

ALIGNMENT

Step Up to Writing and the NCTM Principles and Standards for School Mathematics

The *Step Up to Writing* program provides effective, multisensory writing strategies* to improve students' overall literacy skills, including students' math, science, and technology literacies. This flexible, strategy-based program helps students acquire, apply and communicate mathematical content knowledge. *Step Up* connects reading, critical thinking and writing in the content areas to build a common language of literacy and increase student proficiency across grade levels and across the curriculum.

Extensive modeling, guided practice, and independent practice improve student writing, reading and comprehension, math content-vocabulary, informational note-taking, and critical-thinking skills. Students learn to read, write, listen, speak, and view in math and science courses with skill and confidence.

No one can argue that our students must master mathematics, science, and technology. These are critical 21st century skills. The Content and Process Standards reflected in NCTM's *Principles and Standards for School Mathematics*** provide a strong framework for student inquiry and mathematical processes; the *Step Up to Writing* program fits naturally into this educational framework and assists content-area teachers in improving overall K-12 student literacy in the math classroom and across the curriculum.

To complement the mathematics education vision created by the National Council of Teachers of Mathematics, *Step Up to Writing* offers concrete strategies, methods, and tools for improving students' comprehension of math content, their ability to communicate mathematical processes concisely and effectively, their use of content-specific vocabulary, their ability to read and understand math assessments, and more. *Step Up to Writing* can be used alone or with other literacy programs already implemented in the classroom. *Step Up* provides direction on assessing student writing in the math classroom and also works well with scoring guides or rubrics designed by classroom teachers, schools, school districts, state, and other professional groups.

My notes _____

* All Strategies and Section references in this document refer to *Step Up to Writing*, Third Edition (2008). The program also applies to the content, tools, and strategies found in *Step Up to Writing in Math* (2008) and the First and Second Editions.

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CONTENT STANDARDS

Standard ❶: Number and Operations

The K-12 mathematics curriculum should enable students to:

- “understand numbers”
- “ways of representing numbers”
- “relationships among numbers”
- “number systems”
- “understand meanings of operations and how they relate to one another”
- “compute fluently and make reasonable estimates”

Standard ❷: Algebra

- “understand patterns, relations, and functions”
- “represent and analyze mathematical situations and structures using algebraic equations”
- “use mathematical models to represent and understand quantitative relationships”
- “analyze change in various contexts”

Standard ❸: Geometry

- “analyze characteristics and properties of 2- and 3-dimensional geometric shapes”
- “develop mathematical arguments about geometrical relationships”
- “specify locations and describe spatial relationships using coordinate geometry and other representational systems”
- “apply transformations and use symmetry to analyze mathematical situations”
- “use visualization, spatial reasoning, and geometric modeling to solve problems”

Standard ❹: Measurement

- “understand measurable attributes of objects and the units, systems, and processes of measurements”
- “apply appropriate techniques, tools, and formulas to determine measurement”

Standard ❺: Data Analysis & Probability

- “formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them”
- “select and use appropriate statistical methods to analyze data”
- “develop and evaluate inferences and predictions that are based on data”
- “understand and apply basic concepts of probability”

Step Up to Writing

Asking students to explain or describe their mathematical processes and thinking is an important instructional and assessment tool. *Step Up to Writing* promotes this and other “write to learn” strategies throughout its program. Students benefit from direct instruction in multisensory writing strategies designed to help them formulate critical questions, engage in inquiry in the classroom, clarify their thinking in math; explain their mathematical processes; analyze and evaluate information, data, and visual mediums (such as charts, graphs, etc.); and apply mathematical principles to their own lives, interests, and experiences. These strategies also improve students’ oral communication skills. Teachers are taught to incorporate *Step Up* strategies and activities into their existing math curriculum for all age groups and ability levels. With *Step Up to Writing*, teachers often report seeing an improvement in students’ communication skills and overall confidence in the classroom.

