TO	Faculty Senate
FROM	Ned Moore, Chair, University Curriculum Committee
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SUBJECT	Senate Report for the 4th Round of Curriculum Meetings, Rev A
DATE	4/29/2021

Contents

1.0 Announcements

a. Beth Merenstein is spearheading a pilot FYE course for exploratory students. There will be five sections, each focused on a different study area (business, STEM, etc.) They will run in fall 2022 and the students will be tracked at least until sophomore year to look for differences in retention. Students will be assigned to the course by advisors, and not all exploratory students will participate. Students will earn two general education credits in SK IV.

2.0 Minor Changes

a. HIST 329 - History of Working America - Reinstate a recently deleted course

b. ENG 360 – Cycling change from Even Years to Irregular

c. ENG 361 – Cycling change from Even Years to Irregular

d. ETM 467 – Description Change

   i. Old - Application of the finite element method to structural engineering problems. Study of truss, beam, plane stress, plane strain, shell, and solid continuum finite elements; mesh generation; proper element density and element interfacing; and composite modeling problems.

   ii. New – Application of the finite element method using commercially available finite element software for structural engineering applications including linear static, modal, buckling, and thermal stress analyses in addition to conductive and convective heat transfer analyses. Overview of essential topics from linear algebra including matrix multiplication, matrix inversion, and determinants. Development of the finite element stiffness method for one-dimensional spring problems. Study of truss, beam, plane stress, plane strain, axisymmetric, shell, and solid continuum finite elements; mixed element models; symmetry; stress singularities; and mesh convergence. Three hours of lecture per week.

e. ME 467 – Description Change

   i. Old – A first course in the finite element method that includes the solution of spring and truss structures using the stiffness method and the principle of minimum potential energy. Subsequent study of beam, plane stress, plane strain, axisymmetric, plate, and solid elements. Additional topics include theory of elasticity basics, mesh convergence, element interpolation functions, and element integration schemes. Additional structural applications will include modal, buckling, thermal stress, and dynamic analyses. Heat transfer, fluid mechanics, and nonlinear structural analyses applications will also be introduced. Analyses will include the use of commercially available finite element software. Two hours lecture and two hours laboratory, course meets four hours per week

   ii. New – A first course in the finite element method that includes the solution of spring, truss, and beam structures using the stiffness method and the principle of minimum potential energy applied to spring problems. Subsequent study of beam, plane stress, plane strain, axisymmetric, plate, and solid elements. Additional topics include mixed element models, mesh convergence, symmetry, stress singularities, and an

introduction to element interpolation functions and element integration schemes. Additional structural applications include modal, buckling, dynamics, and thermal stress analyses in addition to conductive and convective heat transfer analyses. Analyses will include the use of commercially available finite element software. Two hours of lecture and two hours of laboratory per week.

f. TE 221

i. Old Title: Innovation & Invention

ii. New Title: Innovation & Invention for Makerspaces and Lab

g. WRT 100 – Description Change

i. Old: Focus on improvement of basic writing skills in order to meet entrance requirements for WRT 110. After review of grammar and punctuation, the course emphasizes sentence and paragraph formation and the development of the coherent essay. Students who are required to take WRT 100 must pass the course with a C- or better before successful completion of 30 hours of coursework. No credit for students with credit for ENG 099, WRT 105 or WRT 110.

ii. New: To prepare students for WRT 110, this course focuses on the fundamental skills of academic writing (developing and presenting a controlling idea; responding to reading; awareness of audience; writing conventions such as tone, mechanics, and citations), and the steps necessary to write successfully in college (crafting sound arguments; developing and organizing essays; prioritizing different writing tasks; reflecting on one's own writing). Students who are required to take WRT 100 must pass the course with a C- or better before successfully completing 30 credits. For students with a WRT 100 placement, this course is a pre-requisite for WRT 105/WRT 105P and WRT 110. No credit given for students with prior credit for ENG 099, WRT 105 and/or WRT 110.

3.0 Consent Agenda

Item	Type	Name
3.1	Change Program	Biomolecular Sciences, B.S.
3.2	New Course	BUS 250 Introduction to Business Analytics and Skills - 3 credits
3.3	Change Course	BUS 544 Business Process Modeling - 3 credits
3.4	Change Course	BUS 548 Business Decision Models - 3 credits
3.5	New Program	Business Administration, B.S.
3.6	New Program	Official Certificate Program in Business Analytics
3.7	New Program	Certificate in Database Management
3.8	Change Program	Management Information Systems, B.S.
3.9	Delete Program	Caribbean Studies Minor
3.10	New Course	DAN 210 Occupational Wellness in Dance Education - 3 credits
3.11	New Course	DATA 576 Topics in Data Science - 4 credits
3.12	Change Course	EDL 605 Leadership in Teaching and Learning I - 3 credits
3.13	Change Course	EDL 606 Leadership in Teaching and Learning II - 3 credits
3.14	Change Course	EDL 610 School Leadership I - 3 credits
3.15	Change Course	EDL 611 School Leadership II - 3 credits
3.16	Change Course	EDL 688 Administration of Programs for Diverse Learners I - 1 credits
3.17	Change Course	EDL 689 Administration Programs for Diverse Learners II - 1 credits
3.18	Change Course	EDL 720 Inquiry Seminar XI: Disseminating Research Findings - 2 credits
3.19	New Course	EDL 734 Leadership and Innovation in Higher Education Administration - 3 credits

