

# Incorporating Writing Skills into Science Curriculum



## Course Goals and Learning Objectives

Upon completion of this course, students will have reliably demonstrated the ability to write in an effective and compelling manner.

Given a prompt, students will be able to:

- 1) independently identify their writing purpose and motivation,
- 2) choose effective words and phrases to fulfill their purpose,
- 3) and compose an engaging and convincing narrative.

## Schedule

	<i><b>Date</b></i>	<i><b>Topic</b></i>
<i>Week 1</i>	9/26	Overview and Motivation
<i>Week 2</i>	10/3	Sentence Structure
<i>Week 3</i>	10/10	Purpose and Paragraph Structure
<i>Week 4</i>	10/17	Word Choice
<i>Week 5</i>	10/24	Jargon
<i>Week 6</i>	10/31	Demonstration
<i>Week 7</i>	11/7	Audience and Framing
<i>Week 8</i>	11/14	Review

## Week 1: Motivation and Overview

### Motivation

You are here to earn a degree, to better yourself and your chances of getting a good job that you enjoy. In that job, you may need the skills and knowledge you gain in your science classes. You will definitely need effective communication skills. When employers hire recent college graduates, they care most about an applicant's communication skills (Hart Research Associates, 2015). Employers care more about communication skills than they do critical thinking or analytical reasoning.

But, traditional disciplinary training does not prepare students to be good communicators. Effective communication requires training and practice beyond discipline-specific lectures and coursework. Students graduate equipped with scientific knowledge but not the communication skills they need to benefit from that knowledge. Often, students don't appreciate the magnitude of this shortcoming. Sixty-five percent of recent college graduates think they are well-prepared in written communication; only twenty-seven percent of employers agree (Hart Research Associates, 2015).

So, this syllabus was made to address the problem. Students will learn valuable written-communication skills and practice these skills in their weekly homework assignments. Very little time is needed to incorporate this syllabus into an established science curriculum, and instructors do not need to be communication experts. All you need is this syllabus, motivation, and a little practice.

### Overview

Each week, we will discuss and practice a new writing skill. In-class discussions will be short, about ten minutes. You will learn more about each skill by reading a short lesson on your own. Then, you will practice these skills by incorporating them in your weekly homework assignments.

These skills will build off each other every week. They will start very basic. We will begin with how to form a well-written sentence. We will then practice how to combine these well-written sentences into well-structure paragraphs that have a clear purpose and overarching narrative. Next, we will craft these paragraphs so that the words and phrases effectively engage our reader.

By the end of this course, you will have the toolbox and practice you need to write in a clear, concise, and engaging way. When you craft your writing in this way, you and your reader get what each of you need.

### Assignment

Over the next week, you will read many things. You will read scientific things like book chapters and syllabi. You will read colloquial things like text messages and advertisements. Over the next week, I want you to think about what you read.

What things did you enjoy reading? Why? Were they easy to understand? Did they engage you? What did they make you feel?

What things did you struggle to read? Why? Were they confusing? Did they feel like they were written for you? What did they make you feel?

You do not need to write anything down. You only need to think and reflect.

## Week 2: Sentence Structure

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“Short sentences aren’t hard to make.  
The difficulty is forcing yourself to keep them short.

There are innumerable ways to write badly.  
The usual way is making sentences that don’t say what you think they do.  
Which can the reader possibly believe? Your sentences or you?

The only link between you and the reader is the sentence you’re making.  
There’s no sign of your intention apart from the sentences themselves,  
And every sentence has its own motives, its own commitments,  
Quite apart from yours.  
It adheres to a set of rules – grammar, syntax, the history and customs of language, a world of  
echoes and allusions and social cues – that pay no heed to your intentions,  
If you don’t heed those rules.

It’s hard to pay attention to what your words are actually saying.  
As opposed to what you mean to say or what you think you’re saying.  
Knowing what you’re trying to say is always important.  
But knowing what you’ve actually said is crucial.  
It’s easier to tell what you’re saying in a short sentence.

You’ve been taught to believe that short sentences are childish,  
Merely a first step toward writing longer sentences.  
You’d like to think your education has carried you well past short sentences.  
But you’ve been delivered into a wilderness of false assumptions and bad habits,  
A desert of jargon and weak constructions, a land of linguistic barbarism,  
A place where it’s nearly impossible to write with clarity or directness,  
Without clichés or meaningless phrases.  
True, you can sound quite grown-up, quite authoritative, in the manner of college professors and  
journalists and experts in every field,  
    (You may be a college professor, a journalist, or an expert in some field.)  
How well do they write?  
How much do you enjoy reading them?

