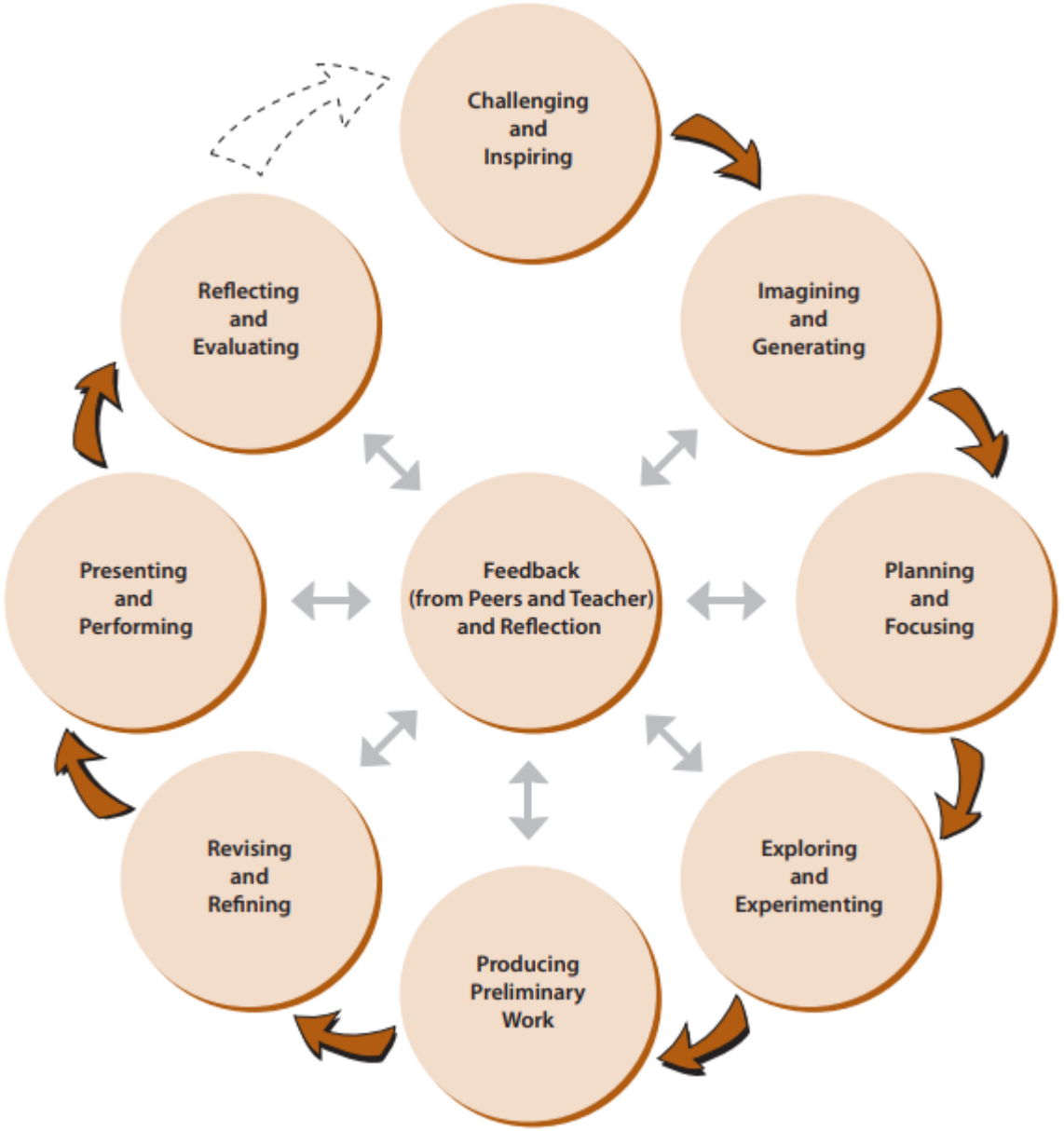
Design Cycle

For the STEAM program

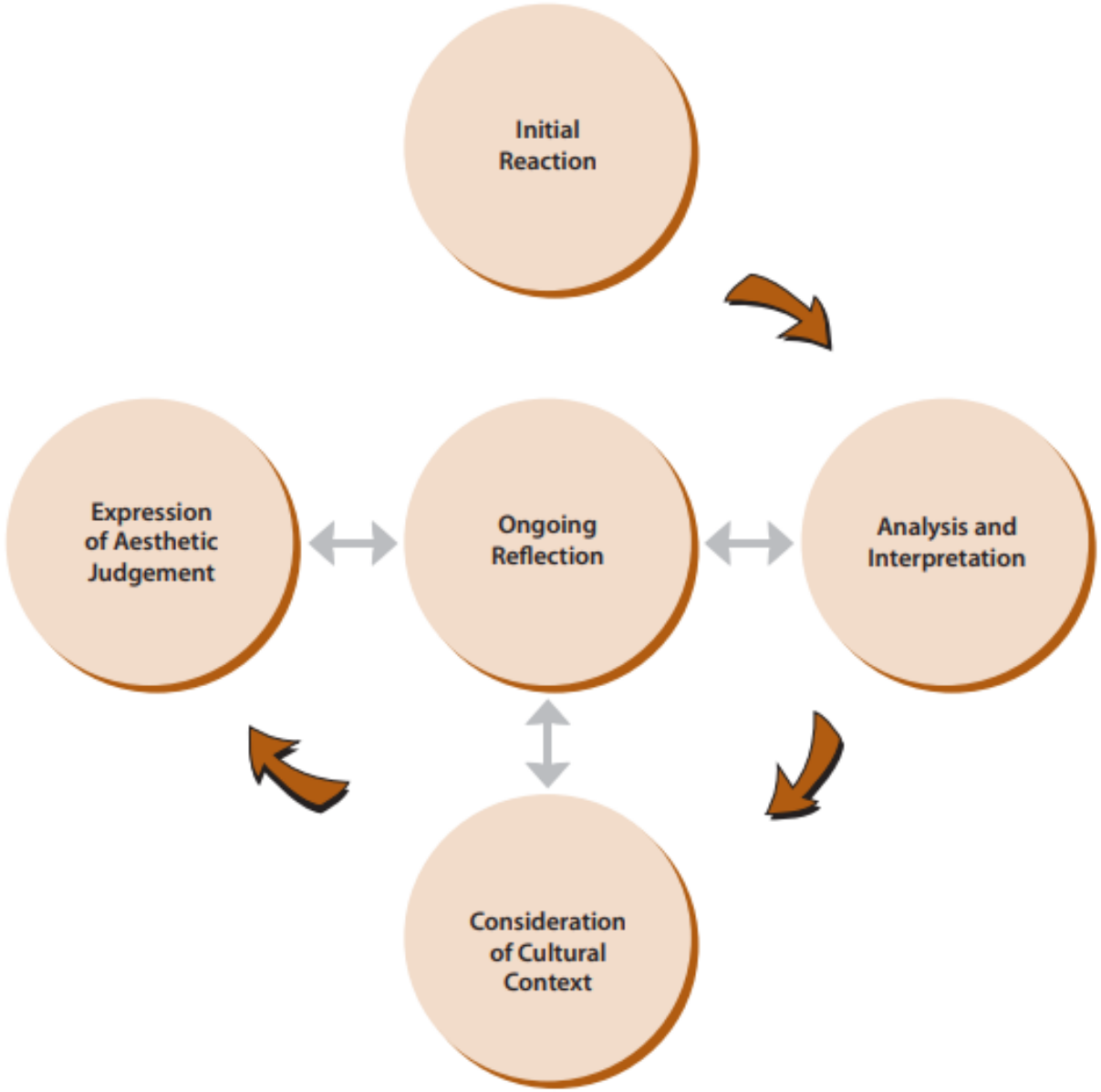
Art

The Creative Process



Art

The Critical Analysis Process



Art

The Critical Analysis Process

Initial Reaction

- What is your first impression of this work?
- What does this work bring to mind?
- What does this movement suggest to you?
- What emotions does this work evoke?
- What puzzles you? What questions do you have?
- What connections can you make between this work and your own experience or other art forms?

