

APPENDIX I

The elementary school standards are set at a level of performance approximately equivalent to the end of fourth grade. The middle school standards are set at a level of performance approximately equivalent to the end of eighth grade. The high school standards are set at a level of performance approximately equivalent to the end of tenth grade. It is expected that some students might achieve these levels earlier and others later than these grades.

An array of work is required to achieve any single standard. The work becomes increasingly refined and sophisticated as students get older. The complexity of the tasks used to generate the work also increases. This notion of requiring students to hone the sophistication of their performances while simultaneously working with increasingly complex assignments cuts across all the English Language Arts standards.

These standards allow for oral performances of student work whenever appropriate.

Elementary School

E1 a The student reads at least twenty-five books or book equivalents each year. The quality and complexity of the materials to be read are illustrated in the sample reading list. The materials should include traditional and contemporary literature (both fiction and non-fiction) as well as magazines, newspapers, textbooks, and on-line materials. Such reading should represent a diverse collection of material from at least three different literary forms and from at least five different writers.

E1 b The student reads and comprehends at least four books (or book equivalents) about one issue or subject, or four books by a single writer, or four books in one genre, and produces evidence of reading that:

- makes and supports warranted and responsible assertions about the texts;
- supports assertions with elaborated and convincing evidence;
- draws the texts together to compare and contrast themes, characters, and ideas;
- makes perceptive and well developed connections;
- evaluates writing strategies and elements of the author's craft.

E1 c The student reads and comprehends informational materials to develop understanding and expertise and produces written or oral work that:

- restates or summarizes information;
- relates new information to prior knowledge and experience;
- extends ideas;
- makes connections to related topics or information.

E1 d The student reads aloud, accurately (in the range of 85-90%), familiar material of the quality and complexity illustrated in the sample reading list, and in a way that makes meaning clear to listeners by:

- self correcting when subsequent reading indicates an earlier miscue;
- using a range of cueing systems, e.g., phonics and context clues, to determine pronunciation and meanings;
- reading with a rhythm, flow, and meter that sounds like everyday speech.

Middle School

E1 a The student reads at least twenty-five books or book equivalents each year. The quality and complexity of the materials to be read are illustrated in the sample reading list. The materials should include traditional and contemporary literature (both fiction and non-fiction) as well as magazines, newspapers, textbooks, and on-line materials. Such reading should represent a diverse collection of material from at least three different literary forms and from at least five different writers.

E1 b The student reads and comprehends at least four books (or book equivalents) about one issue or subject, or four books by a single writer, or four books in one genre, and produces evidence of reading that:

- makes and supports warranted and responsible assertions about the texts;
- supports assertions with elaborated and convincing evidence;
- draws the texts together to compare and contrast themes, characters, and ideas;
- makes perceptive and well developed connections;
- evaluates writing strategies and elements of the author's craft.

E1 c The student reads and comprehends informational materials to develop understanding and expertise and produces written or oral work that:

- restates or summarizes information;
- relates new information to prior knowledge and experience;
- extends ideas;
- makes connections to related topics or information.

E1 d The student demonstrates familiarity with a variety of public documents (i.e., documents that focus on civic issues or matters of public policy at the community level and beyond) and produces written or oral work that does one or more of the following:

- identifies the social context of the document;
- identifies the author's purpose and stance;
- analyzes the arguments and positions advanced and the evidence offered in support of them, or formulates an argument and offers evidence to support it;

High School

E1 a The student reads at least twenty-five books or book equivalents each year. The quality and complexity of the materials to be read are illustrated in the sample reading list. The materials should include traditional and contemporary literature (both fiction and non-fiction) as well as magazines, newspapers, textbooks, and on-line materials. Such reading should represent a diverse collection of material from at least three different literary forms and from at least five different writers.

E1 b The student reads and comprehends at least four books (or book equivalents) about one issue or subject, or four books by a single writer, or four books in one genre, and produces evidence of reading that:

- makes and supports warranted and responsible assertions about the texts;
- supports assertions with elaborated and convincing evidence;
- draws the texts together to compare and contrast themes, characters, and ideas;
- makes perceptive and well developed connections;
- evaluates writing strategies and elements of the author's craft.

E1 c The student reads and comprehends informational materials to develop understanding and expertise and produces written or oral work that:

- restates or summarizes information;
- relates new information to prior knowledge and experience;
- extends ideas;
- makes connections to related topics or information.

E6 Public Documents

E6 a The student critiques public documents with an eye to strategies common in public discourse, including:

- effective use of argument;
- use of the power of anecdote;
- anticipation of counter-claims;
- appeal to audiences both friendly and hostile to the position presented;
- use of emotionally laden words and imagery;
- citing of appropriate references or authorities.

Much writing can be classified as belonging to the public arena. New Standards, however, defines public documents to mean those pieces of text that are concerned with public policy, that address controversial issues confronting the public, or that arise in response to controversial issues or public policy. Public documents are included in the Reading standard at middle school level (E1 d) and constitute a separate standard at high school level (E6). At the middle school level, the issues students write about come primarily from the school or local community. At high school, students should address issues which are of national importance.

Functional writing is writing that exists in order to get things done. Functional writing is ordinarily considered technical writing and, as such, is often not part of the typical English curriculum. New Standards requires students to demonstrate proficiency with functional writing because such writing is of increasing importance to the complex literacy of our culture. Functional documents are included in the Reading standard at middle school level (E1 e) and constitute a separate standard at high school level (E7).

- examines or makes use of the appeal of a document to audiences both friendly and hostile to the position presented;
- identifies or uses commonly used persuasive techniques.

E1 e The student demonstrates familiarity with a variety of functional documents (i.e., documents that exist in order to get things done) and produces written or oral work that does one or more of the following:

- identifies the institutional context of the document;
- identifies the sequence of activities needed to carry out a procedure;
- analyzes or uses the formatting techniques used to make a document user-friendly;
- identifies any information that is either extraneous or missing in terms of audience and purpose or makes effective use of relevant information.

E6 b The student produces public documents, in which the student:

- exhibits an awareness of the importance of precise word choice and the power of imagery and/or anecdote;
- utilizes and recognizes the power of logical arguments, arguments based on appealing to a reader's emotions, and arguments dependent upon the writer's persona;
- uses arguments that are appropriate in terms of the knowledge, values, and degree of understanding of the intended audience;
- uses a range of strategies to appeal to readers.

E7 Functional Documents

E7 a The student critiques functional documents with an eye to strategies common to effective functional documents, including:

- visual appeal, e.g., format, graphics, white space, headers;
- logic of the sequence in which the directions are given;
- awareness of possible reader misunderstandings.

E7 b The student produces functional documents appropriate to audience and purpose, in which the student:

- reports, organizes, and conveys information and ideas accurately;
- includes relevant narrative details, such as scenarios, definitions, and examples;
- anticipates readers' problems, mistakes, and misunderstandings;
- uses a variety of formatting techniques, such as headings, subordinate terms, foregrounding of main ideas, hierarchical structures, graphics, and color;
- establishes a persona that is consistent with the document's purpose;
- employs word choices that are consistent with the persona and appropriate for the intended audience.

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The number of books required for **E1 a** does not increase as students get older, but the length and complexity of what is read does increase (as indicated by the sample reading lists), so, this standard becomes increasingly formidable.

E1 a assumes an adequate library of appropriate reading material. In some places, library resources are too meager to support the amount of reading required for every student to achieve this standard. Where a shortage of books exists, better use of out-of-school resources must be made; for example, students may have to be assured access to local or county libraries.

Reading twenty-five books a year entails a substantial amount of time. Students may use materials read in conjunction with their regular class work, including courses other than English, to satisfy this requirement.

Elementary School

Fiction

Brink, *Caddie Woodlawn*;
 Cleary, *Ramona and Her Father*;
 Coerr, *The Josefina Story Quilt*;
 Cohen, *Fat Jack*;
 De Saint-Exupery, *The Little Prince*;
 Hamilton, *Zeely*;
 Hansen, *The Gift-Giver*;
 Lord, *In the Year of the Boar and Jackie Robinson*;
 Mendez and Byard, *The Black Snowman*;
 Naidoo, *Journey to Jo'burg*;
 O'Dell, *Zia*;
 Ringgold, *Tar Beach*;
 Speare, *The Sign of the Beaver*;
 Yep, *Child of the Owl*.

Non-Fiction

Aliki, *Corn Is Maize: The Gift of the Indians*;
 Baylor, *The Way to Start a Day*;
 Cherry, *The Great Kapok Tree*;
 Epstein, *History of Women in Science for Young People*;
 Fritz, *And Then What Happened, Paul Revere?*;
 Godkin, *Wolf Island*;
 Greenfield, *Childtimes: A Three-Generation Memoir*;
 Hamilton, *Anthony Burns: The Defeat and Triumph of a Fugitive Slave*;
 McGovern, *The Secret Soldier: The Story of Deborah Sampson*;
 McKissack, *Frederick Douglass: The Black Lion*;
 Politi, *Song of the Swallows*;
 Sattler, *Dinosaurs of North America*.

Poetry

Ahlberg, *Heard It in the Playground*;
 Blishen and Wildsmith, *Oxford Book of Poetry for Children*;
 De Regniers, Moore, White, and Carr, eds., *Sing a Song of Popcorn*;
 Giovanni, *Ego-Tripping and Other Poems for Young People*;
 Greenfield, *Honey, I Love and Other Love Poems*;
 Heard, *For the Good of the Earth and Sun*;
 Janeczko, *Strings: A Gathering of Family Poems*;
 Koch and Farrell, eds., *Talking to the Sun*;
 Lobel, ed., *The Random House Book of Mother Goose*;
 Manguel, ed., *Seasons*;
 Mathis, *Red Dog, Blue Fly: Football Poems*;
 Silverstein, *Where the Sidewalk Ends*.

Folklore

French, *Snow White in New York*;
 Goble, *Buffalo Woman*;
 Griego y Maestas, *Cuentos: Tales From the Hispanic Southwest*;
 Huck and Lobel, *Princess Furball*;
 Kipling, *The Elephant's Child*;

Middle School

Fiction

Anaya, *Bless Me, Ultima*;
 Armstrong, *Souder*;
 Bonham, *Durango Street*;
 Cohen, *Tell Us Your Secret*;
 Collier, *My Brother Sam Is Dead*;
 Cormier, *I Am the Cheese*;
 Danziger, *The Cat Ate My Gynsuit*;
 Fast, *April Morning*;
 Gaines, *A Gathering of Old Men*;
 Goldman, *The Princess Bride*;
 Greene, *Summer of My German Soldier*;
 Hansen, *Which Way Freedom*;
 Hinton, *The Outsiders*;
 Holman, *Slake's Limbo*;
 London, *The Call of the Wild*;
 Mathis, *Listen for the Fig Tree*;
 Mohr, *Nilda*;
 Neufeld, *Lisa, Bright and Dark*;
 O'Brien, *Z for Zachariah*;
 Schaefer, *Shane*;
 Stevenson, *Treasure Island*;
 Voigt, *Dacey's Song*;
 Walker, *To Hell With Dying*;
 Walter, *Because We Are*;
 Zindel, *The Pigman*.

Non-Fiction

Amory, *The Cat Who Came for Christmas*;
 Berck, *No Place to Be: Voices of Homeless Children*;
 Frank, *The Diary of a Young Girl*;
 George, *The Talking Earth*;
 Gilbreth, *Cheaper by the Dozen*;
 Haskins, *Outward Dreams*;
 Hautzig, *Endless Steppe: A Girl in Exile*;
 Herriott, *All Creatures Great and Small*;
 Lester, *To Be a Slave*;
 Meyers, *Pearson, a Harbor Seal Pup*;
 Reiss, *The Upstairs Room*;
 Soto, *Living Up the Street*;
 White, *Ryan White: My Own Story*;
 Yates, *Amos Fortune, Free Man*.

Poetry

Adams, *Poetry of Earth and Sky*;
 Eliot, *Old Possum's Book of Practical Cats*;
 Frost, *You Come Too*;
 Greenfield, *Night on Neighborhood Street*;
 Livingston, *Cat Poems*.

Drama

Blinn, *Brian's Song*;
 Davis, *Escape to Freedom*;
 Gibson, *The Miracle Worker*;
 Lawrence and Lee, *Inherit the Wind*;
 Osborn, *On Borrowed Time*;

High School

Fiction

Carroll, *Alice in Wonderland*;
 Cisneros, *The House on Mango Street*;
 Clark, *The Ox-Bow Incident*;
 Golding, *Lord of the Flies*;
 Hawthorne, *The Scarlet Letter*;
 Hemingway, *For Whom the Bell Tolls*;
 Hentoff, *The Day They Came to Arrest the Book*;
 Hilton, *Goodbye, Mr. Chips*;
 Kinsella, *Sholess Joe*;
 Knowles, *A Separate Peace*;
 Lee, *To Kill a Mockingbird*;
 McCullers, *The Heart Is a Lonely Hunter*;
 Orwell, *1984*;
 Paulsen, *Canyons*;
 Portis, *True Grit*;
 Potok, *Davita's Harp*;
 Stoker, *Dracula*;
 Wartski, *A Boat to Nowhere*;
 Welty, *The Golden Apples*.

