Writing in CS: Why and How?

SIGCSE ‘18

Who we are

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Motivation and objectives

Computer scientists are professionals

ACM Curriculum 2013

Professional communication conveys technical information to **various audiences** who may have very **different goals and needs** for that information. Effective professional communication of technical information is **rarely an inherited gift**, but rather needs to be taught in context throughout the undergraduate curriculum.

Motivation and objectives

Computer scientists are professionals

ACM Curriculum 2013

Students need help getting there

"For the first project, the task at hand was to gain a grasp on the different programs and learn how to conduct basic actions, such as making shapes of differing sizes, using those programs. Getting an initial understanding to the programs allows us to further our abilities with the programs like TextWrangler, Python, and Turtle. The real task at hand was not based on how well we were able to perform the simple tasks such as making squares and triangles, but really learning how the systems operate for future reference. "

Motivation and objectives

Computer scientists are professionals

ACM Curriculum 2013

Students need help getting there

Problem: that if a and b are even integers, then their arithmetic mean (a+b)/2 is also an even integer.

Solution: Since a and b are even, then a = 2j and b = 2k. So (2j+2k)/2 = j+k. There are now four cases:

- both j and k are even: then the sum is even
- both j and k are odd: then it is even
- j is odd and k is even: then it is odd
- j is even and k is odd: then it is odd

For example, if j = 6 and k = 5, then j+k = 11.

Motivation and objectives

Writing allows for exploration and conversation

- Clear writing as a vehicle for clear thinking
- Guided metacognition and study skills
- Online cohorts during professional internships

Objectives connected with tasks: what are we trying to get them to do?

Motivation and objectives

CS experts are not necessarily writing pedagogy experts

But there are experts on many of our campuses

And we can work with them (not just send students to them to be “fixed”)

Discussion question

What’s your motivation for coming to the panel?

If you’ve tried writing in your classes: What’s worked? What hasn’t?

If you haven’t, why not?

