Wyoming education partners support a student-centered learning system in which all Wyoming students graduate prepared and empowered to create and own their futures.

WYOMING STATE BOARD OF EDUCATION

AGENDA | March 21, 2019 – 9:00 a.m.

NCSD Community Activity Center 2371 Hickory Street, Casper

State Board of Education

Opening Items

- Call to Order
- Oath of Office for new Board Members
- Roll Call
- Pledge
- Welcome
- Approve Agenda

Consent Agenda

- Minutes
- Treasurer's Report

Public Comment on Agenda Items (other than Computer Science Standards, will be addressed in afternoon)

Convene State Board of Vocational Education

Discussion Item

- Wyoming's Perkins V Transition Plan

Adjourn State Board of Vocational Education

Valerie Bruce 2018-19 Wyoming Teacher of the Year

Reports

- State Superintendent's Update
- Coordinator's Report
    - Legislative Update
    - Basket of Goods Survey and Next Steps
    - Administrative Procedures
- Committees
    - Communications Committee
    - Administrative Committee

Discussion Items 1

- Committee Assignments
- Alternative Schedules
- Certified Personnel Evaluation Systems

Action Items 1

- Administrative Procedures Part One
- Alternative Schedules
- Early Learning Resolution
- Certified Personnel Evaluation Systems

Lunch

Discussion Items 2 – (beginning approx. 12:30 p.m.)

- Basket of Goods
- Computer Science Survey Results
- Public Input on Computer Science Standards (limited to three minutes per speaker; written testimony is also accepted)

Action Items 2

- Computer Science Standards

Future Items

- April Meeting

Board Member Comments

(Comments about meetings or workshops attended, topics of concern, public recognition)

Public Comment

(Final comments from the public)

Adjournment – 5:00 p.m.

WYOMING STATE BOARD OF EDUCATION
February 21-22, 2019
2300 Capitol Ave.
Basement Conference Room
Cheyenne

Wyoming State Board of Education members present: Chairman Wilcox, Sue Belish, Superintendent Balow, Robin Schamber (via Zoom), Nate Breen, Ryan Fuhrman, Ken Rathbun, Kathryn Sessions, and Forrest Smith, Max Mickelson, Dr. Sandy Caldwell, Scotty Ratliff, and Dan McGlade (via Zoom).

Members absent: Dr. Dean Ray Reutzel.

Also present: Kylie Taylor, WDE; Dr. Thomas Sachse; Michelle Panos, WDE; Julie Magee, WDE; Mackenzie Williams, AG; and Randall Lockyear, AG.

February 21, 2019

CALL TO ORDER

Chairman Wilcox called the State Board of Vocational Education to order at 1:14 p.m.

Kylie Taylor conducted roll call and established that a quorum was present.

APPROVAL OF AGENDA

Sue Belish moved to approve the agenda as presented, seconded by Max Mickelson; the motion carried.

John Bole from the WDE updated the board on the state reports and Perkins V Transition Plan, John indicated he would bring the full transition plan back to the board in March for their review and action.

Sue Belish moved to approve the 2018-19 state reports, seconded by Forrest Smith; the motion carried.

The State Board of Vocational Education adjourned at 2:05 p.m.

Chairman Wilcox called the State Board of Education to order at 2:05 p.m.

CONSENT AGENDA

Sue Belish moved to approve the treasurer's report with the correction of the remaining balances that Kylie indicated was a typo, seconded by Forrest Smith; the motion carried.

Superintendent Balow moved to approve the January 2019 minutes, seconded by Kenny Rathbun; the motion carried.

Presentation from Milken Award winner Chris Bessonette

State Superintendent's Update

Superintendent Balow included two memos with her update for February, the first memo was an update that included information on the worked commenced to develop K-12 content and performance standards that address the cultural heritage, history, and contemporary contributions of American Indian tribes of the region, including Eastern Shoshone and Northern Arapaho. Superintendent Balow also updated on WDE staff preparing for the statewide assessment system peer review process as required under the Every Student Succeeds Act.

The second memo Superintendent Balow included for her update was regarding civics education. Superintendent Balow encouraged the SBE to join her in the effort to examine civics education and develop solutions and recommendations that achieve the goal of making Wyoming civics education nothing less than exemplar for the nation.

Coordinator's Report

SBE Coordinator, Tom Sachse, began his report with an update on the Legislative Session. Tom reviewed bills that would have directly impacted the SBE and education. Tom continued his report with an update on the Basket of Goods survey results that may be of value to the state board and/or legislature as each group thinks about the policy implications of the current basket of goods.

Accreditation for Wyoming Cowboy Challenge Academy

Julie Magee, WDE, informed the board that the Wyoming Cowboy ChallenNGe Academy (WCCA) is a program sponsored by the National Guard, the mission of the WCCA is to provide a safe, disciplined, and professional learning environment that empowers non-traditional learners to improve their education level and employment potential and become responsible productive citizens. In January 2019, the WCCA received its educational accreditation from AdvancED. The WCCA is requesting the SBE to approve the AdvancED accreditation designation for this program.

Biennium Budget Request Process

Trent Carroll, WDE, reviewed the biennium budget request process for SBE funds and discussed the roles and responsibilities, budget narratives, and budget summary sheet. Trent reviewed the current funds the SBE has and how to relocate funds if needed.

Sue Belish asked if it would be possible to relocate funds to a different budget if the board wanted to give their Coordinator a raise, Trent indicated that would be possible to do.

That State Board of Education recessed at 5:24 p.m.

February 22, 2019

The State Board of Education reconvened at 8:08 a.m.

Certified Personnel Evaluation Systems

Laurel Ballard, WDE, updated the board on the districts that were required to complete a survey with information about whether their district plans to adopt or implement a state-defined or locally-designed leader evaluation system for their district and school leaders.

Eighteen districts indicated they plan to include other district leaders in their leader evaluation systems defined through Chapter 29 Rules. Fourteen of these evaluation systems will align to the state-defined leader evaluation system. The remaining four will use a locally-designed evaluation system.

Laurel will bring this topic back to the board in March to vote on.

SBE COMMITTEE UPDATES

Communications Committee

Ryan Fuhrman informed the board that the committee is still working on guest blog posts and said the blog post from Dana Wyatt should be posted by the end of this month.

Administrative Committee

Sue Belish indicated a location was chosen for the March board meeting by the committee and said there will be a new board member orientation the day before the March meeting.

BOARD REPORTS AND UPDATES

Trigger Mechanism for Opening Standards

Julie Magee, WDE, and Mackenzie Williams, AG, presented the mechanisms for opening standards, after the WDE and AG's Office consulted with each other, they created a petition document for the SBE's review. The process for petitioning rules, including a request to review the state standards outside of the normal review cycle, will be included in the new iteration of the Chapter 3 Education Rules.

Computer Science Request for Impact Study

Julie Magee reviewed the educator input collection to identify possible impacts of the proposed 2019 Wyoming Computer Science Content and Performance Standards on curriculum and instruction. Julie also reviewed the public input collection that was being taken through an online survey and through public meetings.

Laurie Hernandez and her team will present the results from the public input at the board's March meeting.

Statewide System of Support Guidebook

Julie Magee along with Mark Bowers presented the Statewide System of Support Guidebook on behalf of Shelly Andrews. The current SSOS Model was developed by the SSOS Team in collaboration with Education Northwest. The screening protocol used to identify each school's level of support need incorporates data from state, federal, and special education accountability systems. A separate screening protocol will be utilized for alternative schools beginning with the 2018-19 school year. Small schools will be supported based on identified needs.

The pillars of support were expanded from four to five and represent the key components necessary for a high performing school:
1. Cultivating exceptional leadership.
2. Improving teaching and learning.
3. Developing a high-performance culture.
4. Establishing effective structures and processes.
5. Engaging families and the community.

Accreditation Stickers

Julie Magee presented the draft accreditation stickers for high school diplomas, the board agreed on two designs in case the Secretary of State's Office doesn't let the board use the Wyoming State Seal.

Administrative Procedures

SBE Coordinator, Tom Sachse, reviewed the Administrative Procedures part one of the SBE's policies and procedures. Tom will bring them back to the board in March for their action to approve.

ACTION ITEMS

SBE Communication Policies

Tom Sachse presented the Communication Policies sections 21 and 29 and explained the revisions that were made to the policies from the January board meeting.

Sue Belish moved to approve the communication policies, seconded by Ken Rathbun; the motion carried.

Early Learning Resolution

The board discussed the Early Learning Resolution that was presented during the January meeting, changes were made to the resolution to remove the language of "universal." The correct resolution was not included in the packet so the board will take formal action in March.

State Board of Education Election of Officers

Dicky Shanor moved to keep the elected positions the same as they are currently, Walt Wilcox as Chairman, Sue Belish as Vice Chair, and Max Mickelson as Treasure, seconded by Scotty Ratliff; the motion carried.

Approval of Meeting Dates/Locations

Sue Belish moved to approve the meeting dates and locations as presented in the meeting packet, seconded by Kathryn Sessions; the motion carried.

NASBE Legislative Conference in Washington DC

Kylie Taylor gave an overview of the conference in Washington DC and indicated the board has enough funds to send three board members. Kathryn Sessions, Max Mickelson, and Nate Breen expressed interest in attending.

Accreditation for Wyoming Cowboy Challenge Academy

Kenny Rathbun moved to approve accreditation for Wyoming Cowboy Challenge Academy, seconded by Ryan Fuhrman; the motion carried.

The board recognized Ken Rathbun and Scotty Ratliff for their dedication and service to the State Board of Education.

NEXT MEETING

The board's next meeting will take place in Casper on March 21, 2019

The State Board of Education adjourned at 11:33 a.m.

