

Arizona Draft Computer Science Standards Technical Review Document

Reviewer Name: **Alicia Nicki Washington**

Introduction Section

As you conduct your review of the introduction, please consider the following questions.

- A. Does the introduction provide sufficient information and guidance on how to read the standards? Yes
- B. Does the introduction provide sufficient information on how the standards are structured? Yes
- C. Is there anything missing that should be included in the introduction?

I think there is a missed opportunity (more so a dropped ball) by including this sentence, “Educators and students who engage with these standards are encouraged to actively seek collaboration with those who have different perspectives and backgrounds.” This implies that you’re only encouraging educators and students to seek collaborations and opportunities for equity. Nowhere in this statement (or the overall introduction) is it implied or explicitly written that equity is a top priority. In fact, it’s *not* a priority, but an option, as the sentence suggests. If left up to educators/students to choose to be equitable, this will not happen. This is the current problem with diversity and inclusion in CS. Given the option to be inclusive, most organizations and schools don’t choose to. This should be changed in order to appropriately state that this is a requirement, if it is truly a priority for the state.

Please provide feedback on the Introduction section. Include strengths and well as suggestions for refinements.

Please see note C above. Other than this, it’s a good mapping to the K-12 CS Framework, which is also consistent across other states nationwide. After reviewing the standards, it appears this was also not a thought when creating the impacts of computing standards for middle/high school. Please address this. This should not be the case in 2018 when most of the efforts are on diversifying CS and engaging/retaining more underrepresented students (African-American and Latinx). This type of omission is the exact issue with why these students are still grossly underrepresented.

Standards Section by Grade Level

As you conduct your review of the grade level and High School standards, please consider these questions.

- A. Does the introductory information for the grade band and for each grade level provide enough context to understand how the standards connect within the grade and between grades within each band?
- B. Does each standard clearly state what students should know and be able to do?
- C. Can the standard be measured?
- D. Are there any ambiguous or unclear words/phrases?
- E. Do the standards in each section have appropriate **breadth**?
- F. Do the standards in each section have appropriate **depth of content and rigor** for the grade level?
- G. Is there meaningful alignment and development of skills/knowledge within each grade and from one grade band/grade level to the next?

1. Please provide feedback on Kindergarten:

In the Network, Communication, and Organization, it would be helpful to first understand, discuss, or define what a network is, and leverage non-computing networks that students are a part of to help this point (e.g. family, class, school, etc.). This could be part of the supplemental activities discussed in the standard, not a standard

2. Please provide feedback on Grade 1:

In the Network, Communication, and Organization, it would be helpful to identify the types of computer networks students use (e.g. WiFi, phone, etc.).

3. Please provide feedback on Grade 2:

I like how K-2 reinforce the same standards to students for consistency.

4. Please provide feedback on Grade 3:

3.CS.HS.2- Recognize that hardware can only accomplish the specific tasks the software is designed to accomplish.

This isn't clear. I know what it's trying to state. However, a teacher may find this confusing.

3.AP.PD.1- With teacher guidance, use an iterative process to plan the development of a program by including others' perspectives and considering user preferences.

I understand this fully. However, be mindful some teachers (or other reviewers) may find problems with the terminology (iterative). Although this shouldn't be a problem, it could be. Not sure how to change it for more clarity anyway.

**Many standards include "with teacher guidance." Do you want to include this in the standard itself or just include it in the description of supplemental/suggested activities. It seems this may present some challenges/concerns with teachers and the level of guidance they should provide.

3.IC.SI.1- Seek opportunities for local and global collaboration to facilitate communication and innovation.

I think the Networking standards may be a little more complex than necessary for the grade level. You may want to consider making these a little less detailed (Ethernet cables, wireless paths, etc.).

Depending on the ease of ability to do this within a school, this could present problems in terms of doing and measuring. This implies being able to first research local/global opportunities and then actually taking advantage of them. Consider school resources as well as ability to do this (network/access limitations, etc.).

3.IC.SLE.1- Use public domain or creative commons media, and refrain from copying or using material created by others without permission.