For example:

- Section 1: Writing to improve reading and listening comprehension (Responding to information in the text; making connections to self/text/world; taking notes; making inferences and analyzing; retelling and summarizing; asking and answering questions)
- Section 2: Vocabulary (Developing and using a strong mathematical vocabulary – the language of mathematics; breaking down definitions; concept and word maps; writing meaningful sentences; using precise word choice)
- Section 3: Sentence mastery (Writing better sentences; varying sentence structures; recognizing parts of speech; playing with language)
- Sections 4 and 5: Information/expository paragraphs, essays, and reports (Informal outlines; topic sentences; elaboration; the thinking game; train of thought; accordion races; developing ideas; improving elaboration; “stretch, don’t stack” activities)
- Sections 6 and 7: Story and narrative writing, personal narrative (Planning and prewriting; developing characters; writing dialogue; recognizing the personal narrative pattern; sharing and publishing their writing)
- Section 9: Specific writing assignments (Writing in math; writing to explain a graph or other visual representation of information; writing for assessments; technical writing; science reports; persuasive; compare/contrast; cause/effect; biographical and autobiographical sketches; personal response and reflection; and more)
- Section 10: Assessment and high standards (Quick checks for self-evaluation; scoring guides with *below basic*, *basic*, *proficient*, and *advanced* samples; monitoring student progress)

PROCESS STANDARDS

Standard 6: Problem Solving

The K-12 mathematics curriculum should enable students to:

- “build new mathematical knowledge through problem solving”
- “solve problems that arise in mathematics and other contexts”
- “apply and adapt a variety of appropriate strategies to solve problems”
- “monitor and reflect on the process of mathematical problem solving”

Step Up to Writing

Student inquiry, an important component of learning and grappling with ideas, data, and formulas, is a natural part of the mathematical problem-solving process. As students work through this process, it is important that they monitor and reflect upon their methods, success, and challenges. *Step Up to Writing* provides teachers with the strategies, lessons, and activities that encourage students to think further about their approaches to problem-solving. Through writing and personal reflection, students learn to communicate their thinking, their struggles, and their successes using the language of mathematics with skill and confidence. Teachers can assess quickly where students are struggling and where they are mastering mathematical processes and concepts. Explicit and multisensory writing strategies improve students’ organization, syntax, diction, and development of ideas while easy-to-use scoring guides and rubrics aid both teacher and student in monitoring progress.

For example:

- Section 1: Writing to improve reading and listening comprehension (Responding to information in the text; making connections to self/text/world; taking notes; making inferences and analyzing; retelling and summarizing; asking and answering questions)
- Section 2: Vocabulary (Developing and using a strong mathematical vocabulary – the language of mathematics; breaking down definitions; concept and word maps; writing meaningful sentences; using precise word choice)
- Section 3: Sentence mastery (Writing better sentences; varying sentence structures; recognizing parts of speech; playing with language; considering audience, purpose, and message)
- Sections 4 and 5: Information/expository paragraphs, essays, and reports (Informal outlines; topic sentences; elaboration; the thinking game; train of thought; accordion races; developing ideas; improving elaboration; “stretch, don’t stack” activities)
- Sections 6 and 7: Story and narrative writing, personal narrative (Planning and prewriting; developing characters; writing dialogue; recognizing the personal narrative pattern; sharing and publishing their writing)
- Section 9: Specific writing assignments (Writing in math; writing to explain a graph or other visual representation of information; writing for assessments; technical writing; science reports; persuasive; compare/contrast; cause/effect; biographical and autobiographical sketches; personal response and reflection; poetry; letters; and more)
- Section 10: Assessment and high standards (Editing with CUPS – capitalization, usage, punctuation, and spelling; quick checks for self-evaluation; scoring guides with *below basic*, *basic*, *proficient*, and *advanced* writing samples; monitoring student progress)

Standard 7: Reasoning & Proof

The K-12 mathematics curriculum should enable students to:

- “recognize reasoning and proof as fundamental aspects of mathematics”
- “make and investigate mathematical conjectures”
- “develop and evaluate mathematical arguments and proofs”
- “select and use various types of reasoning and methods of proof”

Step Up to Writing

Many students find that when explaining their reasoning –whether in math class or another content area – they can best express their ideas and insights through writing. Writing provides students the opportunity to “work through” their thinking without feeling committed to a particular answer; a first draft of sorts. As students develop, explain, and evaluate their own

mathematical arguments and proofs, writing allows students to communicate their logic and processes to demonstrate they fully understand their own investigative methods. Similarly, writing can help students clarify their thinking about a problem, justify their procedure, and evaluate their results. With the addition of strategies from *Step Up to Writing* in the math classroom, teachers can quickly assess student learning and application of math, while promoting continued critical thinking skills and improved student literacy.