WYOMING DEPARTMENT OF EDUCATION

SUMMARY REPORT

State Board of Education

FY19 Budget

30 June 2018 thru 12 March 2019

DESCRIPTION - General Fund Appropriation [Appr Unit 001)	BUDGETED	EXPENDED	ENCUMBERED	REMAINING BALANCE	Percentage
Personal Services (0100 series)	30,000.00	15,259.38		14,740.62	49.14%
Supportive Services (0200 series)	157,275.00	54,173.02	3,443.00	99,656.98	63.37%
Data Processing Charges (0400 series)	5,401.00	1,202.92		4,198.08	77.73%
Professional Services (0900 series)	50,794.00	1,500.00	0.00	49,294.00	97.05%
	243,470.00	72,135.32	3,443.00	167,891.68	68.96%

DESCRIPTION - School Foundation Appropriation [Appr Unit 009]	BUDGETED	EXPENDED	ENCUMBERED	REMAINING BALANCE	Percentage
Personal Services (0100 series)	248,428.00	78,198.59	0.00	170,229.41	68.52%
Supportive Services (0200 series)	23,422.00	0.00	8,100.00	15,322.00	65.42%
Professional Services (0900 series)	145,848.00	0.00	0.00	145,848.00	100.00%
	417,698.00	78,198.59	8,100.00	331,399.41	79.34%
TOTAL	661,168.00	150,333.91	11,543.00	499,291.09	

U. S. Department of Education
Office of Career, Technical, and Adult Education

* * * * * * * * * * *

The Carl D. Perkins Career and Technical Education Act of 2006, as amended by the *Strengthening Career and Technical Education for the 21st Century Act* (Perkins V)

GUIDE FOR THE SUBMISSION OF STATE PLANS

OMB Control Number: **1830-0029**
Expiration Date: ________

According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 1830-0029. The time required to complete this information collection is estimated to average INSERT WHEN COMPUTED hours per response, including the time to review instructions, search existing data resources, gather and maintaining the data needed, and complete and review the information collection. If you have any comments concerning the accuracy of the time estimate(s) or suggestions for improving this form, please write to: U.S. Department of Education, Washington, DC 20202-4651. If you have comments or concerns regarding the status of your individual submission of this form, contact your Perkins Regional Coordinator listed on Table 4 (page 5) of this Guide.

Dear Fellow Educators –

The *Strengthening Career and Technical Education for the 21st Century Act* (Perkins V) was signed into law by President Trump on July 31, 2018. This bipartisan measure reauthorizes the *Carl D. Perkins Career and Technical Education Act*, which provides roughly $1.3 billion annually in Federal funding, administered by the U.S. Department of Education (Department), for career and technical education (CTE) for our nation's youth and adults.

This new law represents an important opportunity to advance the Department's vision for our nation's CTE system: *Expand opportunities for every student to explore, choose, and follow career pathways to earn credentials of value.* As stated by U.S. Secretary of Education DeVos regarding passage of the law, "Congress came together to expand educational pathways and opportunities, and give local communities greater flexibility in how best to prepare students for the jobs of today and tomorrow."

Key provisions in the new law include:

- Requiring extensive collaboration among State- and local-level secondary, postsecondary, and business and industry partners to develop and implement high-quality CTE programs and programs of study.
- Introducing a needs assessment to align CTE programs to locally identified in-demand, high-growth, and high-wage career fields.
- Strengthening the CTE teacher and faculty pipeline, especially in hard-to-fill program areas, including STEM.
- Promoting innovative practices to reshape where, how, and to whom CTE is delivered.
- Expanding the reach and scope of career guidance and academic counseling.
- Shifting responsibility to States to determine their performance measures, including new program quality measures, and related levels of performance to optimize outcomes for students.

As you embark on the development of new plans for CTE, it is our hope that you will use the opportunity afforded by the new law as a tool to "rethink" CTE in your State. You might consider asking:

- What is the right "split of funds" between secondary and postsecondary programs given today's environment?
- How can "reserve" funds be used to incentivize "high-quality" CTE programs?
- How do you define and approve high-quality CTE programs?
- How can work-based learning, including "earn and learn programs" such as apprenticeships, be the rule and not the exception?
- How can you build the pipeline of teachers necessary to develop the pathways local communities need?
- What is the best role for employers in the development and delivery of CTE programs?

We hope you will arrive at big and bold goals for CTE in your State under this newly-authorized Perkins V statute. And, we look forward to working with you and helping you along the way.

Sincerely,

Scott Stump
Assistant Secretary for Career, Technical, and Adult Education

TABLE OF CONTENTS

INTRODUCTION AND SUBMISSION REQUIREMENTS

On July 31, 2018, the President signed into law the *Strengthening Career and Technical Education for the 21st Century Act* (Public Law 115-224) (Perkins V, the Act, or statute), which reauthorized and amended the *Carl D. Perkins Career and Technical Education Act of 2006*. The U. S. Department of Education's (Department) Office of Career, Technical, and Adult Education (OCTAE) developed this guide to assist each eligible agency in preparing and submitting a new State Plan under Perkins V and applicable Federal regulations.

The Department recognizes that it will take time for eligible agencies to update their career and technical education (CTE) systems, policies, and programs to align with the requirements of Perkins V. In particular, eligible agencies may not be ready to fully implement the new accountability provisions when Perkins V goes into effect at the beginning of the 2019-2020 school year. To provide for the orderly transition to Perkins V, consistent with Section 4 of the Act, the Secretary is delaying the implementation of certain new provisions until the start of Fiscal Year (FY) 2020. Eligible agencies will not be required to submit, among other things, State determined levels of performance until FY 2020 and may use FY 2019 to gather baseline data. In addition, eligible agencies that submit a 1-Year Transition Plan in FY 2019 will not be required to have their eligible recipients conduct and describe the results of a comprehensive needs assessment in their local applications for FY 2019. Although the Department is providing States with the flexibility to delay implementation of certain provisions in 2019, States are welcome begin implementing Perkins V during the 2019-2020 school year.

Options for the Submission of State Plans in FY 2019

Section 122(a)(1) of Perkins V requires each eligible agency desiring assistance for any fiscal year under the Act to prepare and submit a State plan to the Secretary. Each eligible agency must develop its State plan in consultation with key stakeholders, the Governor, and other State agencies with authority for CTE, consistent with section 122(c) of the Act.

To fulfill the obligation for a State plan, each eligible agency has the following options for how and when it will submit its Perkins V State Plan. It may submit:

- Option 1 – a 1-Year Transition Plan for FY 2019, which is the first fiscal year following the enactment of the law. Under this option, the eligible agency would submit its Perkins V State Plan in FY 2020 covering FY 2020-23.

- Option 2 – a Perkins V State Plan that covers 5 years, which includes a transition year in FY 2019 and then a 4-year period covering FY 2020-23.

Under either option, the eligible agency may choose to submit its State Plan as part of its Workforce Innovation and Opportunity Act (WIOA) Combined State Plan pursuant to section 122(b)(1) of the Act.

Tables 5 and 6, located at the end of this section, provide additional information on the implementation timelines for eligible agencies that submit a 1-Year Transition Plan versus a Perkins V State Plan in FY 2019.

Contents of Perkins V State Plans

State Plans under Perkins V must include the following items:

- A cover page, including a letter providing joint signature authority from the Governor.
- Narrative descriptions required by statute.
- Assurances, certifications, and other forms required by statute and/or applicable Federal regulations, including the Education Department General Administrative Regulations (EDGAR) at 34 CFR Part 76.
- A budget for the upcoming year.
- State determined levels of performance (SDPLs).

Table 1 below provides a comparison of the required items to be submitted for the 1-Year Transition Plan (Option 1) versus the Perkins V State Plan (Option 2) in FY 2019. Table 2 provides a comparison of the required items to be submitted for FY 2020 depending on whether the eligible agency chose Option 1 or Option 2 in FY 2019. As noted above, under both options, eligible agencies will not be required to submit, or held accountable to, State determined performance levels in FY 2019.

As noted with an asterisk on Table 1 below (Option 2, D. Accountability for Results), eligible agencies that submit a Perkins V State plan in FY 2019 will submit their narrative accountability information and SDPL Form, along with any other State plan revisions, and a cover page in FY 2020. Please note that eligible agencies that submit a Perkins V State Plan in FY 2019 will have to complete the hearing, consultation, and public comment procedures identified in section 122(a) and (c) of Perkins V prior to submission of the plan in FY 2019. In addition, those eligible agencies must complete the consultation and public comment procedures required for the accountability system prior to submission to the "Accountability for Results" section of the State Plan in FY 2020. See section 113(b)(3)(B) of Perkins V and section D questions 3 and 4 in the Narrative Descriptions below.

As noted with an asterisk on Table 2 below (Submitted a 1-Year Transition Plan in 2019, A. Plan Development and Coordination), eligible agencies that submit a one-year transition plan in FY2019 must ensure that their full Perkins V State Plan to be submitted in FY 2020, including the sections that were addressed during the transition year, go through the hearing, consultation and public comment procedures identified in section 122(a) and (c) of Perkins V prior to submission in FY 2020.

Table 1: Checklist of Items Required to be Submitted in FY 2019

State Plan Items	OPTION 1: 1-Year Transition Plan (FY 2019 only)	OPTION 2: Perkins V State Plan (FY 2019-2023)
I. Cover Page	Required	Required
II. Narrative Descriptions		
A. Plan Development and Coordination	Not required	Required
B. Program Administration and Implementation	Only Items B.2.a-e, and B.3.a	Required
C. Fiscal Responsibility	Required	Required
D. Accountability for Results	Not required	Not required*
III. Assurances, Certifications, and Other Forms	Required	Required
IV. Budget	Required	Required
V. State Determined Performance Levels (SDPL)	Not required	Not required

Table 2: Checklist of Items Required to be Submitted in FY 2020

State Plan Items	Submitted a 1-Year Transition Plan in 2019 (Option 1 from Table 1)	Submitted a Perkins V State Plan in 2019 (Option 2 from Table 1)
I. Cover Page	Required	Required
II. Narrative Descriptions		
A. Plan Development and Coordination	Required*	Revisions, if any
B. Program Administration and Implementation	Required in full	Revisions, if any
C. Fiscal Responsibility	Revisions, if any	Revisions, if any
D. Accountability for Results	Required	Required
III. Assurances, Certifications, and Other Forms	Revisions, if any	Revisions, if any
IV. Budget	Required	Required
V. State Determined Performance Levels (SDPL)	Required	Required

State Plans and Revisions in Subsequent Years

In subsequent years, each eligible agency must submit State plan revisions, if any, and a budget for the upcoming fiscal year. Consistent with the requirements in section 113(b)(3)(A)(ii) and (iii) of Perkins V, an eligible agency may revise its SDPLs for the subsequent years covered by its Perkins V State Plan.