Analysis and Interpretation

- What elements, principles, and/or conventions of the art form are used in this work?
- How are the elements and/or principles organized, combined, or arranged in this work by the artist (composer, choreographer, playwright, media artist, visual artist)?
- What do you think is the theme or subject of the work? (i.e., What is the artist trying to communicate, and why? or, in reflecting on their own work: What did you intend to communicate, and why?)
- Why do you think the composer, choreographer, playwright, media artist, or visual artist created this work?
- What message or meaning do you think the work conveys?
- What do you feel is the artist's view of the world?
- How does this view match or contrast with your own view of the world?

Expression of Aesthetic Judgement

- How effectively does the artist select and combine elements to achieve an intended effect in this work? (i.e., What works?)
- What doesn't work, and why?
- Has your point of view shifted from your initial reaction? If so, how has it changed? Why?
- In what ways does the artist evoke joy, sadness, or other emotions in this work?

Ongoing Reflection

- In what ways do you feel your work is successful?
- In what ways would you change the work to improve it?
- How did your work affect the audience? Was it the way you intended?
- How would you alter this work for a different audience, or to send a different message?

Consideration of Cultural Context

- What social, political, and historical events may have influenced the artist in this work?
- What cultural movements, events, or traditions or other works may have influenced the artist?
- What events in the artist's life may have affected the creation of the work?
- Identify the similarities and differences between specific works in the past and present
- Identify the way in which a work in the arts represents the perspective of individuals within a cultural group
- Compare the work to examples of other works created in the same period
- Consider the expectations and artistic preferences of audiences at the time the work was created
- Review the initial reception of the work by critics
- Understand the responsibility of an audience, including audience etiquette and responsibility to acknowledge any biases that may influence responses to a work

English

Strands of the English Curriculum

English

READING AND LITERATURE STUDIES

1. **Reading for Meaning:** read and demonstrate an understanding of a variety of literary, informational, and graphic texts, using a range of strategies to construct meaning;
2. **Understanding Form and Style:** recognize a variety of text forms, text features, and stylistic elements and demonstrate understanding of how they help communicate meaning;
3. **Reading With Fluency:** use knowledge of words and cueing systems to read fluently;
4. **Reflecting on Skills and Strategies:** reflect on and identify their strengths as readers, areas for improvement, and the strategies they found most helpful before, during, and after reading.

MEDIA STUDIES

1. **Understanding Media Texts:** demonstrate an understanding of a variety of media texts;
2. **Understanding Media Forms, Conventions, and Techniques:** identify some media forms and explain how the conventions and techniques associated with them are used to create meaning;
3. **Creating Media Texts:** create a variety of media texts for different purposes and audiences, using appropriate forms, conventions, and techniques;
4. **Reflecting on Skills and Strategies:** reflect on and identify their strengths as media interpreters and creators, areas for improvement, and the strategies they found most helpful in understanding and creating media texts.

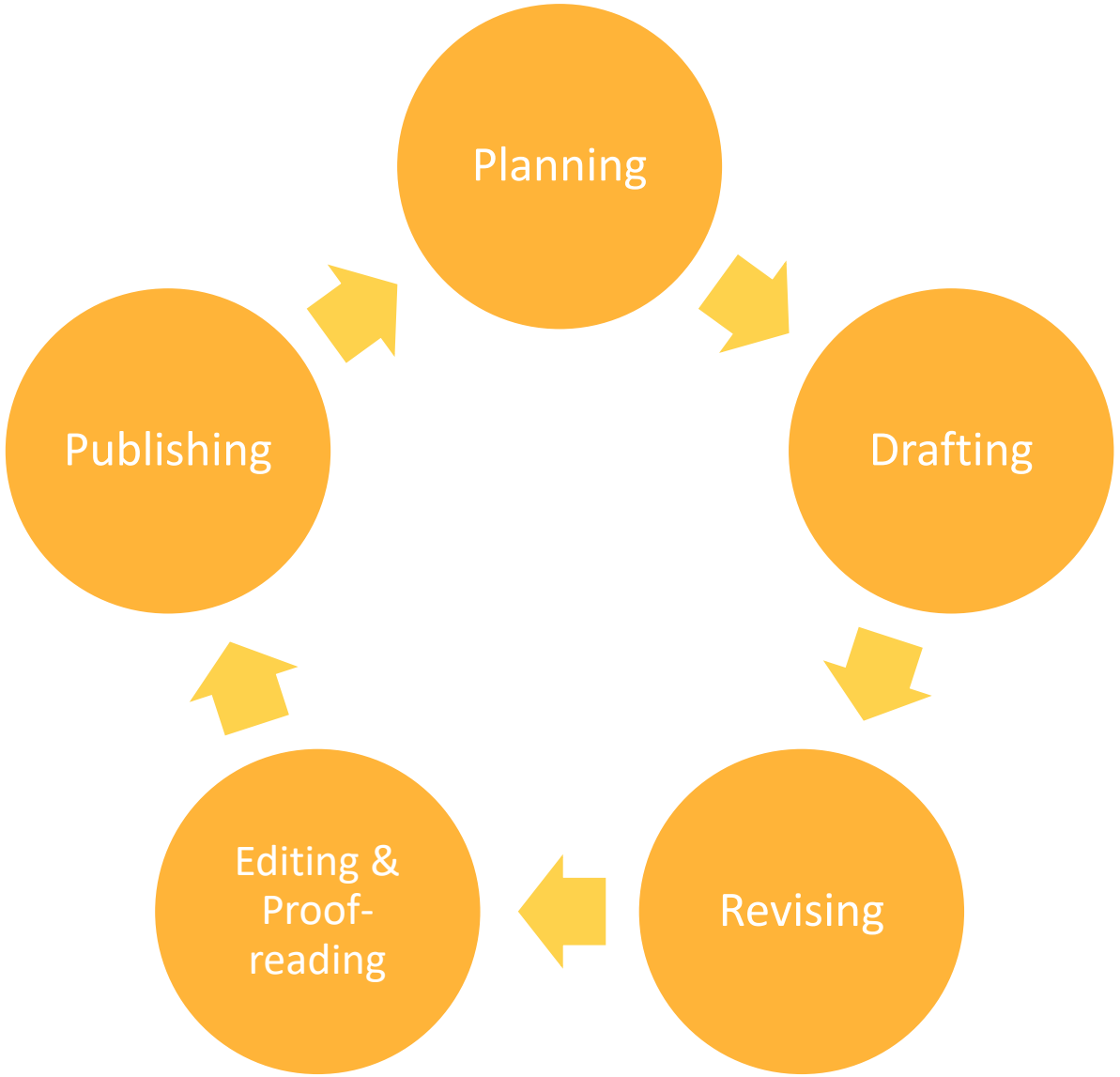
English

ORAL COMMUNICATION

1. **Listening to Understand:** listen in order to understand and respond appropriately in a variety of situations for a variety of purposes;
2. **Speaking to Communicate:** use speaking skills and strategies appropriately to communicate with different audiences for a variety of purposes;
3. **Reflecting on Skills and Strategies:** reflect on and identify their strengths as listeners and speakers, areas for improvement, and the strategies they found most helpful in oral communication situations.