Non-Fiction

Angell, *Late Innings*;
 Angelou, *I Know Why the Caged Bird Sings*;
 Ashe, *Days of Grace*;
 Beal, "I Will Fight No More Forever": *Chief Joseph and the Nez Perce War*;
 Bishop, *The Day Lincoln Was Shot*;
 Bloom, *The Closing of the American Mind*;
 Campbell, *The Power of Myth*;
 Covey, *Seven Habits of Highly Effective People*;
 Galarza, *Barrio Boy*;
 Hawking, *A Brief History of Time*;
 Houston, *Farewell to Manzanar*;
 Kennedy, *Profiles in Courage*;
 Kingsley and Levitz, *Count Us In: Growing Up With Down Syndrome*;
 Kingston, *Woman Warrior*;
 Mazer, ed., *Going Where I'm Coming From*;
 Momaday, *The Way to Rainy Mountain*;
 Rodriguez, *Hunger for Memory*;
 Sternberg, *User's Guide to the Internet*;
 Wright, *Black Boy*.

Poetry

Angelou, *I Shall Not be Moved*;
 Bly, ed., *News of the Universe*;
 Carruth, ed., *The Voice That Is Great Within Us*;
 Cummings, *Collected Poems*;
 Dickinson, *Complete Poems*;
 Hughes, *Selected Poems*;
 Knudson and Swenson, eds., *American Sports Poems*;
 Longfellow, *Evangeline*;
 Randall, ed., *The Black Poets*;
 Wilbur, *Things of This World*.

Luenn, *The Dragon Kite*;
 Steptoe, *Mufaro's Beautiful Daughters*;
 Steptoe, *The Story of Jumping Mouse*.

Modern Fantasy and Science Fiction

Andersen, *The Ugly Duckling*;
 Bond, *A Bear Called Paddington*;
 Dahl, *James and the Giant Peach*;
 Grahame, *The Wind in the Willows*;
 Lewis, *The Lion, the Witch and the Wardrobe*;
 Norton, *The Borrowers*;
 Van Allsburg, *Jumanji*;
 White, *Charlotte's Web*.

Children's magazines

Action (Scholastic);
Creative Classroom;
News (Scholastic);
Social Studies for the Young Learner;
TIME FOR KIDS;
Weekly Reader;
World (National Geographic).

Other

Newspapers, manuals appropriate for elementary school children, e.g., video game instructions, computer manuals.

Shakespeare, *A Midsummer Night's Dream*;
 Stone, *Metamora, or, the Last of the Wampanoags*.

Folklore/Mythology

Blair, *Tall Tale America*;
 Bruchac, *The First Strawberries: A Cherokee Story*;
 Bryan, *Beat the Story-Drum, Pum-Pum*;
 D'Aulaire, *Norse Gods and Giants*;
 Gallico, *The Snow Goose*;
 Lee, *Toad Is the Uncle of Heaven: A Vietnamese Folk Tale*;
 Pyle, *Merry Adventures of Robin Hood*.

Modern Fantasy and Science Fiction

Babbitt, *Tuck Everlasting*;
 Bradbury, *Dandelion Wine*;
 Cooper, *The Grey King*;
 Hamilton, *The Magical Adventures of Pretty Pearl*;
 L'Engle, *A Wrinkle in Time*;
 Tolkien, *The Hobbit*;
 Yep, *Dragon of the Lost Sea*.

Magazines/Periodicals

Calliope (world history);
Cobblestone (American history);
Faces (anthropology);
Junior Scholastic (Scholastic);
Odyssey (science);
Science World (Scholastic);
Scope (Scholastic);
World (National Geographic);.

Other

Computer manuals; instructions; contracts. See also the reading lists included in award books corresponding to reading provided by the Girl Scouts of the U.S.A. and the Boy Scouts of America.

Drama

Christie, *And Then There Were None*;
 Hansberry, *A Raisin in the Sun*;
 McCullers, *The Member of the Wedding*;
 Pomerance, *The Elephant Man*;
 Rose, *Twelve Angry Men*;
 Rostand, *Cyrano de Bergerac*;
 Shakespeare, *Romeo and Juliet*; *Julius Caesar*;
 Van Druten, *I Remember Mama*;
 Wilder, *The Skin of Our Teeth*;
 Wilson, *The Piano Lesson*.

Folklore/Mythology

Burland, *North American Indian Mythology*;
 Evslin, *Adventures of Ulysses*;
 Pinsent, *Greek Mythology*;
 Stewart, *The Crystal Cave*;
 White, *The Once and Future King*.

Modern Fantasy and Science Fiction

Adams, *Watership Down*;
 Asimov, *Foundation*;
 Bradbury, *The Martian Chronicles*;
 Clarke, *2001: A Space Odyssey*;
 Clarke, *Childhood's End*;
 Frank, *Alas, Babylon*;
 Herbert, *Dune*;
 Lewis, *Out of the Silent Planet*;
 McCaffrey, *Dragonflight*;
 Twain, *A Connecticut Yankee in King Arthur's Court*;
 Verne, *20,000 Leagues Under the Sea*.

Magazines and Newspapers

Literary Cavalcade (Scholastic);
National Geographic;
Newsweek;
Omni;
Smithsonian;
Sports Illustrated;
Time.

Other

Computer manuals; instructions; contracts; technical materials.

E2 Writing

APPENDIX I

E2 b is meant to replace the repertoire of responses that students traditionally write when they respond to literature. This type of response requires an understanding of writing strategies.

The work students produce to meet the English Language Arts standards does not all have to come from an English class. Students should be encouraged to use work from subjects in addition to English to demonstrate their accomplishments. The work samples include some examples of work produced in other classes that meet requirements of these standards.

Elementary School

E2 a The student produces a report that:

- engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;
- develops a controlling idea that conveys a perspective on the subject;
- creates an organizing structure appropriate to a specific purpose, audience, and context;
- includes appropriate facts and details;
- excludes extraneous and inappropriate information;
- uses a range of appropriate strategies, such as providing facts and details, describing or analyzing the subject, and narrating a relevant anecdote;
- provides a sense of closure to the writing.

E2 b The student produces a response to literature that:

- engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;
- advances a judgment that is interpretive, analytic, evaluative, or reflective;
- supports judgment through references to the text, references to other works, authors, or non-print media, or references to personal knowledge;
- demonstrates an understanding of the literary work;
- provides a sense of closure to the writing.

E2 c The student produces a narrative account (fictional or autobiographical) that:

- engages the reader by establishing a context, creating a point of view, and otherwise developing reader interest;
- establishes a situation, plot, point of view, setting, and conflict (and for autobiography, the significance of events);
- creates an organizing structure;
- includes sensory details and concrete language to develop plot and character;
- excludes extraneous details and inconsistencies;
- develops complex characters;
- uses a range of appropriate strategies, such as dialogue and tension or suspense;
- provides a sense of closure to the writing.

Middle School

E2 a The student produces a report that:

- engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;
- develops a controlling idea that conveys a perspective on the subject;
- creates an organizing structure appropriate to purpose, audience, and context;
- includes appropriate facts and details;
- excludes extraneous and inappropriate information;
- uses a range of appropriate strategies, such as providing facts and details, describing or analyzing the subject, narrating a relevant anecdote, comparing and contrasting, naming, and explaining benefits or limitations;
- provides a sense of closure to the writing.

E2 b The student produces a response to literature that:

- engages the reader through establishing a context, creating a persona, and otherwise developing reader interest;
- advances a judgment that is interpretive, analytic, evaluative, or reflective;
- supports a judgment through references to the text, references to other works, authors, or non-print media, or references to personal knowledge;
- demonstrates an understanding of the literary work;
- anticipates and answers a reader's questions;
- provides a sense of closure to the writing.

E2 c The student produces a narrative account (fictional or autobiographical) that:

- engages the reader by establishing a context, creating a point of view, and otherwise developing reader interest;
- establishes a situation, plot, point of view, setting, and conflict (and for autobiography, the significance of events and of conclusions that can be drawn from those events);
- creates an organizing structure;
- includes sensory details and concrete language to develop plot and character;
- excludes extraneous details and inconsistencies;

High School

E2 a The student produces a report that:

- engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;
- develops a controlling idea that conveys a perspective on the subject;
- creates an organizing structure appropriate to purpose, audience, and context;
- includes appropriate facts and details;
- excludes extraneous and inappropriate information;
- uses a range of appropriate strategies, such as providing facts and details, describing or analyzing the subject, narrating a relevant anecdote, comparing and contrasting, naming, explaining benefits or limitations, demonstrating claims or assertions, and providing a scenario to illustrate;
- provides a sense of closure to the writing.

E2 b The student produces a response to literature that:

- engages the reader through establishing a context, creating a persona, and otherwise developing reader interest;
- advances a judgment that is interpretive, analytic, evaluative, or reflective;
- supports a judgment through references to the text, references to other works, authors, or non-print media, or references to personal knowledge;
- demonstrates understanding of the literary work through suggesting an interpretation;
- anticipates and answers a reader's questions;
- recognizes possible ambiguities, nuances, and complexities;
- provides a sense of closure to the writing.

E2 c The student produces a narrative account (fictional or autobiographical) that:

- engages the reader by establishing a context, creating a point of view, and otherwise developing reader interest;
- establishes a situation, plot, point of view, setting, and conflict (and for autobiography, the significance of events and of conclusions that can be drawn from those events);
- creates an organizing structure;
- includes sensory details and concrete language to develop plot and character;
- excludes extraneous details and inconsistencies;
- develops complex characters;
- uses a range of appropriate strategies, such as dialogue, tension or suspense, naming, pacing,

E2 d The student produces a narrative procedure that:

- engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;
- provides a guide to action that anticipates a reader's needs; creates expectations through predictable structures, e.g., headings; and provides transitions between steps;
- makes use of appropriate writing strategies such as creating a visual hierarchy and using white space and graphics as appropriate;
- includes relevant information;
- excludes extraneous information;
- anticipates problems, mistakes, and misunderstandings that might arise for the reader;
- provides a sense of closure to the writing.

- develops complex characters;
- uses a range of appropriate strategies, such as dialogue, tension or suspense, naming, and specific narrative action, e.g., movement, gestures, expressions;
- provides a sense of closure to the writing.

E2 d The student produces a narrative procedure that:

- engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;
- provides a guide to action for a relatively complicated procedure in order to anticipate a reader's needs; creates expectations through predictable structures, e.g., headings; and provides transitions between steps;
- makes use of appropriate writing strategies such as creating a visual hierarchy and using white space and graphics as appropriate;
- includes relevant information;
- excludes extraneous information;
- anticipates problems, mistakes, and misunderstandings that might arise for the reader;
- provides a sense of closure to the writing.

E2 e The student produces a persuasive essay that:

- engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;
- develops a controlling idea that makes a clear and knowledgeable judgment;
- creates and organizes a structure that is appropriate to the needs, values, and interests of a specified audience, and arranges details, reasons, examples, and anecdotes effectively and persuasively;
- includes appropriate information and arguments;
- excludes information and arguments that are irrelevant;
- anticipates and addresses reader concerns and counter-arguments;
- supports arguments with detailed evidence, citing sources of information as appropriate;
- provides a sense of closure to the writing.

and specific narrative action, e.g., movement, gestures, expressions;

- provides a sense of closure to the writing.

E2 d The student produces a narrative procedure that:

- engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;
- provides a guide to action for a complicated procedure in order to anticipate a reader's needs; creates expectations through predictable structures, e.g., headings; and provides smooth transitions between steps;
- makes use of appropriate writing strategies, such as creating a visual hierarchy and using white space and graphics as appropriate;
- includes relevant information;
- excludes extraneous information;
- anticipates problems, mistakes, and misunderstandings that might arise for the reader;
- provides a sense of closure to the writing.

E2 e The student produces a persuasive essay that:

- engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;
- develops a controlling idea that makes a clear and knowledgeable judgment;
- creates an organizing structure that is appropriate to the needs, values, and interests of a specified audience, and arranges details, reasons, examples, and anecdotes effectively and persuasively;
- includes appropriate information and arguments;
- excludes information and arguments that are irrelevant;
- anticipates and addresses reader concerns and counter-arguments;
- supports arguments with detailed evidence, citing sources of information as appropriate;
- uses a range of strategies to elaborate and persuade, such as definitions, descriptions, illustrations, examples from evidence, and anecdotes;
- provides a sense of closure to the writing.

E2 f The student produces a reflective essay that:

- engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;
- analyzes a condition or situation of significance;
- develops a commonplace, concrete occasion as the basis for the reflection, e.g., personal observation or experience;
- creates an organizing structure appropriate to purpose and audience;
- uses a variety of writing strategies, such as concrete details, comparing and contrasting, naming, describing, creating a scenario;
- provides a sense of closure to the writing.

E3 Speaking, Listening, and Viewing

APPENDIX I

Elementary School

E3 a The student participates in one-to-one conferences with a teacher, paraprofessional, or adult volunteer, in which the student:

- initiates new topics in addition to responding to adult-initiated topics;
- asks relevant questions;
- responds to questions with appropriate elaboration;
- uses language cues to indicate different levels of certainty or hypothesizing, e.g., “what if...,” “very likely...,” “I’m unsure whether...”;
- confirms understanding by paraphrasing the adult’s directions or suggestions.

E3 b The student participates in group meetings, in which the student:

- displays appropriate turn-taking behaviors;
- actively solicits another person’s comment or opinion;
- offers own opinion forcefully without dominating;
- responds appropriately to comments and questions;
- volunteers contributions and responds when directly solicited by teacher or discussion leader;
- gives reasons in support of opinions expressed;
- clarifies, illustrates, or expands on a response when asked to do so; asks classmates for similar expansions.

E3 c The student prepares and delivers an individual presentation, in which the student:

- shapes information to achieve a particular purpose and to appeal to the interests and background knowledge of audience members;
- shapes content and organization according to criteria for importance and impact rather than according to availability of information in resource materials;
- uses notes or other memory aids to structure the presentation;
- engages the audience with appropriate verbal cues and eye contact;
- projects a sense of individuality and personality in selecting and organizing content, and in delivery.