Timeline for the Issuance of Perkins V Grant Awards

Table 3 below provides the annual timeline for the Department to issue Perkins V grant awards. Congress appropriates funding for Perkins V State grants in two installments, one of which becomes available on July 1 and a second which becomes available on October 1. In each fiscal year, the Secretary will issue program memoranda with State plan requirements and estimated State allocations, respectively, for the upcoming fiscal year.

Table 3: Timeline for the Issuance of Perkins V Grant Awards

Timeline	Actions
January 2019	Department issues *Carl D. Perkins Career and Technical Education Act of 2006*, as amended by the *Strengthening Career and Technical Education for the 21st Century* (*Perkins V*): *Guide for the Submission of State Plans in 2019*
No later than March[1]	Department issues State's Perkins V grant estimated allocations
April	Eligible agencies submit their Perkins V State Plans to the Department
April – June	Department reviews and makes determinations regarding Perkins V State Plans and any annual revisions
July 1	Department issues 1st installment of State's Perkins V grants for the program year to eligible agencies
October 1	Department issues supplemental (and final) installment of State's Perkins V grants for the program year to eligible agencies

[1] The Department will publish estimated State allocations no later than March provided that an appropriation for the next fiscal year has been enacted into law by this time.

Submission Instructions

Each eligible agency must submit its Perkins V State Plan and any annual revisions, including budgets and SDPLs, no later than close of business (5:00 pm EST) of each submission year on the date established by the Secretary in accordance with EDGAR 76.703(b)(3)(ii). Submissions must be entered into the Perkins V State Plan Portal at perkins.ed.gov/pims.[2] As in years past, the Department will provide eligible agencies with online training and technical assistance before and throughout the Perkins V State Plan submission process.

Approval of State Plans in 2019

Section 122(f)(1) of Perkins V requires the Secretary, not less than 120 days after the eligible agency submits its State Plan to approve such State Plan, or a revision of the plan under section 122(a)(2), including a revision of State determined performance levels in accordance with section 113(b)(3)(A)(ii), if the Secretary determines that the State has submitted State determined performance levels that meet the criteria established in section 113(b)(3), including the minimum requirements described in section 113(b)(3)(A)(i)(III). The Secretary shall not disapprove such plan unless the Secretary determines it does not meet the requirements of the Act pursuant to section 122(f)(1) and takes the disapproval actions described in section 122(f)(2) of the Act.

Publication Information

The Department plans to publish Perkins V State Plans, including State determined performance levels (SDPLs), in whole or in part, on its Web site or through other means available.

For Further Information

For questions regarding the Perkins V State Plan submission requirements or process, an eligible agency should contact its Perkins Regional Coordinator (PRC) as provided in Table 4 below.

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[2] Hard copy submissions will not be accepted as the Department met the requirement of 2 CFR 76.720(b)(3) for the transition from hard copy to electronic submission of State plans and revisions during implementation of the *Carl D. Perkins Career and Technical Education Act of 2006* (Perkins IV).

Table 4: Perkins Regional Coordinators

Region	States	Coordinator
1 - Northwestern	Alaska, California, Hawaii, Idaho, Montana, Nevada, North Dakota, Oregon, South Dakota, Washington, Wyoming	Jose Figueroa (202) 245-6054 Jose.figueroa@ed.gov
2 – Southwestern	Arizona, Colorado, Kansas, Nebraska, New Mexico, Oklahoma, Texas, Utah	Andrew (Andy) Johnson (202) 245-7786 Andrew.johnson@ed.gov
3 – Mid-Northern	Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, Wisconsin	Jamelah Murrell (202) 245-6981 Jamelah.murrell@ed.gov
4 – Southern	Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Puerto Rico, South Carolina, Tennessee	Marilyn Fountain (202) 245-7346 Marilyn.fountain@ed.gov
5 – Northeastern	Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, Vermont, Virgin Islands	Sharon Head (202) 245-6131 Sharon.Head@ed.gov
6 – Mid-Atlantic	Delaware, District of Columbia, Maryland, New Jersey, Palau, Pennsylvania, Virginia, West Virginia	Allison Hill (202) 245-7775 Allison.hill@ed.gov

Table 5: Timeline for Eligible Agencies Submitting 1-Year Transition Plans Covering FY 2019

Action	FY 2019 (July 1, 2019 - June 30, 2020)	FY 2020 (July 1, 2020 - June 30, 2021)	FY 2021 (July 1, 2021 - June 30, 2022)	FY 2022 (July 1, 2022 - June 30, 2023)	FY 2023 (July 1, 2023 - June 30, 2024)	FY 2024 (July 1, 2023 – June 30, 2024)
Submission of State Plan and Performance Levels	Spring 2019: Agency submits transition plan covering FY 2019	Spring 2020: Agency submits 4-Year Plan covering FY 2020-23	Spring 2021: Agency submits revisions, if any	Spring 2022: Agency submits revisions, if any	Spring 2023: Agency submits revisions, if any	Spring 2024: Agency submits new 4-Year Plan covering FY 2024-27 or revisions to 4-Year Plan submitted in FY 2020
Submission/ Revision of Performance Levels (as part of State Plan Submission)	N/A	Agency submits SDPLs for FY 20-23, including baseline levels	N/A	Agency revises, as appropriate, SDPLs for FY 2022-23	N/A	Agency submits SDPLs for FY 2024-27 (if new plan) or FY 2024 (if only revisions)
Receipt of Grant Award	July 1, 2019: Agency receives first installment of FY 2019 grant award	July 1, 2020: Agency receives first installment of FY 2020 grant award	July 1, 2021: Agency receives first installment of FY 2020 grant award	July 1, 2022: Agency receives first installment of FY 2020 grant award	July 1, 2023: Agency receives first installment of FY 2020 grant award	July 1, 2024 – Agency receives first installment of FY 2020 grant award
	October 1 2019: Agency receives final installment of FY 2019 grant award	October 1 2020: Agency receives final installment of FY 2020 grant award	October 1 2021: Agency receives final installment of FY 2021 grant award	October 1 2022: Agency receives final installment of FY 2022 grant award	October 1 2023: Agency receives final installment of FY 2023 grant award	October 1 2024: Agency receives final installment of FY 2024 grant award

Table 6: Timeline for Eligible Agencies Submitting Perkins V State Plans Covering FY 2019-23

Action	FY 2019 (July 1, 2019 – June 30, 2020)	FY 2020 (July 1, 2020 – June 30, 2021)	FY 2021 (July 1, 2021 – June 30, 2022)	FY 2022 (July 1, 2022 – June 30, 2023)	FY 2023 (July 1, 2023 – June 30, 2024)	FY 2024 (July 1, 2023 – June 30, 2024)
Submission of State Plan	Spring 2019: Agency submits State plan covering FY 2019-23	Spring 2020: Agency submits revisions, if any	Spring 2021: Agency submits revisions, if any	Spring 2022: Agency submits revisions, if any	Spring 2023: Agency submits revisions, if any	Spring 2024: Agency submits new 4-Year Plan covering FY 2024-27 or revisions to 4-Year Plan submitted in FY 2020
Submission/ Revision of Performance Levels (as part of State Plan Submission)	N/A	Agency submits SDPLs for FY 20-23, including baseline levels	N/A	Agency revises, as appropriate, SDPLs for FY 2022-23	N/A	Agency submits SDPLs for FY 2024-27 (if new plan) or FY 2024 (if only revisions)
Receipt of Grant Award	July 1 2019: Agency receives first installment of FY 2019 grant award	July 1 2020: Agency receives first installment of FY 2020 grant award	July 1 2021: Agency receives first installment of FY 2020 grant award	July 1 2022: Agency receives first installment of FY 2020 grant award	July 1 2023; Agency receives first installment of FY 2020 grant award	July , 2024: Agency receives first installment of FY 2020 grant award
	October 1 2019: Agency receives final installment of FY 2019 grant award	October 1 2020: Agency receives final installment of FY 2020 grant award	October 1 2021: Agency receives final installment of FY 2021 grant award	October 1 2022: Agency receives final installment of FY 2022 grant award	October 1 2023: Agency receives final installment of FY 2023 grant award	October 1 2024: Agency receives final installment of FY 2024 grant award

U. S. Department of Education
Office of Career, Technical, and Adult Education

Strengthening Career and Technical Education for the 21st Century Act (Perkins V) State Plan

I. COVER PAGE

A. State Name: Wyoming

B. Eligible Agency (State Board) Submitting Plan on Behalf of State: Wyoming State Board of Vocational Education

C. Person at, or officially designated by, the eligible agency, identified in Item B above, who is responsible for answering questions regarding this plan. This is also the person designated as the "authorized representative" for the agency.

1. Name: Michelle Aldrich, PhD
2. Official Position Title: State Director for Career and Technical Education
3. Agency: Wyoming Department of Education
4. Telephone: (307) 777-3655
5. Email: michelle.aldrich@wyo.gov

D. Individual serving as the State Director for Career and Technical Education (CTE):

- Check here if this individual is the same person identified in Item C above and then proceed to Item E below. ✓

1. Name:
2. Official Position Title:
3. Agency:
4. Telephone: ( ) 5. Email:

E. Type of Perkins V State Plan Submission - FY 2019 (*Check one*):

- 1-Year Transition Plan (FY2019 only) ✓
- State Plan (FY 2019-23)

F. Type of Perkins V State Plan Submission - Subsequent Years (C*heck one*):

- State Plan (FY 2020-23) ✓

- State Plan Revisions, FY 2020
- State Plan Revisions, FY 2021
- State Plan Revisions, FY 2022
- State Plan Revisions, FY 2023

G. Special Features of State Plan Submission (*Check one*):

- WIOA Combined State Plan - *Secondary and Postsecondary*
- WIOA Combined State Plan - *Postsecondary Only*

H. Governor's Joint Approval of the Perkins V State Plan (*Fill in text box and then check one box below):*

Date Governor was sent State Plan for signature:

The Governor has provided a letter that he or she is jointly approving the State plan for submission to the Department.

✓ The Governor has not provided a letter that he or she is jointly approving the State plan for submission to the Department.

I. By signing this document, the eligible entity, through its authorized representative, agrees:

1. To the assurances, certifications, and other forms enclosed in its State plan submission; and
2. That, to the best of my knowledge and belief, all information and data included in this State plan submission are true and correct.