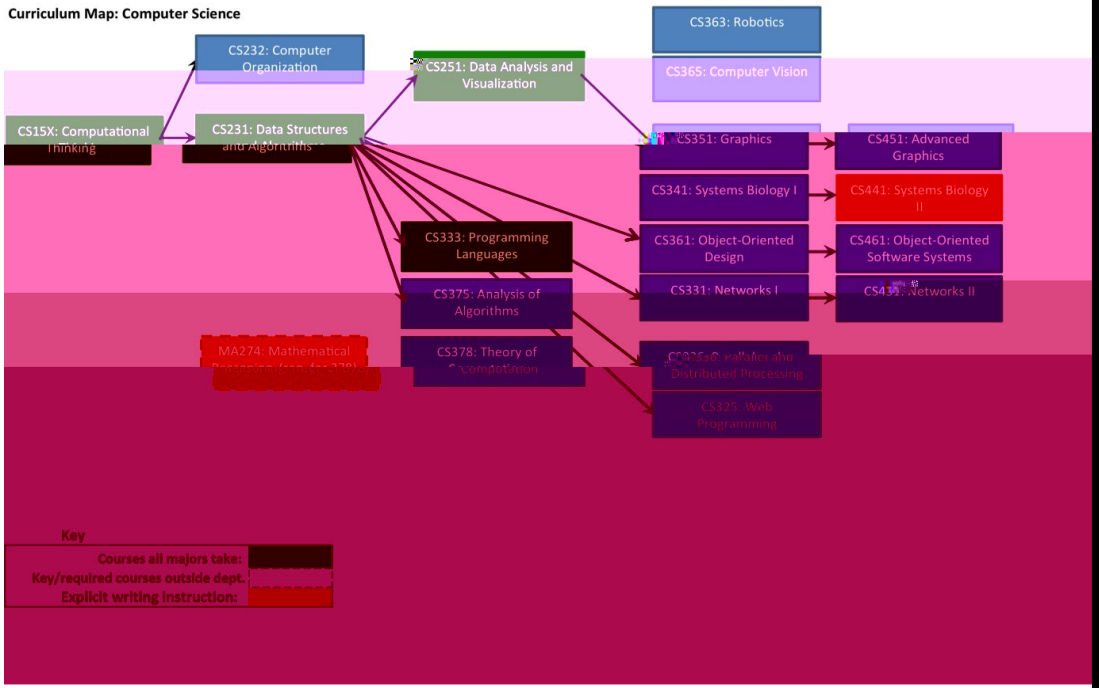
Curriculum and implementation

Curriculum-wide concept

Student reactions

English language learners

Writing-Enriched Curriculum



Mini Lessons

Guidelines for Summaries

To check whether you've made your summary clear, you may ask yourself the following questions:

- Does it describe the ~~CS purpose of~~ lecture concepts used in the project?
- Does it describe the specific project application?
- Does it describe the solution or how it was developed?
- Does it describe the results or outputs?
- Is it concise?
- Are all of the terms well-defined?
- Does it read logically and in the proper order?

Colby

Sample from Summary before Lesson:

The key purpose of this project was to be able to manipulate (r,g,b) values in pixmaps to create filters that change the pixmap. We also learned how to place a pixmap into another.

Grader Feedback:

Your summary captures the two most important aspects of the image-processing, but uses the term (r,g,b) without defining it. Please give a little description of what (r,g,b) means. Also, where is the description of the computer science purpose of the project? I would say something about learning how to use objects and for loops to loop over a 2D grid of pixels.

Summary from subsequent project:

The purpose of this class on the surface was to be able to build a collage from several photos, using several unique effects. In python doing this allowed for working more with for loops, if/elif statements, and lists.

English Language Learners

- Lessons and feedback focus on content -- not grammar
- Focus on making instructions and expectations clear.
  - E.g. have an expert read instructions to give advice on what may not be clear enough
- Work with writing center!
  - Resource for faculty: for assignment development and how to phrase feedback
  - Resource for students: this is where they can learn more about mechanics of writing

Example of feedback to English-Language Learner

Sample Project 3 Summary:
In this project, we simulated a parking garage where cars can park, retrieve when they are supposed to. We implemented stack data structure to finish the project.

Project 4 Summary:
In this project, we used the singly linked list as the primary data structure to implement a Finding Friend simulation. The simulation takes in many agents, each of which has the rule that controls its movement will be influenced by its neighbors.

Project 5 Summary:
In this project, we implemented a simulation of customers with different numbers of items checking out at the counters of the supermarket. The way of each customer to choose a checkout line and join is different and takes up different time. To accomplish this, we made a Customer which stores the information of customer (item numbers, time, timestep etc.) We created a MyQueue which gave the basic algorithms of a checkout Queue, which follows "first-in-first-out" rule. Based on this, we created other algorithms to complete the project.

Project 3 Grader Feedback:
Your summary captures the c.s. purpose and the simulation purpose of the project, and its relates them. But it doesn't provide the reader with any real sense of what your coding solution was (e.g. that you needed one stack for each lane and that multiple cars parked in each lane) or what the results were (e.g. that you simulated multiple parking strategies).

Project 4 Grader Feedback:
Your summary identifies the two main points of the project, but doesn't explain it to your reader. What is a "finding friends simulation"?

Colby

Writing for professional growth

229 students successfully completed CSE 197 in conjunction with full-time summer internships at over 120 different companies around the world.



Students posted over 2800 reflections on Piazza, and over 6000 comments on each other's reflections. In Fall, students presented their summer projects in posters during a day long Symposium.

UC San Diego

Writing for professional growth

Each weekly post should have **quick notes** (bullet points are fine) and a **deeper reflection** (at least 300 words, but more is fine). Every week, you'll also read your group members' reflections. Pick at least two posts and respond to them with specific questions: **what** do you want to know more about, and **why**? In your writing in this course, be **honest**, **empathetic**, and **analytical** about your experiences.

Example prompt from week 6:

Quick notes: In what ways does your company communicate to you its norms and expectations for professional and ethical behavior?