English

Stages of the Recursive Writing Process



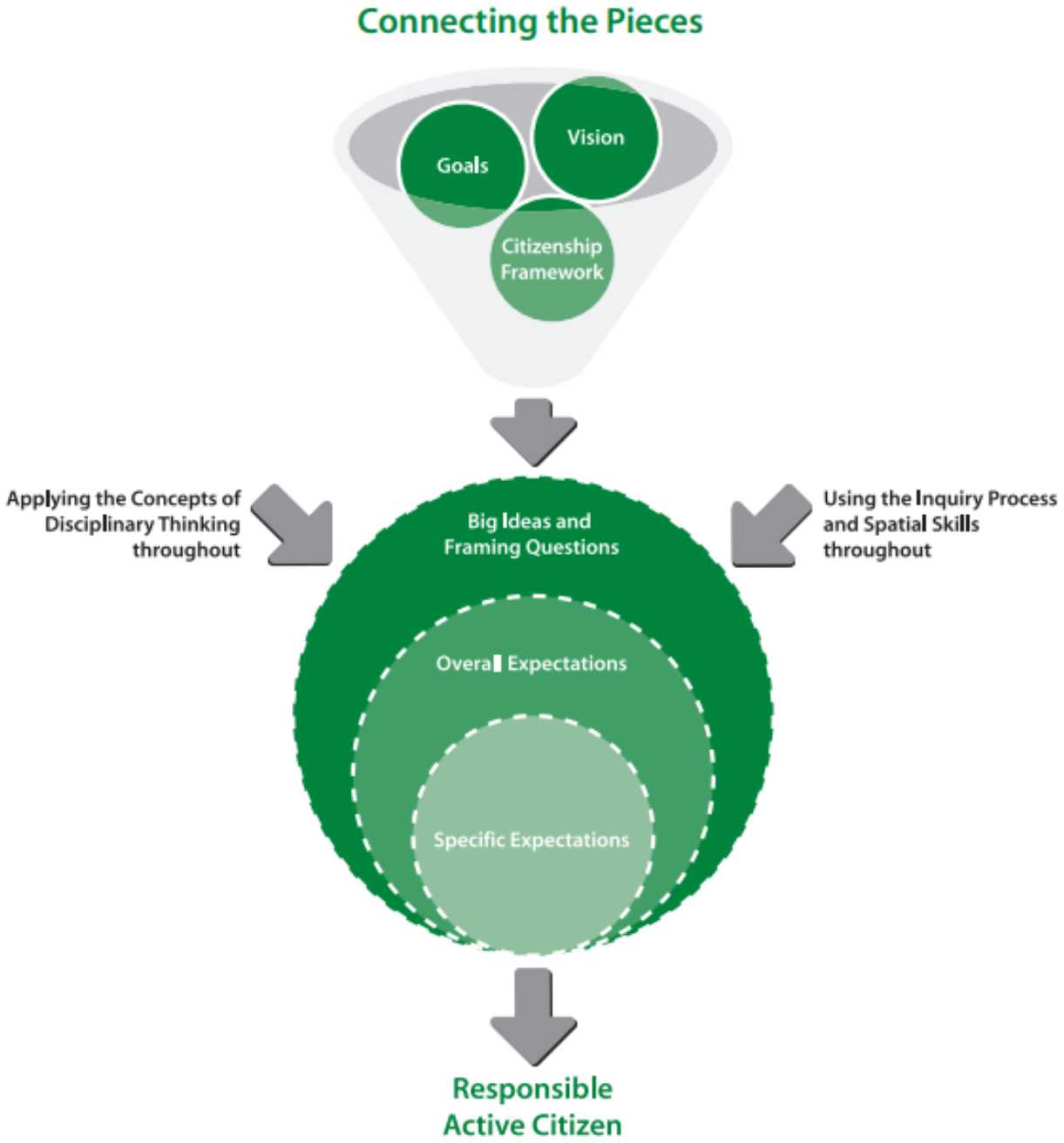
Used with the consideration of the Elements of Effective Writing:

- ideas/content
- organization
- voice
- word choice
- sentence fluency
- language conventions
- presentation