You’ll make long sentences again, but they’ll be short sentences at heart.  
Sentences listening for the silence around them. Listening for their own pulse.”

[ Several Short Sentences About Writing – Klinkenborg (2012) ]

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## Lesson

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The classrooms where students come to learn from their instructors who know a lot about science and practice explaining it have got to change for the sake of their careers.

[ poorly-written sentence ]

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What makes this sentence so hard to read and understand?

- The sentence's primary subject (classrooms) and primary verb (have) are separated by many clauses. These clauses have their own subject/verb pairs (i.e. students come, instructors teach). As a result, the reader may not immediately make a mental connection between the primary subject and verb.
- Pronouns are not clear. What is **it** that the teachers are explaining? For the sake of **their** careers - whose careers, the students' or instructors'?
- The purpose of the sentence is not clear. Do the classrooms themselves need to change, as in the classrooms' physical structures of walls and chairs? Or do the instructors' teaching practices need to change?
- Some clauses are unnecessary to the purpose. If the point of the sentence is to state that teaching practices have got to change, why include that instructors know a lot about science?

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Instructors should incorporate instruction on writing skills into science classes. These valuable communication skills will benefit the students in their future careers.

[ well-written sentence(s) ]

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## Assignment

Practice good sentence-writing skills when you complete your homework this week. Things to consider:

- Is the verb close to the subject? Do not separate the subjects and verbs with unnecessary clauses.
- Are all pronouns clear? There should be no other participant (teacher, boy, dog, etc.) between the pronoun and the participant the pronoun refers to.
- Is the purpose of the sentence clear? There should be no alternative interpretations of the sentence. Try reading the sentence out loud or asking a friend for their interpretation.
- Are there any clauses unnecessary to the purpose? If you don't need it, get rid of it.

## Week 3: Purpose and Paragraph Structure

# ABT FRAMEWORK BASICS

The Elements of ABT (And, But, Therefore) Universal Narrative Template

### REFERENCE CARD

The **ABT Narrative Template** is a new tool for organizing the narrative structure of any amount of content. It is at the core of storytelling, logic, reason, argument and the scientific method.

It is the idea of shrinking a narrative thread down to a single sentence using three connector words: **and, but, therefore**. It embodies the three forces of narrative:

**AGREEMENT** – and  
**CONTRADICTION** – but  
**CONSEQUENCE** – therefore

You can  
also think  
of it as:

**SET UP** – and  
**PROBLEM** – but  
**SOLUTION/ACTION** – therefore

The ABT Narrative Template was developed in 2012 by scientist-turned-filmmaker Randy Olson, though its origin reaches back thousands of years to Aristotle and the beginning of narrative culture.

### NARRATIVE ANALYSIS

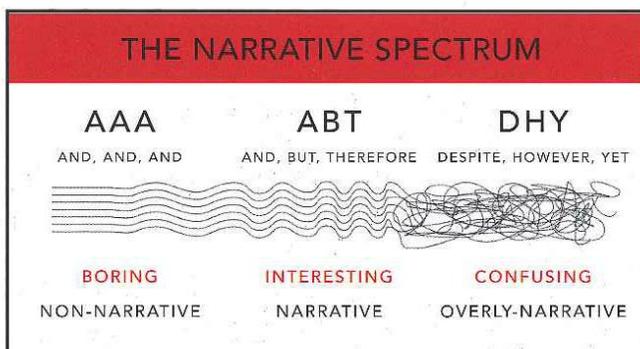
#### Good Narrative Form

ABT (And, But, Therefore) – the optimal amount of narrative content

#### Bad Narrative Form

AAA (And, And, And) – too little narrative (no contradiction = no narrative content)

DHY (Despite, However, Yet) – too much narrative content (multiple contradictions)



The Narrative Spectrum is the fundamental tool for **NARRATIVE ANALYSIS**.

For further **ABT** insight:  
[www.StoryCirclesTraining.com](http://www.StoryCirclesTraining.com)

## Lesson 1: Purpose

When we write, we want our readers to read, grasp, and remember our purpose. How can we make that happen?

1. Make your written text visually appealing.

At first, you see only text. Would you rather read a huge block of continuous text? Or text that has been broken up into short paragraphs with plenty of dynamic white space on the paper?

