questions, as contrasted to questions involving symbolic and/or analytical reasoning.
2. L.S.S.U. student average scores are higher the further they advance in their mathematics education at the college level. This is shown clearly when comparing average scores attained by students per course.

Actions: The School of Mathematics decided that the General Education Quiz approach is fruitful and informative and that it should be continued for the coming semesters. Since only three semesters of data are available, no action was deemed necessary for now, even though, particular attention should be directed to the study of how (a) symbolic and (b) decision making skills are incorporated and taught in our curriculum. Adjustments and further deliberation will be carried out as necessary when more data become available in the coming semesters.

1. Approximately 45% of the cars sold in the United States in 2017 were of American make. How many of the approximately 6.33 million (M) vehicles sold in 2017 were of foreign make?

   (a) 2.85M (b) 3.12M (c) 3.48M (d) 4.11M

2. A circle of radius r and a square of side s have the same area. Which expression describes the ratio $\frac{r}{s}$?

   (a) $\frac{r}{s} = \frac{1}{\pi}$ (b) $\frac{r}{s} = \frac{1}{\sqrt{\pi}}$ (c) $\frac{r}{s} = \sqrt{\pi}$ (d) $\frac{r}{s} = \pi$

3. Protocol decrees:

   "If a patient is over 80 years old and has heart disease, then medication X shall not be prescribed."

   Mr. Jones, who is 84 years old, was not prescribed medication X by Dr. Gonzalez. Which of the following conclusions may be drawn with certainty?

   (a) Mr. Jones has heart disease. (b) Mr. Jones does not have heart disease. (c) Dr. Gonzalez violated protocol. (d) None of (a)-(c).

COURSE\QUESTION	Q1	Q2	Q3	Total	Pts/Std	
Math 087-001	6	0	1	7	1.00	
Math 088-001	8	1	6	31	0.48	
Math 088-002	2	2	2	7	0.86	
Math 102-001	16	3	10	27	1.07	
Math 102-002	10	4	4	16	1.13	DEVELOP.
Math 102-003	6	2	3	13	0.85	0.85
Math 110-001	8	3	7	15	1.20	
Math 111-001	11	8	11	19	1.58	
Math 111-002	15	12	8	21	1.67	
Math 111-003	18	2	7	20	1.35	
Math 131-001	14	9	13	24	1.50	
Math 207-001	17	7	8	25	1.28	
Math 207-002	23	7	11	28	1.46	PRECALC
Math 207-003	12	9	10	24	1.29	1.42
Math 112-001	11	0	8	13	1.46	
Math 112-002	23	4	10	26	1.42	CALC
Math 151-001	14	8	6	16	1.75	1.53
AVRGE/TOTAL	0.64	0.24	0.38	332		
AVRGE/DEVELOP.	0.48	0.12	0.26	101		LSSU
AVRGE/GEN.ED.	0.72	0.3	0.43	231		1.45