

Dispositions of Computational Thinking (DoCT) Instrument Content Expert Validation

Thank you for agreeing to provide feedback on our survey! We know your time is extremely valuable, and we appreciate your sharing your expertise with us.

Purpose & background of this instrument

Below you will find a draft of our survey designed to identify the dispositions used while engaging in computational thinking (CT). This instrument seeks to identify and define the learner dispositions that impact CT education.

We define CT as encompassing many of the critical problem-solving practices and concepts that draw on computer science (Wing, 2006), including “problem representation, prediction, and abstraction” (Israel et al., 2015, p. 264). Computer science in this view is identified as the study of computers, their hardware, software, and the algorithmic processes and applications that impact society (Lye & Koh, 2014). In educational contexts, CT also involves adapting problem-solving approaches from computer science in order to connect to a wide array of fields (Grover & Pea, 2013).

While progress has been made over the last two decades regarding the teaching and learning of CT skills and knowledge (Grover & Pea, 2013), the critical role that dispositions play in CT education remains largely unexplored (Cabrera, 2019). A learning disposition is a pattern of behaviors, situated in the context of the environment, that when recognized and developed by those who can manipulate the environment, may lead to gains in the acquisition of knowledge, skills, and understandings (Carr & Claxton, 2002).

We define these Dispositions of Computational Thinking (DoCT) as a pattern of learned behavior that is highly situated in relation to the problem solving activities utilized in a CT learning environment. Such behaviors, when recognized and developed by those who can manipulate the learning environment, may lead to gains in CT knowledge acquisition, CT skills, and understanding (Shute, Sun, & Asbell-Clarke, 2017).

According to Claxton & Carr (2004), while learning involves a set of necessary skills and strategies for learning (sometimes called capabilities), these are not sufficient for substantive, enduring learning to occur, especially in academic settings. Learning also requires specific dispositions, or affective variables, which according to Katz (1993) constitute a “domain of human attributes not attributed to knowledge, skill, or behavior.” Drawing from the dispositions work outlined in Carr and Claxton, “real-life learning power” boils down to two interwoven facets: capabilities and dispositions. Put simply, there is a difference between *having the ability to* engage in CT, and *being predisposed to* substantively engage in CT as part of a purposeful response to environmental cues.

Our purpose for designing and implementing this survey is to determine existing and perceived dispositions as they relate to CT. Data from this instrument will allow us to better provide resources for teachers and students as they work in this area.

Structure of this instrument

The assessment is currently organized to include eight to ten items for each of our six identified dispositions.

We framed these items to focus on self-efficacy as it relates to utilizing DoCT.

The items in this instrument will have participants respond in a likert-style response. We will ask participants to indicate their level of confidence for each items using the following scale:

highly confident
fairly confident
developing confidence
not confident
not sure

What we need from you

In part one, we are asking that you review and provide feedback on the six DoCT we have identified and the definitions for each. In part two, we ask that you review and provide feedback on the items for each of the six dispositions.

The beginning and end of each section is highlighted to make it easier for you to work across sections. Each section will begin with an identification of the construct, and a glossary of terms if appropriate.

As you review the items in each section, we would appreciate your feedback on the following elements. We have included these prompts below in each of the sections to assist in your review:

- Do the questions appropriately align with the constructs in each section?
- Are there items that should be added to more completely represent the constructs in each section?
- Is terminology clearly defined?
- Does the wording of the constructs and items lend itself to possible misunderstandings or multiple interpretations?
- Are there comments regarding usability and practicality of the items within each section or of the overall survey?
- Please provide any other feedback on items in this section.

Please review and provide feedback on the survey by **Sunday, July 16th, 2021**. Feel free to mark up and annotate this document in any way that will assist in your review and return your comments via email. If you have any questions on the purpose or process, please do not hesitate to email.

Again, thank you for your help in this important endeavor.

Sincerely,

W. Ian O'Byrne, College of Charleston

Melanie Blanton, The Citadel, The Military College of South Carolina

Part One - Dispositions of Computational Thinking (DoCT)

Notes for Reviewers: The following constructs were identified following a review of the literature in CT, CS, coding, programming, and related fields. The specific citations were not included below to make this document a bit shorter. We can forward these to you for your reference if needed.

As a reminder, please give feedback on the following. Please feel free to mark up and annotate this document in any way that will assist in your review.

- Do the constructs appropriately align with the dispositions required in CT?
 - Are there constructs that should be added to more completely represent the CT?
 - Are the constructs clearly defined?
 - Does the wording of the constructs and definitions lend itself to possible misunderstandings or multiple interpretations?
 - Are there comments regarding usability and practicality of the constructs as they relate to the purpose of this survey or the work in the field?
 - Please provide any other feedback on items in this section.
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SURVEY CONSTRUCTS

Comfort with Ambiguity - Being open to more than one interpretation and dealing with ambiguity, unfamiliarity, and complexity in a problem.

Analytic Thinking - Breaking down a problem into smaller parts to make a model and then ultimately determine and follow a plan in order to find solutions.

Divergent Thinking - Willingness to tinker, explore, and creatively explore many possible solutions as you engage with a problem.

Perseverance - Ability to show form continuance in action, reframe failure, and continue despite adversity.

Reflective Stance - Active, exploratory use of reflection as a metacognitive tool before, during, and after learning to give time and energy to processing individually.