2. Choose a single main purpose.

You should be able to condense that purpose into a single sentence.

My purpose for formatting this page the way I have is to demonstrate how to make text visually appealing and how write in a narrative style.

3. Form a narrative.

Take advantage of humanity's tendency to remember stories.

I bet you can recite the storyline of the last book you read. But, how much can you remember from the last non-narrative lecture you sat through?

## Lesson 2: Paragraph Structure

You begin reading text, and you finish the first paragraph, and you keep going on to the second, and after the second you skim down to see how much further you need to go, and your mind wonders... what were you even reading?

When we write, we must string together many thoughts, and we can do this with conjunctions like the word *and*. But, when we only use words like *and*, we bore our readers. There is no hook or suspense to keep them interested. So, we should introduce complications by using words like *but*, *however*, and *although*, and then resolve those complications with words like *therefore*, *consequently*, and *thus*.

Effective narratives are made by intertwining ABT frameworks. Small ABT frameworks can be made into single paragraphs and then those paragraphs can be strung together into a larger ABT narrative. But, be careful. If you introduce too many complications without balancing with set up or concluding with solutions, your piece may become over-narrative and ineffective. To become effective narrators, you'll have to practice.

## Assignment

Practice good paragraph structure to support your purpose when you complete your homework this week. Things to do when asked to write long responses:

- Identify the purpose of your exposition. What is the one thing you want your reader to remember?
- Each paragraph should scaffold that main purpose.
  - First paragraph – provide context to set the scene.
  - Second paragraph - introduce a problem or conundrum to hook your reader.
  - Third paragraph – offer a solution or consequence to wrap it all up.
- Make sure that each sentence and each paragraph supports your purpose in some way. If you don't need it, get rid of it.

## Week 4: Word Choice



### Lesson 1: Passive vs. Active Voice

Active voice is more impactful than passive voice.

#### Active Voice

You chose the perfect words.

doer of action    action    receiver of action

#### Passive Voice

The perfect words were chosen by you.

receiver of action    action    doer of action

### Lesson 2: Over-Used, Flowery, and Cliché Language

Some words are weak because they are too commonly used. You want your writing to stand out and be memorable, not drown in a stack of papers that are essentially identical.

**Passionate, Love**      These words are over used and can read as juvenile.

**Really, Truly, Deeply**    Flowery language and excessive adverbs come off as insincere.

**Think outside the box**    Cliché phrases come off as trendy rather than creative.

You may be tempted to use a thesaurus to find more unique and smarter-sounding words. Tread with caution! Do not use words or phrases that you are unfamiliar with or that sound unnatural in your writing. Often, the simplest words are the most effective at showcasing your skills and personality.

## Lesson 3: Word Strength

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This is a good document that tells about written communication.

[ weak words ]

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What makes these words so weak?

- **Good** provides a general judgement but does not explain how, why, or in what way.
  - **Document** does not tell us what kind of document this is.
  - **Tells** does not demonstrate how this document communicates information.
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This class syllabus outlines and describes how to effectively incorporate written-science communication into a science curriculum.

[ strong words ]

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## Lesson 4: Wordiness

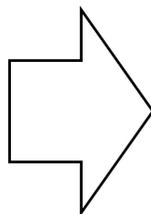
Reduce wordiness to make your writing more concise, easier to understand, and more pleasant to read.

Due to the fact that

In the event that

Concerning the matter of

I came to the conclusion that



Because

If

About

I concluded that

## Assignment

Practice selecting strong words and phrases when you complete your homework this week. Things to consider:

- Are you using an active voice? Remember to start your sentences with the doer of action rather than the receiver of action.
  - After you write your first draft, reconsider the strength of all your nouns and verbs. Can you use another word that is more descriptive? Can you use another word that is more unique?
  - Don't be overly wordy. If a phrase sounds awkward when spoken out loud, try shortening it to be more concise and read more naturally.
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## Week 5: Jargon

### What is jargon?

Jargon refers to words or expressions that are specific to a discipline and may be difficult for “outsiders” to understand.

### Why can using jargon be good?

Jargon is often more efficient and precise.

Using jargon demonstrates your knowledge of a topic and lends you credibility.

Readers like to learn new jargon.



### Why can using jargon be bad?

Using jargon can intimidate a reader if they feel less intelligent or knowledgeable.

Using jargon just to sound smart often makes writing sound convoluted and hard to understand.

