

CRITICAL COMPONENTS: DEFINITIONS AND EXPLANATIONS

There are some program elements that developers may not deem “critical” to the implementation of the program but still believe they can contribute to student learning. We refer to this as “contributing program elements” and mark them with an asterisk.

Below are descriptions of each of the common critical components.

Structural/Procedural

Structural Procedural critical components indicate the step-by-step actions a teacher is expected to take. They focus on what the teacher needs to *do* to enact the intended program.

Common to Mathematics and Science

1. **Duration of Unit:** The specified length of time in weeks that a unit is taught. The time period starts with the beginning of the first **class session** of the unit and goes to the completion of the unit’s last class session. We are not measuring frequency because there are no particular mandates about frequency in the instructional materials.
2. **Time Spent on Instruction:** The specified amount of time spent on instruction. This is the quantification of class time spent on teaching the program. Programs often specify it as the amount of minutes a lesson or portion of a lesson is intended to last. Not all programs specify the amount of time that each lesson should take.
3. **Lesson Order:** The specified sequence of lessons in the unit. Most programs offer explicit or implicit indications that the lessons conceptually build on one another and therefore should be taught in a particular order.
4. **Order of Segments and Parts within Lesson:** The specified order of lesson segments and parts within those segments. The *segments* of the lesson are the organizational sections. Most programs offer explicit or implicit indications that the lessons’ segments conceptually build on one another and therefore should be taught in a particular order.
5. **Inclusion of All Essential Segments within a Lesson:** The presence of essential segments of a lesson.
6. **Inclusion of All Essential Lessons:** The use of the required lessons in a unit. In some programs, *all* lessons are considered to be required while other programs indicate that some lessons are required and others are optional.
7. **Lesson Overview:** Teacher reading or review of the portion of the lesson that provides specific information about what students will do during the lesson, the content they will learn, and the materials they will use. It does not include lesson preparation, which is addressed in another critical component.
8. **Lesson Preparation:** Teacher reading, review, and/or enactment of the preparation that is required directly before the lesson. This includes any materials management and organization that is specified at the beginning of the lesson. Lesson preparation that is not specified in the lesson is accounted for as a moderating variable (e.g. reading the lesson, grouping students, assembling materials). Reading the lesson overview is accounted for in that critical component.
9. **Materials Presence:** The presence in the classroom of the non-print materials, manipulatives, and tools called for in the lesson, unit, or program.

10. **Writing Structures:** Teacher use of the student writing structures specified in the instructional materials when they are called for. “Writing Structures” can include any of a range of writing formats and tools (e.g. individual pre-formatted sheets, assembled notebooks or journals).
11. **Readings:** Teacher use of the student readings in the instructional materials when they are called for. Readings may include books with assigned text or copies of readings from the instructional materials. These are required readings and do not include any optional reading resources that may be specified in the lesson; the latter are considered contributing program elements.
12. **Assessments and Assessment Tools:** Teacher use of the assessments and assessment tools in the instructional materials. “Assessments” include those program elements designed to measure student knowledge and vary in their levels of formality. They may include formal tests and quizzes, projects, performance tasks, informal or assessment opportunities specified in the lesson, and student self-assessments. “Assessment tools” are those tools that help the teacher *interpret* information gathered in the assessments and include scoring guides, rubrics, checklists, and student exemplars. Assessment tools target specific learning goals in the materials and do not include general information on assessment strategies. General assessment information is accounted for in the Educative category of critical components.
13. **Content of Lesson:** The teacher addresses the content in the lesson. Content is further delineated as:
 - Facts: e.g. “a triangle has three sides” or “there are 206 bones in the adult human body”;
 - Procedures: e.g. “how to solve an algebraic equation” or “how to complete a titration”;
 - Concepts: e.g. “real numbers” or “adaptation”; and
 - Processes: e.g. communicating or predicting outcomes.
14. **Class Structures:** The teacher implements the class structures (e.g. small group, whole class, partners, independent work) indicated in the instructional materials within and across class sessions.
15. **Instructional Delivery Formats:** The teacher implements the instructional delivery formats (e.g. learning centers, discussions, games, readings, student interactions with materials) indicated in the instructional materials within and across class sessions.
16. **Projects*:** Teacher use of projects from the instructional materials. Projects are learning activities that do not use the regular lesson format. They can take the form of a single class session, take place across lessons, or take place outside of regular class time, but are all clearly designated as projects.
17. **Extensions*:**
 - a. **Discipline-related extensions:** Teacher enactment of discipline-related extensions from the written lessons when called for. These are activities suggested in the materials that extend the lesson content focus within the discipline.
 - b. **Non-discipline-related extensions:** Teacher enactment of non-discipline-related extensions from the written lessons. These are activities suggested in the materials that extend the lesson content focus to other subject areas (social studies, language arts, art).
18. **Additional Resources*:** Teacher uses, suggests, or makes available to students the additional resources identified in the instructional materials. Additional resources are supplemental materials recommended in the instructional materials. They include books, magazines, software, web resources, and videos. They are intended for both student and teacher use.