Middle School

E3 a The student participates in one-to-one conferences with a teacher, paraprofessional, or adult volunteer, in which the student:

- initiates new topics in addition to responding to adult-initiated topics;
- asks relevant questions;
- responds to questions with appropriate elaboration;
- uses language cues to indicate different levels of certainty or hypothesizing, e.g., “what if...,” “very likely...,” “I’m unsure whether...”;
- confirms understanding by paraphrasing the adult’s directions or suggestions.

E3 b The student participates in group meetings, in which the student:

- displays appropriate turn-taking behaviors;
- actively solicits another person’s comment or opinion;
- offers own opinion forcefully without dominating;
- responds appropriately to comments and questions;
- volunteers contributions and responds when directly solicited by teacher or discussion leader;
- gives reasons in support of opinions expressed;
- clarifies, illustrates, or expands on a response when asked to do so; asks classmates for similar expansions;
- employs a group decision-making technique such as brainstorming or a problem-solving sequence (e.g., recognize problem, define problem, identify possible solutions, select optimal solution, implement solution, evaluate solution).

E3 c The student prepares and delivers an individual presentation in which the student:

- shapes information to achieve a particular purpose and to appeal to the interests and background knowledge of audience members;
- shapes content and organization according to criteria for importance and impact rather than according to availability of information in resource materials;
- uses notes or other memory aids to structure the presentation;

High School

E3 a The student participates in one-to-one conferences with a teacher, paraprofessional, or adult volunteer, in which the student:

- initiates new topics in addition to responding to adult-initiated topics;
- asks relevant questions;
- responds to questions with appropriate elaboration;
- uses language cues to indicate different levels of certainty or hypothesizing, e.g., “what if...,” “very likely...,” “I’m unsure whether...”;
- confirms understanding by paraphrasing the adult’s directions or suggestions.

E3 b The student participates in group meetings, in which the student:

- displays appropriate turn-taking behaviors;
- actively solicits another person’s comment or opinion;
- offers own opinion forcefully without dominating;
- responds appropriately to comments and questions;
- volunteers contributions and responds when directly solicited by teacher or discussion leader;
- gives reasons in support of opinions expressed;
- clarifies, illustrates, or expands on a response when asked to do so; asks classmates for similar expansions;
- employs a group decision-making technique such as brainstorming or a problem-solving sequence (e.g., recognize problem, define problem, identify possible solutions, select optimal solution, implement solution, evaluate solution);
- divides labor so as to achieve the overall group goal efficiently.

E3 c The student prepares and delivers an individual presentation, in which the student:

- shapes information to achieve a particular purpose and to appeal to the interests and background knowledge of audience members;
- shapes content and organization according to criteria for importance and impact rather than according to availability of information in resource materials;

E3 d The student makes informed judgments about television, radio, and film productions; that is, the student:

- demonstrates an awareness of the presence of the media in the daily lives of most people;
- evaluates the role of the media in focusing attention and in forming an opinion;
- judges the extent to which the media provide a source of entertainment as well as a source of information;
- defines the role of advertising as part of media presentation.

- develops several main points relating to a single thesis;
- engages the audience with appropriate verbal cues and eye contact;
- projects a sense of individuality and personality in selecting and organizing content, and in delivery.

E3 d The student makes informed judgments about television, radio, and film productions; that is, the student:

- demonstrates an awareness of the presence of the media in the daily lives of most people;
- evaluates the role of the media in focusing attention and in forming opinion;
- judges the extent to which the media are a source of entertainment as well as a source of information;
- defines the role of advertising as part of media presentation.

- uses notes or other memory aids to structure the presentation;
- develops several main points relating to a single thesis;
- engages the audience with appropriate verbal cues and eye contact;
- projects a sense of individuality and personality in selecting and organizing content, and in delivery.

E3 d The student makes informed judgments about television, radio, and film productions; that is, the student:

- demonstrates an awareness of the presence of the media in the daily lives of most people;
- evaluates the role of the media in focusing attention and in forming opinion;
- judges the extent to which the media are a source of entertainment as well as a source of information;
- defines the role of advertising as part of media presentation.

E3 e The student listens to and analyzes a public speaking performance; that is, the student:

- takes notes on salient information;
- identifies types of arguments (e.g., causation, authority, analogy) and identifies types of logical fallacies (e.g., ad hominem, inferring causation from correlation, over-generalization);
- accurately summarizes the essence of each speaker's remarks;
- formulates a judgment about the issues under discussion.

E4 Conventions, Grammar, and Usage of the English Language

APPENDIX I

Elementary School

E4 a The student demonstrates a basic understanding of the rules of the English language in written and oral work, and selects the structures and features of language appropriate to the purpose, audience, and context of the work. The student demonstrates control of:

- grammar;
- paragraph structure;
- punctuation;
- sentence construction;
- spelling;
- usage.

E4 b The student analyzes and subsequently revises work to clarify it or make it more effective in communicating the intended message or thought. The student's revisions should be made in light of the purposes, audiences, and contexts that apply to the work. Strategies for revising include:

- adding or deleting details;
- adding or deleting explanations;
- clarifying difficult passages;
- rearranging words, sentences, and paragraphs to improve or clarify meaning;
- sharpening the focus;
- reconsidering the organizational structure.

Middle School

E4 a The student demonstrates an understanding of the rules of the English language in written and oral work, and selects the structures and features of language appropriate to the purpose, audience, and context of the work. The student demonstrates control of:

- grammar;
- paragraph structure;
- punctuation;
- sentence construction;
- spelling;
- usage.

E4 b The student analyzes and subsequently revises work to clarify it or make it more effective in communicating the intended message or thought. The student's revisions should be made in light of the purposes, audiences, and contexts that apply to the work. Strategies for revising include:

- adding or deleting details;
- adding or deleting explanations;
- clarifying difficult passages;
- rearranging words, sentences, and paragraphs to improve or clarify meaning;
- sharpening the focus;
- reconsidering the organizational structure.

High School

E4 a The student independently and habitually demonstrates an understanding of the rules of the English language in written and oral work, and selects the structures and features of language appropriate to the purpose, audience, and context of the work. The student demonstrates control of:

- grammar;
- paragraph structure;
- punctuation;
- sentence construction;
- spelling;
- usage.

E4 b The student analyzes and subsequently revises work to clarify it or make it more effective in communicating the intended message or thought. The student's revisions should be made in light of the purposes, audiences, and contexts that apply to the work. Strategies for revising include:

- adding or deleting details;
- adding or deleting explanations;
- clarifying difficult passages;
- rearranging words, sentences, and paragraphs to improve or clarify meaning;
- sharpening the focus;
- reconsidering the organizational structure;
- rethinking and/or rewriting the piece in light of different audiences and purposes.

E5 Literature

APPENDIX I

Elementary School

E5 a The student responds to non-fiction, fiction, poetry, and drama using interpretive, critical, and evaluative processes; that is, the student:

- identifies recurring themes across works;
- analyzes the impact of authors' decisions regarding word choice and content;
- considers the differences among genres;
- evaluates literary merit;
- considers the function of point of view or persona;
- examines the reasons for a character's actions, taking into account the situation and basic motivation of the character;
- identifies stereotypical characters as opposed to fully developed characters;
- critiques the degree to which a plot is contrived or realistic;
- makes inferences and draws conclusions about contexts, events, characters, and settings.

E5 b The student produces work in at least one literary genre that follows the conventions of the genre.

Middle School

E5 a The student responds to non-fiction, fiction, poetry, and drama using interpretive, critical, and evaluative processes; that is, the student:

- identifies recurring themes across works;
- interprets the impact of authors' decisions regarding word choice, content, and literary elements;
- identifies the characteristics of literary forms and genres;
- evaluates literary merit;
- identifies the effect of point of view;
- analyzes the reasons for a character's actions, taking into account the situation and basic motivation of the character;
- makes inferences and draws conclusions about fictional and non-fictional contexts, events, characters, settings, and themes;
- identifies stereotypical characters as opposed to fully developed characters;
- identifies the effect of literary devices such as figurative language, allusion, diction, dialogue, and description.

E5 b The student produces work in at least one literary genre that follows the conventions of the genre.

High School

E5 a The student responds to non-fiction, fiction, poetry, and drama using interpretive, critical, and evaluative processes; that is, the student:

- makes thematic connections among literary texts, public discourse, and media;
- evaluates the impact of authors' decisions regarding word choice, style, content, and literary elements;
- analyzes the characteristics of literary forms and genres;
- evaluates literary merit;
- explains the effect of point of view;
- makes inferences and draws conclusions about fictional and non-fictional contexts, events, characters, settings, themes, and styles;
- interprets the effect of literary devices, such as figurative language, allusion, diction, dialogue, description, symbolism;
- evaluates the stance of a writer in shaping the presentation of a subject;
- interprets ambiguities, subtleties, contradictions, ironies, and nuances;
- understands the role of tone in presenting literature (both fictional and non-fictional);
- demonstrates how literary works (both fictional and non-fictional) reflect the culture that shaped them.

E5 b The student produces work in at least one literary genre that follows the conventions of the genre.

M1 Arithmetic and Number Concepts/Number and Operation Concepts

APPENDIX II

The elementary school standards are set at a level of performance approximately equivalent to the end of fourth grade. The middle school standards are set at a level of performance approximately equivalent to the end of eighth grade. The high school standards are set at a level of performance approximately equivalent to the end of tenth grade or the end of the common core. It is expected that some students might achieve these levels earlier and others later than these grades.

Elementary School

The student produces evidence that demonstrates understanding of arithmetic and number concepts; that is, the student:

M1 a Adds, subtracts, multiplies, and divides whole numbers, with and without calculators; that is:

- adds, i.e., joins things together, increases;
- subtracts, i.e., takes away, compares, finds the difference;
- multiplies, i.e., uses repeated addition, counts by multiples, combines things that come in groups, makes arrays, uses area models, computes simple scales, uses simple rates;
- divides, i.e., puts things into groups, shares equally; calculates simple rates;
- analyzes problem situations and contexts in order to figure out when to add, subtract, multiply, or divide;
- solves arithmetic problems by relating addition, subtraction, multiplication, and division to one another;
- computes answers mentally, e.g., $27 + 45$, 30×4 ;
- uses simple concepts of negative numbers, e.g., on a number line, in counting, in temperature, “owing.”

M1 b Demonstrates understanding of the base ten place value system and uses this knowledge to solve arithmetic tasks; that is:

- counts 1, 10, 100, or 1,000 more than or less than, e.g., 1 less than 10,000, 10 more than 380, 1,000 more than 23,000, 100 less than 9,000;
- uses knowledge about ones, tens, hundreds, and thousands to figure out answers to multiplication and division tasks, e.g., 36×10 , 18×100 , $7 \times 1,000$, $4,000 \div 4$.

M1 c Estimates, approximates, rounds off, uses landmark numbers, or uses exact numbers, as appropriate, in calculations.

M1 d Describes and compares quantities by using concrete and real world models of simple fractions; that is:

- finds simple parts of wholes;
- recognizes simple fractions as instructions to divide, e.g., $\frac{1}{4}$ of something is the same as dividing something by 4;
- recognizes the place of fractions on number lines, e.g., in measurement;

Middle School

The student produces evidence that demonstrates understanding of number and operation concepts; that is, the student:

M1 a Consistently and accurately adds, subtracts, multiplies, and divides rational numbers using appropriate methods (e.g., the student can add $\frac{1}{2} + \frac{3}{8}$ mentally or on paper but may opt to add $\frac{13}{24} + \frac{5}{8}$ on a calculator) and raises rational numbers to whole number powers. (Students should have facility with the different kinds and forms of rational numbers, i.e., integers, both whole numbers and negative integers; and other positive and negative rationals, written as decimals, as percents, or as proper, improper, or mixed fractions. Irrational numbers, i.e., those that cannot be written as a ratio of two integers, are not required content but are suitable for introduction, especially since the student should be familiar with the irrational number π .)

M1 b Uses and understands the inverse relationships between addition and subtraction, multiplication and division, and exponentiation and root-extraction (e.g., squares and square roots, cubes and cube roots); uses the inverse operation to determine unknown quantities in equations.

M1 c Consistently and accurately applies and converts the different kinds and forms of rational numbers.

M1 d Is familiar with characteristics of numbers (e.g., divisibility, prime factorization) and with properties of operations (e.g., commutativity and associativity), short of formal statements.

M1 e Interprets percent as part of 100 and as a means of comparing quantities of different sizes or changing sizes.

M1 f Uses ratios and rates to express “part-to-part” and “whole-to-whole” relationships, and reasons proportionally to solve problems involving equivalent fractions, equal ratios, or constant rates, recognizing the multiplicative nature of these problems in the constant factor of change.

M1 g Orders numbers with the $>$ and $<$ relationships and by location on a number line; estimates and compares rational numbers using sense of the magnitudes and relative magnitudes of numbers and of base-ten place values (e.g., recognizes relationships to “benchmark” numbers $\frac{1}{2}$ and 1 to conclude that the sum $\frac{1}{2} + \frac{3}{8}$ must be between 1 and $1\frac{1}{2}$ (likewise, $\frac{13}{24} + \frac{5}{8}$)).

High School

The student produces evidence that demonstrates understanding of number and operation concepts; that is, the student:

M1 a Uses addition, subtraction, multiplication, division, exponentiation, and root-extraction in forming and working with numerical and algebraic expressions.

M1 b Understands and uses operations such as opposite, reciprocal, raising to a power, taking a root, and taking a logarithm.

M1 c Has facility with the mechanics of operations as well as understanding of their typical meaning and uses in applications.