The reader can misinterpret the writing if they assign different meanings to jargon terms.

Type	Example	Remedy	
Noun Word Stacks (many jargon terms strung together)	Headwater coniferous stream ecosystems	Deconstruct	Ecosystems in the headwaters of streams where there are many conifer trees.
Multiple Meanings	Shear (shear stress vs. shear a sheep) Model (computer vs. runway)	Provide Context Clues	I used a computer model to simulate the wind shear in a hurricane.
Negative Connotations	Bias (connotation linked to race, gender, politics) Manipulate (connotation of illicit tampering)	Use Different Words	Bias → offset from an observation Manipulate → scientific data processing

## Lesson

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The **skills-building communication curriculum** will be **facilitated** to **augment capacity scaffolding** and **utilize preexisting resources** to **engineer evidence-based practices**.

[ bad jargon ]

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Why is the jargon used in this sentence bad?

- Too much jargon. Even if a reader knows each single word, the sentence becomes incomprehensible when so many jargon words are used together.
  - The jargon does not serve a purpose.
    - a. The reader is not impressed. Rather, they may just be confused or intimidated.
    - b. The reader does not learn. There are too many jargon words and not enough context clues for the reader to learn the meaning of a new jargon term.
    - c. The sentence is not efficient or precise. The jargon words are just bigger and more complicated than non-jargon words.
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This curriculum, which will **strengthen students' communication skills**, was developed using **evidence-based teaching strategies** and is designed to easily integrate into existing science courses.

[ good jargon ]

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Why is the jargon used in this sentence good?

- This sentence has only one jargon phrase, so the reader won't be overwhelmed or confused.
- The writer demonstrates their knowledge of education theory by using a jargon phrase that is specific and commonly used in the field of education research.
- The reader can learn. The rest of the sentence is easy to understand, so the reader can focus on this single jargon phrase and figure out its meaning using context clues and prior knowledge.

## Assignment

Practice using good jargon and avoiding bad jargon when you complete your homework this week. Things to consider:

- Strategically use 2-3 jargon terms and/or phrases. Think of why you used them.
    - Do they serve a constructive purpose?
    - Would another word be just as effective but less confusing?
    - Have you used jargon to effectively demonstrate your knowledge of the topic?
    - Have you provided enough context clues to help your reader understand and to demonstrate that you fully understand the words you use?
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## Week 6: Demonstration

Readers are naturally skeptical. You have to earn their trust by demonstrating that you have a reason to make a claim, both personally and scientifically. Anyone can say “I am passionate about fighting against climate change”, but only those who actually are can prove it.

### Lesson 1: Personal Claims

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#### The Teller

“I am passionate about fighting against climate change.

I think it is my duty, as a human, to protect our planet for future generations. To achieve this goal, I want to continue to learn about climate modeling and work with my mentors to become more effective at talking to policy makers about climate change.”

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#### The Demonstrator

“I work hard to prevent future generations from suffering from climate change.

I have participated in climate-modeling workshops and collaborated with senior climate scientists on their research to become more proficient in the field. I have also attended local meetings and offered my expertise to policy makers.”

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### How to demonstrate your own personality, expertise, and point of view:

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#### Tell

I know how to use GIS.

I am a good leader.

I know a lot about forestry.

I feel the impacts of climate change.

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#### Demonstrate

I use GIS to predict flood hazards.

As the leader of a team that studied flood hazards, I organized meetings, delegated duties, and oversaw the production of our collaborative report.

I am on track to earn a bachelor’s degree in forestry by the end of this year.

Even though my family has lived in the Carolinas for generations, I am nervous about inheriting land that is flooded more and more with each hurricane season.

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## Lesson 2: Scientific Claims

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### The Teller

“Over time, climate change has made hurricanes, which form over ocean water, much larger and much more dangerous.”

### The Demonstrator

“The number of major hurricanes in the Atlantic Ocean has essentially doubled since 1970, likely because hurricanes are fueled by the warmer ocean water and moister sea air.”

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## How to demonstrate the validity of scientific claims:

### Tell

Larger hurricanes cause more coastal flooding.

GIS is a good tool to use to map flood hazards.

### Demonstrate

High-magnitude hurricanes produce stronger winds and more rain. Strong winds and rain increase coastal flooding by enhancing storm surge and freshwater runoff, respectively.

GIS can be used to accurately predict flood hazards by mapping predicted storm surge over high-resolution digital elevation models.