For example:

- Section 1: Writing to improve reading and listening comprehension (Responding to information in the text; making connections to self/text/world; taking notes; making inferences and analyzing; retelling and summarizing; asking and answering questions)
 - Section 2: Vocabulary (Developing and using a strong mathematical vocabulary – the language of mathematics; breaking down definitions; concept and word maps; writing meaningful sentences; using precise word choice)
 - Sections 4 and 5: Information/expository paragraphs, essays, and reports (Informal outlines; topic sentences; elaboration; the thinking game; train of thought; accordion races; developing ideas; improving elaboration; “stretch, don’t stack” activities)
 - Section 9: Specific writing assignments (Writing in math; writing to explain a graph or other visual representation of information; writing for assessments; technical writing; science reports; persuasive; compare/contrast; cause/effect; biographical and autobiographical sketches; personal response and reflection; poetry; letters; and more)
 - Section 10: Assessment and high standards (Editing with CUPS – capitalization, usage, punctuation, and spelling; quick checks for self-evaluation; scoring guides with *below basic*, *basic*, *proficient*, and *advanced* writing samples; monitoring student progress)
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Standard ③: Communication

The K-12 mathematics curriculum should enable students to:

- “organize and consolidate their mathematical thinking through communication”
- “communicate their mathematical thinking coherently and clearly to peers, teachers, and others”
- “analyze and evaluate the mathematical thinking and strategies of others”
- “use the language of mathematics to express mathematical ideas precisely”

Step Up to Writing

Precision is a key mathematical principle as well as an important communication skill, both oral and written communication. *Step Up to Writing* strategies teach students to plan, organize, draft, and revise their thinking and writing in order to communicate effectively. By teaching students to use content-area vocabulary precisely and consistently, teachers ensure students continue to “use the language of mathematics” to express their ideas and processes. The *Step Up* strategies and activities help students communicate orally and in writing their comprehension, application, analysis, and evaluation of mathematical concepts and ideas. Students develop confidence and skill in writing about math that translates to classroom, district, state, and national assessments.

For example:

- Section 1: Writing to improve reading and listening comprehension (Responding to information in the text; making connections to self/text/world; taking notes; making inferences and analyzing; retelling and summarizing; asking and answering questions)
- Section 2: Vocabulary (Developing and using a strong mathematical vocabulary – the language of mathematics; breaking down definitions; concept and word maps; writing meaningful sentences; using precise word choice)
- Section 3: Sentence mastery (Writing better sentences; varying sentence structures; recognizing parts of speech; playing with language; considering audience, purpose, and message)
- Sections 4 and 5: Information/expository paragraphs, essays, and reports (Informal outlines; topic sentences; elaboration; the thinking game; train of thought; accordion races; developing ideas; improving elaboration; “stretch, don’t stack” activities)
- Sections 6 and 7: Story and narrative writing, personal narrative (Planning and prewriting; developing characters; writing dialogue; recognizing the personal narrative pattern; sharing and publishing their writing)
- Section 8: Speeches (Planning, organizing, and delivering effective speeches and presentations – formal and informal; asking and answering questions; improving impromptu speaking, informational and how-to speeches, and persuasive speeches; focusing on your audience; developing good listening skills; participating in a discussion)

- Section 9: Specific writing assignments (Writing in math; writing to explain a graph or other visual representation of information; writing for assessments; technical writing; science reports; persuasive; compare/contrast; cause/effect; biographical and autobiographical sketches; personal response and reflection; poetry; letters; and more)
 - Section 10: Assessment and high standards (Editing with CUPS – capitalization, usage, punctuation, and spelling; quick checks for self-evaluation; scoring guides with *below basic*, *basic*, *proficient*, and *advanced* writing samples; monitoring student progress)
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Standard ⑨: Connections

The K-12 mathematics curriculum should enable students to:

- “recognize and use connections among mathematical ideas”
- “understand how mathematical ideas interconnect and build on one another to produce a coherent whole”
- “recognize and apply mathematics in contexts outside of mathematics”

Step Up to Writing

Mathematics study is an integral part of the whole education of a student and is widely recognized as being tied to other content areas such as science, technology. However, mathematics is also closely tied to language arts, social studies, art, and more. *Step Up to Writing* strategies and activities encourage students to recognize connections between the various areas of math study as well as across the curriculum. Students are challenged to apply and explain how mathematical thinking and processes connect to their own lives, interests, and experiences and to the larger society and world around them. Many *Step Up* writing activities encourage these connections including reflection and personal response, narrative and personal narrative, expository and informational writing, compare/contrast, cause/effect, how-to or process analysis, and more.