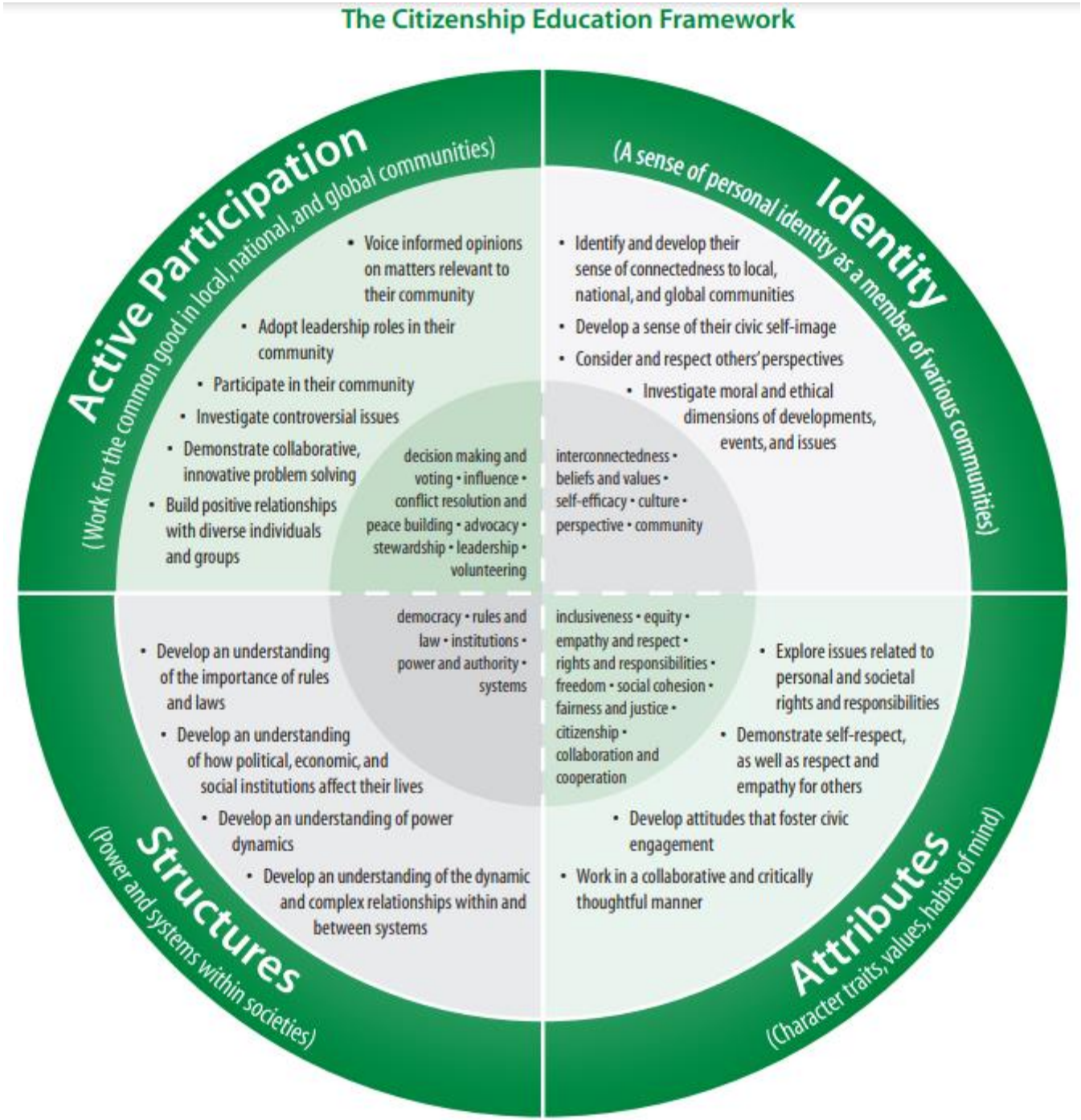
Civics

The Inquiry Process

Civics

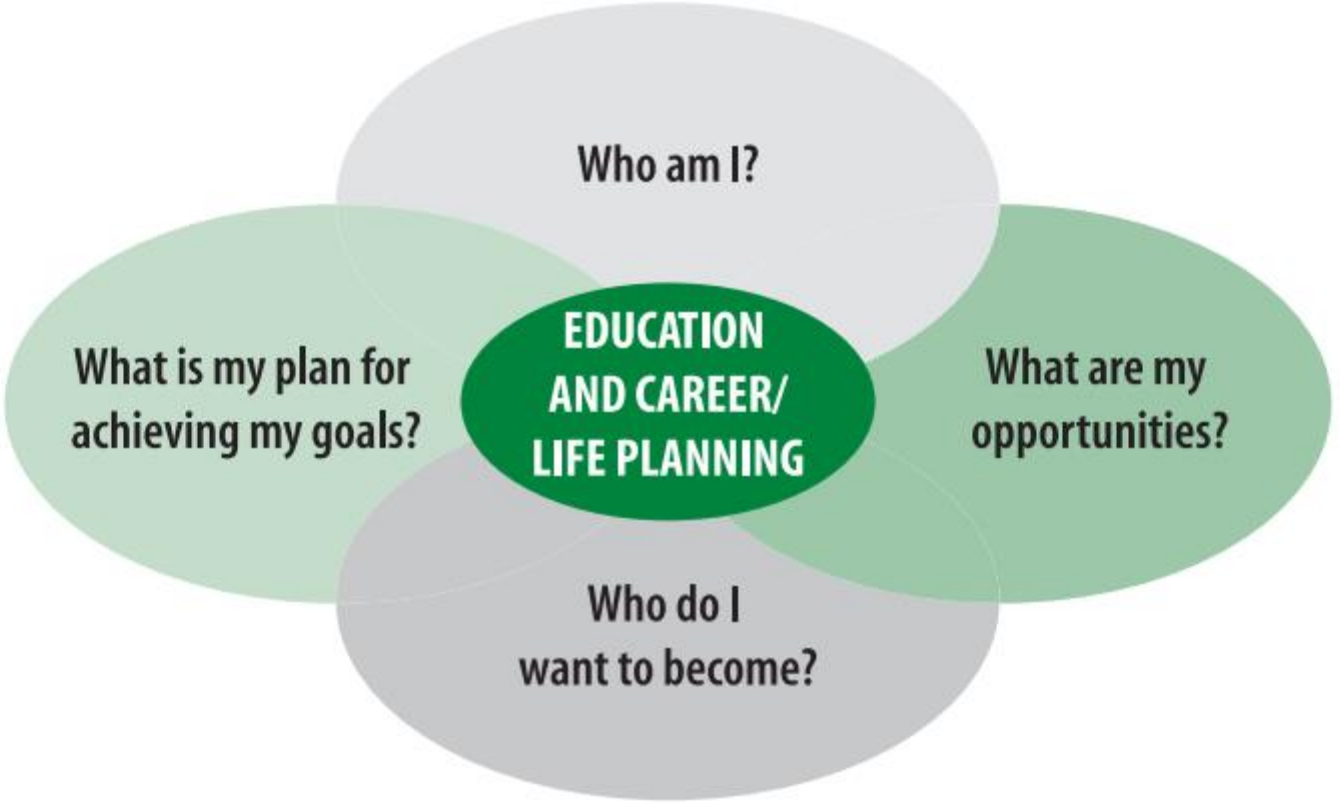

Connecting the Pieces
Vision
Goals
Citizenship Framework
Applying the Concepts of Disciplinary Thinking throughout
Big Ideas and Framing Questions
Using the Inquiry Process and Spatial Skills throughout
Overall Expectations
Specific Expectations
Responsible Active Citizen

Civics


The Citizenship Education Framework
Active Participation
(Work for the common good in local, national, and global communities)
• Voice informed opinions on matters relevant to their community
• Adopt leadership roles in their community
• Participate in their community
• Investigate controversial issues
• Demonstrate collaborative, innovative problem solving
• Build positive relationships with diverse individuals and groups
decision making and voting • influence • conflict resolution and peace building • advocacy • stewardship • leadership • volunteering
Identity
(A sense of personal identity as a member of various communities)
• Identify and develop their sense of connectedness to local, national, and global communities
• Develop a sense of their civic self-image
• Consider and respect others' perspectives
• Investigate moral and ethical dimensions of developments, events, and issues
interconnectedness • beliefs and values • self-efficacy • culture • perspective • community
Structures
(Power and systems within societies)
democracy • rules and law • institutions • power and authority • systems
• Develop an understanding of the importance of rules and laws
• Develop an understanding of how political, economic, and social institutions affect their lives
• Develop an understanding of power dynamics
• Develop an understanding of the dynamic and complex relationships within and between systems
Attributes
(Character traits, values, habits of mind)
inclusiveness • equity • empathy and respect • rights and responsibilities • freedom • social cohesion • fairness and justice • citizenship • collaboration and cooperation
• Explore issues related to personal and societal rights and responsibilities
• Demonstrate self-respect, as well as respect and empathy for others
• Develop attitudes that foster civic engagement
• Work in a collaborative and critically thoughtful manner

Civics

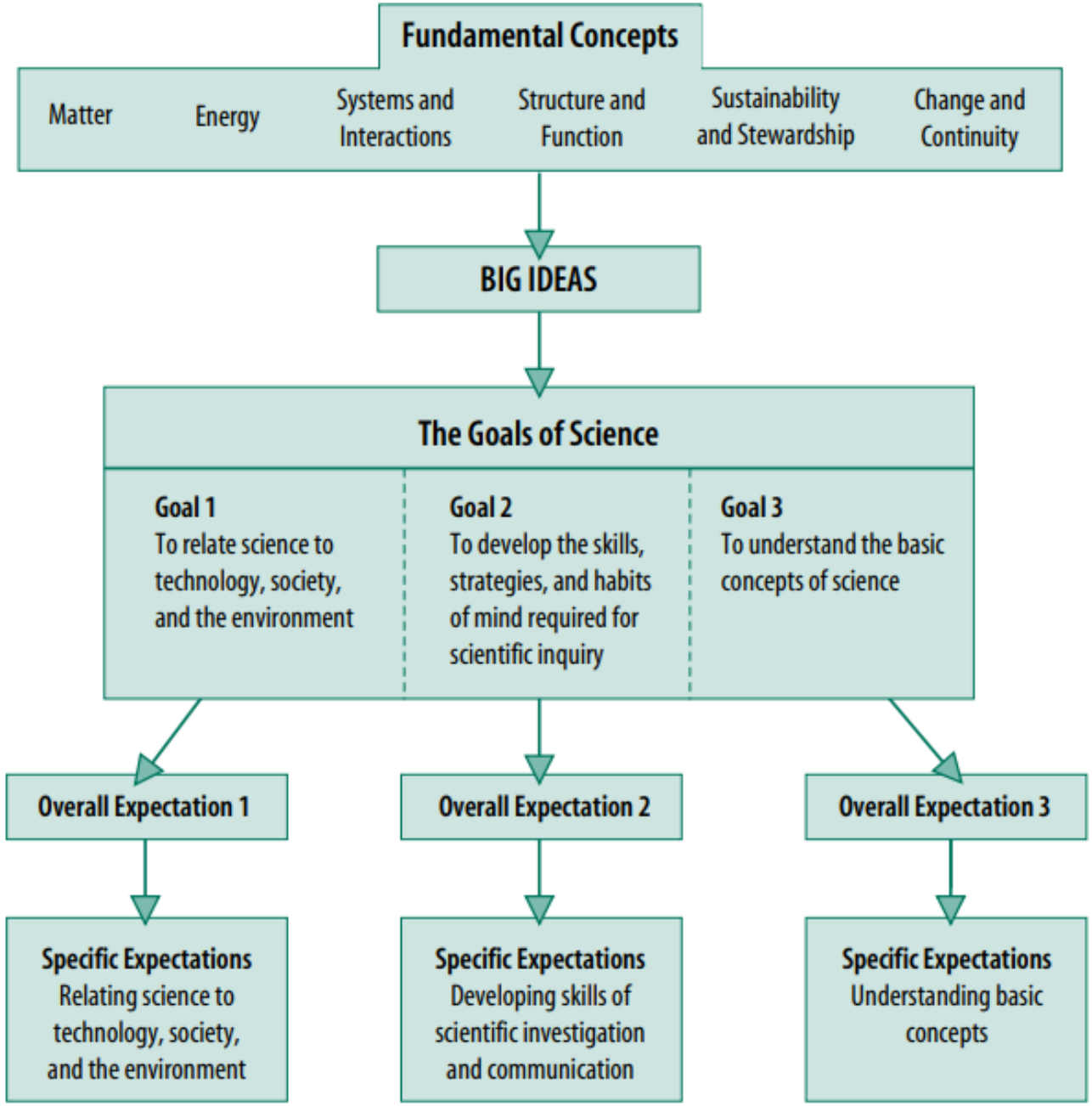
The framework of the program is a four-step inquiry process based on four questions linked to four areas of learning: (1) knowing yourself – Who am I?; (2) exploring opportunities – What are my opportunities?; (3) making decisions and setting goals – Who do I want to become?; and, (4) achieving goals and making transitions – What is my plan for achieving my goals?.



