

Assessing intensive writing assignments for mathematical programming content

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Teaching Computation in the Sciences using MATLAB Workshop 2019

Does writing in math courses help learning?

Questions as instructors:

- Is writing about mathematics (in full sentences) helpful to students?
- How can I measure their learning gains through writing and is it different than students submitting code only and final answers?
- Is automatically graded code enough?

Classroom Context

- Cal State Univ Channel Islands: Hispanic Serving Institution
- 2/3 Female Population; not seen in upper division courses w/ computing
- Introductory Numerical Analysis course fulfilling upper division GE
 - Traditional Math Content and programming corresponding algorithms
 - Read/write topics: historical numerics disasters, gender in computing, philosophical perspectives (US-western vs. Chinese-eastern in medicine)
- 24 students, scalable to some extent
 - math, CS, mechatronics, and applied physics majors (some chem) - seniors
- MATLAB Site License (one-year ago)

How do I assess their work?

Grading Rubrics

CORRECTNESS			
4. Claims fully demonstrated with correct math logic	3. Claims demonstrated with minor logical gap and/or incorrect statements	2. Claims partially supported with some correct logic	1. Claims not supported
COMPLETENESS	2. Assignment features complete sentences and clear descriptions, including correct spelling, grammar, and notation. All components are complete	1. Assignment uses sentence fragments with partial descriptions and/or proof is overly wordy and/or there are minor problems with spelling, grammar, and notation. Some missing components.	0. Assignment is difficult to understand because of terseness and/or verbosity and/or severe problems with spelling, grammar, and notation. Several missing components.
TECHNIQUE	2. Technique clearly indicated and components of arguments and/or supporting figures easily identifiable	1. Technique and structure clear only after multiple readings	0. Technique is unclear and/or structure is incorrect
CLARITY	2. Most students in this course would be able to read and understand this assignment or submission	1. Some students could understand this assignment with careful reading	0. Assignment is very difficult to follow and requires multiple readings to begin to understand.

Traits Assessed	Consistent Evidence 8-10 points	Some Evidence 5-7 points	Insufficient Evidence 0-4 points
New Learning, Connects &/or Challenges (10 points) NOTE: In order to be evaluated for the second trait, Academic Writing, you must score a minimum of 5 points on this trait of New Learning, Connections, &/or Challenges.	The writer demonstrates familiarity with and understanding of main ideas in all or almost all (80-100%) assigned texts/materials. New learning is compellingly evident. New ideas are reinforced and/or challenged through connections to other assigned texts/materials, previous knowledge/content.	The writer demonstrates familiarity with and accurate understanding of main ideas in most (60-75%) assigned texts/materials. New learning is evident, but connections between texts or previous knowledge/content are not provided.	It is unclear if assigned texts were read and/or understood &/or there is no evidence of familiarity with content from the required text. Little to no new learning is described.
Academic Writing (10 points) NOTE: As noted above, your writing will not be eligible to be evaluated for Academic Writing if it is not very clear that you read at least 60% of the assigned texts/videos. A score of 0 for Academic Writing will be assigned if your paper is found to have "Insufficient Evidence" (0-6 points) of New Learning, Connections, &/or Challenges.	Strong academic writing skills are evident: The paper is content-rich and well structured (e.g., developed paragraphs, logically sequenced), Specific and correct in-text citations are provided, The writing is grammatically and mechanically flawless , or very nearly so.	Emerging academic writing skills are evident: A logical flow of thought exists, but the paper lacks content, depth &/or solid organizational structure. In-text citations are present with minor errors. Correct attribution of sources was attempted well. Grammatical &/or mechanical errors occasionally impede flow for the reader.	Formal academic writing does not seem to have been attempted: The entry may be a stream of consciousness sharing of opinions w/out substance &/or organization. General references may be made to assigned texts. In-text citations are absent or are included with significant errors. Grammatical &/or mechanical errors are significant, impeding flow/understanding.
Correctness (10 points)			Technique & Clarity (5pts) This includes any code implementation

*Rubrics designed in collaboration with Drs. Kaia Tollefson, Kathryn Leonard, Geoff Buhl, and Marie Francois

arity. Points for Clarity and Technique can only be earned for complete assignments.

25/40

§2.2 #5, 8, 16 §2.3 #5, 6, 15

2.2.5 4/4	2.3.5 4/4	Code & Implementation 9/10 code is good; include explicit command line per problem
2.2.8 2/4 explain why Thm 2.3 req are satisfied	2.3.6 4/4	
2.2.16 0/4	2.3.15 0/4	

1/2	features complete sentences and clear descriptions, including correct spelling, grammar, and notation. All components are complete	sentence <u>fragments</u> with <u>partial descriptions</u> and/or proof is overly wordy and/or there are minor problems with spelling, grammar, and notation. Some <u>missing components</u> .
TECHNIQUE 0/2 The math technique was unclear; writing needs attention.	2. Technique clearly indicated and components of arguments and/or supporting figures easily identifiable	1. Technique and structure clear only after multiple readings

Student #2 is progressing in the course in an average way. Rubric provides feedback and areas of improvement.

(different assignment)

Student #1 continues to excel throughout the course, rubric provides feedback on areas to improve.

§2.2 #5, 8, 16 §2.3 #5, 6, 15

2.2.5 4/4	2.3.5 CORRECTNESS 4/4	Code & Implementation 10/10
2.2.8 4/4 careful w/ necessary vs. sufficient	2.3.6 4/4	
2.2.16 4/4	2.3.15 4/4	

Next Level Considerations

- Mastery Based Grading: Allowing students to re-write their work until they have mastered the learning outcome
- Adapting the work to newly available tools: Grader & Live Scripts