Reflection: Describe a recent newsworthy example of a company that is facing an ethical question or issue. (Choose a company from the sector in which you're working.) What impacts do public ethical dilemmas have on how you act as a professional? How do they change how you see your role as a professional?

UC San Diego

Additional Implementation Issues

Who grades the writing and provides feedback to students?

- Need clear rubrics
- Need to train student graders

How do we develop excellent, reusable assignments?

- Spend time
- Consult writing center

Discussion question

What are you doing at your institution?

What would you most like to do at your institution?

Assessment

- Many opportunities, and many challenges.
- At different levels: program-level, individual classes, individual assignments.
- Collaboration with writing center, discussion with other programs, and participation in University of Minnesota's Writing-Enriched Curriculum program, and its assessment processes.
- Various types of ongoing assessment such as writing sample collection.
- Assessment of a variety of types of writing.
- Central role of faculty in implementing/modifying course writing activities based on assessment data.
- Supporting assessment: resources, tools, practices, training.

Example 1: Evaluation of Program

Joint process between the Writing-Enriched Curriculum program and the CS Department. This assessment is done every three years.

1. Student writing samples gathered from upper-level elective.
2. A subgroup of samples selected and anonymized.
3. A team of evaluators (not all from the department) rates the samples based on faculty-constructed criteria.
4. The results are reported back to the department, as well as to the Writing-Enriched Curriculum administrators and staff.
5. Department uses results in further writing decisions (in our case, the results have confirmed students strengths and weaknesses we saw elsewhere). WEC and University use ratings to assess usefulness of WEC.

Example 2: Assignment Evaluation Process

Due to our large class sizes, many writing assignments are graded by TAs. This, of course, presents many challenges. Here is one approach we often use:

1. The teacher or an experienced TA constructs a rubric. Here's an example. Alternatively, an existing rubric is re-used, a general set of writing criteria is modified to fit the assignment, or a more general external rubric is used.
2. The teacher leads an exercise where all TAs for the class use the rubric to grade one or more "answers."
3. The teachers and TAs discuss the results of the exercise to try to resolve large grading differences, ambiguity in the rubric, etc.
4. If needed, the rubric is modified.

Assessment: Discussion Question (time permitting)

What writing assessment challenges do you experience (or foresee) at your institution?

Audience Q&A

Additional Slides

Mini Lessons

Guidelines for Summaries

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Does it describe the specific project application?
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Is it concise?
Are all of the terms well-defined?
Does it read logically and in the proper order?

Guidelines for Integrating Text and Images

To check whether you've made your images and their text clear, you may ask yourself the following questions:

Does the text describe the content of the image?
Does the text describe how the content was generated? (this will be relevant if the image is of a drawing that was created by a program or of data that was collected or analyzed by your code).
Does the text describe any implications of the content? (e.g. if the content is results from a simulation, does it analyze the results. This may not be relevant in CS151.)
If the image contains data, are the data properly labeled? (This may not be relevant in CS151.)
If the image contains a lot of parts (e.g. the screen dump of a lot of numbers), are the most important parts highlighted in some way? (I.e. is the image or graph too cluttered or does it tell a clear story?)

Mini Lessons

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Colby

Sample #1

The task of this assignment was to create a 2D grid with articles that interact with the grid and simulate activities. In this assignment, I created three classes, including a Cell class, a Landscape class and a Life Simulation class, which together created the grid, made the simulation, and in the end created a text-based simulation of Conway?s Game of Life.

Sample #2

The overall task of this project was to learn how to use 2D Arrays. In the project, we create a class Cell, and a class Landscape. Landscape contains a grid in which we store various cell objects which are either “alive” or “dead”.

Sample #3

The point of this project was to use Arrays to make a 2D grid and simulate a game of life. In order to do this I had to create a class of Cell objects, capable of storing their “alive” or “dead” status, a Landscape class to hold a grid of the cell representations, and a Simulation class to create interaction.