Science

FUNDAMENTAL CONCEPTS	
Matter	Matter is anything that has mass and occupies space. Matter has particular structural and behavioural characteristics.
Energy	Energy comes in many forms, and can change forms. It is required to make things happen (to do work). Work is done when a force causes movement.
Systems and Interactions	A system is a collection of living and/or non-living things and processes that interact to perform some function. A system includes inputs, outputs, and relationships among system components. Natural and human systems develop in response to, and are limited by, a variety of environmental factors.
Structure and Function	This concept focuses on the interrelationship between the function or use of a natural or human-made object and the form that the object takes.
Sustainability and Stewardship	Sustainability is the concept of meeting the needs of the present without compromising the ability of future generations to meet their needs. Stewardship involves understanding that we need to use and care for the natural environment in a responsible way and making the effort to pass on to future generations no less than what we have access to ourselves. Values that are central to responsible stewardship are: using non-renewable resources with care; reusing and recycling what we can; switching to renewable resources where possible.
Change and Continuity	Change is the process of becoming different over time, and can be quantified. Continuity represents consistency and connectedness within and among systems over time. Interactions within and among systems result in change and variations in consistency.

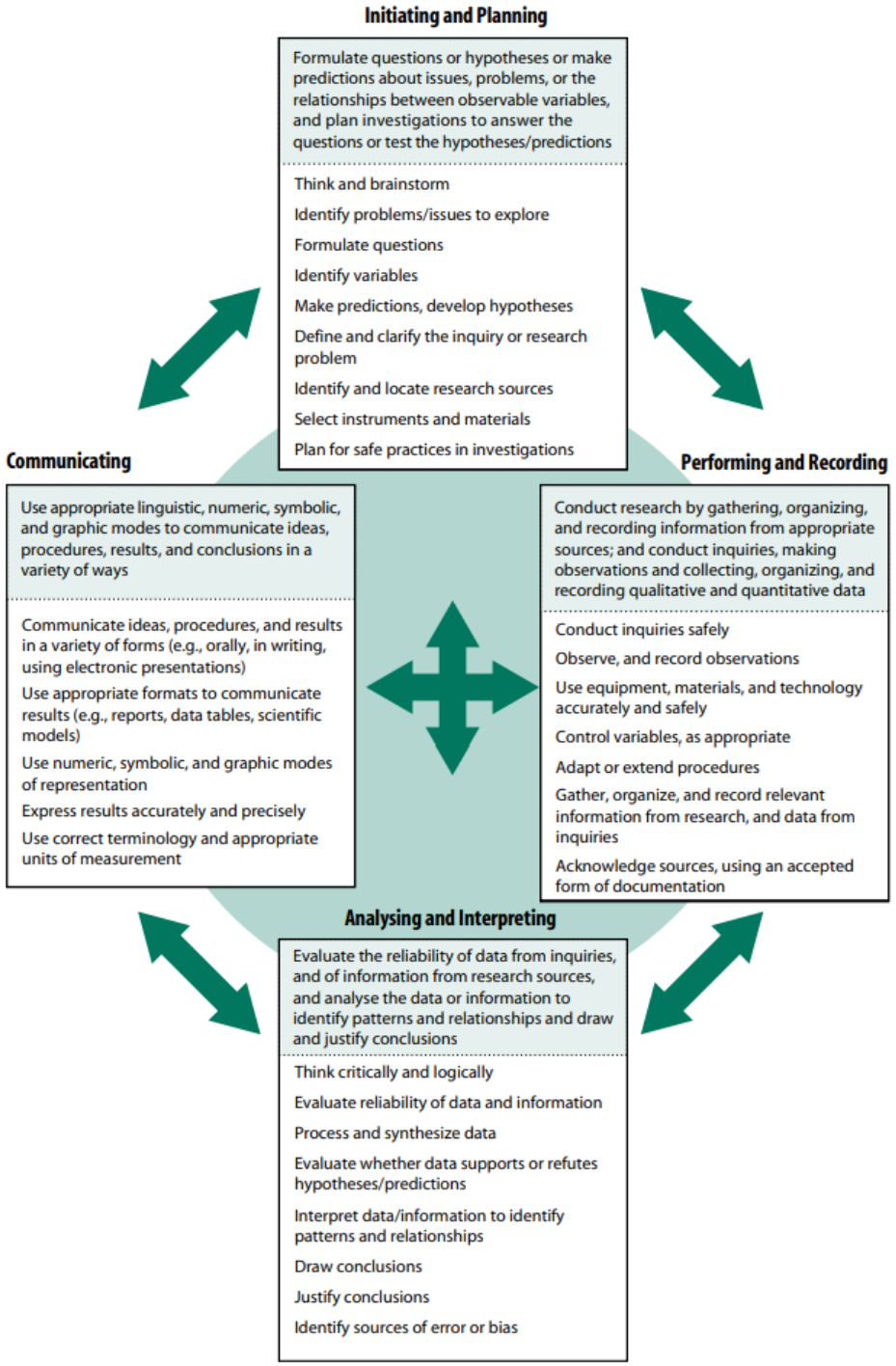
Science


Fundamental Concepts
Matter
Energy
Systems and Interactions
Structure and Function
Sustainability and Stewardship
Change and Continuity
BIG IDEAS
The Goals of Science
Goal 1
To relate science to technology, society, and the environment
Goal 2
To develop the skills, strategies, and habits of mind required for scientific inquiry
Goal 3
To understand the basic concepts of science
Overall Expectation 1
Overall Expectation 2
Overall Expectation 3
Specific Expectations
Relating science to technology, society, and the environment
Specific Expectations
Developing skills of scientific investigation and communication
Specific Expectations
Understanding basic concepts