Authorized Representative Identified in Item C Above (Printed Name)	Telephone:
Signature of Authorized Representative	Date:

II. NARRATIVE DESCRIPTIONS

A. Plan Development and Consultation

1. Describe how the State plan was developed in consultation with the stakeholders and in accordance with the procedures in section 122(c) (2) of Perkins V and as provided in Text Box 1 on the following page.

   Not applicable during the transition year

2. Consistent with section 122(e) (1) of Perkins V, each eligible agency must develop the portion of the State plan relating to the amount and uses of any funds proposed to be reserved for adult career and technical education, postsecondary career and technical education, and secondary career and technical education after consultation with the State agencies identified in section 122(e) (1) (A)-(C) of the Act. If a State agency, other than the eligible agency, finds a portion of the final State plan objectionable, the eligible agency must provide a copy of such objections and a description of its response in the final plan submitted to the Secretary. (Section 122(e)(2) of Perkins V)

   Not applicable during the transition year

3. Describe opportunities for the public to comment in person and in writing on the State plan. (Section 122(d)(14) of Perkins V)

   Not applicable during the transition year

B. Program Administration and Implementation

1. **State's Vision for Education and Workforce Development**

   a. Provide a summary of State-supported workforce development activities (including education and training) in the State, including the degree to which the State's career and technical education programs and programs of study are aligned with and address the education and skill needs of the employers in the State identified by the State workforce development board. (Section 122(d)(1) of Perkins V)

      Not applicable during the transition year

   b. Describe the State's strategic vision and set of goals for preparing an educated and skilled workforce (including special populations) and for meeting the skilled workforce needs of employers, including in existing and emerging in-demand industry sectors and occupations as identified by the State, and how the State's career and technical education programs will help to meet these goals. (Section 122(d)(2) of Perkins V)

      Not applicable during the transition year

Text Box 1: State Plan Development

(c) PLAN DEVELOPMENT.—
(1) IN GENERAL.—The eligible agency shall—
(A) develop the State plan in consultation with—

(i) representatives of secondary and postsecondary career and technical education programs, including eligible recipients and representatives of 2-year minority serving institutions and historically Black colleges and universities and tribally controlled colleges or universities in States where such institutions are in existence, adult career and technical education providers, and charter school representatives in States where such schools are in existence, which shall include teachers, faculty, school leaders, specialized instructional support personnel, career and academic guidance counselors, and paraprofessionals;
(ii) interested community representatives, including parents, students, and community organizations;
(iii) representatives of the State workforce development board established under section 101 of the Workforce Innovation and Opportunity Act (29 U.S.C. 3111) (referred to in this section as the ''State board'');
(iv) members and representatives of special populations;
(v) representatives of business and industry (including representatives of small business), which shall include representatives of industry and sector partnerships in the State, as appropriate, and representatives of labor organizations in the State;
(vi) representatives of agencies serving out-of-school youth, homeless children and youth, and at-risk youth, including the State Coordinator for Education of Homeless Children and Youths established or designated under section 722(d)(3) of the McKinney-Vento Homeless Assistance Act (42 U.S.C. 11432(d)(3));
(vii) representatives of Indian Tribes and Tribal organizations located in, or providing services in, the State; and
(viii) individuals with disabilities; and

(B) consult the Governor of the State, and the heads of other State agencies with authority for career and technical education programs that are not the eligible agency, with respect to the development of the State plan.
(2) ACTIVITIES AND PROCEDURES.—The eligible agency shall develop effective activities and procedures, including access to information needed to use such procedures, to allow the individuals and entities described in paragraph (1) to participate in State and local decisions that relate to development of the State plan.
(3) CONSULTATION WITH THE GOVERNOR.—The consultation described in paragraph (1)(B) shall include meetings of officials from the eligible agency and the Governor's office and shall occur—
(A) during the development of such plan; and
(B) prior to submission of the plan to the Secretary.

(Section 122(c)(1) of Perkins V)

c. Describe the State's strategy for any joint planning, alignment, coordination, and leveraging of funds between the State's career and technical education programs and programs of study with the State's workforce development system, to achieve the strategic vision and goals described in section 122(d)(2) of Perkins V, including the core programs defined in section 3 of the Workforce Innovation and Opportunity Act (29 U.S.C. 3102) and the elements related to system alignment under section 102(b)(2)(B) of such Act (29 U.S.C. 3112(b)(2)(B)); and for programs carried out under this title with other Federal programs, which may include programs funded under the Elementary and Secondary Education Act of 1965 and the Higher Education Act of 1965. (Section 122(d)(3) of Perkins V)

Not applicable during the transition year

d. Describe how the eligible agency will use State leadership funds made available under section 112(a) (2) of the Act for purposes under section 124 of the Act. (Section 122(d)(7) of Perkins V)

Not applicable during the transition year

2. Implementing Career and Technical Education Programs and Programs of Study

a. Describe the career and technical education programs or programs of study that will be supported, developed, or improved at the State level, including descriptions of the programs of study to be developed at the State level and made available for adoption by eligible recipients. (Section 122(d)(4)(A) of Perkins V)

Response: Wyoming will continue to support and expand the adopted Career Clusters as defined by the National Association of State Directors of CTE and the United States Department of Education. Thus, the following Career Clusters are the CTE Programs of Study for Wyoming:

- Agriculture, Food & Natural Resources
- Architecture & Construction
- Arts, A/V Technology & Communications
- Business Management & Administration
- Education & Training
- Finance
- Government & Public Administration
- Health Science
- Hospitality & Tourism
- Human Services
- Information Technology
- Law, Public Safety, Corrections & Security
- Manufacturing
- Marketing
- Science, Technology, Engineering & Mathematics
- Transportation, Distribution & Logistics

These Programs of Study were developed by the Wyoming Department of Education in a format that can be modified by the local district and post-secondary institutions to include their specific courses and options.

b. Describe the process and criteria to be used for approving locally developed programs of study or career pathways, including how such programs address State workforce development and education needs and the criteria to assess the extent to which the local application under section 132 will—
   i. promote continuous improvement in academic achievement and technical skill attainment;
   ii. expand access to career and technical education for special populations; and
   iii. support the inclusion of employability skills in programs of study and career pathways. (Section 122(d)(4)(B) of Perkins V)

Response: Strengthening integration between CTE and traditional academic core areas, particularly those emphasized within ESSA, enhances the academic attainment of all students including those from special populations. Data from the Wyoming Test of Proficiency and Progress (WY-TOPP) will continue to impact program improvement goals at the secondary eligible recipient level.

Access to CTE for special populations will be supported through professional development and technical assistance to secondary and post-secondary faculty and staff. Wyoming CTE programs will be provided in the least restrictive environment with courses for secondary students aligned with the IEP requirements. Career guidance and counseling services will include provisions to ensure that students from special populations are made aware of opportunities available through CTE programs in the same manner or alternative format if required and at the same time as all students.

Individuals who are members of special populations will be provided equal access as all CTE programs comply with Office for Civil Rights regulations. Compliance will be assured through the Wyoming Department of Education monitoring processes. High quality instruction and intervention will be provided through Wyoming's Response to Intervention (RTI) process.

Using the Wyoming CTE (WyCTE) Collection, special population results will be reported in disaggregated form. The Wyoming Department of Education reviews WyCTE results and the local annual report for each district and institution. Each recipient also receives assessment results for their district or institution for use in conducting an annual evaluation to determine to what degree performance measures and standards are being met. The information provided by the assessment data will be used by the Wyoming Department of Education and grant recipients for development of CTE programs for students from special populations.

With input from business and stakeholders, the Wyoming Department of Education developed technical skill assessments to ensure a degree of comparability and consistency of learning across regions of the state within each career cluster. The technical skill competencies will include those needed for current and emerging employment opportunities as well as entrepreneurship. To every extent possible Career Technical Student Organization (CTSO) guidelines will be used in the development of these skill competencies to increase industry relevance and to provide congruency and instruction with those skills needed for state and national competitions.

These technical skill competencies and related skill assessments will be based on the occupations identified as high skill, high wage, or in-demand occupations within the Career Cluster Guide publications. After defining the technical skill competencies, emphasis will be placed on professional development for secondary and post-secondary Career Technical and Academic instructors to facilitate improved instruction aligned with the competencies within the programs of study.

c. Describe how the eligible agency will:

i. make information on approved programs of study and career pathways (including career exploration, work-based learning opportunities, early college high schools, and dual or concurrent enrollment program opportunities) and guidance and advisement resources, available to students (and parents, as appropriate), representatives of secondary and postsecondary education, and special populations, and to the extent practicable, provide that information and those resources in a language students, parents, and educators can understand;

Response: Through student orientations that take place in the 7th- 9th grade level, all students in Wyoming are made aware of the Career Technical Programs of Study. The Wyoming Department of Education, conducts annual training for school district personnel statewide to acquaint them with the use of the career clusters and programs of study. Efforts are in place to increase career development awareness through the state's Facilitating Career Development Course. Alignment between WyoLearn and programs of study make up-to-date, student-driven data available to all stakeholders.

ii. facilitate collaboration among eligible recipients in the development and coordination of career and technical education programs and programs of study and career pathways that include multiple entry and exit points.

Response: Through a collaborative effort among offices within the Wyoming Department of Education and local education agency staff members responsible for career and technical education and college, military, and career readiness facilitation in the development and coordination of education programs and programs of study and career pathways will include a number of entry and exit points described below.