M1 d Understands and uses number systems: natural, integer, rational, and real.

M1 e Represents numbers in decimal or fraction form and in scientific notation, and graphs numbers on the number line and number pairs in the coordinate plane.

M1 f Compares numbers using order relations, differences, ratios, proportions, percents, and proportional change.

M1 g Carries out proportional reasoning in cases involving part-whole relationships and in cases involving expansions and contractions.

M1 h Understands dimensionless numbers, such as proportions, percents, and multiplicative factors, as well as numbers with specific units of measure, such as numbers with length, time, and rate units.

M1 i Carries out counting procedures such as those involving sets (unions and intersections) and arrangements (permutations and combinations).

M1 j Uses concepts such as prime, relatively prime, factor, divisor, multiple, and divisibility in solving problems involving integers.

M1 k Uses a scientific calculator effectively and efficiently in carrying out complex calculations.

M1 l Recognizes and represents basic number patterns, such as patterns involving multiples, squares, or cubes.

- uses drawings, diagrams, or models to show what the numerator and denominator mean, including when adding like fractions, e.g., $\frac{1}{8} + \frac{1}{8}$, or when showing that $\frac{3}{4}$ is more than $\frac{1}{2}$;
- uses beginning proportional reasoning and simple ratios, e.g., “about half of the people.”

MI e Describes and compares quantities by using simple decimals; that is:

- adds, subtracts, multiplies, and divides money amounts;
- recognizes relationships among simple fractions, decimals, and percents, i.e., that $\frac{1}{2}$ is the same as 0.5, and $\frac{1}{2}$ is the same as 50%, with concrete materials, diagrams, and in real world situations, e.g., when discovering the chance of a coin landing on heads or tails.

MI f Describes and compares quantities by using whole numbers up to 10,000; that is:

- connects ideas of quantities to the real world, e.g., how many people fit in the school’s cafeteria; how far away is a kilometer;
- finds, identifies, and sorts numbers by their properties, e.g., odd, even, multiple, square.

M2 Geometry and Measurement Concepts

APPENDIX II

Elementary School

The student produces evidence that demonstrates understanding of geometry and measurement concepts; that is, the student:

- M2 a** Gives and responds to directions about location, e.g., by using words such as “in front of,” “right,” and “above.”
- M2 b** Visualizes and represents two dimensional views of simple rectangular three dimensional shapes, e.g., by showing the front view and side view of a building made of cubes.
- M2 c** Uses simple two dimensional coordinate systems to find locations on a map and to represent points and simple figures.
- M2 d** Uses many types of figures (angles, triangles, squares, rectangles, rhombi, parallelograms, quadrilaterals, polygons, prisms, pyramids, cubes, circles, and spheres) and identifies the figures by their properties, e.g., symmetry, number of faces, two- or three-dimensionality, no right angles.
- M2 e** Solves problems by showing relationships between and among figures, e.g., using congruence and similarity, and using transformations including flips, slides, and rotations.
- M2 f** Extends and creates geometric patterns using concrete and pictorial models.
- M2 g** Uses basic ways of estimating and measuring the size of figures and objects in the real world, including length, width, perimeter, and area.
- M2 h** Uses models to reason about the relationship between the perimeter and area of rectangles in simple situations.
- M2 i** Selects and uses units, both formal and informal as appropriate, for estimating and measuring quantities such as weight, length, area, volume, and time.
- M2 j** Carries out simple unit conversions, such as between cm and m, and between hours and minutes.
- M2 k** Uses scales in maps, and uses, measures, and creates scales for rectangular scale drawings based on work with concrete models and graph paper.

Middle School

The student produces evidence that demonstrates understanding of geometry and measurement concepts in the following areas; that is, the student:

- M2 a** Is familiar with assorted two- and three-dimensional objects, including squares, triangles, other polygons, circles, cubes, rectangular prisms, pyramids, spheres, and cylinders.
- M2 b** Identifies similar and congruent shapes and uses transformations in the coordinate plane, i.e., translations, rotations, and reflections.
- M2 c** Identifies three dimensional shapes from two dimensional perspectives; draws two dimensional sketches of three dimensional objects that preserve significant features.
- M2 d** Determines and understands length, area, and volume (as well as the differences among these measurements), including perimeter and surface area; uses units, square units, and cubic units of measure correctly; computes areas of rectangles, triangles, and circles; computes volumes of prisms.
- M2 e** Recognizes similarity and rotational and bilateral symmetry in two- and three-dimensional figures.
- M2 f** Analyzes and generalizes geometric patterns, such as tessellations and sequences of shapes.
- M2 g** Measures angles, weights, capacities, times, and temperatures using appropriate units.
- M2 h** Chooses appropriate units of measure and converts with ease between like units, e.g., inches and miles, within a customary or metric system. (Conversions between customary and metric are not required.)
- M2 i** Reasons proportionally in situations with similar figures.
- M2 j** Reasons proportionally with measurements to interpret maps and to make smaller and larger scale drawings.
- M2 k** Models situations geometrically to formulate and solve problems.

High School

The student produces evidence that demonstrates understanding of geometry and measurement concepts; that is, the student:

- M2 a** Models situations geometrically to formulate and solve problems.
- M2 b** Works with two- and three-dimensional figures and their properties, including polygons and circles, cubes and pyramids, and cylinders, cones, and spheres.
- M2 c** Uses congruence and similarity in describing relationships between figures.
- M2 d** Visualizes objects, paths, and regions in space, including intersections and cross sections of three dimensional figures, and describes these using geometric language.
- M2 e** Knows, uses, and derives formulas for perimeter, circumference, area, surface area, and volume of many types of figures.
- M2 f** Uses the Pythagorean Theorem in many types of situations, and works through more than one proof of this theorem.
- M2 g** Works with similar triangles, and extends the ideas to include simple uses of the three basic trigonometric functions.
- M2 h** Analyzes figures in terms of their symmetries using, for example, concepts of reflection, rotation, and translation.
- M2 i** Compares slope (rise over run) and angle of elevation as measures of steepness.
- M2 j** Investigates geometric patterns, including sequences of growing shapes.
- M2 k** Works with geometric measures of length, area, volume, and angle; and non-geometric measures such as weight and time.
- M2 l** Uses quotient measures, such as speed and density, that give “per unit” amounts; and uses product measures, such as person-hours.
- M2 m** Understands the structure of standard measurement systems, both SI and customary, including unit conversions and dimensional analysis.
- M2 n** Solves problems involving scale, such as in maps and diagrams.
- M2 o** Represents geometric curves and graphs of functions in standard coordinate systems.
- M2 p** Analyzes geometric figures and proves simple things about them using deductive methods.
- M2 q** Explores geometry using computer programs such as CAD software, Sketchpad programs, or LOGO.

M3 Function and Algebra Concepts

APPENDIX II

Elementary School

The student produces evidence that demonstrates understanding of function and algebra concepts; that is, the student:

M3 a Uses linear patterns to solve problems; that is:

- shows how one quantity determines another in a linear (“repeating”) pattern, i.e., describes, extends, and recognizes the linear pattern by its rule, such as, the total number of legs on a given number of horses can be calculated by counting by fours;
- shows how one quantity determines another quantity in a functional relationship based on a linear pattern, e.g., for the “number of people and total number of eyes,” figure out how many eyes 100 people have all together.

M3 b Builds iterations of simple non-linear patterns, including multiplicative and squaring patterns (e.g., “growing” patterns) with concrete materials, and recognizes that these patterns are not linear.

M3 c Uses the understanding that an equality relationship between two quantities remains the same as long as the same change is made to both quantities.

M3 d Uses letters, boxes, or other symbols to stand for any number, measured quantity, or object in simple situations with concrete materials, i.e., demonstrates understanding and use of a beginning concept of a variable.

Middle School

The student produces evidence that demonstrates understanding of function and algebra concepts; that is, the student:

M3 a Discovers, describes, and generalizes patterns, including linear, exponential, and simple quadratic relationships, i.e., those of the form $f(n)=n^2$ or $f(n)=cn^2$, for constant c , including $A=r^2$, and represents them with variables and expressions.

M3 b Represents relationships with tables, graphs in the coordinate plane, and verbal or symbolic rules.

M3 c Analyzes tables, graphs, and rules to determine functional relationships.

M3 d Finds solutions for unknown quantities in linear equations and in simple equations and inequalities.

High School

The student produces evidence that demonstrates understanding of function and algebra concepts; that is, the student:

M3 a Models given situations with formulas and functions, and interprets given formulas and functions in terms of situations.

M3 b Describes, generalizes, and uses basic types of functions: linear, exponential, power, rational, square and square root, and cube and cube root.

M3 c Utilizes the concepts of slope, evaluation, and inverse in working with functions.

M3 d Works with rates of many kinds, expressed numerically, symbolically, and graphically.

M3 e Represents constant rates as the slope of a straight line graph, and interprets slope as the amount of one quantity (y) per unit amount of another (x).

M3 f Understands and uses linear functions as a mathematical representation of proportional relationships.

M3 g Uses arithmetic sequences and geometric sequences and their sums, and sees these as the discrete forms of linear and exponential functions, respectively.

M3 h Defines, uses, and manipulates expressions involving variables, parameters, constants, and unknowns in work with formulas, functions, equations, and inequalities.

M3 i Represents functional relationships in formulas, tables, and graphs, and translates between pairs of these.

M3 j Solves equations symbolically, graphically, and numerically, especially linear, quadratic, and exponential equations; and knows how to use the quadratic formula for solving quadratic equations.

M3 k Makes predictions by interpolating or extrapolating from given data or a given graph.

M3 l Understands the basic algebraic structure of number systems.

M3 m Uses equations to represent curves such as lines, circles, and parabolas.

M3 n Uses technology such as graphics calculators to represent and analyze functions and their graphs.

M3 o Uses functions to analyze patterns and represent their structure.

M4 Statistics and Probability Concepts

APPENDIX II

Elementary School

The student produces evidence that demonstrates understanding of statistics and probability concepts in the following areas; that is, the student:

M4 a Collects and organizes data to answer a question or test a hypothesis by comparing sets of data.

M4 b Displays data in line plots, graphs, tables, and charts.

M4 c Makes statements and draws simple conclusions based on data; that is:

- reads data in line plots, graphs, tables, and charts;
- compares data in order to make true statements, e.g., “seven plants grew at least 5 cm”;
- identifies and uses the mode necessary for making true statements, e.g., “more people chose red”;
- makes true statements based on a simple concept of average (median and mean), for a small sample size and where the situation is made evident with concrete materials or clear representations;
- interprets data to determine the reasonableness of statements about the data, e.g., “twice as often,” “three times faster”;
- uses data, including statements about the data, to make a simple concluding statement about a situation, e.g., “This kind of plant grows better near sunlight because the seven plants that were near the window grew at least 5 cm.”

M4 d Gathers data about an entire group or by sampling group members to understand the concept of sample, i.e., that a large sample leads to more reliable information, e.g., when flipping coins.

M4 e Predicts results, analyzes data, and finds out why some results are more likely, less likely, or equally likely.

M4 f Finds all possible combinations and arrangements within certain constraints involving a limited number of variables.

Middle School

The student produces evidence that demonstrates understanding of statistics and probability concepts; that is, the student:

M4 a Collects data, organizes data, and displays data with tables, charts, and graphs that are appropriate, i.e., consistent with the nature of the data.

M4 b Analyzes data with respect to characteristics of frequency and distribution, including mode and range.

M4 c Analyzes appropriately central tendencies of data by considering mean and median.

M4 d Makes conclusions and recommendations based on data analysis.

M4 e Critiques the conclusions and recommendations of others’ statistics.

M4 f Considers the effects of missing or incorrect information.

M4 g Formulates hypotheses to answer a question and uses data to test hypotheses.

M4 h Represents and determines probability as a fraction of a set of equally likely outcomes; recognizes equally likely outcomes, and constructs sample spaces (including those described by numerical combinations and permutations).

M4 i Makes predictions based on experimental or theoretical probabilities.

M4 j Predicts the result of a series of trials once the probability for one trial is known.

High School

The student demonstrates understanding of statistics and probability concepts; that is, the student:

M4 a Organizes, analyzes, and displays single-variable data, choosing appropriate frequency distribution, circle graphs, line plots, histograms, and summary statistics.

M4 b Organizes, analyzes, and displays two-variable data using scatter plots, estimated regression lines, and computer generated regression lines and correlation coefficients.

M4 c Uses sampling techniques to draw inferences about large populations.

M4 d Understands that making an inference about a population from a sample always involves uncertainty and that the role of statistics is to estimate the size of that uncertainty.

M4 e Formulates hypotheses to answer a question and uses data to test hypotheses.

M4 f Interprets representations of data, compares distributions of data, and critiques conclusions and the use of statistics, both in school materials and in public documents.

M4 g Explores questions of experimental design, use of control groups, and reliability.

M4 h Creates and uses models of probabilistic situations and understands the role of assumptions in this process.

M4 i Uses concepts such as equally likely, sample space, outcome, and event in analyzing situations involving chance.

M4 j Constructs appropriate sample spaces, and applies the addition and multiplication principles for probabilities.

M4 k Uses the concept of a probability distribution to discuss whether an event is rare or reasonably likely.

M4 l Chooses an appropriate probability model and uses it to arrive at a theoretical probability for a chance event.

M4 m Uses relative frequencies based on empirical data to arrive at an experimental probability for a chance event.

M4 n Designs simulations including Monte Carlo simulations to estimate probabilities.

M4 o Works with the normal distribution in some of its basic applications.