There's a simpler way to write this that isn't so overwhelming for educators. "Use material that is publicly available and/or permissible to use."

5. Please provide feedback on Grade 4:

I suggest removing the use of "with teacher guidance." This is almost implied and could be described in the supplemental activities that are described.

4.CS.T.1- Develop a model with teacher guidance common troubleshooting strategies to solve simple hardware and software problems.

Suggest "Develop troubleshooting strategies to solve simple hardware and software problems." Many of these standards are too lengthy and can be simplified.

4.DA.CVT.1- Independently select tools to collect, organize, and present data visually to highlight relationships and support a claim.

Phrasing issue again. Select tools to collect, organize, and present data visually... "independently" is not needed.

4.DA.S.1- Recognize different file extensions and how they are stored on a computing device.

This can be misread. "How they are stored" can imply a much more complex meaning than implied. Given the description, it seems you mean "recognize different file extensions and the different amounts of storage required for each." Storage could be replaced with memory.

4.AP.V.1-Create programs that use variables to store and modify data, recognizing that the data type determines the values that can be stored and the operations that can be performed on the data.

Too long

4.IC.C.1- Identify and discuss computing technologies that have changed the world, and express how those technologies influence, and are influenced by, cultural practices.

Reads more like it should be two separate standards, yet you're trying to cram all of this into one. Think about measurability.

4.IC.SI.1- Seek opportunities for local and global collaboration to facilitate communication and innovation.

See prior comment from Grade 3

4.IC.SLE.1- Use public domain or creative commons media, and refrain from copying or using material created by others without permission.

See prior comment from Grade 3

6. Please provide feedback on Grade 5:

5.CS.T.1-condense, see prior comments.

5.NI.NCO.1-analyze/evaluate should be one or the other, not both.

Data and Analysis-All three standards are too long and include multiple verbs from Bloom's taxonomy. Use one and condense it to highlight JUST that.

5.DA.IM.1, 5.AP.V.1-same as DA

5.AP.C.1, 5.AP.M.1, which read well as is.

Suggest not using "remix." That isn't a common CS term, nor is it a term that is commonly used by educators in the same manner. The implementations of the standards via the curriculum is the appropriate place for using terminology like that. However, this is not measurable (nor should it be).

IC-use of multiple words in Bloom's taxonomy should be removed again. Also, there is nothing that speaks to differences in culture/race/ethnicity. Attempt is made in 5.IC.C.1. However, the first part of that standard negates the latter. "Discuss how computing influences or has been influenced by various..."

7. Please provide feedback on Grade 6:

CS-Devices-shorten this standard, it reads too long and can be simplified and more concise.

6.AP.PD.4-another standard that will be hard to measure because of the inclusion of multiple verbs. Suggest condensing.

6.IC.C.2-YES!!! Love this!

8. Please provide feedback on Grade 7:

7.NI.NCO.1-too lengthy. Condense to be more concise

9. Please provide feedback on Grade 8:

8.CS.D.1-length issue. Make this more concise.

8.CS.HS.1, 8.CS.T.1, 8.DA.CVT.1, 8.DA.IM.1, 8.AP.PD.1, 8.AP.PD.4-these should actually be two separate standards that progress (two verbs again). Suggest removing one altogether or placing it in a logical progression within or between grades. If removing one, you can find way to make these combined into one standard that reads easier for educators to measure.

8.AP.V.1-“clearly named” is relative. Avoid phrasing like this and make it such that it is not left for interpretation.

10. Please provide feedback on High School:

HS.NI.C.1-simplify wording to be concise. “Provide examples of how sensitive data is affected by...”

HS.NI.C.2-if naming factors in the standard, be cautious, as it could become required to illustrate these.

NI-This concept reads as if you’re trying to condense a lot into only 3-4 standards total, across 3-4 subconcepts. This is virtually impossible, and you’re placing a LOT of emphasis on the educator being able to do all of this in one measurable outcome. Suggest you take some real time and flesh this area out, especially for high school. This is a critical area that many students need to understand and don’t. The standards written here will do a disservice to students in that area (more so because educators will not want to teach this and be unable to do an adequate job). There is no way NCO should be one standard. Same goes for other areas in Networking. This should be a logical progression across levels, if not grades. Every other grade has logical progressions, why is HS lumped into one set? Is there only going to be one HS course for all students? Please do some more work on this. There are multiple standards given to AP and IC, why not this? It’s very important...EXTREMELY.