3.20	Change Course	EXS 407 Exercise Physiology and Applied Biomechanics - 3 credits
3.21	New Course	EXS 517 Exercise Physiology and Applied Biomechanics - 3 credits
3.22	Change Course	PE 404 Methods of Teaching School Health Education - 3 credits
3.23	New Course	PE 514 Methods of Teaching School Health Education - 3 credits
3.24	New Course	PE 516 Adapted Physical Education - 3 credits
3.25	Change Course	PE 406 Adapted Physical Education - 3 credits
3.26	New Course	MUS 102 Fundamentals of Musicianship - 3 credits
3.27	Change Course	MUS 235 Music History I - 3 credits
3.28	Change Course	MUS 334 Music History II - 3 credits
3.29	Change Course	MUS 335 Music History III - 3 credits
3.30	Change Program	Robotics and Mechatronics Engineering, B.S.
3.31	Change Course	GRT 272 Packaging Technology - 3 credits
3.32	Change Program	Electrical Engineering, B.S.
3.33	Change Program	Statistics Minor
3.34	Change Course	COMM 410 Public Opinion - 4 credits
3.35	Change Program	Strategic Communication, B.A.
3.36	Change Course	TE 150 Fundamentals of Engineering and Technology for Teachers - 3 credits

4.0 Changes to general education Student Learning Outcomes (SLO)

- These changes are the result of two years of effort by a committee of faculty members.
- We do not have the rubrics that will be used to evaluate these outcomes, so we are forced to make assumptions.
- There are nine sets of SLOs. They can be approved or rejected individually.
- Rejection must be accompanied by written justification.
- Each community college and university gets one vote.
- Changes to the following SLO were approved by the general education subcommittee
    - Oral Communication
    - Scientific Reasoning
    - Historical Knowledge and Understanding
    - Social and Behavioral Sciences
    - Arts and Humanities
    - Continuing Learning/Information Literacy
- Changes to these SLOs were not approved by the general education subcommittee.
    - Written Communication
    - Quantitative Reasoning
    - Scientific Knowledge and Reasoning
- The representatives of the English and Biology departments withdrew concerns related to their respective domains, and voted to approve at the main meeting after voting against them at the general education subcomittee. Their concerns were relayed to the committee that produced the new SLOs.
- The representative from the Math department objected to the quantitative reasoning SLO and has provided written justification (See Appendix A). This stance was supported by the representative from Engineering.
- The entire slate was approved as a package by the full curriculum committee by a vote of 14-5 with numerous abstentions.

A Critique of the Proposed SLO's

Existing Quantitative Reasoning SLOs (2012):

1. Represent mathematical, and quantitative information symbolically, graphically, numerically, and verbally.
2. Apply quantitative methods to investigate routine and novel problems. This includes calculations/procedures, mathematical and/or statistical modeling, prediction, and evaluation.
3. Interpret mathematical and quantitative information and draw logical inferences from representations such as formulas, equations, graphs, tables, and schematics.
4. Evaluate the results obtained from quantitative methods for accuracy and/or reasonableness.

New Proposed Quantitative Reasoning SLOs (February 2022):

Given an authentic context or everyday life situation:

1. Convert relevant information into an appropriate mathematical form, such as an equation, graph, diagram, table, or words.
2. Use arithmetic, algebra, geometry, statistics, or logic to solve related problems.
3. Interpret the significance, reasonableness, or implications of calculated results.

Based on the only document [1] provided to us a few days ago, we were asked to vote yes or no on some rewording of the learning outcomes in quantitative reasoning. The document contains a few links about the process and is making some claims. We could not verify these claims, nor find any standards, nor any sample questions.

The following microanalysis is based on this partial information. It is provided as a professional curtesy to the faculty who worked on the proposal. The faculty 'were provided' with the Guided Principles by FIRC with the claim that the outcomes were 'too cumbersome to assess'. The proposal claims to be written 'by and for the faculty at the request of the faculty.'

According to their guidelines, the number of outcomes should be reduced to 3, and we should use verbs 'with an eye to … courses with no prerequisites.' We cannot verify the connection between prerequisite and assessment, but we can make a connection with the ACME policy.