CS1 (Visual Media) Student 1
Proj 2:
This week's project is mainly about these points:
1. Learn to create complex shapes with simple shapes stored in our own shape library.
2. Learn to use the random package.
3.Learn to import different packages into the python file.
Proj 3: This week's project is based on last week's project 2, although we are free to recreate the shapes. The key idea is to control the functions as we want, adding parameters to functions. We should also be able to freely scale different scenes that may be composed by other scenes.
In short, I would describe the tasks as manipulation, use of loop and scaling of different scenes.

CS1 (Visual Media) Student 2
Proj 2:
In this project we were given the opportunity of creating different shapes and using functions and function parameters to create nice turtle graphics, such as a landscape image. I created shapes and functions that repeated these shapes over and over to the desired location on the screen. Using these functions I could call these shapes and series of shapes from a different cleaner looking page to make a nice picture.
Proj 3:
The goal of this project was to incorporate loops and conditionals into code, as well as practice encapsulating code. The task for project #3 was to basically take the scenes that we created from the last project and re-write the shapes as well as the functions in a more efficient manner. Taking advantage of looping which we learned in lab as well as adding more parameters to our functions so we could give the scenes the ability to do more. After this was done we were responsible for creating scenes that we could move and scale as well as change certain features about them rather easily do to the parameters that were added in.

CS1 (Visual Media) Student 3
Proj 2:
This project uses functions, combinations of functions, and parameters for the functions to create complex shapes and scenes of coastal Maine.
Proj 3:
One of the goals of this project was to work on encapsulation (putting code into functions) in order to draw scenes within scenes using the Turtle module of Python. Another goal was to make our code more simple and elegant by using techniques such as the for loop, which repeats a segment of code as many times as specified. Additionally, I utilized conditional statements to change the colors in a scene based on an input in the command line.

CS1 (Visual Media) Student 4
Proj 2:
The purpose of this project was to use the turtle module to create two Maine scenes. I created simple shapes, including a rectangle, a trapezoid, a triangle, and a hexagon, and called on them to create animals and other objects. I also used different parameters, including x position, y position, and scale, to create aggregate functions.
Proj 3:
The purpose of this project was to recode the coastal Maine scenes that were defined last week in order to make them more variable and user friendly. For example, for loops were added wherever possible in order to shorten the code by simply telling the turtle to repeat a certain command a certain number of times. Additionally, command line arguments were added so that the user could define certain parameters in the terminal. Lastly, the entire scene was parameterized by x location, y location, and scale so that the scene could be drawn anywhere on the screen at any size. This allowed us to draw museum scenes that encapsulated our previously defined coast scenes.

CS1 (Visual Media) Student 5
Proj 2:
1. Create functions with parameters.
2. Create complex functions that call basic functions.
3. Call functions from shapelib.py, in which we defined basic and aggregate shapes, in main.py.
Proj 3;
The purpose of this project is to improve the previous function by adding more parameters such as "fill" parameter, which controls whether shapes are filled with color or not, to use loops as efficiently as possible, and to allow the user to assign values for parameters by using the command line. Basically, we define a shape library first, and then call them in two scenes functions with scale and location parameters so that scenes could be called at any location on any scale, which makes the final figure, a museum scene with the two Maine coast scenes, consist of several levels of encapsulation.

CS1 Student 1
Proj 8: The purpose of this lab was both to further explore creating and using classes as well as exploring the graphics and time modules.
Proj 9: This purpose of this project was to expand on our knowledge of how classes work by creating parent and child classes, which also enables to to make our code for the physics objects simulation much less dense. In addition, we implemented the use of a dictionary which allowed us to make the process of having collisions occur more easy. We made a pinball machine that would release a ball into a window and there would be objects of various shapes and sizes as obstacles for the ball.

CS1 Student 2
Proj 8: In our physics_objects file, we created classes for all the objects that we wanted to draw in the graphics window, specifically the ball, floor, and walls. Then, we created a separate file to open up the window and draw the objects based on their classes from the physics_objects file. We also had to write collision methods within the classes which described when the balls collided with the walls or floor, and the file that drew the objects contained if statements to describe what to do when a collision happened.
Proj 9: For this project, we went more in depth with parent and child classes to create a pinball simulation. In the simulation, the ball collides with walls, floors, blocks, and other balls whenever the centers of the obstacles get too close to that of the ball. Working with the new collision methods and graphics objects allowed us to make a more elaborate simulation than last week.