Entry Points:

(1) Grades 5-8:

Students will participate in the following events including, but not limited to the following:

(a) Career Fairs
(b) Business/Industry tours and guest speakers
(c) Tours of high school CTE programs [academies]
(d) Makerspace labs, fabrication labs, Science Technology Engineering Arts and Mathematics labs (etc)
(e) Student professional development days
(f) Project Based Learning
(g) Career Technical Student Organization(s) participation
(h) Project Lead the Way
(i) Job Shadow

(j) Interest and Career Inventories

(2) Grades 9-12:
Students at the secondary level will prepare for the postsecondary component of a chosen career. Secondary school guidance counselors will help each student choose the classes that will give him or her the background to meet the entrance requirements for a particular occupation or postsecondary education, and students will participate in the following events including, but not limited to the following:
(a) Career Fairs
(b) Business/Industry tours and guest speakers
(c) Makerspace labs, fabrication labs, Science Technology Engineering Arts and Mathematics labs, (etc)
(d) Student professional development days
(e) Work Based Learning
(f) Project Based Learning
(g) Career Technical Student Organization(s) participation
(h) Project Lead the Way
(i) WorkKeys
(j) Interest and Career Inventories

(3) Post- Secondary:
Post-secondary academic advisors will help each student choose the classes that will give him or her the background to meet the entrance requirements for a particular occupation or postsecondary education, and students will participate in the following events including, but not limited to the following:
(a) Career Fairs
(b) Business/Industry tours and guest speakers
(c) Makerspace labs, fabrication labs, Science Technology Engineering Arts and Mathematics labs, (etc)
(d) Student professional development days
(e) Work Based Learning
(f) Project Based Learning
(g) Career Technical Student Organization(s) participation
(h) Project Lead the Way
(i) WorkKeys
(j) Interest and Career Inventories

Exit Points:
(1) Grades 5-8 - Selecting a CTE Cluster

(2) Grades 9-12
(a) Participating or completing a pathway and earning an industry recognized credential, or passing a career readiness assessment in the aligned pathway

(b) Graduation

(3) Post-Secondary
   (a) Earning an Associate's of Applied Science or an Associate's of Science
   (b) Earning an Associate's of Arts
   (c) Earned an Associate's of Nursing
   (d) Earned an industry certification or credential

iii. use State, regional, or local labor market data to determine alignment of eligible recipients' programs of study to the needs of the State, regional, or local economy, including in-demand industry sectors and occupations identified by the State board, and to align career and technical education with such needs, as appropriate;

Response: The Wyoming Department of Workforce Services in conjunction with the Wyoming Community College Commission facilitate discussions among member agencies, coordinate among agencies and colleges those workforce initiatives with a statewide impact, and share workforce-related information with each other and the colleges, including information about high-skill, high-wage, high-demand, and non-traditional occupations. Through involvement of representatives from business and industry in the design and implementation of new courses that lead to an industry recognized credential or degree, courses will be developed that meet these occupational needs.

iv. ensure equal access to approved career and technical education programs of study and activities assisted under this Act for special populations;

Response: Wyoming does not differentiate between CTE students and other students as far as high school graduation requirements. All students have the same Carnegie Unit requirement established by statute and by additional district requirements, and all students must meet the common core of knowledge and skills dictated by statute. Thus, CTE students will graduate with a set of knowledge and skills that is equivalent to the general population. Increased emphasis on academic integration, a tenet of high school or secondary school reform, is to increase the graduation rates of CTE students as they see the relevance of academic instruction with the context of the Career Clusters.

Special population students must also meet the same standards, but they may graduate with differing expectations according to their Individual Education Plans (IEPs). All students, but particularly special population students, will benefit from the increased emphasis on academic integration because learning will become more relevant. Both CTE teachers and core academic teachers will be involved in class design. Increased emphasis on reaching students with various learning styles and effective use of project based instruction has been an emphasis of professional development.

v. coordinate with the State board to support the local development of career pathways and articulate processes by which career pathways will be developed by local workforce development boards, as appropriate;

Response: The local needs assessment will drive this process for each eligible recipient.

vi. support effective and meaningful collaboration between secondary schools, postsecondary institutions, and employers to provide students with experience in, and understanding of, all aspects of an industry, which may include work-based learning such as internships, mentorships, simulated work environments, and other hands-on or inquiry-based learning activities; and

Response: Career Technical Education programs in Wyoming will be required to have local advisory committees that oversee the planning and implementation of quality programs. These advisory committees will be made up of parents, academic and career and technical education secondary and post-secondary teachers, administrators and faculty, career guidance and academic counselors, local business (including small businesses), and labor organizations. The existence of such an advisory committee will be reported on the annual Perkins' application.

vii. improve outcomes and reduce performance gaps for CTE concentrators, including those who are members of special populations. (Section 122(d)(4)(C) of Perkins V)

Response: Efforts are being made to continuously monitor CTE program areas and technical skill assessments. Through the monitoring process, the WDE will continue to identify CTE program areas focused upon in the state – these are the program areas technical skill assessments are given. Identification of CTE programs of study are based on several considerations, including but not limited to:1) historical enrollment and course-taking patterns; and 2) the degree to which program(s) are preparing students for high-skill, high-wage and/or high-demand occupations. Second, within these identified CTE program areas, syllabi will be articulated which clearly state the competencies that students including students from special population groups are expected to attain upon completion of the CTE program. These syllabi will provide guidance for selecting technical skill assessment(s) that are aligned to these competencies and measure the articulated competencies with sufficient coverage and depth. Third, technical skill assessments are reviewed on a continuous basis in order to determine whether the existing assessments will meet the needs of Wyoming.

d. Describe how the eligible agency, if it chooses to do so, will include the opportunity for secondary school students to participate in dual or concurrent enrollment programs, early college high school, or competency-based education. (Section 122(d)(4)(D) of Perkins V)

Response: Articulation agreements currently exist in Wyoming. The Career Programs of Study, as well as the state course reporting process encourage and track articulated courses. The Secondary Classification for Exchange of Data (SCED) system from the National Center for Education Statistics (NCES) has been implemented to improve the articulation process.

Career Programs of Study include transitions to postsecondary institutions through improvement of the articulation agreement process, and development of common criteria for adjunct faculty.

All CTE Programs of Study lead to industry certification, or an associate or baccalaureate degree. The Wyoming Department of Education will continue to encourage offering of credentials and certificates by secondary and postsecondary institutions as well through industry groups and organizations. The Wyoming Community College Commission maintains a listing of certification and credentialing programs by Career Cluster for Wyoming.

e. Describe how the eligible agency will involve parents, academic and career and technical education teachers, administrators, faculty, career guidance and academic counselors, local business (including small businesses), labor organizations, and representatives of Indian Tribes and Tribal organizations, as appropriate, in the planning, development, implementation, and evaluation of its career and technical education programs. (Section 122(d)(12) of Perkins V)

Response: Career Technical Education programs in Wyoming are expected to hold local advisory board meetings twice during the program year that oversee the planning and implementation of quality programs. These advisory boards will be made up of parents, academic and career and technical education teachers, administrators, faculty, career guidance and academic counselors, local business, labor organizations, and members of Indian Tribes and Tribal Organizations. The existence of such advisory boards will be reported on the annual Perkins' application.

In addition, all CTE programs in Wyoming are aligned to the state Career Technical Standards. These standards are reviewed and updated on a five-year cycle. The makeup of the standards review group is of similar makeup to the required list of advisory board members.

f. Include a copy of the local application template that the eligible agency will require eligible recipients to submit pursuant to section 134(b) of Perkins V.

Not applicable during the transition year

g. Include a copy of the local needs assessment template that the eligible agency will require eligible recipients to submit pursuant to section 134(c) of Perkins V.

Not applicable during the transition year

h. Provide the definition for "size, scope, and quality" that the eligible agency will use to make funds available to eligible recipients pursuant to section 135(B) of Perkins V.

Not applicable during the transition year

3. <u>Meeting the Needs of Special Populations</u>

a. Describe its program strategies for special populations, including a description of how individuals who are members of special populations:

i. will be provided with equal access to activities assisted under this Act.

Response: Wyoming CTE programs will be provided in the least restrictive environment with courses for identified secondary students aligned with their IEP requirements. Career guidance and counseling services will include provisions to ensure that students from special populations are made aware of opportunities available through CTE programs in the same manner or alternative format if required and at the same time as all students.

ii. will not be discriminated against on the basis of status as a member of a special population.

Response: Individuals who are members of special populations will be provided equal access as all CTE programs comply with Office for Civil Rights regulations. Compliance will be assured through the Wyoming Department of Education monitoring processes. High quality instruction and intervention will be provided through Wyoming's Response to Intervention (RTI) process.

The U.S. Department of Education, Office for Civil Rights (OCR), requires the Wyoming Department of Education to conduct site visits as part of its Vocational Education Methods of Administration civil rights compliance of districts that receive federal funding. On-site reviews are based on U.S. Department of Education regulations implementing Title VI (34 CFR, Part 100), Title IX (34 CFR, Part 106), Section 504 (34 CFR, Part 104), and the Department of Justice regulations implementing Title II of the Americans with Disabilities Act (ADA) (28 CFR, Part 35), as well as the Guidelines for Eliminating Discrimination and Denial of Services on the Basis of Race, Color, National Origin, Sex and Disability in Vocational Education Programs (34 CFR, Part 100, Appendix B).

The purpose of onsite reviews is to conduct a comprehensive assessment of the selected districts' CTE programs, as well as all facilities housing CTE programs or used by CTE-enrolled students to ensure compliance with the following Federal Civil Rights authorities and regulations. Federal law requires that all school districts receiving funding support from the U.S. Education Department, and providing CTE programs shall comply with:

- Title VI of the Civil Rights Act of 1964 (prohibiting discrimination based on race, color, and national origin) 34 CFR Part 100
- Title IX of the Education Amendments of 1972 (prohibiting discrimination based on gender) 34 CFR Part 106
- Section 504 of the Rehabilitation Act of 1973 (prohibiting discrimination based on disability) 34 CFR Part 104
- Education Program Guidelines for Eliminating Discrimination and Denial of Services on the Basis of Race, Color, National Origin, Sex and Handicap, published in the Federal Register March 21, 1979 (Guidelines).
- U.S. Department of Justice regulations implementing:
  Title II of the Americans with Disabilities Act of 1990 (Title II), 28 CFR Part 35

iii. will be provided with programs designed to enable individuals who are members of special populations to meet or exceed State determined levels of performance described in section 113, and prepare special populations for further learning and for high-skill, high-wage, or in-demand industry sectors or occupations.

Response: The Wyoming CTE (WyCTE) results are reported in disaggregated form by gender, students with disabilities, disadvantaged, limited English proficient, non-traditional, corrections, single parents, and displaced homemakers in the WyCTE Collection Database. The Wyoming Department of Education reviews results and the local annual report for each district and community college. Each recipient also receives assessment results for their district or institution for use in conducting an annual evaluation to determine to what degree performance measures and standards are being met. The information provided by the assessment data will be used by the Wyoming Department of Education and grant recipients for development of CTE programs for students from special populations.