M5 Problem Solving and Mathematical Reasoning

APPENDIX II

Elementary School

The student demonstrates logical reasoning throughout work in mathematics, i.e., concepts and skills, problem solving, and projects; demonstrates problem solving by using mathematical concepts and skills to solve non-routine problems that do not lay out specific and detailed steps to follow; and solves problems that make demands on all three aspects of the solution process—formulation, implementation, and conclusion.

Formulation

M5 a Given the basic statement of a problem situation, the student:

- makes the important decisions about the approach, materials, and strategies to use, i.e., does not merely fill in a given chart, use a pre-specified manipulative, or go through a predetermined set of steps;
- uses previously learned strategies, skills, knowledge, and concepts to make decisions;
- uses strategies, such as using manipulatives or drawing sketches, to model problems.

Implementation

M5 b The student makes the basic choices involved in planning and carrying out a solution; that is, the student:

- makes up and uses a variety of strategies and approaches to solving problems and uses or learns approaches that other people use, as appropriate;
- makes connections among concepts in order to solve problems;
- solves problems in ways that make sense and explains why these ways make sense, e.g., defends the reasoning, explains the solution.

Conclusion

M5 c The student moves beyond a particular problem by making connections, extensions, and/or generalizations; for example, the student:

- explains a pattern that can be used in similar situations;
- explains how the problem is similar to other problems he or she has solved;
- explains how the mathematics used in the problem is like other concepts in mathematics;
- explains how the problem solution can be applied to other school subjects and in real world situations;
- makes the solution into a general rule that applies to other circumstances.

Middle School

The student demonstrates problem solving by using mathematical concepts and skills to solve non-routine problems that do not lay out specific and detailed steps to follow, and solves problems that make demands on all three aspects of the solution process—formulation, implementation, and conclusion.

Formulation

M5 a The student participates in the formulation of problems; that is, given the basic statement of a problem situation, the student:

- formulates and solves a variety of meaningful problems;
- extracts pertinent information from situations and figures out what additional information is needed.

Implementation

M5 b The student makes the basic choices involved in planning and carrying out a solution; that is, the student:

- uses and invents a variety of approaches and understands and evaluates those of others;
- invokes problem solving strategies, such as illustrating with sense-making sketches to clarify situations or organizing information in a table;
- determines, where helpful, how to break a problem into simpler parts;
- solves for unknown or undecided quantities using algebra, graphing, sound reasoning, and other strategies;
- integrates concepts and techniques from different areas of mathematics;
- works effectively in teams when the nature of the task or the allotted time makes this an appropriate strategy.

Conclusion

M5 c The student provides closure to the solution process through summary statements and general conclusions; that is, the student:

- verifies and interprets results with respect to the original problem situation;
- generalizes solutions and strategies to new problem situations.

High School

The student demonstrates problem solving by using mathematical concepts and skills to solve non-routine problems that do not lay out specific and detailed steps to follow, and solves problems that make demands on all three aspects of the solution process—formulation, implementation, and conclusion.

Formulation

M5 a The student participates in the formulation of problems; that is, given the statement of a problem situation, the student:

- fills out the formulation of a definite problem that is to be solved;
- extracts pertinent information from the situation as a basis for working on the problem;
- asks and answers a series of appropriate questions in pursuit of a solution and does so with minimal “scaffolding” in the form of detailed guiding questions.

Implementation

M5 b The student makes the basic choices involved in planning and carrying out a solution; that is, the student:

- chooses and employs effective problem solving strategies in dealing with non-routine and multi-step problems;
- selects appropriate mathematical concepts and techniques from different areas of mathematics and applies them to the solution of the problem;
- applies mathematical concepts to new situations within mathematics and uses mathematics to model real world situations involving basic applications of mathematics in the physical and biological sciences, the social sciences, and business.

Conclusion

M5 c The student provides closure to the solution process through summary statements and general conclusions; that is, the student:

- concludes a solution process with a useful summary of results;
- evaluates the degree to which the results obtained represent a good response to the initial problem;
- formulates generalizations of the results obtained;
- carries out extensions of the given problem to related problems.

Mathematical reasoning

M5 d The student demonstrates mathematical reasoning by generalizing patterns, making conjectures and explaining why they seem true, and by making sensible, justifiable statements; that is, the student:

- formulates conjectures and argues why they must be or seem true;
- makes sensible, reasonable estimates;
- makes justified, logical statements.

Mathematical reasoning

M5 d The student demonstrates mathematical reasoning by using logic to prove specific conjectures, by explaining the logic inherent in a solution process, by making generalizations and showing that they are valid, and by revealing mathematical patterns inherent in a situation. The student not only makes observations and states results but also justifies or proves why the results hold in general; that is, the student:

- employs forms of mathematical reasoning and proof appropriate to the solution of the problem at hand, including deductive and inductive reasoning, making and testing conjectures, and using counterexamples and indirect proof;
- differentiates clearly between giving examples that support a conjecture and giving a proof of the conjecture.

M6 Mathematical Skills and Tools

APPENDIX II

Elementary School

The student demonstrates fluency with basic and important skills by using these skills accurately and automatically, and demonstrates practical competence and persistence with other skills by using them effectively to accomplish a task, perhaps referring to notes, books, or other students, perhaps working to reconstruct a method; that is, the student:

M6 a Adds, subtracts, multiplies, and divides whole numbers correctly; that is:

- knows single digit addition, subtraction, multiplication, and division facts;
- adds and subtracts numbers with several digits;
- multiplies and divides numbers with one or two digits;
- multiplies and divides three digit numbers by one digit numbers.

M6 b Estimates numerically and spatially.

M6 c Measures length, area, perimeter, circumference, diameter, height, weight, and volume accurately in both the customary and metric systems.

M6 d Computes time (in hours and minutes) and money (in dollars and cents).

M6 e Refers to geometric shapes and terms correctly with concrete objects or drawings, including triangle, square, rectangle, side, edge, face, cube, point, line, perimeter, area, and circle; and refers with assistance to rhombus, parallelogram, quadrilateral, polygon, polyhedron, angle, vertex, volume, diameter, circumference, sphere, prism, and pyramid.

M6 f Uses +, -, ×, ÷, /, $\overline{\hspace{1cm}}$, \$, ¢, %, and . (decimal point) correctly in number sentences and expressions.

M6 g Reads, creates, and represents data on line plots, charts, tables, diagrams, bar graphs, simple circle graphs, and coordinate graphs.

M6 h Uses recall, mental computations, pencil and paper, measuring devices, mathematics texts, manipulatives, calculators, computers, and advice from peers, as appropriate, to achieve solutions; that is, uses measuring devices, graded appropriately for given situations, such as rulers (customary to the $\frac{1}{8}$ inch; metric to the millimeter), graph paper (customary to the inch or half-inch; metric to the centimeter), measuring cups (customary to the ounce; metric to the milliliter), and scales (customary to the pound or ounce; metric to the kilogram or gram).

Middle School

The student demonstrates fluency with basic and important skills by using these skills accurately and automatically, and demonstrates practical competence and persistence with other skills by using them effectively to accomplish a task (perhaps referring to notes, or books, perhaps working to reconstruct a method); that is, the student:

M6 a Computes accurately with arithmetic operations on rational numbers.

M6 b Knows and uses the correct order of operations for arithmetic computations.

M6 c Estimates numerically and spatially.

M6 d Measures length, area, volume, weight, time, and temperature accurately.

M6 e Refers to geometric shapes and terms correctly.

M6 f Uses equations, formulas, and simple algebraic notation appropriately.

M6 g Reads and organizes data on charts and graphs, including scatter plots, bar, line, and circle graphs, and Venn diagrams; calculates mean and median.

M6 h Uses recall, mental computations, pencil and paper, measuring devices, mathematics texts, manipulatives, calculators, computers, and advice from peers, as appropriate, to achieve solutions.

High School

The student demonstrates fluency with basic and important skills by using these skills accurately and automatically, and demonstrates practical competence and persistence with other skills by using them effectively to accomplish a task, perhaps referring to notes, or books, perhaps working to reconstruct a method; that is, the student:

M6 a Carries out numerical calculations and symbol manipulations effectively, using mental computations, pencil and paper, or other technological aids, as appropriate.

M6 b Uses a variety of methods to estimate the values, in appropriate units, of quantities met in applications, and rounds numbers used in applications to an appropriate degree of accuracy.

M6 c Evaluates and analyzes formulas and functions of many kinds, using both pencil and paper and more advanced technology.

M6 d Uses basic geometric terminology accurately, and deduces information about basic geometric figures in solving problems.

M6 e Makes and uses rough sketches, schematic diagrams, or precise scale diagrams to enhance a solution.

M6 f Uses the number line and Cartesian coordinates in the plane and in space.

M6 g Creates and interprets graphs of many kinds, such as function graphs, circle graphs, scatter plots, regression lines, and histograms.

M6 h Sets up and solves equations symbolically (when possible) and graphically.

M6 i Knows how to use algorithms in mathematics, such as the Euclidean Algorithm.

M6 j Uses technology to create graphs or spreadsheets that contribute to the understanding of a problem.

M6 k Writes a simple computer program to carry out a computation or simulation to be repeated many times.

M6 l Uses tools such as rulers, tapes, compasses, and protractors in solving problems.

M6 m Knows standard methods to solve basic problems and uses these methods in approaching more complex problems.

M7 Mathematical Communication

APPENDIX II

Elementary School

The student uses the language of mathematics, its symbols, notation, graphs, and expressions, to communicate through reading, writing, speaking, and listening, and communicates about mathematics by describing mathematical ideas and concepts and explaining reasoning and results; that is, the student:

M7 a Uses appropriate mathematical terms, vocabulary, and language, based on prior conceptual work.

M7 b Shows mathematical ideas in a variety of ways, including words, numbers, symbols, pictures, charts, graphs, tables, diagrams, and models.

M7 c Explains solutions to problems clearly and logically, and supports solutions with evidence, in both oral and written work.

M7 d Considers purpose and audience when communicating about mathematics.

M7 e Comprehends mathematics from reading assignments and from other sources.

Middle School

The student uses the language of mathematics, its symbols, notation, graphs, and expressions, to communicate through reading, writing, speaking, and listening, and communicates about mathematics by describing mathematical ideas and concepts and explaining reasoning and results; that is, the student:

M7 a Uses mathematical language and representations with appropriate accuracy, including numerical tables and equations, simple algebraic equations and formulas, charts, graphs, and diagrams.

M7 b Organizes work, explains facets of a solution orally and in writing, labels drawings, and uses other techniques to make meaning clear to the audience.

M7 c Uses mathematical language to make complex situations easier to understand.

M7 d Exhibits developing reasoning abilities by justifying statements and defending work.

M7 e Shows understanding of concepts by explaining ideas not only to teachers and assessors but to fellow students or younger children.

M7 f Comprehends mathematics from reading assignments and from other sources.

High School

The student uses the language of mathematics, its symbols, notation, graphs, and expressions, to communicate through reading, writing, speaking, and listening, and communicates about mathematics by describing mathematical ideas and concepts and explaining reasoning and results; that is, the student:

M7 a Is familiar with basic mathematical terminology, standard notation and use of symbols, common conventions for graphing, and general features of effective mathematical communication styles.

M7 b Uses mathematical representations with appropriate accuracy, including numerical tables, formulas, functions, equations, charts, graphs, and diagrams.

M7 c Organizes work and presents mathematical procedures and results clearly, systematically, succinctly, and correctly.

M7 d Communicates logical arguments clearly, showing why a result makes sense and why the reasoning is valid.

M7 e Presents mathematical ideas effectively both orally and in writing.

M7 f Explains mathematical concepts clearly enough to be of assistance to those who may be having difficulty with them.

M7 g Writes narrative accounts of the history and process of work on a mathematical problem or extended project.

M7 h Writes succinct accounts of the mathematical results obtained in a mathematical problem or extended project, with diagrams, graphs, tables, and formulas integrated into the text.

M7 i Keeps narrative accounts of process separate from succinct accounts of results, and realizes that doing so can enhance the effectiveness of each.

M7 j Reads mathematics texts and other writing about mathematics with understanding.

MB Putting Mathematics to Work

APPENDIX II

Elementary School

The student conducts at least one large scale project each year, beginning in fourth grade, drawn from the following kinds and, over the course of elementary school, conducts projects drawn from at least two of the kinds.

A single project may draw on more than one kind.

MB a Data study, in which the student:

- develops a question and a hypothesis in a situation where data could help make a decision or recommendation;
- decides on a group or groups to be sampled and makes predictions of the results, with specific percents, fractions, or numbers;
- collects, represents, and displays data in order to help make the decision or recommendation; compares the results with the predictions;
- writes a report that includes recommendations supported by diagrams, charts, and graphs, and acknowledges assistance received from parents, peers, and teachers.

MB b Science study, in which the student:

- decides on a specific science question to study and identifies the mathematics that will be used, e.g., measurement;
- develops a prediction (a hypothesis) and develops procedures to test the hypothesis;
- collects and records data, represents and displays data, and compares results with predictions;
- writes a report that compares the results with the hypothesis; supports the results with diagrams, charts, and graphs; acknowledges assistance received from parents, peers, and teachers.

MB c Design of a physical structure, in which the student:

- decides on a structure to design, the size and budget constraints, and the scale of design;
- makes a first draft of the design, and revises and improves the design in response to input from peers and teachers;
- makes a final draft and report of the design, drawn and written so that another person could make the structure; acknowledges assistance received from parents, peers, and teachers.

Middle School

The student conducts at least one large scale investigation or project each year drawn from the following kinds and, over the course of middle school, conducts investigations or projects drawn from three of the kinds.

A single investigation or project may draw on more than one kind.