CS1 Student 3
Proj 8: The purpose of the project is to gain more experience working with classics and graphics.
Proj 9: In this project, we expanded on our knowledge of classes by incorporating inheritance and dictionaries. We revisited last week's physics simulation and simplified it using the concept of inheritance in classes. We made calling the appropriate collision function similar using a dictionary.

CS1 Student 4
Proj 8: This project focused on creating objects and drawing them using the graphics package. We created balls, walls, and floors, and could check for collisions between them.
Proj 9: In this project we continued to work with classes, this time extending the use to parent classes as well, which made the code more simple. We explored the use of dictionaries as well. We also worked more with the graphics package, in order to create a pinball table animation, with various obstacles.

CS1 Student 5
Proj 8: This week we shifted our focus on drawing graphics. By using graphics.py and implementing object-oriented designs, we could directly acquire graphics from python codes. In Project 8 , we focused on drawing bouncing balls with several interesting features.
Proj 9: This week we kept our focus on the graphic design. We used the inheritance model for this week's project. An inheritance model uses classes and divides them into parent classes and child classes. Inheritance models drastically improve coding efficiency and simplicity. In this project, we simulated the movement of pinball. We created a pinball table, launched the ball and observed the movement of the ball.

Data Structures Student 1
Proj 2:
For this project we had to recreate John Conway's Game of Life simulation. To do this we had to use 2D arrays to act as a grid for cells to either live or die in depending on the game rules.

Proj3:
In this project we learned about stacks and used them to create a simulation of a parking garage. This parking garage has a set number of lanes and a set maximum number of cars that can fit in each lane. We had to simulate garage attendants shifting around cars when a car wanted to leave with the help of pop and push methods in our main CarStack class.

Data Structures Student 2
Proj 2:
For this project, we were to simulate Conway's Game of Life. This game is based on mathematical functions determining a visual representation of "cells" that are either dead or alive. The state of the cell is determined based on various methods and functions, taking into account the state of the neighboring cells.
In order to achieve this goal, we used Cell, Landscape, LandscapeDisplay and LifeSimulation classes.

Proj 3:
Our goal for this project was to simulate a parking garage using a "stack" data structure. By using stacks, we were able to simulate parking lanes in a parking garage and retrieve specific cars within these lanes. By using push and pop methods (explained in detail later), we had the ability to remove all cars in front of a given car and place them back into the lane in their original order once the specified car had been removed. In order to successfully execute this project we used a Car Class, CarStack Class, Parking Garage Class, ParkingGarageDisplay class, and a Parking Simulation Class.

INTEGRATIVE LEARNING VALUE RUBRIC

for more information, please contact value@aacu.org

The VALUE rubrics were developed by teams of faculty experts representing colleges and universities across the United States through a process that examined many existing campus rubrics and related documents for each learning outcome and incorporated additional feedback from faculty. The rubrics articulate fundamental criteria for each learning outcome, with performance descriptors demonstrating progressively more sophisticated levels of attainment. The rubrics are intended for institutional-level use in evaluating and discussing student learning, not for grading. The core expectations articulated in all 15 of the VALUE rubrics can and should be translated into the language of individual campuses, disciplines, and even courses. The utility of the VALUE rubrics is to position learning at all undergraduate levels within a basic framework of expectations such that evidence of learning can by shared nationally through a common dialog and understanding of student success.

Definition

Integrative learning is an understanding and a disposition that a student builds across the curriculum and co-curriculum, from making simple connections among ideas and experiences to synthesizing and transferring learning to new, complex situations within and beyond the campus.