Wyoming does not differentiate between CTE students and other students as far as high school graduation requirements. Career Technical Education students will graduate with a set of knowledge and skills that is equivalent to the general population. Increased emphasis on academic integration, a tenet of high school or secondary school reform, is to increase the graduation rates of CTE students as they see the relevance of academic instruction with the context of the Career Clusters.

All students have the same Carnegie Unit requirements established by statute and by additional district requirements, and must meet the common core of knowledge and skills dictated by statute. Special population students must also meet the same standards, but they may graduate with differing expectations according to their Individual Education Plans (IEPs). All students, but particularly special population students, will benefit from the increased emphasis on academic integration because learning will become more relevant. Both CTE teachers and core academic teachers will be involved in class design, incorporating an increased emphasis on reaching students with various learning styles and effective use of project based instruction.

iv. will be provided with appropriate accommodations.

Response: Wyoming CTE programs will be provided in the least restrictive environment with courses for identified secondary students aligned with their IEP requirements. Career guidance and counseling services will include provisions to ensure that students from special populations are made aware of opportunities available through CTE programs in the same manner or an alternative format if required and at the same time as all students. Individuals who are members of special populations will be provided equal access as all CTE programs comply with Office for Civil Rights regulations. Compliance will be assured through the Wyoming Department of Education monitoring processes. High quality instruction and intervention will be provided through Wyoming's Response to Intervention (RTI) process.

v. will be provided instruction and work-based learning opportunities in integrated settings that support competitive, integrated employment. (Section 122(d)(9) of Perkins V).

Response: Wyoming does not discriminate between CTE students and other students as far as work-based learning opportunities in integrated settings that support competitive, integrated employment. Students enrolled in CTE programs, including those of special populations, will be given the opportunity to interact with industry or community professionals in real workplace settings or simulated environments at an educational institution that foster in-depth, firsthand engagement with the tasks required in a given career field. These work-based learning opportunities will be aligned to curriculum and instruction meeting state standards. Special population students must also meet the same standards in the workplace setting, but they may graduate with differing expectations according to their Individual Education Plans (IEPs).

4. Preparing Teachers and Faculty

a. Describe how the eligible agency will support the recruitment and preparation of teachers, including special education teachers, faculty, school principals, administrators, specialized instructional support personnel, and paraprofessionals to provide career and technical education instruction, leadership, and support, including professional development that provides the knowledge and skills needed to work with and improve instruction for special populations. (Section 122(d)(6) of Perkins V).

Not applicable during the transition year

C. <u>Fiscal Responsibility</u>

1. Describe the criteria and process for how the eligible agency will approve eligible recipients for funds under this Act, including how—

    a. each eligible recipient will promote academic achievement.

Response: Criteria for approval of funds is guided by Wyoming Statute 21-9-101: “Educational programs for schools; standards; core of knowledge and skills; special needs programs; class size requirements; co-curricular activities.” Under this provision, career technical content in all courses must be aligned to, and all students must meet state mandated content standards for both CTE and academic content. Thus, academic requirements for career technical students are identical to all students that graduate from Wyoming schools. Strengthening integration between CTE and core areas, particularly those emphasized within ESSA, will enhance the academic attainment of all students. Clearly, data from the Wyoming Test of Proficiency and Progress (WY-TOPP) will continue to impact program improvement goals at the secondary eligible recipient level.

    b. each eligible recipient will promote skill attainment, including skill attainment that leads to a recognized postsecondary credential.

Response: With input from business and stakeholders, the Wyoming Department of Education will develop technical skill assessments to assure a degree of comparability and consistency of learning across regions of the state within each career cluster. The technical skill competencies will include those needed for current and emerging employment opportunities as well as entrepreneurship. To every extent possible, Career Technical Student Organization guidelines will be used in the development of these skill competencies to increase industry relevance and to provide congruence in instruction with those skills needed for state and national competition. These technical skill competencies and related skill assessments will be based on the occupations identified as high-skill, high demand or high wage within the Career Clusters. After defining the technical skill competencies, emphasis will be placed on professional development for secondary and postsecondary Career Technical and Academic instructors to facilitate improved instruction aligned with the competencies within each program of study.

c. each eligible recipient will ensure the local needs assessment under section 134 takes into consideration local economic and education needs, including, where appropriate, in-demand industry sectors and occupations. (Section 122(d)(5) of Perkins V).

Response: The local needs assessment will incorporate economic and education needs through the required annual Perkins' application within the E-Grants Management System.

2. Describe how funds received by the eligible agency through the allotment made under section 111 of the Act will be distributed:

   a. among career and technical education at the secondary level, or career and technical education at the postsecondary and adult level, or both, including how such distribution will most effectively provide students with the skills needed to succeed in the workplace.

Response - The Wyoming Department of Education (WDE) under the Perkins V; *Strengthening Career and Technical Education for the 21st Century Act* will do a split of 60% for Local Education Agencies (LEAs) and 40% for Postsecondary (Community Colleges).

   b. among any consortia that may be formed among secondary schools and eligible institutions, and how funds will be distributed among the members of the consortia, including the rationale for such distribution and how it will most effectively provide students with the skills needed to succeed in the workplace. (Section 122(d)(8) of Perkins V).

Response - The award amount for postsecondary education institutions is $1,595,646. Wyoming received $4,693,077 in basic state grant award for 2018-2019. Wyoming does take $250,000 for state administration. State leadership funds are 9.67301%. Using the award amount, this equals $453,962 ($93,861 allocation for individuals in State institutions and $80,000 for nontraditional training and employment). Additional funding is awarded from the leadership category for corrections and nontraditional programs through the competitive grant process. Wyoming is using the reserve option. Local funds amount to 85%. The distribution of funds will be 40% for postsecondary and 60% for secondary.

3. Provide the specific dollar allocations made available by the eligible agency for career and technical education programs and programs of study under section 131(a)-(e) of the Act and describe how these allocations are distributed to local educational agencies, areas career and technical education schools and educational service agencies within the State. (Section 131(g) of Perkins V).

Response - The Wyoming Department of Education (WDE) under the Perkins V; *Strengthening Career and Technical Education for the 21st Century Act* will do a split of 60% for Local Education Agencies (LEAs) and 40% for Postsecondary (Community Colleges). The 2019 FY funding for Wyoming was $4,693,077. The amount for local funds (Secondary and Post-Secondary) career and technical education is $3,989,115. Breaking down the 60/40 split there is $2,393,469 for Secondary (60%) and $1,595,646 for Post-Secondary (40%). The allocations are dispersed into the WDEs Grant Management System (GMS) where LEAs apply for their funding annually.

4. Provide the specific dollar allocations made available by the eligible agency for career and technical education programs and programs of study under section 132(a) of the Act and describe how these allocations are distributed to eligible institutions and consortia of eligible institutions within the State.

Response - The Wyoming Department of Education (WDE) under the Perkins V; *Strengthening Career and Technical Education for the 21st Century Act* will do a split of 60 percent for Local Education Agencies (LEAs) and 40 percent% for Postsecondary (Community Colleges). The 2019 FY funding for Wyoming was $4,693,077. The amount for local funds (Secondary and Post-Secondary) career and technical education is $3,989,115. Breaking down the 60/40 split there is $2,393,469 for Secondary (60%) and $1,595,646 for Post-Secondary (40 percent). The allocations are dispersed into the WDEs Grant Management System (GMS) where Community Colleges apply for their funding annually.

5. Describe how the eligible agency will adjust the data used to make the allocations to reflect any changes in school district boundaries that may have occurred since the population and/or enrollment data was collected, and include local education agencies without geographical boundaries, such as charter schools and secondary schools funded by the Bureau of Indian Education (BIE). (Section 131(a)(3) of Perkins V).

Response - Wyoming will provide every charter school and BIE level secondary school the opportunity to participate in funding. Technical assistance will be provided in every capacity necessary to satisfy the federal and state requirements for service. By state statutes [Wyoming Statute W.S. 21-3-301-314], charter schools are recognized as schools within a school district in Wyoming, thereby qualifying them as eligible recipients for funding.

6. If the eligible agency will submit an application for a waiver to the secondary allocation formula described in section 131(a):
   a. include a proposal for such an alternative formula; and
   b. describe how the waiver demonstrates that a proposed alternative formula more effectively targets funds on the basis of poverty (as defined by the Office of Management and Budget and revised annually in accordance with section 673(2) of the Community Services Block Grant Act (42 U.S.C. 9902(2)) to local educational agencies with the State. (Section 131(b) of Perkins V).

Also indicate if this is a waiver request for which you received approval under the prior Carl D. Perkins Career and Technical Education Act of 2006 (Perkins IV).

Response - No waiver request will be submitted. Under Perkins IV a waiver request was not submitted.

7. If the eligible agency will submit an application for a waiver to the postsecondary allocation formula described in section 132(a)—
   a. include a proposal for such an alternative formula; and
   b. describe how the formula does not result in a distribution of funds to the eligible institutions or consortia with the State that have the highest numbers of economically disadvantaged individuals and that an alternative formula will result in such a distribution. (Section 132(b) of Perkins V).

Also indicate if this is a waiver request for which you received approval under the prior Carl D. Perkins Career and Technical Education Act of 2006 (Perkins IV).

Response - No waiver request will be submitted. Under Perkins IV a waiver request was not submitted.

8. If the eligible agency will award reserve funds to eligible recipients under section 112(c) of Perkins V, describe the process and criteria for awarding those funds.

Response - Perkins State Reserve – Workforce Discovery Grants

Section 112(c) of the Strengthening Career and Technical Education for the 21st Century Act 2018 (Perkins V) allows a state to reserve up to 10% of the minimum 85% of funds that must flow to the local level to distribute to local eligible recipients for local uses of funds.

From the amounts made available under subsection (a)(1) to carry out this subsection, an eligible agency may award grants to eligible recipients for career and technical education activities described in section 135 in -

(1) in ---

(A) rural areas;
(B) areas with high percentages of CTE concentrators or CTE participants;
(C) areas with high numbers of CTE concentrators or CTE participants; and
(D) areas with disparities or gaps in performance as described in section 113(b)(3)(C)(ii)(II); and

(2) in order to ---

(A) foster innovation through the identification and promotion of promising and proven career and technical education programs, practices, and strategies, which may include programs, practices, and strategies that prepare individuals for nontraditional fields; or
(B) promote the development, implementation, and adoption of programs of study or career pathways aligned with State-identified high-skill, high-wage, or in-demand occupations or industries.