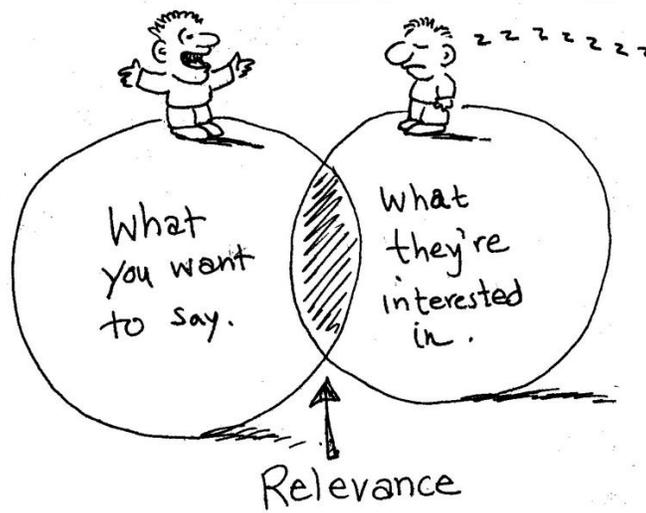
## Assignment

Practice demonstrating your claims when you complete your homework this week. Things to consider:

- Make a claim at the beginning of your homework response. Follow the claim with specific examples that demonstrate why the claim is true and why your point of view is valuable.
- When you make a claim about yourself:
  - Provide an example of a past action that demonstrates your personality
  - List accomplishments or accolades that demonstrate your expertise
  - Provide context to demonstrate why your point of view is relevant
- When you make a claim about science:
  - Provide specific examples, statistics, events, etc.
  - Include reliable sources
  - Clearly state scientific cause and effect

## Week 7: Audience and Framing

We all have a unique perspective, and everything your audience sees and hears is filtered through their perspective, regardless of what you intended to communicate.



The only link between you and the reader is the sentence you're making.  
 There's no sign of your intention apart from the sentences themselves,  
 And every sentence has its own motives, its own commitments,  
 Quite apart from yours.

[ Several Short Sentences About Writing – Klinkenborg (2012) ]

### Lesson 1: Consider Your Audience

Before you write, consider your audience's perspective. For example, what may be the perspectives of a science student, their parent, and their future employer?

	Science Student	Parent	Employer
<b>What do they value?</b>	Learning about interesting and useful science	Their child earning a degree that will give them a prosperous future	Having a competent applicant pool, students learning applicable skills
<b>What are their concerns?</b>	Daily schedules, mental stress, unclear futures, grades	Child's health and happiness, their relationship	The success of their business and bottom line
<b>What are their preconceived notions?</b>	Their degree will be useful to their career, their professors are experts in the field	The degree will be useful to their child's career, the professors don't care enough about their children	Applicants generally don't learn broad applicable skills like communication

## Lesson 2: Frame Your Writing

After you've considered your audience, frame your writing to fit their perspective. Do this both in what you say and how you say it.

### What to say

- Discuss your audience's values and concerns. Recognize that their values and concerns may be different from your own.
- Relate what you are writing to your audience's life.

### How to say it

- Use **jargon** that your audience is familiar with.
- Explain the **science** at the level your audience understands and values.
- Explain your **motivation** at the level your audience understands and values.

For example, if I wanted to explain why these lessons are important:

**Student:** Why are these lessons important?

**Me:** By working through this syllabus, you will gain valuable writing skills that will help you market yourself to get the job you want in less time and with less stress. You will also learn to better communicate with your friends, family, and colleagues so that they understand and appreciate what you have to say.

**Parent:** Why are these lessons important?

**Me:** Your child will gain communication skills that will help them in their future careers, from applying for the job to negotiating a raise and retirement plan.

**Student's Future Employer:** Why are these lessons important?

**Me:** Your future applicants will be able to better communicate with you, their fellow employees, and to your customer. This will increase your yield by decreasing the time needed to explain concepts as well as stimulate valuable discussion and collaboration within your company.

## Assignment

Practice considering your audience when you complete your homework this week. Things to consider:

- Know who your audience is before you begin writing. This will either be given to you in the prompt or you will be asked to choose your audience.
- Frame your response around your audience's perspective. What do they value? How knowledgeable are they of the subject matter?
- Use jargon strategically. What is your purpose for using jargon with this specific audience? To impress? To educate?