Framing Language

Fostering students' abilities to integrate learning—across courses, over time, and between campus and community life—is one of the most important goals and challenges for higher education. Initially, students connect previous learning to new classroom learning. Later, significant knowledge within individual disciplines serves as the foundation, but integrative learning goes beyond academic boundaries. Indeed, integrative experiences often occur as learners address real-world problems, unscripted and sufficiently broad, to require multiple areas of knowledge and multiple modes of inquiry, offering multiple solutions and benefiting from multiple perspectives. Integrative learning also involves internal changes in the learner. These internal changes, which indicate growth as a confident, lifelong learner, include the ability to adapt one's intellectual skills, to contribute in a wide variety of situations, and to understand and develop individual purpose, values and ethics. Developing students' capacities for integrative learning is central to personal success, social responsibility, and civic engagement in today's global society. Students face a rapidly changing and increasingly connected world where integrative learning becomes not just a benefit...but a necessity.

Because integrative learning is about making connections, this learning may not be as evident in traditional academic artifacts such as research papers and academic projects unless the student, for example, is prompted to draw implications for practice. These connections often surface, however, in reflective work, self assessment, or creative endeavors of all kinds. Integrative assignments foster learning between courses or by connecting courses to experientially-based work. Work samples or collections of work that include such artifacts give evidence of integrative learning. Faculty are encouraged to look for evidence that the student connects the learning gained in classroom study to learning gained in real life situations that are related to other learning experiences, extra-curricular activities, or work. Through integrative learning, students pull together their entire experience inside and outside of the formal classroom; thus, artificial barriers between formal study and informal or tacit learning become permeable. Integrative learning, whatever the context or source, builds upon connecting both theory and practice toward a deepened understanding.

Assignments to foster such connections and understanding could include, for example, composition papers that focus on topics from biology, economics, or history; mathematics assignments that apply mathematical tools to important issues and require written analysis to explain the implications and limitations of the mathematical treatment; or art history presentations that demonstrate aesthetic connections between selected paintings and novels. In this regard, some majors (e.g., interdisciplinary majors or problem-based field studies) seem to inherently evoke characteristics of integrative learning and result in work samples or collections of work that significantly demonstrate this outcome. However, fields of study that require accumulation of extensive and high-consensus content knowledge (such as accounting, engineering, or chemistry) also involve the kinds of complex and integrative constructions (e.g., ethical dilemmas and social consciousness) that seem to be highlighted so extensively in self reflection in arts and humanities, but they may be embedded in individual performances and less evident. The key in the development of such work samples or collections of work will be in designing structures that include artifacts and reflective writing or feedback that support students' examination of their learning and give evidence that, as graduates, they will extend their integrative abilities into the challenges of personal, professional, and civic life.

Glossary

The definitions that follow were developed to clarify terms and concepts used in this rubric only.

- Academic knowledge: Disciplinary learning, learning from academic study, texts, etc.
- Content: The information conveyed in the work samples or collections of work.
- Contexts: Actual or simulated situations in which a student demonstrates learning outcomes. New and challenging contexts encourage students to stretch beyond their current frames of reference.
- Co-curriculum: A parallel component of the academic curriculum that is in addition to formal classroom (student government, community service, residence hall activities, student organizations, etc.).
- Experience: Learning that takes place in a setting outside of the formal classroom, such as workplace, service learning site, internship site or another.
- Form: The external frameworks in which information and evidence are presented, ranging from choices for particular work sample or collection of works (such as a research paper, PowerPoint, video recording, etc.) to choices in make-up of the eportfolio.
- Performance: A dynamic and sustained act that brings together knowing and doing (creating a painting, solving an experimental design problem, developing a public relations strategy for a business, etc.); performance makes learning observable.
- Reflection: A meta-cognitive act of examining a performance in order to explore its significance and consequences.
- Self Assessment: Describing, interpreting, and judging a performance based on stated or implied expectations followed by planning for further learning.

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Evaluators are encouraged to assign a zero to any work sample or collection of work that does not meet benchmark (cell one) level performance.