Science

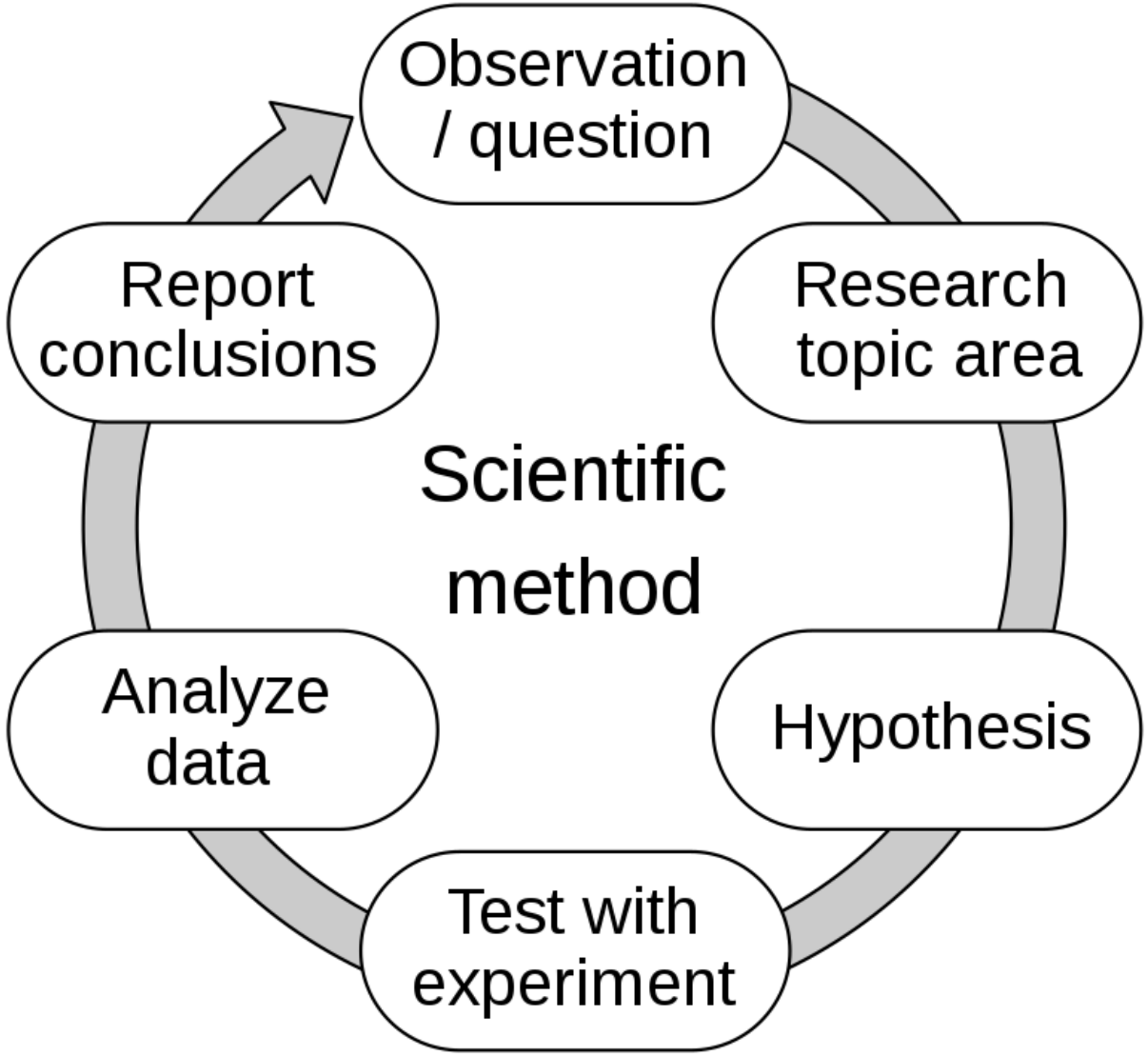
Scientific Investigation Skills

- Initiating and planning skills include formulating questions or hypotheses or making predictions about ideas, issues, problems, or the relationships between observable variables, and planning investigations to answer those questions or test those hypotheses.
- Performing and recording skills include conducting research by gathering, organizing, and recording information, and safely conducting inquiries to make observations and to collect, organize, and record data.
- Analysing and interpreting skills include evaluating the adequacy of the data from inquiries or the information from research sources, and analysing the data or information in order to draw and justify conclusions.
- Communication skills include using appropriate linguistic, numeric, symbolic, and graphic modes of representation, and a variety of forms, to communicate ideas, procedures, and results.



Science

The Scientific Method
(from Wikipedia)



Math

MATHEMATICAL PROCESS EXPECTATIONS

Problem Solving	• develop, select, apply, compare, and adapt a variety of problem-solving strategies as they pose and solve problems and conduct investigations, to help deepen their mathematical understanding;
Reasoning and Proving	• develop and apply reasoning skills (e.g., use of inductive reasoning, deductive reasoning, and counter-examples; construction of proofs) to make mathematical conjectures, assess conjectures, and justify conclusions, and plan and construct organized mathematical arguments;
Reflecting	• demonstrate that they are reflecting on and monitoring their thinking to help clarify their understanding as they complete an investigation or solve a problem (e.g., by assessing the effectiveness of strategies and processes used, by proposing alternative approaches, by judging the reasonableness of results, by verifying solutions);
Selecting Tools and Computational Strategies	• select and use a variety of concrete, visual, and electronic learning tools and appropriate computational strategies to investigate mathematical ideas and to solve problems;
Connecting	• make connections among mathematical concepts and procedures, and relate mathematical ideas to situations or phenomena drawn from other contexts (e.g., other curriculum areas, daily life, current events, art and culture, sports);
Representing	• create a variety of representations of mathematical ideas (e.g., numeric, geometric, algebraic, graphical, pictorial representations; onscreen dynamic representations), connect and compare them, and select and apply the appropriate representations to solve problems;
Communicating	• communicate mathematical thinking orally, visually, and in writing, using precise mathematical vocabulary and a variety of appropriate representations, and observing mathematical conventions.

Math

Data Management Investigation

1. Designing and Carrying Out a Culminating Investigation

By the end of this course, students will:

1.1 pose a significant problem of interest that requires the organization and analysis of a suitable set of primary or secondary quantitative data (e.g., primary data collected from a student-designed game of chance, secondary data from a reliable source such as E-STAT), and conduct appropriate background research related to the topic being studied

1.2 design a plan to study the problem (e.g., identify the variables and the population; develop an ethical survey; establish the procedures for gathering, summarizing, and analysing the primary or secondary data; consider the sample size and possible sources of bias)

1.3 gather data related to the study of the problem (e.g., by using a survey; by using the Internet; by using a simulation) and organize the data (e.g., by setting up a database; by establishing intervals), with or without technology

1.4 interpret, analyse, and summarize data related to the study of the problem (e.g., generate and interpret numerical and graphical statistical summaries; recognize and apply a probability distribution model; calculate the expected value of a probability distribution), with or without technology

1.5 draw conclusions from the analysis of the data (e.g., determine whether the analysis solves the problem), evaluate the strength of the evidence (e.g., by considering factors such as sample size or bias, or the number of times a game is played), specify any limitations of the conclusions, and suggest follow-up problems or investigations

2. Presenting and Critiquing the Culminating Investigation

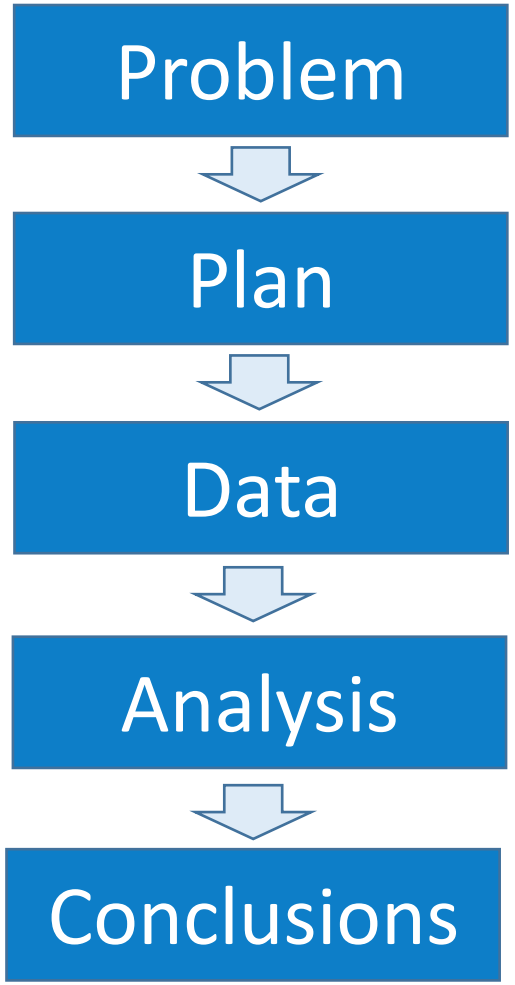
By the end of this course, students will:

2.1 compile a clear, well-organized, and detailed report of the investigation

2.2 present a summary of the culminating investigation to an audience of their peers within a specified length of time, with technology (e.g. presentation software) or without technology

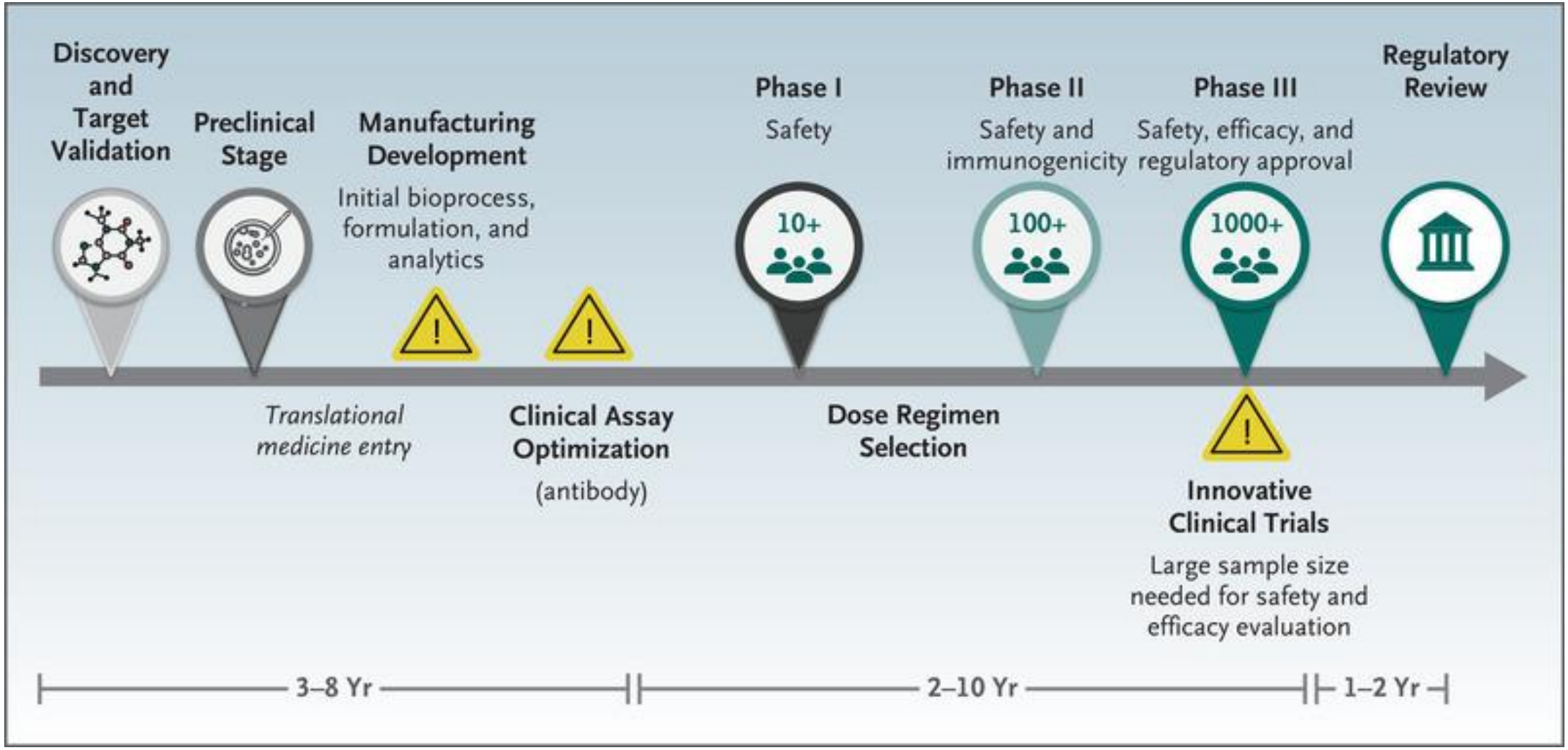
2.3 answer questions about the culminating investigation and respond to critiques (e.g., by elaborating on the procedures; by justifying mathematical reasoning)

2.4 critique the mathematical work of others in a constructive manner



Math

Vaccine Development Process



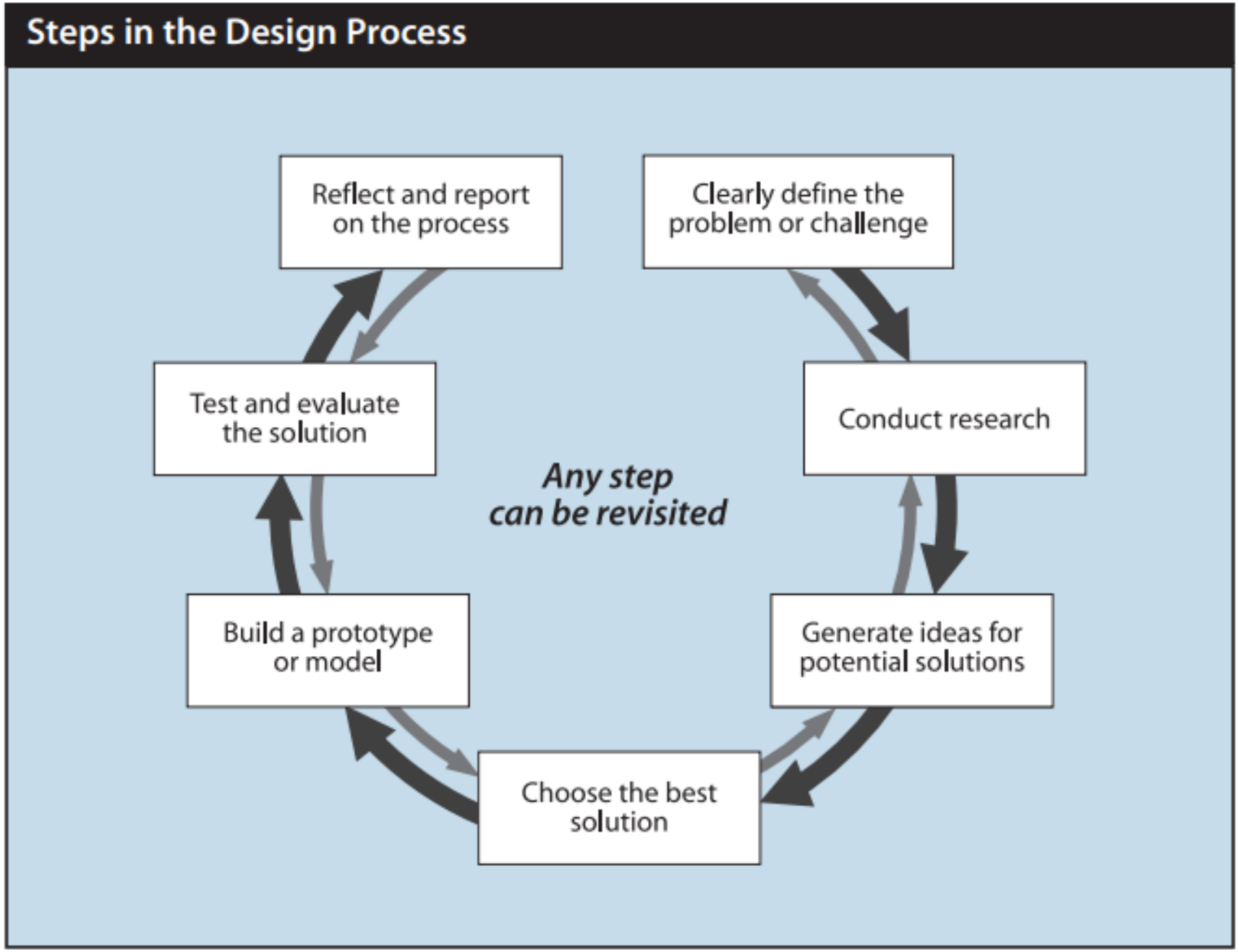
New England Journal of Medicine, https://www.nejm.org/doi/full/10.1056/NEJMe2025111