- 19. Homework*:** These are activities that are extensions of the lesson, but are specified to be done at home. Most programs do not have explicit home activities.

Common to Mathematics

- A. Unit Order:** The specified order of the units within a mathematics program. In mathematics, each unit often builds on concepts and skills from earlier units, and should therefore be taught in order. This is not necessarily true for distinct units in science.

Unique to *Science Companion*

- i. Science Center:** The presence of a table or area in the classroom that has science materials accessible for student use. The materials in the science center are not the same as the kit materials associated with a specific written lesson. In *Science Companion*, there are particular activities called for in the science center in the “Ongoing Learning” section.

Structural/Educative

Educative critical components communicate generalizable information about content and pedagogy. If information is not generalizable – meaning, if it is relevant only to the particular written lesson(s) of the program - then it falls in the procedural category (not educative) and would likely be part of the lesson overview or lesson preparation. Likewise, by definition, the information in educative critical components is information that the user could have obtained somewhere outside of the written materials (e.g. in a course, professional development, other written pieces). Educative components illustrate the developers’ expectations for what the teacher needs to know in order to enact the program as intended.

Common to Mathematics and Science

- 1. Background Information on Content:** The teacher consults the background information on content at any point. The unit level background details the content covered throughout the unit and tends to cover the big ideas and broader concepts of the unit as well as pedagogical content knowledge. The lesson level background details the content specific to a lesson. It often appears at the beginning of a lesson as part of an overview.
- 2. Background Information on Pedagogy:** The teacher consults the background information on pedagogy. This entails any information on pedagogy and includes general teaching strategies that the teacher can use while teaching the program. It is often in the front matter of the instructional materials.
- 3. National Standards and Benchmarks Information*:** The teacher consults the information contained in the materials on Standards and Benchmarks. This information refers to documents such as the National Science Education Standards, the Project 2061 Benchmarks for Science Literacy, or the National Council of Teachers of Mathematics Standards.
- 4. Lesson Notes:** The teacher consults the information contained in the lesson notes (both educative and procedural). These are the notes in the lesson that give the teacher information or tell the teacher what to do. Educative and procedural notes are not separated, because most of the instructional materials do not clearly distinguish between the two. Safety notes are included in the science-specific “Safety” critical component.

Common to Science

- A. Safety:** The teacher consults the information about safety, which can be in a single place in the unit and/or included in notes. Information that is specific to a particular activity (e.g. make sure students wear goggles) and general information (e.g. don’t eat inside a lab) are both included here.

Instructional/Pedagogical

Instructional critical components reflect the intended teacher and student behaviors and interactions that take place during program use. The behaviors and interactions embedded in the instructional critical components (with a few exceptions) can take place at any point during a lesson, and are not bound to specific structural critical components. For example, “Teacher Facilitation of Student Discussion” can take place at many points during a lesson, embedded in several of the lesson’s structural elements.

Common to Mathematics and Science

- 1. Teacher Facilitation of Small Group Work:** The teacher employs strategies that promote productive formal group interactions. Small groups include partners or pairs of students. Strategies include promoting on-task behavior, establishing guidelines and norms for group interaction, encouraging each group member to participate and ensuring that all students understand the task at hand.
- 2. Teacher Facilitation of Student Discussion:** The teacher encourages and promotes the students’ discussions with him/her and with one another. In this case, “discussion” is an on-topic, substantive exchange of ideas. It can occur at any time during a lesson, but must include a back-and-forth exchange (A-B-A) (e.g. it cannot be only a student asks a question and the teacher answers). Strategies include the teacher asking students to rephrase, repeat, or respond to others’ thoughts, using appropriate wait time, clarifying points students make, and using Think, Pair, Share or a similar strategy.
- 3. Teacher Facilitation of Students Doing Potentially Intellectually Challenging Work:** This critical component is where many thinking and process skills reside. The teacher helps students apply knowledge to new settings, consider alternative arguments or explanations, predict, interpret their experiences, analyze data, analyze subject-specific text, explain their reasoning, consider relationships between lesson content and real world phenomena and current events, consider relationships between lesson content and academic topics, and support their conclusions with evidence.
- 4. Teacher Emphasis on Types of Content:** The teacher approaches the time spent on, questions asked about, and focus on depth of content (facts, concepts, processes, procedures) in a manner consistent with the instructional materials. Programs might note that certain lessons are a more appropriate fit with a focus on facts and procedures instead of concepts. This critical component focuses on the extent to which the relative emphasis of the enacted content is consistent with the expectations in the instructional materials.
- 5. Teacher Facilitation of Student Autonomy:** The teacher promotes student independence in and ownership of their learning. Strategies include encouraging students to use the range of resources available to them to solve problems, allowing students to take a leadership role in discussion and assist others in finding solutions, and providing opportunities for students to work without regulation.
- 6. Teacher Facilitation of Students Taking Risks:** The teacher creates a classroom where students are willing to take chances. This might include the teacher encouraging students to share an answer even if they are not sure it is correct or commending students’ efforts when they do take risks.
- 7. Teacher Facilitation of Student Interest:** The teacher relates the students’ current interest(s) to a lesson or unit. This can include teachers asking students to express their opinions or attempting to create and pique student interest in the topic by communicating practical applications of the content being taught.
- 8. Teacher Facilitation of Materials, Manipulatives, and Tools Use:** The teacher demonstrates and ensures the proper use of materials, manipulatives, and tools.

