NCTM Standards (2020) Step-by-Step Guide for Documenting Course Grades as an Assessment of Candidate Content Knowledge

This step-by-step guide is designed to assist program report compilers and reviewers in understanding how CAEP's Grade Policy is operationalized when used in conjunction with the *NCTM Standards (2020)*.

NCTM accepts grades in mathematics and mathematics education courses as evidence of candidates' content knowledge. Most often this is evidence related to mathematics content and mathematical practices (Standards 1 and 2). If programs choose to use course grades as one assessment, *these instructions take the place of the general instructions for submitting assessments cited at the beginning of Section IV of the program report.*

Specifications

- Course grades can be used for only one of the following content assessments: Assessment #1 (only if there is no state licensure test), or Assessment #2 (recommended). Content-specific course grades cannot be used for multiple assessments.
- Faculty may choose which required content-specific courses are used in this assessment. For example, all courses in an academic major could be chosen, or a cluster of courses that address a specific content domain could be chosen.
- Courses or course areas (see #1 below) must be required for all candidates in the program, as evidenced in the Program of Study submitted in Section I of the program report.
- Syllabi cannot be submitted.
- Programs must use the *Template for Course Grades and/or Transcript Analysis*. This editable document guides the program through all required information and documentation.

Documentation

1. Curriculum requirements including required course numbers, names, and catalog descriptions must be supplied.
2. It is strongly recommended that programs only use courses required for all program completers. In cases where a program has multiple versions of highly related coursework and one of the courses in the category is indeed required, a fully developed justification for how components are aligned across course options in a manner that ensures all candidates are exposed to the same content may be provided. For example, in cases where programs offer two versions of applied statistics and candidates must take at least one of these, alignment may be possible for topics and experiences that overlap.
3. Selected content courses must be aligned to components of *NCTM Standards (2020).* All documents are available at *www.nctm.org/caep*.
4. For undergraduate and graduate programs where coursework is mostly completed at the submitting institution, documentation must be consistent with course listings provided in the Program of Study submitted in Section I of the program report.

   For a graduate level program that relies on coursework taken at another institution, the course grades-based assessment must include responses to all questions in the transcript analysis section of the appropriate *Template for Course Grades and/or Transcript Analysis*. This will describe the process and procedures used to determine sufficiency of courses taken at another institution and to specify coursework required to remediate deficiencies in content for admitted candidates. See the Transcript Review section below for a few guiding principles.
5. Grade evidence must be accompanied by the institution's grade policy, definitions of grades, and minimum expectations for candidate performance.
6. Grade data is reported by academic year in which the candidates complete, not when the course is offered.

7. The number of completers/candidates in the data tables for each academic year must be consistent with the number of completers/candidates reported in Section I, Context #5 of the program report.
8. Grade data must be disaggregated by program level (e.g., undergraduate or graduate completers), program type (e.g., Baccalaureate, MAT, or M. Ed.), grade level (e.g., middle level or secondary), program site (only if assessments differ by site), and academic year or term.

Transcript Analysis

In addition to the general guidelines already presented the following are specifically related to transcript review.

- Through the questions provided in the *Template for Course Grades and/or Transcript Analysis*, the program will describe the process and expectations around the requirements for sufficiency and currency of coursework accepted.
- Through the questions provided in the *Template for Course Grades and/or Transcript Analysis*, the program will address remediation expectations/processes.
- Through the questions provided in the *Template for Course Grades and/or Transcript Analysis*, the program will address how the use of technology and concrete materials in the learning of mathematics is reviewed.
- The form used to review/document individual applicant content coursework must be uploaded in Section I.

Format

The five-part format outlined below is required for submission of course grades as an assessment under Section IV of the program report. The appropriate *Template for Course Grades and/or Transcript Analysis* is established to help the program ensure sufficient evidence is provided. For this specific assessment, *these instructions take the place of the general instructions for submitting assessments cited at the beginning of Section IV*.

Part 1. Description of the Assessment

Identify the required mathematics major courses chosen for inclusion and supply a rationale for the selection of this particular set of mathematics or mathematics education courses. Provide a rationale for how these courses align with specific components of the *NCTM Standards (2020)* for Middle Level or Secondary. (Limit to one page.)

If course grades are used as an assessment for a graduate level program that relies on undergraduate coursework taken at another institution, a transcript analysis form is required. Further discussion to address questions must provide a description of how the program uses a transcript analysis to determine the sufficiency of courses taken at another institution while identifying coursework required for remediating deficiencies in content of admitted candidates. Guiding questions are provided to assist the program in discussing this process.

In addition to the completed template uploaded in Section IV of the reporting shell, a program of study and transcript review form should be uploaded in Section I.

Part 2. Course Alignment with Components of NCTM Standards (2020)

Include two or three alignment tables. Table 1 requires programs to discuss the way in which technology and concrete materials are used by candidates across components of Standard 1 to learn mathematics. Table 2 aligns courses to Standard 1 components. Table 3 is required when programs align courses to standards other than Standard 1.