Tech

Problem Solving

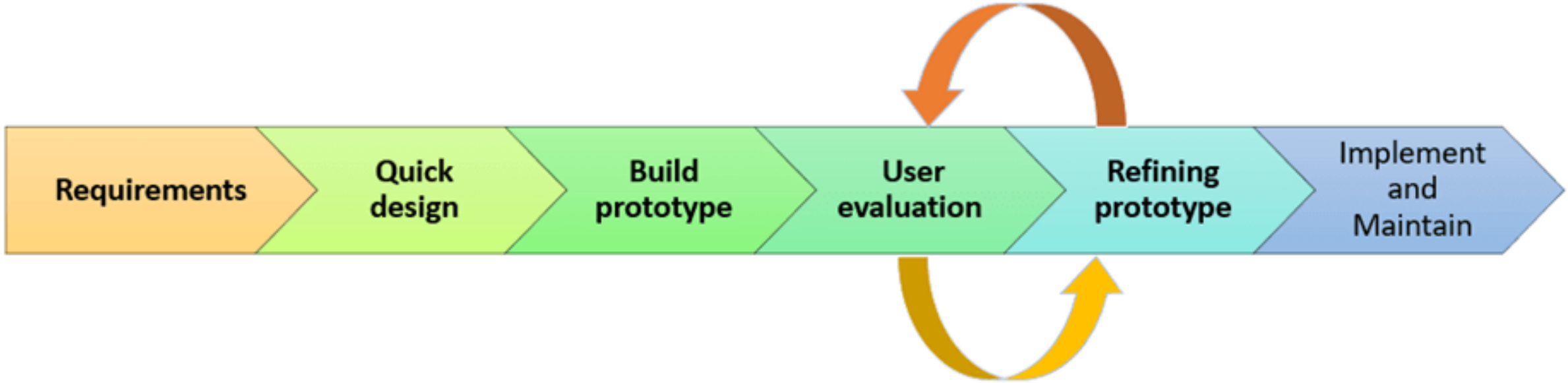
- Parts Substitution: Simply substitute parts until the problem is solved. Although it is not the most scientific method of problem solving, there may be no other alternative if tests do not indicate what could be causing the problem.
- Diagnostics: Eg. troubleshooting an engine fault in an automobile. After identifying the general problem, the technician would run tests to pinpoint the fault. The test results would be used as a guide for further testing or for part replacement, which would also be tested. This process continues until the solution is found.
- Reverse Engineering: Reverse engineering is the process of discovering the technological principles underlying the design of a device by taking the device apart, or carefully tracing its workings or its circuitry. It is useful when students are attempting to build something for which they have no formal drawings or schematics.
- Divide and Conquer: “Divide and conquer” is the technique of breaking down a problem into subproblems, then breaking the subproblems down even further until each of them is simple enough to be solved. Divide and conquer may be applied to allow groups of students to tackle subproblems of a larger problem, or when a problem is so large that its solution cannot be visualized without breaking it down into smaller components.
- Extreme Cases: Considering “extreme cases” – envisioning the problem in a greatly exaggerated or greatly simplified form, or testing using an extreme condition – can often help to pinpoint a problem. An example of the extreme-case method is purposely inputting an extremely high number to test a computer program.
- Trial and Error: The trial-and-error method involves trying different approaches until a solution is found. It is often used as a last resort when other methods have been exhausted.

Tech


Steps in the Design Process
Clearly define the problem or challenge
Conduct research
Generate ideas for potential solutions
Choose the best solution
Build a prototype or model
Test and evaluate the solution
Reflect and report on the process
Any step can be revisited

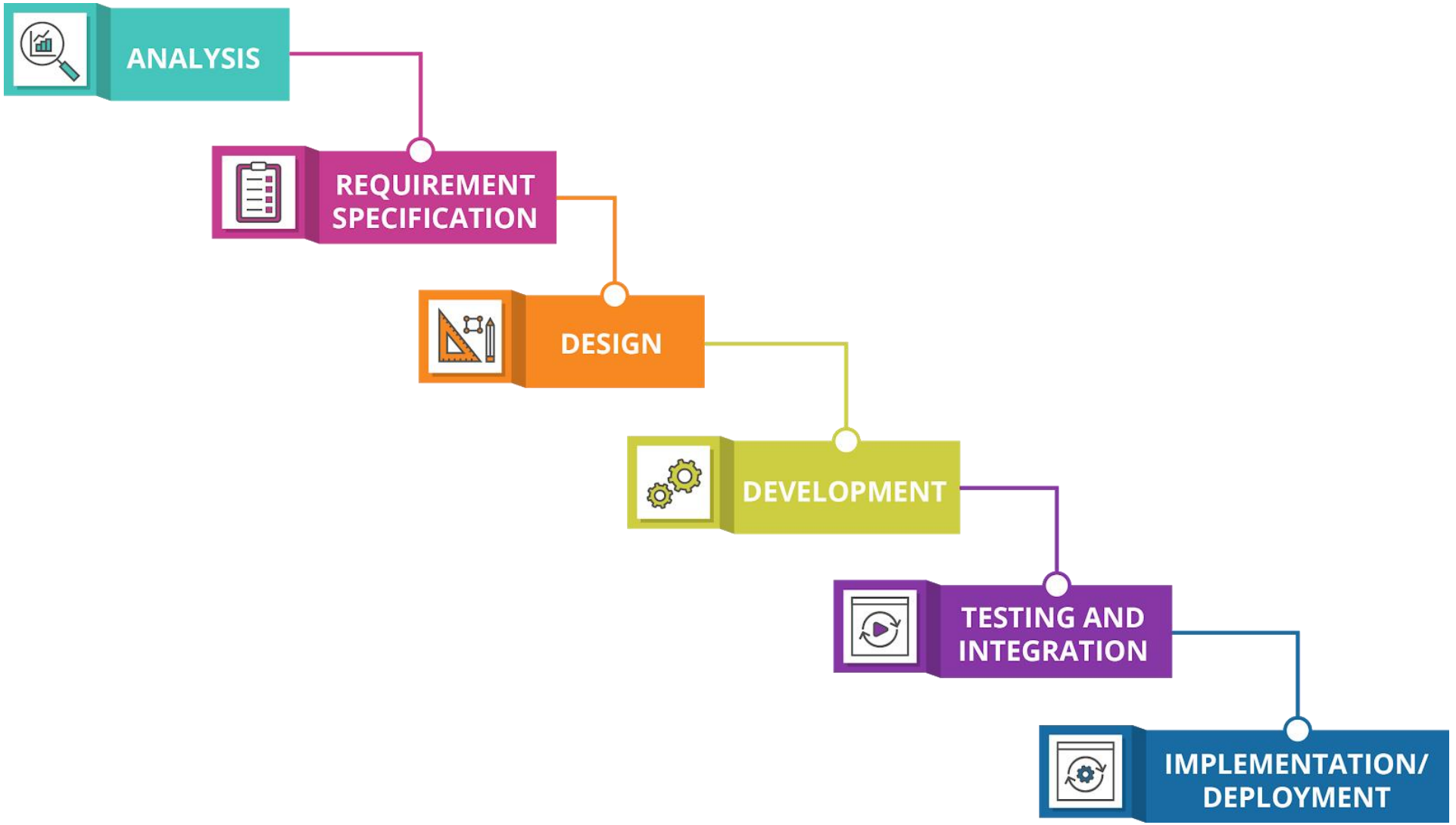
Tech

Rapid Prototyping PDLC



Tech

Waterfall PDLC



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Boehm's Spiral Model PDLC