9. **Teacher Use of Assessment to Inform Instruction:** The teacher uses information about the students' current understandings of the content to shape or alter the lesson in progress or a future lesson. Other terms apply to this critical component are “formative” and “ongoing assessment.” Strategies include the teacher addressing misconceptions, changing instruction based on student responses, and changing future instruction based on observations.
10. **Teacher Use of Differentiation:** The teacher customizes instruction to special or unique needs of individuals or small groups of students in the class. Strategies include scaffolding ideas and activities for individual students, suggesting different activities based on ability or learning modality, and providing access to the full variety of activities used during a class session.

Common to Science

- A. **Teacher Facilitation of Student Data Collection:** The teacher has students observe phenomena or use other methods to collect data.

Common to Mathematics

- A. **Teacher Supports Multiple Solution Strategies:** The teacher encourages students to try different methods for solving a problem.

Instructional/Student Engagement

Student engagement critical components reflect the intended student behaviors and interactions during the enactment of the program. Some of the student engagement critical components are also desired outcomes of these programs, but in this context, they are considered essential elements of program *implementation*. For example, one might identify “students engage in intellectually challenging work” as an outcome. But in this work we are not measuring their increased ability capacity to engage in intellectually challenging work as a result of participating in the program. Rather, we are measuring the extent to which they *did* (or are) engaging in that activity during the enactment of the lesson.

Some of the student engagement critical components align directly with the pedagogical critical components. For example, “Students Contribute to Group Work” aligns with “Teacher Facilitation of Group Work.” Others align more with the structural/procedural critical components such as “students do/complete essential activities.”

Common to Mathematics and Science

1. **Students Contribute to Small Group Work:** Students participate in and contribute to productive formal group interactions and learning. This includes students managing time efficiently, staying on task, and working respectfully with their peers.
2. **Students Engage in Discussion:** Students engage in on-topic, substantive exchange of ideas with one another and the teacher. It can occur at any time during a lesson, but must include a back-and-forth exchange (A-B-A) (e.g. it cannot be only a student asks a question and the teacher answers). This includes responding to the teacher's questions and attending to others' contributions.
3. **Students Engage in Potentially Intellectually Challenging Work:** Students use thinking and process skills. This includes students applying knowledge to new settings, considering alternative arguments or explanations, predicting, interpreting their experiences, analyzing data, analyzing subject-specific text, explaining their reasoning, considering relationships between lesson content and real world phenomena and current events, considering relationships between lesson content and academic topics, and supporting their conclusions with evidence.

4. **Students Demonstrate Autonomy:** Students have independence in and ownership of their learning. This is demonstrated by assisting other students, making independent choices during the course of the lesson and using the range of resources available to them to solve problems.
5. **Students Take Risks:** Students share ideas, ask questions, and reveal their own uncertainties about their work. This includes trying new things (e.g. touching worms). This includes both intellectual and emotional risk taking.
6. **Students Do/Complete Essential Activities:** Students do or complete activities required by the instructional materials that are assigned in class. This includes readings, writing structures, assessments, and hands-on activities.
7. **Students Do/Complete Optional or Non-Essential Activities:** Students do or complete activities in the instructional materials that are assigned in class, but are considered optional. This includes disciplinary and non-disciplinary extensions and additional resources.

Common to Science

- A. **Students Collect Data:** Students use observation and other methods to collect data.

Common to Mathematics

- A. **Students Use Multiple Solution Strategies:** Students try different methods to solve a mathematics problem.