MB a Data study based on civic, economic, or social issues, in which the student:

- selects an issue to investigate;
- makes a hypothesis on an expected finding, if appropriate;
- gathers data;
- analyzes the data using concepts from Standard 4, e.g., considering mean and median, and the frequency and distribution of the data;
- shows how the study's results compare with the hypothesis;
- uses pertinent statistics to summarize;
- prepares a presentation or report that includes the question investigated, a detailed description of how the project was carried out, and an explanation of the findings.

MB b Mathematical model of physical phenomena, often used in science studies, in which the student:

- carries out a study of a physical system using a mathematical representation of the structure;
- uses understanding from Standard 3, particularly with respect to the determination of the function governing behavior in the model;
- generalizes about the structure with a rule, i.e., a function, that clearly applies to the phenomenon and goes beyond statistical analysis of a pattern of numbers generated by the situation;
- prepares a presentation or report that includes the question investigated, a detailed description of how the project was carried out, and an explanation of the findings.

MB c Design of a physical structure, in which the student:

- generates a plan to build something of value, not necessarily monetary value;
- uses mathematics from Standard 2 to make the design realistic or appropriate, e.g., areas and volumes in general and of specific geometric shapes;

High School

The student conducts at least one large scale investigation or project each year drawn from the following kinds and, over the course of high school, conducts investigations or projects drawn from at least three of the kinds.

A single investigation or project may draw on more than one kind.

MB a Data study, in which the student:

- carries out a study of data relevant to current civic, economic, scientific, health, or social issues;
- uses methods of statistical inference to generalize from the data;
- prepares a report that explains the purpose of the project, the organizational plan, and conclusions, and uses an appropriate balance of different ways of presenting information.

MB b Mathematical model of a physical system or phenomenon, in which the student:

- carries out a study of a physical system or phenomenon by constructing a mathematical model based on functions to make generalizations about the structure of the system;
- uses structural analysis (a direct analysis of the structure of the system) rather than numerical or statistical analysis (an analysis of data about the system);
- prepares a report that explains the purpose of the project, the organizational plan, and conclusions, and uses an appropriate balance of different ways of presenting information.

MB c Design of a physical structure, in which the student:

- creates a design for a physical structure;
- uses general mathematical ideas and techniques to discuss specifications for building the structure;
- prepares a report that explains the purpose of the project, the organizational plan, and conclusions, and uses an appropriate balance of different ways of presenting information.

MB d Management and planning analysis, in which the student:

- carries out a study of a business or public policy situation involving issues such as optimization, cost-benefit projections, and risks;
- uses decision rules and strategies both to analyze options and balance trade-offs; and brings

M8 d Management and planning, in which the student:

- decides on what to manage or plan, and the criteria to be used to see if the plan worked;
- identifies unexpected events that could disrupt the plan and further plans for such contingencies;
- identifies resources needed, e.g., materials, money, time, space, and other people;
- writes a detailed plan and revises and improves the plan in response to feedback from peers and teachers;
- carries out the plan (optional);
- writes a report on the plan that includes resources, budget, and schedule, and acknowledges assistance received from parents, peers, and teachers.
- writes a report that includes recommendations supported by diagrams, charts, and graphs, and acknowledges assistance received from parents, peers, and teachers.

M8 e Pure mathematics investigation, in which the student:

- decides on the area of mathematics to investigate, e.g., numbers, shapes, patterns;
- describes a question or concept to investigate;
- decides on representations that will be used, e.g., numbers, symbols, diagrams, shapes, or physical models;
- carries out the investigation;
- writes a report that includes any generalizations drawn from the investigation, and acknowledges assistance received from parents, peers, and teachers.

- summarizes the important features of the structure;
- prepares a presentation or report that includes the question investigated, a detailed description of how the project was carried out, and an explanation of the findings.

M8 d Management and planning, in which the student:

- determines the needs of the event to be managed or planned, e.g., cost, supply, scheduling;
- notes any constraints that will affect the plan;
- determines a plan;
- uses concepts from any of Standards 1 to 4, depending on the nature of the project;
- considers the possibility of a more efficient solution;
- prepares a presentation or report that includes the question investigated, a detailed description of how the project was carried out, and an explanation of the plan.

M8 e Pure mathematics investigation, in which the student:

- extends or “plays with,” as with mathematical puzzles, some mathematical feature, e.g., properties and patterns in numbers;
- uses concepts from any of Standards 1 to 4, e.g., an investigation of Pascal’s triangle would have roots in Standard 1 but could tie in concepts from geometry, algebra, and probability; investigations of derivations of geometric formulas would be rooted in Standard 2 but could require algebra;
- determines and expresses generalizations from patterns;
- makes conjectures on apparent properties and argues, short of formal proof, why they seem true;
- prepares a presentation or report that includes the question investigated, a detailed description of how the project was carried out, and an explanation of the findings.

in mathematical ideas that serve to generalize the analysis across different conditions;

- prepares a report that explains the purpose of the project, the organizational plan, and conclusions, and uses an appropriate balance of different ways of presenting information.

M8 e Pure mathematics investigation, in which the student:

- carries out a mathematical investigation of a phenomenon or concept in pure mathematics;
- uses methods of mathematical reasoning and justification to make generalizations about the phenomenon;
- prepares a report that explains the purpose of the project, the organizational plan, and conclusions, and uses an appropriate balance of different ways of presenting information.

M8 f History of a mathematical idea, in which the student:

- carries out a historical study tracing the development of a mathematical concept and the people who contributed to it;
- includes a discussion of the actual mathematical content and its place in the curriculum of the present day;
- prepares a report that explains the purpose of the project, the organizational plan, and conclusions, and uses an appropriate balance of different ways of presenting information.

SI Physical Sciences Concepts

APPENDIX III

The elementary school standards are set at a level of performance approximately equivalent to the end of fourth grade. The middle school standards are set at a level of performance approximately equivalent to the end of eighth grade. The high school standards are set at a level of performance approximately equivalent to the end of tenth grade. It is expected that some students might achieve these levels earlier and others later than these grades.

The Science standards are founded upon both the National Research Council's *National Science Education Standards* and the American Association for the Advancement of Science's Project 2061 *Benchmarks for Science Literacy*. These documents, each of which runs to several hundred pages, contain detailed explication of the concepts identified here.

Elementary School

The student produces evidence that demonstrates understanding of:

- SI a** Properties of objects and materials, such as similarities and differences in the size, weight, and color of objects; the ability of materials to react with other substances; and different states of materials.
- SI b** Position and motion of objects, such as how the motion of an object can be described by tracing and measuring its position over time; and how sound is produced by vibrating objects.
- SI c** Light, heat, electricity, and magnetism, such as the variation of heat and temperature; how light travels in a straight line until it strikes an object or how electrical circuits work.

Middle School

The student produces evidence that demonstrates understanding of:

- SI a** Properties and changes of properties in matter, such as density and boiling point; chemical reactivity; and conservation of matter.
- SI b** Motions and forces, such as inertia and the net effects of balanced and unbalanced forces.
- SI c** Transfer of energy, such as transformation of energy as heat; light, mechanical motion, and sound; and the nature of a chemical reaction.

High School

The student produces evidence that demonstrates understanding of:

- SI a** Structure of atoms, such as atomic composition, nuclear forces, and radioactivity.
- SI b** Structure and properties of matter, such as elements and compounds; bonding and molecular interaction; and characteristics of phase changes.
- SI c** Chemical reactions, such as everyday examples of chemical reactions; electrons, protons, and energy transfer; and factors that affect reaction rates such as catalysts.
- SI d** Motions and forces, such as gravitational and electrical; net forces and magnetism.
- SI e** Conservation of energy and increase in disorder, such as kinetic and potential energy; energy conduction, convection, and radiation; random motion; and effects of heat and pressure.
- SI f** Interactions of energy and matter, such as waves, absorption and emission of light, and conductivity.

S2 Life Sciences Concepts

APPENDIX III

Elementary School

The student produces evidence that demonstrates understanding of:

S2 a Characteristics of organisms, such as survival and environmental support; the relationship between structure and function; and variations in behavior.

S2 b Life cycles of organisms, such as how inheritance and environment determine the characteristics of an organism; and that all plants and animals have life cycles.

S2 c Organisms and environments, such as the interdependence of animals and plants in an ecosystem; and populations and their effects on the environment.

S2 d Change over time, such as evolution and fossil evidence depicting the great diversity of organisms developed over geologic history.

Middle School

The student produces evidence that demonstrates understanding of:

S2 a Structure and function in living systems, such as the complementary nature of structure and function in cells, organs, tissues, organ systems, whole organisms, and ecosystems.

S2 b Reproduction and heredity, such as sexual and asexual reproduction; and the role of genes and environment on trait expression.

S2 c Regulation and behavior, such as senses and behavior; and response to environmental stimuli.

S2 d Populations and ecosystems, such as the roles of producers, consumers, and decomposers in a food web; and the effects of resources and energy transfer on populations.

S2 e Evolution, diversity, and adaptation of organisms, such as common ancestry, speciation, adaptation, variation, and extinction.

High School

The student produces evidence that demonstrates understanding of:

S2 a The cell, such as cell structure and function relationships; regulation and biochemistry; and energy and photosynthesis.

S2 b Molecular basis of heredity, such as DNA, genes, chromosomes, and mutations.

S2 c Biological evolution, such as speciation, biodiversity, natural selection, and biological classification.

S2 d Interdependence of organisms, such as conservation of matter; cooperation and competition among organisms in ecosystems; and human effects on the environment.

S2 e Matter, energy, and organization in living systems, such as matter and energy flow through different levels of organization; and environmental constraints.

S2 f Behavior of organisms, such as nervous system regulation; behavioral responses; and connections with anthropology, sociology, and psychology.

S3 Earth and Space Sciences Concepts

APPENDIX III

Elementary School

The student produces evidence that demonstrates understanding of:

- S3 a** Properties of Earth materials, such as water and gases; and the properties of rocks and soils, such as texture, color, and ability to retain water.
- S3 b** Objects in the sky, such as Sun, Moon, planets, and other objects that can be observed and described; and the importance of the Sun to provide the light and heat necessary for survival.
- S3 c** Changes in Earth and sky, such as changes caused by weathering, volcanism, and earthquakes; and the patterns of movement of objects in the sky.

Middle School

The student produces evidence that demonstrates understanding of:

- S3 a** Structure of the Earth system, such as crustal plates and land forms; water and rock cycles; oceans, weather, and climate.
- S3 b** Earth's history, such as Earth processes including erosion and movement of plates; change over time and fossil evidence.
- S3 c** Earth in the Solar System, such as the predictable motion of planets, moons, and other objects in the Solar System including days, years, moon phases, and eclipses; and the role of the Sun as the major source of energy for phenomena on the Earth's surface.
- S3 d** Natural resource management.

High School

The student produces evidence that demonstrates understanding of:

- S3 a** Energy in the Earth system, such as radioactive decay, gravity, the Sun's energy, convection, and changes in global climate.
- S3 b** Geochemical cycles, such as conservation of matter; chemical resources and movement of matter between chemical reservoirs.
- S3 c** Origin and evolution of the Earth system, such as geologic time and the age of life forms; origin of life; and evolution of the Solar System.
- S3 d** Origin and evolution of the universe, such as the "big bang" theory; formation of stars and elements; and nuclear reactions.
- S3 e** Natural resource management.

S4 Scientific Connections and Applications

APPENDIX III

Elementary School

The student produces evidence that demonstrates understanding of:

- S4 a** Big ideas and unifying concepts, such as order and organization; models, form and function; change and constancy; and cause and effect.
- S4 b** The designed world, such as development of agricultural techniques; and the viability of technological designs.
- S4 c** Personal health, such as nutrition, substance abuse, and exercise; germs and toxic substances; personal and environmental safety.
- S4 d** Science as a human endeavor, such as communication, cooperation, and diverse input in scientific research; and the importance of reason, intellectual honesty, and skepticism.

Middle School

The student produces evidence that demonstrates understanding of:

- S4 a** Big ideas and unifying concepts, such as order and organization; models, form, and function; change and constancy; and cause and effect.
- S4 b** The designed world, such as the reciprocal nature of science and technology; the development of agricultural techniques; and the viability of technological designs.
- S4 c** Health, such as nutrition, exercise, and disease; effects of drugs and toxic substances; personal and environmental safety; and resources and environmental stress.
- S4 d** Impact of technology, such as constraints and trade-offs; feedback; benefits and risks; and problems and solutions.
- S4 e** Impact of science, such as historical and contemporary contributions; and interactions between science and society.

High School

The student produces evidence that demonstrates understanding of:

- S4 a** Big ideas and unifying concepts, such as order and organization; models, form and function; change and constancy; and cause and effect.
- S4 b** The designed world, such as the reciprocal relationship between science and technology; the development of agricultural techniques; and the reasonableness of technological designs.
- S4 c** Health, such as nutrition and exercise; disease and epidemiology; personal and environmental safety; and resources, environmental stress, and population growth.
- S4 d** Impact of technology, such as constraints and trade-offs; feedback; benefits and risks; and problems and solutions.
- S4 e** Impact of science, such as historical and contemporary contributions; and interactions between science and society.

S5 Scientific Thinking

APPENDIX III

Elementary School

The student demonstrates scientific inquiry and problem solving by using thoughtful questioning and reasoning strategies, common sense and conceptual understanding from Science Standards 1 to 4, and appropriate methods to investigate the natural world; that is, the student:

- S5 a** Asks questions about natural phenomena; objects and organisms; and events and discoveries.
- S5 b** Uses concepts from Science Standards 1 to 4 to explain a variety of observations and phenomena.
- S5 c** Uses evidence from reliable sources to construct explanations.
- S5 d** Evaluates different points of view using relevant experiences, observations, and knowledge; and distinguishes between fact and opinion.
- S5 e** Identifies problems; proposes and implements solutions; and evaluates the accuracy, design, and outcomes of investigations.
- S5 f** Works individually and in teams to collect and share information and ideas.