For example:

- Section 1: Writing to improve reading and listening comprehension (Responding to information in the text; making connections to self/text/world; taking notes; making inferences and analyzing; retelling and summarizing; asking and answering questions)
 - Sections 4 and 5: Information/expository paragraphs, essays, and reports (Informal outlines; topic sentences; elaboration; the thinking game; train of thought; accordion races; developing ideas; improving elaboration; “stretch, don’t stack” activities)
 - Sections 6 and 7: Story and narrative writing, personal narrative (Planning and prewriting; developing characters; writing dialogue; recognizing the personal narrative pattern; sharing and publishing their writing)
 - Section 9: Specific writing assignments (Writing in math; writing to explain a graph or other visual representation of information; writing for assessments; technical writing; science reports; persuasive; compare/contrast; cause/effect; how-to or process analysis; biographical and autobiographical sketches; personal response and reflection; poetry; descriptive; letters; and more)
 - Section 10: Assessment and high standards (Editing with CUPS – capitalization, usage, punctuation, and spelling; quick checks for self-evaluation; scoring guides with *below basic*, *basic*, *proficient*, and *advanced* writing samples; monitoring student progress)
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Standard ⑩: Representations

The K-12 mathematics curriculum should enable students to:

- “create and use representations to organize, record, and communicate mathematical ideas”
- “select, apply, and translate among mathematical representations to solve problems”
- “use representations to model and interpret physical, social, and mathematical phenomena”

Step Up to Writing

Literacy is more than just reading and communicating through written language; rather, it includes reading and communicating through visual representations and narratives, a critical component of thinking and problem-solving. Charts, maps, grids, symbols, pictures, and more, help students understand, summarize, and analyze information

presented to them, and not just in math class. *Step Up to Writing* recognizes the importance of helping students comprehend and work with visual media; it is an element of the overall program strategies that teachers can use with their students. Not only are students encouraged to use precise mathematical language – whether in writing or through number and letter symbols, but they are also taught to display, summarize, analyze, and evaluate information presented in visual forms. Teachers are encouraged to adapt specific writing assignments to match individual visual literacy goals.

For example:

- Section 1: Writing to improve reading and listening comprehension (Responding to information in the text with words, symbols, and pictures; making connections to self/text/world; quick sketches; taking notes; making inferences and analyzing; retelling and summarizing; asking and answering questions – oral and written)
- Section 2: Vocabulary (Developing and using a strong mathematical vocabulary – the language of mathematics; breaking down definitions with examples and illustrations; concept and word maps; writing meaningful sentences; using precise word choice)
- Section 9: Specific writing assignments (Writing in math; writing to explain a graph or other visual representation of information; writing for assessments; technical writing; science reports; persuasive; compare/contrast; cause/effect; biographical and autobiographical sketches; personal response and reflection; poetry; letters; and more)
- Section 10: Assessment and high standards (Editing with CUPS – capitalization, usage, punctuation, and spelling; quick checks for self-evaluation; scoring guides with *below basic*, *basic*, *proficient*, and *advanced* writing samples; monitoring student progress)

REFERENCES

Auman, Maureen. *Step Up to Writing*. 3rd ed. Boston: Sopris West Educational Services, 2008.

National Council of Teachers of Mathematics. *Principles and Standards for School Mathematics*. 2000. 10 Sep 2008. <<http://standards.nctm.org/>>

See also:

Auman, Maureen and Debbie Valette. *Step Up to Writing in Math*. Boston: Sopris West Educational Services, 2008.

CONTENTS:

- Section 1: Vocabulary
- Section 2: Reading & Note Taking
- Section 3: Summarizing
- Section 4: Asking and Answering Questions
- Section 5: Writing for Assessments
- Section 6: Writing for General Assignments
- Section 7: Creative and Personal Writing