If any Basic Perkins Grant funds are not expended at the local level within the program year (July 1 to September 30 of the following year) for which they are provided, these funds must be returned to the state. Starting in the 2017-18 program year, these returned funds will no longer be re-allocated to eligible subrecipients using the allocation formula from previous years. Returned funds ($35,767.23 from this program year 2016-2017) will be placed in a state reserve fund, and re-distributed to eligible sub-recipients utilizing a competitive Workforce Discovery Grant application process.

This competitive grant may be used to support innovative CTE initiatives at the secondary and post-secondary levels, specifically those that do the following: 1) develop more comprehensive and robust career pathways leading to viable career or post-secondary training options for students; 2) provide work-based learning experiences for students that are in industries closely related to CTE pathways; 3) develop meaningful partnerships between schools/institutions and business/industry representatives. In order to be eligible for the grant, both secondary and post-secondary applicants must have at least one formal partnership established with business or industry (this may include a registered apprenticeship). The grant may not be used to pay for food and/or beverages or any other unallowable uses of funds under the Perkins V. Applications will be reviewed and scored by a grant review committee at the WDE, and amounts awarded will be equal to or less than $12,000 each.

The grant application will be open for submission between mid-October and mid-December of each program year. Funds will be awarded in early January.

9. Provide the State's fiscal effort per student, or aggregate expenditures for the State, that will establish the baseline for the Secretary's annual determination on whether the State has maintained its fiscal effort, and indicate whether the baseline is a continuing level or new level. If the baseline is new, please provide the fiscal effort per student, or aggregate expenditures for the State, for the preceding fiscal year. (Section 211(b)(1)(D) of Perkins V)

Response - The reduced estimate of aggregate budget totals for federal FY19 (with the WDE exercising the '95 percent option') is the $397,260 amount. Please note, this is half of the current MOE biennial appropriation and not 95 percent of the $417,670 total.

	2016-17 (7/1/16-6/30/17)	**2017-18** (7/1/17-6/30/18)
Concentrator Count Total by Program Year	7,532	9,432
Participant Count Total by Program Year	31,742	33,960
Aggregate MOE	$416,731.93	$417,670.28
TOTAL MOE by Concentrators	$55.33	$44.28
TOTAL MOE by Participants	$13.13	$12.30
Perkins Leadership	382,238.00	382,238.00
Perkins Administration	250,000.00	250,000.00
TOTAL Federal Expenditures	$632,238.00	$632,238.00

D. Accountability for Results

1. Identify and include at least one (1) of the following indicators of career and technical education program quality:
   a. the percentage of CTE concentrators (see Text Box 2 on the following page) graduating from high school having attained a recognized postsecondary credential;
   b. the percentage of CTE concentrators graduating high school having attained post-secondary credits in relevant career and technical education programs and programs of study earned through a dual or concurrent enrollment program or another credit transfer agreement; and/or
   c. the percentage of CTE concentrators graduating from high school having participated in work-based learning. (Section 113(b)(2)(A)(iv)(I) of Perkins V)

   Include any other measure of student success in career and technical education that is statewide, valid, and reliable, and comparable across the State. (Section 113(b)(2)(A)(iv)(II) of Perkins IV).

Provide the eligible agency's measurement definition with a numerator and denominator for each of the quality indicator(s) the eligible agency selects to use.

Not applicable during the transition year

2. Provide on the form in Section V.B, for each year covered by the State plan beginning in FY 2020, State determined levels of performance for each of the secondary and postsecondary core indicators, with the levels of performance being the same for all CTE concentrators in the State. (Section 113(b)(3)(A)(i)(I) of Perkins V).

   Not applicable during the transition year

3. Provide a written response to the comments provided during the public comment period described in section 113(b)(3)(B) of the Act. (Section 113(b)(3)(B)(iii) of Perkins V).

   Not applicable during the transition year

Text Box 2: Definition of CTE Concentrator

The term ‘CTE concentrator’ means—

(A) at the secondary school level, a student served by an eligible recipient who has completed at least 2 courses* in a single career and technical education program or program of study; and

(B) at the postsecondary level, a student enrolled in an eligible recipient who has—

(i) earned at least 12 credits within a career and technical education program or program of study; or

(ii) completed such a program if the program encompasses fewer than 12 credits or the equivalent in total. (Section 3(12) of Perkins V)

* This means that once a student completes 2 courses in a single CTE program or program of study, he or she is counted as a CTE concentrator.

(Section 3(12) of Perkins V)

4. Describe the procedure the eligible agency adopted for determining State determined levels of performance described in section 113 of the Act, which at a minimum shall include—
    a. a description of the process for public comment under section 113(b)(3)(B) of Perkins V as part of the development of the State determined levels of performance under that section as provided in the text box on the following page;
    b. an explanation for the State determined levels of performance; and
    c. a description of how the state determined levels of performance set by the eligible agency align with the levels, goals and objectives other Federal and State laws, (Section 122(d)(10) of Perkins V); and
    d. As part of the procedures for determining State determined levels of performance, describe the process that will be used to establish a baseline for those levels.

Not applicable during the transition year

5. Describe how the eligible agency will address disparities or gaps in performance as described in section 113(b)(3)(C)(ii)(II) of Perkins V in each of the plan years, and if no meaningful progress has been achieved prior to the third program year, a description of the additional actions the eligible agency will take to eliminate these disparities or gaps. (Section 122(d)(11) of Perkins V)

Not applicable during the transition year

Text Box 3:

(B) PUBLIC COMMENT.—

(i) IN GENERAL.—Each eligible agency shall develop the levels of performance under subparagraph (A) in consultation with the stakeholders identified in section 122(c)(1)(A).

(ii) WRITTEN COMMENTS.—Not less than 60 days prior to submission of the State plan, the eligible agency shall provide such stakeholders with the opportunity to provide written comments to the eligible agency, which shall be included in the State plan, regarding how the levels of performance described under subparagraph (A)—

(I) meet the requirements of the law;

(II) support the improvement of performance of all CTE concentrators, including subgroups of students, as described in section 1111(h)(1)(C)(ii) of the Elementary and Secondary Education Act of 1965, and special populations, as described in section 3(48); and

(III) support the needs of the local education and business community.

(iii) ELIGIBLE AGENCY RESPONSE.—Each eligible agency shall provide, in the State plan, a written response to the comments provided by stakeholders under clause (ii).

(Section 113(b)(3)(B) of Perkins V)

III. ASSURANCES, CERTIFICATIONS, AND OTHER FORMS

A. Statutory Assurances

✓ The eligible agency assures that:

1. It made the State plan publicly available for public comment[3] for a period of not less than 30 days, by electronic means and in an easily accessible format, prior to submission to the Secretary for approval and such public comments were taken into account in the development of this State plan. (Section 122(a)(4) of Perkins V).

2. It will use the funds to promote preparation for high-skill, high-wage, or in-demand industry sectors or occupations and non-traditional fields, as identified by the State. (Section 122(d)(13)(C) of Perkins V).

3. It will provide local educational agencies, area career and technical education schools, and eligible institutions in the State with technical assistance, including technical assistance on how to close gaps in student participation and performance in career and technical education programs. (section 122(d)(13)(E) of Perkins V).

4. It will comply with the requirements of this Act and the provisions of the State plan, including the provision of a financial audit of funds received under this Act, which may be included as part of an audit of other Federal or State programs. (Section 122(d)(13)(A) of Perkins V).

5. None of the funds expended under this Act will be used to acquire equipment (including computer software) in any instance in which such acquisition results in a direct financial benefit to any organization representing the interests of the acquiring entity or the employees of the acquiring entity, or any affiliate of such an organization. (Section 122(d)(13)(B) of Perkins V).

6. It will use the funds provided under this Act to implement career and technical education programs and programs of study for individuals in State correctional institutions, including juvenile justice facilities. (Section 122 (d)(13)(D) of Perkins V).

[3] An eligible agency that submits a 1-Year Transition Plan in FY 2019 is not required to hold a public comment period on the 1-Year Transition Plan. Such agency must assure that it meets this public comment requirement prior to submitting its Perkins V State Plan in FY 2020.

B. EDGAR Certifications

✓ By submitting a Perkins V State Plan, consistent with 34 CFR 76.104, the eligible agency certifies that:

1. It is eligible to submit the Perkins State plan.
2. It has authority under State law to perform the functions of the State under the Perkins program(s).
3. It legally may carry out each provision of the plan.
4. All provisions of the plan are consistent with State law.
5. A State officer, specified by title in Item C on the Cover Page, has authority under State law to receive, hold, and disburse Federal funds made available under the plan.
6. The State officer who submits the plan, specified by title in Item C on the Cover Page, has authority to submit the plan.
7. The entity has adopted or otherwise formally approved the plan.
8. The plan is the basis for State operation and administration of the Perkins program.

C. Other Forms

✓ The eligible agency certifies and assures compliance with the following enclosed forms:

1. Assurances for Non-Construction Programs (SF 424B) Form (OMB Control No. 0348-0040) - https://www2.ed.gov/fund/grant/apply/appforms/sf424b.pdf
2. Disclosure of Lobbying Activities (SF LLL) (OMB Control No. 4040-0013): https://apply07.grants.gov/apply/forms/sample/SFLLL_1_2-V1.2.pdf
3. Certification Regarding Lobbying (ED 80-0013 Form): https://www2.ed.gov/fund/grant/apply/appforms/ed80-013.pdf
4. General Education Provisions Act (GEPA) 427 Form (OMB Control No. 1894-0005): https://www2.ed.gov/fund/grant/apply/appforms/gepa427.pdf

IV. BUDGET

A. Instructions

1. On the form in Item IV.B below, provide a budget for the upcoming fiscal year. As you prepare your budget, refer to the statutory descriptions and assurances in Section II.C and Section III.A, respectively, of this guide.