Thinking Out Loud - Making your thinking visible so others can give feedback, collaborate, and participate in the problem solving process.

This concludes the section on the constructs used to frame the survey.

The next section focuses on items for each of the constructs.

Part Two - Dispositions of Computational Thinking (DoCT) Items

Notes for Reviewers: The following items were developed for each of the constructs identified above. For each construct, we developed 10 to 12 items for your review. In the final version of the instrument, we will include 8 to 10 items for each construct. These items will be randomly listed in the survey.

The final survey will not list the constructs or definitions you have already reviewed.

As a reminder, please give feedback on the following. Please feel free to mark up and annotate this document in any way that will assist in your review.

- Do the items appropriately align with the identified constructs?
- Are there items that should be added to more completely represent the constructs?
- Are the items clearly defined?
- Does the wording of the items and item stems lend itself to possible misunderstandings or multiple interpretations?
- Are there comments regarding usability and practicality of the items as they relate to the purpose of this survey or the work in the field?
- Please provide any other feedback on items in this section.

SURVEY ITEMS

Comfort with Ambiguity - Being open to more than one interpretation and dealing with ambiguity, unfamiliarity, and complexity in a problem.

I am confident in my ability to:

- Make decisions in complex situations
- Make decisions in unfamiliar situations
- Handle data and information in a disorganized problem
- Work without fixed guidelines or directions to solve a problem
- Make sense of the information and data presented in order to solve a problem
- Understand what information is missing when I am trying to solve a problem
- Handle a disorganized or complex problem
- Appreciate the flexibility in an ambiguous problem
- Not panic when the unexpected happens when solving a problem
- Solve a problem without all of the information I need
- Solve a problem when I'm not entirely sure what the expectations are to complete the work

Analytic Thinking - Breaking down a problem into smaller parts to make a model and then ultimately determine and follow a plan in order to find solutions.

I am confident in my knowledge of:

- Previous problems and use that information to help me solve new problems

I am confident in my ability to:

- Identify problems in situations or practice
- Break down a problem into smaller parts to make it easier to understand
- Restate the problem in my own words
- Develop a plan in order to solve a problem
- Follow the plan I devised in order to solve a problem
- Recognize errors in my plan as I work to solve a problem
- Checking my results to determine whether I followed my plan and solved the problem
- Learn from the development and implementation of my plan
- Summarize the approach that I took to solve a problem
- Indicate why I decided to solve a problem

Divergent Thinking - Willingness to tinker, explore, and creatively explore many possible solutions as you engage with a problem.

I am confident in my ability to:

- Generate different ideas as I think about the information I have been presented
- Brainstorm different ideas as I think about a problem I have been presented
- Group ideas based on similarities and differences
- Reduce and categorize ideas for solving a problem
- Evaluate and rank an idea to use as I engage with a problem
- Select an idea to use as I engage with a problem
- Make sense of the information in a problem through a variety of approaches
- Make a decision to stray from an idea or plan after recognizing potential errors
- Make a decision to stray from an idea or plan after noticing an opportunity for a more efficient solution?)
- Take a risk when interpreting or working with a problem

Perseverance - Ability to show form continuance in action, reframe failure, and continue despite adversity.

I am confident in my ability to:

- Not be stopped by challenges as I work with coding or computational languages

- Work through situations in which I am unfamiliar with the information I have been presented
- Continue to work even as problems become more complex
- Continue to work even as problems are not solved by previous solutions
- Work on problems that are not too easy for me to complete and understand
- Work on problems that are not too hard for me to complete and understand
- Build my ability to work with informations and problems through effort
- Build my competence for working with harder problems through effort
- Make mistakes and learn from these mistakes to help me solve future problems
- Continue to improve solutions despite finding initial success or completing a project

Reflective Stance - Active, exploratory use of reflection as a metacognitive tool before, during, and after learning to give time and energy to processing individually.

I am confident in my knowledge of:

- Strategies to promote thinking about my thinking
- Methods to encourage thinking about my thinking

I am confident in my ability to:

- Recognize potential points of contention or frustration
- Pause to ponder on progress or lack of progress
- Use knowledge about something I already know about this problem to help me solve it
- Identify the most confusing or complex thing I encountered as I worked with a problem
- Understand what I am learning as I solve a problem
- Identify the best way for me to work with information as I solve a problem
- Develop goals as I'm solving a problem to help answer internally developed questions
- Manage my own learning to help answer internally developed questions
- Gauge the level of effectiveness as I have worked to solve a problem
- Evaluate decisions made previously in order to modify current project or plan future work

Thinking Out Loud - Making your thinking visible so others can give feedback, collaborate, and participate in the problem solving process.

I am confident in my ability to:

- Visualize what I have learned to easier to share with others
- Make visual representations of what I have learned to make it easier to review my work
- Remix and learn from the problem solving efforts of others
- Act out in a physical space my thinking as I engage with a problem
- Think out loud as I work with information to solve a problem

- Listen to someone else as they think out loud and solve a problem
- Share the process I've used to solve a problem with another person
- Clarify my process to solve a problem to make it easier for someone else to understand
- Provide clear explanations to justify my reasoning for how I worked with information in a problem
- Utilize the work and ideas of others to inspire a new solution to my own problem
- Use language as a way to communicate my ideas with others

Thank you for your valuable feedback! We appreciate your help and dedication.