Middle School

The student demonstrates scientific inquiry and problem solving by using thoughtful questioning and reasoning strategies, common sense and conceptual understanding from Science Standards 1 to 4, and appropriate methods to investigate the natural world; that is, the student:

- S5 a** Frames questions to distinguish cause and effect; and identifies or controls variables in experimental and non-experimental research settings.
- S5 b** Uses concepts from Science Standards 1 to 4 to explain a variety of observations and phenomena.
- S5 c** Uses evidence from reliable sources to develop descriptions, explanations, and models.
- S5 d** Proposes, recognizes, analyzes, considers, and critiques alternative explanations; and distinguishes between fact and opinion.
- S5 e** Identifies problems; proposes and implements solutions; and evaluates the accuracy, design, and outcomes of investigations.
- S5 f** Works individually and in teams to collect and share information and ideas.

High School

The student demonstrates skill in scientific inquiry and problem solving by using thoughtful questioning and reasoning strategies, common sense and diverse conceptual understanding, and appropriate ideas and methods to investigate science; that is, the student:

- S5 a** Frames questions to distinguish cause and effect; and identifies or controls variables in experimental and non-experimental research settings.
- S5 b** Uses concepts from Science Standards 1 to 4 to explain a variety of observations and phenomena.
- S5 c** Uses evidence from reliable sources to develop descriptions, explanations, and models; and makes appropriate adjustments and improvements based on additional data or logical arguments.
- S5 d** Proposes, recognizes, analyzes, considers, and critiques alternative explanations; and distinguishes between fact and opinion.
- S5 e** Identifies problems; proposes and implements solutions; and evaluates the accuracy, design, and outcomes of investigations.
- S5 f** Works individually and in teams to collect and share information and ideas.

S6 Scientific Tools and Technologies

APPENDIX III

S6 makes explicit reference to using telecommunications to acquire and share information. A recent National Center on Education Statistics survey recently reported that only 50% of schools and fewer than 9% of instructional rooms currently have access to the Internet. We know this is an equity issue—that far more than 9% of the homes in the United States have access to the Internet and that schools must make sure that students' access to information and ideas does not depend on what they get at home—so we have crafted performance standards that would use the Internet so that people will make sure that all students have access to it. New Standards partners have made a commitment to create the learning environments where students can develop the knowledge and skills delineated here.

Elementary School

The student demonstrates competence with the tools and technologies of science by using them to collect data, make observations, analyze results, and accomplish tasks effectively; that is, the student:

- S6 a** Uses technology and tools (such as rulers, computers, balances, thermometers, watches, magnifiers, and microscopes) to gather data and extend the senses.
- S6 b** Collects and analyzes data using concepts and techniques in Mathematics Standard 4, such as average, data displays, graphing, variability, and sampling.
- S6 c** Acquires information from multiple sources, such as experimentation and print and non-print sources.

Middle School

The student demonstrates competence with the tools and technologies of science by using them to collect data, make observations, analyze results, and accomplish tasks effectively; that is, the student:

- S6 a** Uses technology and tools (such as traditional laboratory equipment, video, and computer aids) to observe and measure objects, organisms, and phenomena, directly, indirectly, and remotely.
- S6 b** Records and stores data using a variety of formats, such as data bases, audiotapes, and videotapes.
- S6 c** Collects and analyzes data using concepts and techniques in Mathematics Standard 4, such as mean, median, and mode; outcome probability and reliability; and appropriate data displays.
- S6 d** Acquires information from multiple sources, such as print, the Internet, computer data bases, and experimentation.
- S6 e** Recognizes sources of bias in data, such as observer and sampling biases.

High School

The student demonstrates competence with the tools and technologies of science by using them to collect data, make observations, analyze results, and accomplish tasks effectively; that is, the student:

- S6 a** Uses technology and tools (such as traditional laboratory equipment, video, and computer aids) to observe and measure objects, organisms, and phenomena, directly, indirectly, and remotely, with appropriate consideration of accuracy and precision.
- S6 b** Records and stores data using a variety of formats, such as data bases, audiotapes, and videotapes.
- S6 c** Collects and analyzes data using concepts and techniques in Mathematics Standard 4, such as mean, median, and mode; outcome probability and reliability; and appropriate data displays.
- S6 d** Acquires information from multiple sources, such as print, the Internet, computer data bases, and experimentation.
- S6 e** Recognizes and limits sources of bias in data, such as observer and sample biases.

S7 Scientific Communication

APPENDIX III

Elementary School

The student demonstrates effective scientific communication by clearly describing aspects of the natural world using accurate data, graphs, or other appropriate media to convey depth of conceptual understanding in science; that is, the student:

- S7 a** Represents data and results in multiple ways, such as numbers, tables, and graphs; drawings, diagrams, and artwork; and technical and creative writing.
- S7 b** Uses facts to support conclusions.
- S7 c** Communicates in a form suited to the purpose and the audience, such as writing instructions that others can follow.
- S7 d** Critiques written and oral explanations, and uses data to resolve disagreements.

Middle School

The student demonstrates effective scientific communication by clearly describing aspects of the natural world using accurate data, graphs, or other appropriate media to convey depth of conceptual understanding in science; that is, the student:

- S7 a** Represents data and results in multiple ways, such as numbers, tables, and graphs; drawings, diagrams, and artwork; and technical and creative writing.
- S7 b** Argues from evidence, such as data produced through his or her own experimentation or by others.
- S7 c** Critiques published materials.
- S7 d** Explains a scientific concept or procedure to other students.
- S7 e** Communicates in a form suited to the purpose and the audience, such as by writing instructions that others can follow; critiquing written and oral explanations; and using data to resolve disagreements.

High School

The student demonstrates effective scientific communication by clearly describing aspects of the natural world using accurate data, graphs, or other appropriate media to convey depth of conceptual understanding in science; that is, the student:

- S7 a** Represents data and results in multiple ways, such as numbers, tables, and graphs; drawings, diagrams, and artwork; technical and creative writing; and selects the most effective way to convey the scientific information.
- S7 b** Argues from evidence, such as data produced through his or her own experimentation or data produced by others.
- S7 c** Critiques published materials, such as popular magazines and academic journals.
- S7 d** Explains a scientific concept or procedure to other students.
- S7 e** Communicates in a form suited to the purpose and the audience, such as by writing instructions that others can follow; critiquing written and oral explanations; and using data to resolve disagreements.

SS Scientific Investigation

APPENDIX III

Best practice in science has always included extensive inquiry and investigation, but these are frequently given less emphasis at the elementary level in the face of competing demands from English language arts and mathematics. There are many opportunities to learn science outside of school, including Scouts, Boys and Girls Clubs, 4-H, and Future Farmers of America. The work done in these venues can and should be used to provide evidence of meeting the standards.

Elementary School

The student demonstrates scientific competence by completing projects drawn from the following kinds of investigations, including at least one full investigation each year and, over the course of elementary school, investigations that integrate several aspects of Science Standards 1 to 7 and represent all four of the kinds of investigation:

- SS a** An experiment, such as conducting a fair test.
- SS b** A systematic observation, such as a field study.
- SS c** A design, such as building a model or scientific apparatus.
- SS d** Non-experimental research using print and electronic information, such as journals, video, or computers.

A single project may draw on more than one kind of investigation.

A full investigation includes:

- Questions that can be studied using the resources available.
- Procedures that are safe, humane, and ethical; and that respect privacy and property rights.
- Data that have been collected and recorded (see also Science Standard 6) in ways that others can verify and analyze using skills expected at this grade level (see also Mathematics Standard 4).
- Data and results that have been represented (see also Science Standard 7) in ways that fit the context.
- Recommendations, decisions, and conclusions based on evidence.
- Acknowledgment of references and contributions of others.
- Results that are communicated appropriately to audiences.
- Reflection and defense of conclusions and recommendations from other sources and peer review.

Middle School

The student demonstrates scientific competence by completing projects drawn from the following kinds of investigations, including at least one full investigation each year and, over the course of middle school, investigations that integrate several aspects of Science Standards 1 to 7 and represent all four of the kinds of investigation:

- SS a** Controlled experiment.
- SS b** Fieldwork.
- SS c** Design.
- SS d** Secondary research, such as use of others' data.

A single project may draw on more than one type of investigation.

A full investigation includes:

- Questions that can be studied using the resources available.
- Procedures that are safe, humane, and ethical; and that respect privacy and property rights.
- Data that have been collected and recorded (see also Science Standard 6) in ways that others can verify, and analyzed using skills expected at this grade level (see also Mathematics Standard 4).
- Data and results that have been represented (see also Science Standard 7) in ways that fit the context.
- Recommendations, decisions, and conclusions based on evidence.
- Acknowledgment of references and contributions of others.
- Results that are communicated appropriately to audiences.
- Reflection and defense of conclusions and recommendations from other sources and peer review.

High School

The student demonstrates scientific competence by completing projects drawn from the following kinds of investigation, including at least one full investigation each year and, over the course of high school, investigations that integrate several aspects of Science Standards 1 to 7 and represent all four of the kinds of investigation:

- SS a** Controlled experiment.
- SS b** Fieldwork.
- SS c** Design.
- SS d** Secondary research.

A single project may draw on more than one type of investigation.

A full investigation includes:

- Questions that can be studied using the resources available.
- Procedures that are safe, humane, and ethical; and that respect privacy and property rights.
- Data that have been collected and recorded (see also Science Standard 6) in ways that others can verify, and analyzed using skills expected at this grade level (see also Mathematics Standard 4).
- Data and results that have been represented (see also Science Standard 7) in ways that fit the context.
- Recommendations, decisions, and conclusions based on evidence.
- Acknowledgment of references and contributions of others.
- Results that are communicated appropriately to audiences.
- Reflection and defense of conclusions and recommendations from other sources and peer review.

A1 Problem Solving

APPENDIX IV

The elementary school standards are set at a level of performance approximately equivalent to the end of fourth grade. The middle school standards are set at a level of performance approximately equivalent to the end of eighth grade. The high school standards are set at a level of performance approximately equivalent to the end of tenth grade. It is expected that some students might achieve these levels earlier and others later than these grades.

Elementary School

The student conducts projects involving at least two of the following kinds of problem solving each year and, over the course of elementary school, conducts projects involving all three kinds of problem solving.

- **Design a Product, Service, or System:** Identify needs that could be met by new products, services, or systems and create solutions for meeting them.
- **Improve a System:** Develop an understanding of the way systems of people, machines, and processes work; troubleshoot problems in their operation and devise strategies for improving their effectiveness.
- **Plan and Organize an Event or an Activity:** Take responsibility for all aspects of planning and organizing an event or an activity from concept to completion, making good use of the resources of people, time, money, and materials and facilities.

Each project should involve subject matter related to the standards for English Language Arts, and/or Mathematics, and/or Science, and/or other appropriate subject content.

Design a Product, Service, or System

A1 a The student designs and creates a product, service, or system to meet an identified need; that is, the student:

- develops ideas for the design of the product, service, or system;
- chooses among the design ideas and justifies the choice;
- establishes criteria for judging the success of the design;
- uses an appropriate format to represent the design;
- plans and carries out the steps needed to turn the design into a reality;
- evaluates the design in terms of the criteria established for success.

Improve a System

A1 b The student troubleshoots problems in the operation of a system in need of repair or devises and tests ways of improving the effectiveness of a system in operation; that is, the student:

- identifies the parts of the system and the way the parts connect with each other;

Middle School

The student conducts projects involving at least two of the following kinds of problem solving each year and, over the course of middle school, conducts projects involving all three kinds of problem solving.

- **Design a Product, Service, or System:** Identify needs that could be met by new products, services, or systems and create solutions for meeting them.
- **Improve a System:** Develop an understanding of the way systems of people, machines, and processes work; troubleshoot problems in their operation and devise strategies for improving their effectiveness.
- **Plan and Organize an Event or an Activity:** Take responsibility for all aspects of planning and organizing an event or an activity from concept to completion, making good use of the resources of people, time, money, and materials and facilities.

Each project should involve subject matter related to the standards for English Language Arts, and/or Mathematics, and/or Science, and/or other appropriate subject content.

Design a Product, Service, or System

A1 a The student designs and creates a product, service, or system to meet an identified need; that is, the student:

- develops a range of ideas for design of the product, service, or system;
- selects one design option to pursue and justifies the choice with reference, for example, to functional, aesthetic, social, economic, or environmental considerations;
- establishes criteria for judging the success of the design;
- uses appropriate conventions to represent the design;
- plans and carries out the steps needed to create the product, service, or system;
- makes adjustments as needed to conform with specified standards or regulations regarding quality and safety;
- evaluates the quality of the design in terms of the criteria for success and by comparison with similar products, services, or systems.

High School

The student conducts projects involving at least two of the following kinds of problem solving each year and, over the course of high school, conducts projects involving all three kinds of problem solving.

- **Design a Product, Service, or System:** Identify needs that could be met by new products, services, or systems and create solutions for meeting them.
- **Improve a System:** Develop an understanding of the way systems of people, machines, and processes work; troubleshoot problems in their operation and devise strategies for improving their effectiveness.
- **Plan and Organize an Event or an Activity:** Take responsibility for all aspects of planning and organizing an event or activity from concept to completion, making good use of the resources of people, time, money, and materials and facilities.