Examples of the tables are provided below.

- Describe course components that specifically address cited standard components.
- Justification should go beyond catalog descriptions.
- Programs are encouraged to be specific to the component being addressed and not provide a single broad justification that may lack the detail required to provide the necessary evidence of all aspects of the component.

In addition to the completed template uploaded in Section IV of the reporting shell, programs should provide a document containing **catalog descriptions** of those courses included in the course grades assignment as an **attachment in Section I**.

Example for: Technology and Representational Tools Including Concrete Models by Component

(Note that the full table is not provided in this example.)

1c) Calculus	MATH 200/201/302 Calculus Sequence: Candidates use graphing calculators (TI-84Plus and TI-Nspire) and *Maple* software during course lectures, while completing problems, and to investigate patterns and procedures. MATH 200/201/302 Calculus Sequence : Candidates use web-based resources (e.g., http://mathdemos.org/mathdemos/TaylorPolynomials/, and http://www.wolframalpha.com/examples/) to illustrate concepts, model results, and/or support exploration. MATH 200/201/302 Calculus Sequence: Candidates use concrete models such as a roll of pennies, party hat, bagel or doughnut, orange, hula hoop, and geometric solids with removable lids as investigative and learning tools. MATH 421 History of Mathematics Candidates have opportunities to experiment with tools such as linear or polar planimeters to determine the area of two-dimensional shapes.

Example for: Rationale for Content Preparation through Coursework for Standard 1

(Note that the full table is not provided in this example.)

Standard 1: Knowing and Understanding Mathematics

Candidates demonstrate and apply understandings of major mathematics concepts, procedures, knowledge, and applications within and among mathematical domains of Number; Algebra and Functions; Calculus; Statistics and Probability; Geometry, Trigonometry, and Measurement.

	Required Course Number(s) and Name(s) with a specific description of how the indicated component is addressed in the course
1c) Essential Concepts in Calculus. Candidates demonstrate and apply understandings of major mathematics concepts, procedures, knowledge, and applications of calculus, including the mathematical study of the calculation of instantaneous rates of change and the summation of infinitely many small factors to determine some whole. Essential Concepts in Calculus include limits, continuity, the Fundamental Theorem of Calculus, and the meaning and techniques of differentiation and integration.	**MATH 200 Calculus I** - Topics include limits, differentiation of algebraic and trigonometric functions, emphasis on rate of change, applications of derivatives, antidifferentiation, simple differential equations, the area under a curve, the fundamental theorem of calculus, and differentiation and integration of exponential and logarithmic functions. Topics include processes and applications with differentiation of algebraic and trigonometric functions. **MATH 201 Calculus II** - Topics include techniques and applications with derivatives and integrals (especially with inverse trigonometric functions, indeterminate forms and L'Hopital's rule). Links back to limits, continuity, meanings of processes and results, and review of rates of change. Topics also include evaluation and applications of trigonometric integrals; integrals with inverse trigonometric functions; and the use of trigonometric substitutions to evaluate integrals. **MATH 302 Calculus III** - Topics include parametric curves and applications; vector algebra, lines, planes, and curves in three dimensions; vector calculus; and evaluation of double integrals in rectangular and polar coordinates. Topics also include functions of several variables and their applications; partial differentiation; and iterated integrals and their applications. Topics also include functions of several variables and their applications; partial differentiation; and iterated integrals and their applications.

Example for: Rationale for Standards other than Standard 1 through Coursework

Note programs are not required to align additional components, but typically programs can find some support for at least Standard 2. It is important to note that grades have very limited potential to provide evidence for components expecting planning for K-12 classroom instruction or application of knowledge and skills in the K-12 classroom. The table in the *Template for Course Grades and/or Transcript Analysis* includes components from Standard 2 preloaded for the convenience of program report compilers. Additional components as appropriate can be added and components from Standard 2 can be removed.

Component number	Required Course Number(s) and Name(s) with a specific description of how the indicated component is addressed in the course(s)
2b) Reasoning and Communicating. Candidates organize their mathematical reasoning and use the language of mathematics to express their mathematical reasoning precisely, both orally and in writing, to multiple audiences.	**MATH 201 - Calculus II**: Multiple opportunities for candidates to recognize structure (e.g., infinite series) and to express regularity in patterns (e.g., Taylor series and representations of exponential and trigonometric functions) of mathematical reasoning permeate assignments, projects, and tests. **MATH 312 - College Geometry:** This course provides a foundation for the development of reasoning and proof as fundamental aspects of mathematics. • Candidates develop their ability to reason abstractly, reflectively, and quantitatively with attention to units (e.g., formulas of two- and three-dimensional objects) in myriad ways. • Candidates engage in constructing viable arguments and proofs of many theorems in two-dimensional Euclidean geometry (e.g., congruence and similarity), recognizing and discussing axiomatic structure (e.g., triangle congruence and similarity criteria derived from axioms), and expressing regularity in patterns of mathematical reasoning (e.g., triangle congruence theorems). • Representation and modeling of generalizations (e.g., transformations in the plane and periodic phenomena) regularly occur in candidates' demonstrated coursework. • Use of appropriate mathematical vocabulary and symbols to communicate ideas is regularly evidenced through in-class discussions (oral), assignments (written), projects (written), and tests (written). **MATH 360 – Abstract Algebra:** This course is designated as writing intensive and requires that candidates utilize appropriate mathematical vocabulary and symbols to communicate ideas clearly. • Construction of viable arguments and proofs plays a central role in building on and expanding candidates' abilities to reason abstractly and reflectively in a more rigorous and formalized setting. • Candidates regularly engage in critiquing classmates' proof attempts, discussing what constitutes a valid proof, and recognizing emergent patterns in mathematical reasoning. • Concepts of abstract algebra are used to develop the structure of the real number system and justify operations in it. • Candidates develop an appreciation of mathematical rigor as a fundamental tool for mathematical inquiry, as evidenced throughout the course via assignments, in-class discussions, and tests.