	Capstone 4	Milestones 3	Milestones 2	Benchmark 1
Connections to Experience *Connects relevant experience and academic knowledge*	Meaningfully **synthesizes** connections among experiences outside of the formal classroom (including life experiences and academic experiences such as internships and travel abroad) to **deepen understanding** of fields of study and to broaden own points of view.	Effectively **selects and develops** examples of life experiences, drawn from a variety of contexts (e.g., family life, artistic participation, civic involvement, work experience), to **illuminate** concepts/theories/frameworks of fields of study.	**Compares** life experiences and academic knowledge to infer differences, as well as similarities, and **acknowledge perspectives** other than own.	**Identifies** connections between life experiences and those academic texts and ideas **perceived as similar and related** to own interests.
Connections to Discipline *Sees (makes) connections across disciplines, perspectives*	Independently creates wholes out of multiple parts (synthesizes) or draws conclusions by combining examples, facts, or theories from more than one field of study or perspective.	Independently connects examples, facts, or theories from more than one field of study or perspective.	When prompted, connects examples, facts, or theories from more than one field of study or perspective.	When prompted, presents examples, facts, or theories from more than one field of study or perspective.
Transfer *Adapts and applies skills, abilities, theories, or methodologies gained in one situation to new situations*	Adapts and applies, independently, skills, abilities, theories, or methodologies gained in one situation to new situations **to solve difficult problems or explore complex issues in original ways.**	Adapts and applies skills, abilities, theories, or methodologies gained in one situation to new situations **to solve problems or explore issues.**	Uses skills, abilities, theories, or methodologies gained in one situation in a new situation **to contribute to understanding of problems or issues.**	Uses, in a basic way, skills, abilities, theories, or methodologies gained in one situation **in a new situation.**
Integrated Communication	Fulfills the assignment(s) by choosing a format, language, or graph (or other visual representation) **in ways that enhance meaning**, making clear the interdependence of language and meaning, thought, and expression.	Fulfills the assignment(s) by choosing a format, language, or graph (or other visual representation) **to explicitly connect content and form**, demonstrating awareness of purpose and audience.	Fulfills the assignment(s) by choosing a format, language, or graph (or other visual representation) that **connects in a basic way** what is being communicated (content) with how it is said (form).	Fulfills the assignment(s) (i.e. to produce an essay, a poster, a video, a PowerPoint presentation, etc.) **in an appropriate form.**
Reflection and Self-Assessment *Demonstrates a developing sense of self as a learner, building on prior experiences to respond to new and challenging contexts (may be evident in self-assessment, reflective, or creative work)*	Envisions a future self (and possibly makes plans that build on past experiences) that have occurred across multiple and diverse contexts.	Evaluates changes in own learning over time, recognizing complex contextual factors (e.g., works with ambiguity and risk, deals with frustration, considers ethical frameworks).	Articulates strengths and challenges (within specific performances or events) to increase effectiveness in different contexts (through increased self-awareness).	Describes own performances with general descriptors of success and failure.

Writing samples: internship reflections

I grew this week by just realizing something. It is too early in my career to decide on a specialization, like networking or computer vision... I remember that famous quote about known knowns, known unknowns, and unknown unknowns. I need to eliminate my unknown unknowns, the stuff that I don't know that I don't know (2014 Student # 212t, week 9).

I would like to help make people's lives easier/more efficient in some way, preferably doing something more meaningful than enabling speedier food delivery or writing boring corporate software. Besides my colleagues having their days endlessly greatened by my cherubic presence, the company having to pay an intern, the subways and trains being subjected to a large white man twice a day, and a midtown sandwich shop line being made one person longer I cannot think of any real ways in which my job affects the world aside from the products I am building. The product I am building, however, will directly influence millions of lives, helping patients receive better, more attentive and thorough care, being able to reduce their healthcare bills, and of course, helping save our company tons of money in government fines ... (2015 Student # 04qc, week 9).

But really, I feel like my work isn't as big as I'd like it to be… I like the idea of doing something that feels important, even if only a small way, as long as I can witness the kind of effect it has on a community of people...I suppose that everyone wants to feel important, like they mean something. … [I]t is still important for one to feel as if they at least have *some* ambition in life, otherwise they wouldn't really be living; they'd just be, like, a blob of human jelly staring blankly at a TV screen eating copious amounts of ice cream. I mean that's just fine, I do that on certain nights, but… well yeah (2015 Student # 64qm, week 9).