The learning outcomes for QR were trimmed down because they were assessable but not 'more assessable,' sufficient 'as is' but not 'clear'. In other words, 'too cumbersome to assess.' Trimming was done down to 'bare necessities' (undefined) and 'fundamental skills' (defined as lacking analysis and application). The expression 'novel problem' was interpreted as student 'original work' and the word 'verbal' was interpreted as 'oral'.

According to the proposal, students are not expected to use oral math language, nor to analyze anything, nor to apply anything, nor to do 'original work'. Instead, they are supposed to convert information into math, use any math they know to solve routine exercises, and to interpret the calculations in some 'authentic context or everyday life situation'. Although the word 'authentic' was taken from some AACU Value Rubric, in the context of ACME policy it sounds ideologically charged [2].

Assuming that the intent was to apply math to a real-world situation, we know that the real-world situations are described by functions. But the concept of function is not specifically included in any of the outcomes. This suggests that SLO 2 leaves open the door to lower the standards from applied algebra to the eighth grade arithmetic.

In this situation, we are voting NO on the proposal.

Quantitative Reasoning

Quantitative reasoning is a misnomer for algebraic reasoning or 'applied algebra.' The science of numbers and calculations is called 'algebra' in honor of al-Khwarizmi, a Persian mathematician who wrote an influential book around 820 AD on calculation by completion and balancing. The title of that book in Arab contains the word 'al-jabr' which was latinized into the word 'algebra'. Currently this science is based on the eighth grade arithmetic, or 'math foundations', and high school algebra, centered on the concept of function. This concept appeared in mathematics in the seventeenth century with the work of Descartes on the relationships between variables. The linear functions and the quadratic functions are the first two degrees of approximation of reality, enough to understand uniform motions and gravity. The exponential functions are the multiplicative version of linear functions and describe quantitatively the life and death of organisms.

Paraphrasing [3] and [4], the purpose of undergraduate general education is 'the upgrading of the mind so that it is capable of high quality rigorous thought.' For example, we want students to solve problems on their own and one excellent way to practice this skill is to use patterns provided by math. There are many problems that an English major must solve when they want to write a wonderful work of fiction. There is a skill to sitting down and having the willpower to think for long periods of time, to upload many different things into your head and interweave them with each other. Everything complex that modern life entails. Culturally, saying that math is difficult and I never really got the hang of it is akin to saying reading is difficult and I never really got the hang of it.

At CCSU we have a robust program in math foundations (MATH 099) and applied algebra (MATH 102) that addresses the learning needs of our students. Math Foundations is essentially a course in the eighth grade arithmetic and is not a college course. Applied Algebra satisfies the quantitative reasoning (QR) requirement.

CCSU Applied Algebra (CCSU AA) Standards

1. **Quantitative Analysis Standards**
   a) Distinguish between quantitative and qualitative information
   b) Identify and label the constants and variables in a real-world situation
   c) Translate verbal quantitative information into mathematical language
   d) Create and write formulas related to a real-world situation
   e) Draw diagrams depicting geometric or numerical data
2. **Quantitative Problem Solving Standards**
   a) Identify and solve linear and power equations in one unknown
   b) Solve basic linear and power systems of equations by substitution
   c) Analyze systems and interpret their solutions in the context of a situation
3. **The Concept of Function Standards**
   a) Analyze relationships between two variables
   b) Recognize relationships that are functions
   c) Create scatterplots and analyze directional trends
   d) Analyze and interpret graphs in the context of a situation
4. **Linear, Exponential, and Quadratic Models Standards**
   a) Recognize linear, exponential, and quadratic patterns in tables and graphs
   b) Write linear and exponential function equations using two data points
   c) Interpret the rates of change and the multipliers as directional trends
   d) Solve exponential and quadratic equations and interpret their solutions
   e) Make predictions using interpolation and extrapolation with a model
   f) Determine the real-world domain and range of a model
   g) Calculate and interpret the important points of a quadratic graph

These standards are just a reinforcement at a slightly higher level of complexity of what any high school student is supposed to know before college. Students are placed in this course if their SAT scores indicate they do not meet the high school standards in algebra. We feel a student meeting the standards of College Level Quantitative Reasoning should be able to

QR 1: *Recognize mathematical patterns in real-world situations: constants and variables; functional relationships between variables; various types of functions from tables and graphs*
CCSU AA Standards 1 a), b); 3 a), b); 4 a)

QR 2: *Represent patterns in real-world situations in mathematical language: create and write formulas; draw diagrams, tables, and graphs; write function equations from data*
CCSU AA Standards 1 c), d), e); 3 c); 4 b)