Part 3. Grade Policy and Minimum Expectation

Submit grading policy/definitions of grades that are used by the institution or program and the minimum expectation for candidate performance (e.g., candidates must achieve a C or better in required coursework).

Part 4. Data Tables

Fillable data tables are available in the *Template for Course Grades and/or Transcript Analysis*. The tables below are provided as examples.

Data Table A (Coursework Taken at Submitting Institution)

Data Table A is to be used for undergraduate and graduate completers whose mathematics and/or mathematics education coursework is mostly completed at the submitting institution. Mean course grades and grade distribution (range) in selected required mathematics or mathematics education courses, number of undergraduate or graduate completers, and percentage of completers meeting the minimum expectation disaggregated by level (e.g., undergraduate or graduate program completers) and by academic year must be included.

Grades in Required Mathematics and/or Mathematics Education Courses Secondary Mathematics Education Undergraduate Program Completers						
Grade Scale: A = 4.0, B = 3.0, C = 2.0, D = 1.0						
	2018-2019			**2019-2020**		
Course Number and Name	**Mean Course Grade and (Range)**	**Number of Completers (n=12)**	**% of Completers Meeting Minimum Expectation (C or better)**	**Mean Course Grade and (Range)**	**Number of Completers (n=9)**	**% of Completers Meeting Minimum Expectation (C or better)**
MATH 200: Calculus I	3.75 (3.0 – 4.0)	11*	100%	3.7 (3.0 – 3.8)	9	100%
MATH 312: College Geometry	3.3 (1.0 – 4.0)	12	92%	3.4 (3.2 – 3.7)	9	100%

*One candidate had AP credit, no grade is assigned.

Data Table B (Mathematics Major Coursework GPA)

Data Table B is to be used for both undergraduate and graduate program completers to report overall mathematics GPAs across all required mathematics major courses listed on the plan of study or transcript review form submitted in Section I of the program report. The table should be duplicated for each program reported. Data Table B may replace Data Table A for a graduate level program that relies on coursework taken at another institution. Data disaggregated by academic year on completers', mean grade point average (GPA) and grade distribution (range) across all required undergraduate mathematics major courses, number of completers, and percentage of completers meeting the minimum expectation must be included.

Mean GPA in Required Mathematics Major Courses for Secondary Mathematics Education Completers Baccalaureate Program			
Grade Scale: A = 4.0, B = 3.0, C = 2.0, D = 1.0			
Academic Year	**Mean GPA and (Range)**	**Number of Completers**	**% of Completers Meeting Minimum Expectation (2.0)**
2018-2019	3.25 (2.90 – 3.95)	12	100%
2019-2020	3.00 (2.5 – 3.5)	9	100%

Data Table C (Graduate Program Transcript Analysis Results)

Data Table C is to be used to report transcript analysis results for a graduate level program that relies on coursework taken at another institution. Data disaggregated by academic year on the number of completers for whom a transcript analysis was done, how many completers required remediation, nature of remediation (e.g., coursework or special project) by course or content, and the number of completers, if any, who received waivers (explanation required) from the process must be included.

Transcript Analysis Results for Secondary Mathematics Education Completers Post-Baccalaureate Program					
Academic Year	**Number of Completers**	**Number Requiring Remediation**	**Nature of Remediation by Course or Content**	**Number Receiving Waivers**	**Waiver Explanation**
2018-2019	6	1	MATH 6120 – College Geometry required for program completion	0	N/A
2019-2020	8	2	Completer 1: MATH 6700 – History of Mathematics required for program completion Completer 2: Secondary Content Addendum (A.2, A.3, A.4, and A.6) – Special technology project targeting the design and implementation of math-specific technological tools for teaching algebra, geometry, statistics, and discrete mathematics lessons required in capstone course	1	Completer 4 provided both business coursework and professional experiences as an actuary to meet the applied statistics requirements on the transcript analysis.

Part 5. *Analysis*

Provide an analysis of grade data. An explanation of any inconsistencies within the data tables must accompany the data tables.