CS/DA-see prior NI comment. These need additional work. You’ve provided strong lead-in at grades K-8, then these drop the ball in HS. Is this because of one course that will be at the HS level? If so, then that needs to be clarified somewhere. Even still, it almost can’t be, given the heavy standards included on programming and impacts of computing.

Standards Section organized by Essential Concept, Subconcept and learning progression

You have also been provided with each standard organized by essential concept to review and provide feedback on the development of the learning progression for each essential concept. As you conduct your review of the progression, please consider the following questions.

- A. Does the standard address meaningful content within each essential concept? Yes, for the most part.

- B. Do the standards within each progression, including subconcepts have appropriate **depth of content and rigor**? No, see HS comments. This requires significant fleshing out, thought, and clarification.
- C. Is there meaningful alignment and development of skills/knowledge within each grade and from one grade level to the next for each progression? This is mainly true for K-8. However, there is no progression demonstrated anywhere in HS, which is a critical component if students are to enter university programs.

1. **Please provide feedback on the Essential Concept Computing Systems:**
This should be beefed up for HS. It's not clear why there are limited inclusions of certain concepts at the HS level, including this one.
2. **Please provide feedback on the Essential Concept Networking and the Internet:**
Please give this much more thought and effort. It's needed and most relevant.
3. **Please provide feedback on the Essential Concept Data and Analysis:**
This can be beefed up in the HS level. See prior notes and questions.
4. **Please provide feedback on the Essential Concept Algorithms and Programming:**
Probably one of the stronger concepts across all grade bands. Thought has been given to this.
5. **Please provide feedback on the Essential Concept Impacts of Computing:** **This concept misses an EXTREMELY important opportunity to teach about diversity in CS in terms of women and underrepresented minorities, specifically African-American and Latinx. These should absolutely be included throughout, especially in MS/HS. I don't understand how this wasn't included anywhere in this document, especially since you discuss leveraging the K-12 National Framework. Please update this. This is unacceptable and is in no way helping girls and underrepresented students see themselves in the discipline, which is a major reason why they are STILL underrepresented.**

Glossary and Additional Resources

Please provide any additional comments related to the Glossary and Additional Resources section that you would like the working group to consider.

Additional Feedback

Please provide any additional comments about this draft that you want the revision working group to consider. Also use this an opportunity to summarize the strengths of the draft standards.

Overall notes:

1. Be consistent with wording. Some standards use “decompose” while others use “break down.” Go with clear and concise. Less is more and it makes it less overwhelming for educators who are going to take issue with a lot of the standards if they have no prior CS experience. Make it as simple for them by making the standards short and succinct.
2. There are some grammatical errors noted. However, I assume this will be addressed once the final standard draft is completed.
3. Don’t try to put too much into one standard. This should be easily measurable by teachers. If necessary, create a second standard or find a way to condense it.
4. Many of the standards are too lengthy in description. This leaves room for issues with understanding and what exactly is being measured. I’ve noted these throughout as examples. You should really keep the standards short.
5. Some of the standards are great ideas. However, the actual implementation may prove challenging (see the Grade 3 local and global collaboration). If this is what EVERY teacher is going to have to accomplish with students, then ensure that even the most resource-challenged school can successfully implement this with minimal issues. It seems challenging that given access restrictions on the web, etc. that something like that could be successfully implemented, or that educators would want to open up something like that.
6. Many of the standards include the phrase “with teacher guidance.” I strongly suggest removing this. This requires some measure of teacher guidance to be included. What if one teacher is more hands-on than another? It can be mentioned in the supplemental activities that teachers can provide guidance. However, it shouldn’t be a part of the actual standards.
7. Addition of IC info on identifying women and underrepresented computer scientists is nowhere in any standard. This needs to be done...immediately.