QR 3: *Solve math problems related to real-world situations: simple algebraic and exponential equations and systems, interpolation and extrapolation using a model, domain and range*
CCSU AA Standards 2 a), b); 4 d), e), f)

QR 4: *Interpret calculated results in the context of a real-world situation: solutions of equations and systems, rates of change and multipliers, important points of a quadratic graph*
CCSU AA Standards 2 c); 3 d); 4 c), g)

In this context SLO 1, SLO 2, and SLO 3 approximately align with QR 2, QR 3, and QR 4 respectively. The current and the proposed outcomes are missing QR 1. Hence, students may have a very hard time for example to setup the correct model for a quantity which grows by 2 units every day versus a quantity which grows by 2% every day. The SLO 1, SLO 2, and SLO 3 are open to interpretation, are lacking college level specificity, and are not backed up by any standards and assessment tools to our knowledge.

Students in Applied Algebra course are rigorously assessed by a final exam, which can be used to produce meaningful, reliable, valid data, aligned with each QR learning outcome. This exam is administered as a common exam among all sections, and is graded using a common grading rubric by qualified faculty. The grading is done in common sessions where the coordinator of the course calibrates the rubric. Data for the last five years shows that about 83% of the students who took the final exam in applied algebra earned the minimal passing score or above for the final exam. The alignment with the QR outcomes can be easily made according to [5]. The graduation rate at CCSU is about 51%. Based on this evidence, QR is definitely NOT ‘a barrier’ for graduation.

CCSU admits hundreds of underprepared students that fill up multiple sections of MATH 099. The placement is determined by the lowest band of the SAT scores. By some pre- and post-tests [6], about 80% of these students cannot calculate a simple percent out of an integer. The goal of remedial math is to close the achievement gap in the eighth grade arithmetic. This is done by a cumulative effort by students to reach ‘math foundation’ maturity. That happens when a student evolves from ‘I have no idea what’s going on’ to ‘everything makes sense.’ This effort involves study habits such as hard work, conversations, focus, and organization to internalize information and skills. This takes time! Undermining these habits is one root cause for academic failure.

Indeed, remedial MATH 099 is assessed in the same way as Applied Algebra. Data over the last five years shows that about 70% of the students who took the final exam earned the minimal passing score or above for the final exam. About 50% of the same population earned a score of 70% or higher. The strong correlation between success in remedial math and graduation rates is evidence for ‘math foundations’ maturity as being a main predictor of academic success across disciplines, as noted above.

The ACME policy has serious flaws as just-in-time support has never worked. A much better approach is to streamline the math foundations curriculum, pedagogy, and supporting resources by spring 2023, based on the principles of teaching at the right level [7]:

(1) Divide students in groups based on learning needs;
(2) Dedicate time to basic skills rather than focusing solely on the curriculum;
(3) Regularly assess student performance.

Paraphrasing an open letter [8] by mathematicians, scientists, and educators, data science - computer science, statistics, artificial intelligence - is built on the foundations of algebra, calculus, and logical thinking. While these fields are centuries old, they are even more critical today than in the past. Reducing access to essential mathematics and elevating trendy but shallow courses ('pathways') over foundational skills would cause lasting damage to higher education and exacerbate inequality by diminishing access to the skills needed for social mobility. A policy that proposes drastic changes based on scant and inconclusive evidence instead of using incremental experimentation building on lessons learned and using credible measures of success is the height of irresponsibility.

In conclusion, the proposed SLOs cannot be taken seriously without knowing the standards behind these outcomes and the assessment tools. If the goal is to play linguistic gimmicks to force TAP equivalences based on the ACME policy, we have serious concerns about the unintended consequences of this approach.

Suggested Alternative

The standards for the QR requirement at college level cannot be strictly at or below high school algebra. Sample questions aligned with the learning outcomes are presented together with an explanation of how the answers to these questions are assessed. Data should be reliable, valid, and verifiable. The use of data should be corroborated with qualitative analysis based on best practices in the field.

In the context of a real-world situation, the student should be able to:

AQR 1: Recognize mathematical patterns and represent them symbolically, graphically, numerically, and verbally

AQR 2: Solve related math problems using simple algebraic and exponential equations and systems, interpolation and extrapolation with models

AQR 3: Interpret calculated results such as solutions of equations and systems, rates of change and multipliers, important points of a graph

References

[1] New Proposed TAP Framework30, February 2022
[2] New Discourses Dictionary
[3] Bret Weinstein podcast, 2021
[4] Alex Kontorovich podcast, 2021
[5] Sample Final Exam Math 102, Fall 2021, available by request
[6] Bridges Pre-test Post-test Item Analysis, Summer 2018, available by request
[7] Teaching at the Right Level (TaRL)
[8] Open Letter on K-12 Mathematics