Each project should involve subject matter related to the standards for English Language Arts, and/or Mathematics, and/or Science, and/or other appropriate subject content.

Design a Product, Service, or System

A1 a The student designs and creates a product, service, or system to meet an identified need; that is, the student:

- develops a design proposal that:
 - shows how the ideas for the design were developed;
 - reflects awareness of similar work done by others and of relevant design standards and regulations;
 - justifies the choices made in finalizing the design with reference, for example, to functional, aesthetic, social, economic, and environmental considerations;
 - establishes criteria for evaluating the product, service, or system;
 - uses appropriate conventions to represent the design;
- plans and implements the steps needed to create the product, service, or system;
- makes adjustments as needed to conform with specified standards or regulations regarding quality or safety;
- evaluates the product, service, or system in terms of the criteria established in the design

- identifies parts or connections in the system that have broken down or that could be made to work better;
- devises ways of making the system work again or making it work better;
- evaluates the effectiveness of the strategies for improving the system and supports the evaluation with evidence.

Plan and Organize an Event or an Activity

A1 c The student plans and organizes an event or an activity; that is, the student:

- develops a plan for the event or activity that:
 - includes all the factors and variables that need to be considered;
 - shows the order in which things need to be done;
 - takes into account the resources available to put the plan into action, including people and time;
- implements the plan;
- evaluates the success of the event or activity by identifying the parts of the plan that worked best and the parts that could have been improved by better planning and organization;
- makes recommendations to others who might consider planning and organizing a similar event or activity.

Improve a System

A1 b The student troubleshoots problems in the operation of a system in need of repair or devises and tests ways of improving the effectiveness of a system in operation; that is, the student:

- describes the structure and management of the system in terms of its logic, sequences, and control;
- identifies the operating principles underlying the system, i.e., mathematical, scientific, organizational;
- evaluates the way the system operates;
- devises strategies for putting the system back in operation or improving its performance;
- evaluates the effectiveness of the strategies for improving the system and supports the evaluation with evidence.

Plan and Organize an Event or an Activity

A1 c The student plans and organizes an event or activity; that is, the student:

- develops a plan that:
 - reflects research into relevant precedents and regulations;
 - includes all the factors and variables that need to be considered;
 - shows the order in which things need to be done;
 - takes into account the resources available to put the plan into action, including people and time;
- implements the plan in ways that:
 - reflect the priorities established in the plan;
 - respond effectively to unforeseen circumstances;
- evaluates the success of the event or activity;
- makes recommendations to others who might consider planning and organizing a similar event or activity.

proposal, and with reference to:

- information gathered from sources such as impact studies, product testing, or market research;
- comparisons with similar work done by others.

Improve a System

A1 b The student troubleshoots problems in the operation of a system in need of repair or devises and tests ways of improving the effectiveness of a system in operation; that is, the student:

- explains the structure of the system in terms of its:
 - logic, sequences, and control;
 - operating principles, that is, the mathematical, scientific, and/or organizational principles underlying the system;
- analyzes the way the system works, taking account of its functional, aesthetic, social, environmental, and commercial requirements, as appropriate, and using a relevant kind of modeling or systems analysis;
- evaluates the operation of the system, using qualitative methods and/or quantitative measurements of performance;
- develops and tests strategies to put the system back in operation and/or optimize its performance;
- evaluates the effectiveness of the strategies for improving the system and supports the evaluation with evidence.

Plan and Organize an Event or an Activity

A1 c The student plans and organizes an event or an activity; that is, the student:

- develops a planning schedule that:
 - is sensible in terms of the goals of the event or activity;
 - is logical and achievable;
 - reflects research into relevant precedents and regulations;
 - takes account of all relevant factors;
 - communicates clearly so that a peer or colleague could use it;
- implements and adjusts the planning schedule in ways that:
 - make efficient use of time, money, people, resources, facilities;
 - reflect established priorities;
 - respond effectively to unforeseen circumstances;
- evaluates the success of the event or activity using qualitative and/or quantitative methods;
- makes recommendations for planning and organizing subsequent similar events or activities.

A2 Communication Tools and Techniques

APPENDIX IV

Elementary School

A2 a The student makes an oral presentation of project plans or findings to an appropriate audience; that is, the student:

- organizes the presentation in a logical way appropriate to its purpose;
- speaks clearly and presents confidently;
- responds to questions from the audience;
- evaluates the effectiveness of the presentation.

A2 b The student composes and sends correspondence, such as thank-you letters and memoranda providing information; that is, the student:

- expresses the information or request clearly;
- writes in a style appropriate to the purpose of the correspondence.

A2 c The student writes and formats information for short publications, such as brochures or posters; that is, the student:

- organizes the information into an appropriate form for use in the publication;
- checks the information for accuracy;
- formats the publication so that it achieves its purpose.

Middle School

A2 a The student makes an oral presentation of project plans or findings to an audience beyond the school; that is, the student:

- organizes the presentation in a logical way appropriate to its purpose;
- adjusts the style of presentation to suit its purpose and audience;
- speaks clearly and presents confidently;
- responds appropriately to questions from the audience;
- evaluates the effectiveness of the presentation.

A2 b The student conducts formal written correspondence with an organization beyond the school; that is, the student:

- expresses the information or request clearly for the purpose and audience;
- writes in a style appropriate to the purpose and audience of the correspondence.

A2 c The student publishes information using several methods and formats, such as overhead transparencies, handouts, and computer generated graphs and charts; that is, the student:

- organizes the information into an appropriate form for use in the publication;
- checks the information for accuracy;
- formats the published material so that it achieves its purpose.

High School

A2 a The student makes an oral presentation of project plans or findings to an audience with expertise in the relevant subject matter; that is, the student:

- organizes the presentation in a logical way appropriate to its purpose;
- adjusts the style of presentation to suit its purpose and audience;
- speaks clearly and presents confidently;
- responds appropriately to questions from the audience;
- evaluates the effectiveness of the presentation and identifies appropriate revisions for a future presentation.

A2 b The student prepares a formal written proposal or report to an organization beyond the school; that is, the student:

- organizes the information in the proposal or report in a logical way appropriate to its purpose;
- produces the proposal or report in a format similar to that used in professionally produced documents for a similar purpose and audience.

A2 c The student develops a multi-media presentation, combining text, images, and/or sound; that is, the student:

- selects an appropriate medium for each element of the presentation;
- uses the selected media skillfully, including editing and monitoring for quality;
- achieves coherence in the presentation as a whole;
- communicates the information effectively, testing audience response and revising the presentation accordingly.

A3 Information Tools and Techniques

APPENDIX IV

Elementary School

A3 a The student gathers information to assist in completing project work; that is, the student:

- identifies potential sources of information to assist in completing the project;
- uses appropriate techniques to collect the information, e.g., considers sampling issues in conducting a survey;
- distinguishes relevant from irrelevant information;
- shows evidence of research in the completed project.

A3 b The student uses information technology to assist in gathering, organizing, and presenting information; that is, the student:

- acquires information for specific purposes from on-line sources, such as the Internet, and other electronic data bases, such as an electronic encyclopedia;
- uses word-processing, drawing, and painting programs to produce project reports and related materials.

Middle School

A3 a The student gathers information to assist in completing project work; that is, the student:

- identifies potential sources of information to assist in completing the project;
- uses appropriate techniques to collect the information, e.g., considers sampling issues in conducting a survey;
- interprets and analyzes the information;
- evaluates the information for completeness and relevance;
- shows evidence of research in the completed project.

A3 b The student uses information technology to assist in gathering, analyzing, organizing, and presenting information; that is, the student:

- acquires information for specific purposes from on-line sources, such as the Internet, and other electronic data bases, such as a scientific data base on CD ROM;
- uses word-processing, graphics, data base, and spreadsheet programs to produce project reports and related materials.

High School

A3 a The student gathers information to assist in completing project work; that is, the student:

- identifies potential sources of information to assist in completing the project;
- uses appropriate techniques to collect the information, e.g., considers sampling issues in conducting a survey;
- interprets and analyzes the information;
- evaluates the information in terms of completeness, relevance, and validity;
- shows evidence of research in the completed project.

A3 b The student uses on-line sources to exchange information for specific purposes; that is, the student:

- uses E-mail to correspond with peers and specialists in the subject matter of their projects;
- incorporates into E-mail correspondence data of different file types and applications.

A3 c The student uses word-processing software to produce a multi-page document; that is, the student:

- uses features of the software to create and edit the document;
- uses features of the software to format the document, including a table of contents, index, tabular columns, charts, and graphics;
- uses features of the software to create templates and style sheets for the document.

A3 d The student writes, adds content to, and analyzes a data base program that uses a relational data base; that is, the student:

- writes a program capable of handling data with at least two files;
- creates macros to facilitate data entry, analysis, and manipulation;
- creates multiple report formats that include summary information;
- merges data from the data base with other files.

A3 e The student creates, edits, and analyzes a spreadsheet of information that displays data in tabular, numeric format and includes multiple graphs; that is, the student:

- creates a spreadsheet that displays the use of formulas and functions;
- uses features of the software to sort, arrange, display, and extract data for specific purposes;
- uses features of the software to create multiple spreadsheets and to synthesize the spreadsheets into a single presentation.

A4 Learning and Self-management Tools and Techniques

APPENDIX IV

Elementary School

A4 a The student learns from models; that is, the student:

- consults with or observes other students and adults at work, and identifies the main features of what they do and the way they go about their work;
- examines models for the results of project work, such as professionally produced publications, and analyzes their qualities;
- uses what he or she learns from models to assist in planning and conducting project activities.

A4 b The student keeps records of work activities in an orderly manner; that is, the student:

- sets up a system for storing records of work activities;
- maintains records of work activities in a way that makes it possible to find specific materials quickly and easily.

A4 c The student identifies strengths and weaknesses in his or her own work; that is, the student:

- understands and establishes criteria for judging the quality of work processes and products;
- assesses his or her own work processes and products.

Middle School

A4 a The student learns from models; that is, the student:

- consults with or observes other students and adults at work, and identifies the main features of what they do and the way they go about their work;
- identifies models for the results of project work, such as professionally produced publications, and analyzes their qualities;
- uses what he or she learns from models to assist in planning and conducting project activities.

A4 b The student develops and maintains a schedule of work activities; that is, the student:

- establishes a schedule of work activities that reflects priorities and deadlines;
- seeks advice on the management of conflicting priorities and deadlines;
- updates the schedule regularly.

A4 c The student sets goals for learning and reviews his or her progress; that is, the student:

- sets goals for learning;
- reviews his or her progress towards meeting the goals;
- seeks and responds to advice from others in setting goals and reviewing progress.

High School

A4 a The student learns from models; that is, the student:

- consults with and observes other students and adults at work and analyzes their roles to determine the critical demands, such as demands for knowledge and skills, judgment and decision making;
- identifies models for the results of project work, such as professionally produced publications, and analyzes their qualities;
- uses what he or she learns from models in planning and conducting project activities.

A4 b The student reviews his or her own progress in completing work activities and adjusts priorities as needed to meet deadlines; that is, the student:

- develops and maintains work schedules that reflect consideration of priorities;
- manages time;
- monitors progress towards meeting deadlines and adjusts priorities as necessary.

A4 c The student evaluates his or her performance; that is, the student:

- establishes expectations for his or her own achievement;
- critiques his or her work in light of the established expectations;
- seeks and responds to advice and criticism from others.

A5 Tools and Techniques for Working With Others

APPENDIX IV

Elementary School

A5 a The student works with others to complete a task; that is, the student:

- reaches agreement with group members on what work needs to be done to complete the task and how the work will be tackled;
- takes a share of the responsibility for the work;
- consults with group members regularly during the task to check on progress in completing the task, to decide on any changes that are required, and to check that all parts have been completed at the end of the task.

A5 b The student shows or explains something clearly enough for someone else to be able to do it.

A5 c The student responds to a request from a client; that is, the student:

- interprets the client's request;
- asks questions to clarify the demands of a task.

Middle School

A5 a The student takes responsibility for a component of a team project; that is, the student:

- reaches agreement with team members on what work needs to be done to complete the task and how the work will be tackled;
- takes specific responsibility for a component of the project;
- takes all steps necessary to ensure appropriate completion of the specific component of the project within the agreed upon time frame.

A5 b The student coaches or tutors; that is, the student:

- assists one or more others to learn on the job;
- analyzes coaching or tutoring experience to identify more and less effective ways of providing assistance to support on-the-job learning;
- uses the analysis to inform subsequent coaching or tutoring activities.

A5 c The student responds to a request from a client; that is, the student:

- consults with a client to clarify the demands of a task;
- interprets the client's request and translates it into an initial plan for completing the task, taking account of available resources;
- negotiates with the client to arrive at an agreed upon plan.

High School

A5 a The student participates in the establishment and operation of self-directed work teams; that is, the student:

- defines roles and shares responsibilities among team members;
- sets objectives and time frames for the work to be completed;
- establishes processes for group decision making;
- reviews progress and makes adjustments as required.

A5 b The student plans and carries out a strategy for including at least one new member in a work program; that is, the student:

- plans and conducts an initial activity to introduce the new member to the work program;
- devises ways of providing continuing on-the-job support and advice;
- monitors the new member's progress in joining the program, and revises the kinds and ways of providing support and advice accordingly;
- reviews the success of the overall strategy.

A5 c The student completes a task in response to a commission from a client; that is, the student:

- negotiates with the client to arrive at a plan for meeting the client's needs that is acceptable to the client, achievable within available resources, and includes agreed-upon criteria for successful completion;
- monitors client satisfaction with the work in progress and makes adjustments accordingly;
- evaluates the result in terms of the negotiated plan and the client's evaluation of the result.