2. In completing the budget form, provide--

   Line 1: The total amount of funds allocated to the eligible agency under section 112(a) of Perkins V. *This amount should correspond to the amount of funds noted in the Department's program memorandum with estimated State allocations for the fiscal year.*

   Line 2: The amount of funds made available to carry out the administration of the State plan under section 112(a)(3). *The percent should equal not more than 5 percent of the funds allocated to the eligible agency as noted on Line 1, or $250,000, whichever is greater.*

   Line 3: The amount of funds made available to carry out State leadership activities under section 112(a)(2) of Perkins V. *The percent should equal not more than 10 percent of the funds allocated to the eligible agency as noted on Line 1.*

   Line 4: The percent and amount of funds made available to serve individuals in State institutions, such as: (a) correctional institutions; (b) juvenile justice facilities; and (c) educational institutions that serve individuals with disabilities pursuant to section 112(a)(2)(A) of Perkins V. *The percent of funds should equal not more than 2 percent of the funds allocated to the eligible agency as noted on Line 1.*

   Line 5: The amount of funds to be made available for services that prepare individuals for non-traditional fields pursuant to section 112(a)(2)(B) of Perkins V. *The amount of funds should be not less than $60,000 and not more than $150,000.*

   Line 6: The amount of funds to be made available for the recruitment of special populations to enroll in career and technical education programs pursuant to section 112 (a)(2)(C) of Perkins V. *The percent of funds should equal 0.1 percent of the funds allocated to the eligible agency, or $50,000, whichever is lesser.*

   Line 7: The percent and amount of funds to be made available to eligible recipients [local education agencies (secondary recipients) and institutions of higher education (postsecondary recipients)] pursuant to section 112(a)(1) of Perkins V. *The percent of funds should be not less than 85 percent of the funds allocated to the eligible agency as noted on Line 1.*

Line 8: The percent and amount, if any, of funds to be reserved and made available to eligible recipients under section 112(c) of Perkins V. *The percent of funds should be not more than 15 percent of the 85 percent of funds noted on Line 7.*

Line 9: The percent and amount, if any, of funds to be reserved and made available to secondary recipients under section 112(c) of Perkins V.

Line 10: The percentage and amount, if any, of funds to be reserved and made available to postsecondary recipients under section 112(c) of Perkins V.

Line 11: The percent and amount of funds to be made available to eligible recipients under section 112(a)(1) of Perkins V. *The percent and amount of funds should represent the funds remaining after subtracting any reserve as noted on Line 8.*

Line 12: The percent and amount of funds to be distributed to secondary recipients under the allocation formula described in section 131 of Perkins V.

Line 13: The percent and amount of funds to be distributed to postsecondary recipients under the allocation formula described in section 132 of Perkins V.

Line 14: The amount of funds to be made available for the State administration match requirement under section 112(b) of Perkins. *The amount of funds shall be provided from non-Federal sources and on a dollar-for-dollar basis.*

B: Budget Form

State Name: Wyoming

Fiscal Year (FY): 2020

Line Number	Budget Item	Percent of Funds	Amount of Funds
1	**Total Perkins V Allocation**	**Not applicable**	$**4,693,077**
2	**State Administration**	%	$**250,000**
3	**State Leadership**	9.6%	$**453,962**
4	● Individuals in State Institutions	2.0%	$**93,861**
4a	– Correctional Institutions	**Not required**	$56,316.60
4b	– Juvenile Justice Facilities	**Not required**	$18,772.20
4c	– Institutions that Serve Individuals with Disabilities	**Not required**	$18,772.20
5	● Nontraditional Training and Employment	**Not applicable**	$**80,000**
6	● Special Populations Recruitment	0.1%	$**45,396**
7	**Local Formula Distribution**	%	$
8	● Reserve	%	$**0**
9	– Secondary Recipients	%	$**0**
10	– Postsecondary Recipients	%	$**0**
11	● Allocation to Eligible Recipients	85%	$**3,989,115**
12	– Secondary Recipients	60%	$**2,393,469**
13	– Postsecondary Recipients	40%	$**1,595,646**
14	**State Match *(from non-federal funds)***	**Not applicable**	$**416,732**

V. STATE DETERMINED PERFORMANCE LEVELS (SDPL)

A. Instructions

1. On the form in Item V.B below, provide State determined performance levels (SDPLs), covering FY 2020-23, for each of the secondary and postsecondary core indicators of performance for all CTE concentrators in the State described in section 113(b) of Perkins V. See Table 7 below. In preparing your SDPLs, refer to your narrative descriptions in Section II.D of this guide.

2. In completing the SDPL form, provide:

   Column 2: Baseline level
   Columns 3-6: State determined levels of performance for each year covered by the State plan, beginning for FY 2020, expressed in percentage or numeric form and that meets the requirements of section 113(b)(3)(A)(III) of Perkins V as provided in the text box on the following page.

3. Revise, as applicable, the State determined levels of performance for any of the core indicators of performance:

   i. Prior to the third program year covered by the state plan for the subsequent program years covered by the State plan pursuant to section 113(b)(3)(A)(ii).
   ii. Should unanticipated circumstances arise in a State or changes occur related to improvement in data or measurement approaches pursuant to section 113(b)(3)(A)(iii).
   iii. An eligible agency shall not be eligible to adjust performance levels while executing an improvement plan under this section pursuant to section 123(a)(5).

Text Box 4: State Determined Performance Levels (SDPLs)

(III) Requirements.—Such State determined levels of performance shall, at a minimum—

- (aa) be expressed in a percentage or numerical form, so as to be objective, quantifiable, and measurable;
- (bb) require the State to continually make meaningful progress toward improving the performance of all career and technical education students, including the subgroups of students described in section 1111(h)(1)(C)(ii) of the Elementary and Secondary Education Act of 1965, and special populations, as described in section 3(48); and
- (cc) have been subject to the public comment process described in subparagraph (B), and the eligible agency has provided a written response;
- (dd) when being adjusted pursuant to clause (ii), take into account how the levels of performance involved compare with the State levels of performance established for other States, considering factors including the characteristics of actual (as opposed to anticipated) CTE concentrators when the CTE concentrators entered the program, and the services or instruction to be provided;
- (ee) when being adjusted pursuant to clause (ii), be higher than the average actual performance of the 2 most recently completed program years, except in the case of unanticipated circumstances that require revisions in accordance with clause (iii); and
- (ff) take into account the extent to which the State determined levels of performance advance the eligible agency's goals, as set forth in the State plan.

(Section 113(b)(3)(A)(III) of Perkins V)

Table 7: Section 113(b) Core Indicators of Performance

Indicator Descriptions	Indicator Codes	Indicator Names
Secondary Level		
The percentage of CTE concentrators who graduate high school, as measured by the four-year adjusted cohort graduation rate (defined in section 8101 of the Elementary and Secondary Education Act of 1965).	1S1	Four-Year Graduation Rate
(At the State's discretion) The percentage of CTE concentrators who graduate high school, as measured by extended-year adjusted cohort graduation rate defined in such section 8101.	1S2	Extended Graduation Rate
CTE concentrator proficiency in the challenging State academic standards adopted by the State under section1111(b)(1) of the Elementary and Secondary Education Act of 1965, as measured by the academic assessments in reading/language arts as described in section 1111(b)(2) of such Act.	2S1	Academic Proficiency in Reading/Language Arts
CTE concentrator proficiency in the challenging State academic standards adopted by the State under section1111(b)(1) of the Elementary and Secondary Education Act of 1965, as measured by the academic assessments in mathematics as described in section 1111(b)(2) of such Act.	2S2	Academic Proficiency in Mathematics
CTE concentrator proficiency in the challenging State academic standards adopted by the State under section1111(b)(1) of the Elementary and Secondary Education Act of 1965, as measured by the academic assessments in science as described in section 1111(b)(2) of such Act.	2S3	Academic Proficiency in Science
The percentage of CTE concentrators who, in the second quarter after exiting from secondary education, are in postsecondary education or advanced training, military service or a service program that receives assistance under title I of the National and Community Service Act of 1990 (42 U.S.C. 12511 et seq.), are volunteers as described in section 5(a) of the Peace Corps Act (22 U.S.C. 2504(a)), or are employed.	3S1	Postsecondary Placement

Indicator Descriptions	Indicator Codes	Indicator Names
Secondary Level (continued)		
The percentage of CTE concentrators in career and technical education programs and programs of study that lead to non-traditional fields.	4S1	Non-traditional Program Enrollment
The eligible agency must include at least one program quality indicator—5S1, 5S2, or 5S3—and may include any other quality measure that is statewide, valid, reliable, and comparable across the State, 5S4.		
The percentage of CTE concentrators graduating from high school having attained a recognized postsecondary credential.	5S1;y	Program Quality – Attained Recognized Postsecondary Credential
The percentage of CTE concentrators graduating from high school having attained postsecondary credits in the relevant career and technical education program or program of study earned through a dual or concurrent enrollment or another credit transfer agreement	5S2	Program Quality – Attained Postsecondary Credits
The percentage of CTE concentrators graduating from high school having participated in work-based learning.	5S3	Program Quality – Participated in Work-Based Learning
The percentage of CTE concentrators achieving on any other measure of student success in career and technical education that is statewide, valid, and reliable, and comparable across the State. Please identify.	5S4	Program Quality – Other

Indicator Descriptions	Indicator Codes	Indicator Names
Postsecondary Level		
The percentage of CTE concentrators who, during the second quarter after program completion, remain enrolled in postsecondary education, are in advanced training, military service, or a service program that receives assistance under title I of the National and Community Service Act of 1990 (42 U.S.C. 12511 et seq.), are volunteers as described in section 5(a) of the Peace Corps Act (22 U.S.C. 2504(a)), or are placed or retained in employment.	1P1	Postsecondary Retention and Placement
The percentage of CTE concentrators who receive a recognized postsecondary credential during participation in or within 1 year of program completion.*	2P1	Earned Recognized Postsecondary Credential
The percentage of CTE concentrators in career and technical education programs and programs of study that lead to non-traditional fields.	3P1	Non-traditional Program Enrollment

* This means that a student gets counted under this indicator whether the student obtains the credential during participation or within 1 year of completion. The Department interprets “within 1 year of completion” to have the plain meaning of those words: that the student would be counted if the student obtains the credential in the 1 year following that student’s completion of the program.

B: State Determined Performance Levels (SDPL) Form

State Name:

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Indicators	**Baseline Level**	**Performance Levels**			
		FY 2020	**FY 2021**	**FY 2022**	**FY 2023**
Secondary Indicators					
1S1: Four-Year Graduation Rate					
1S2: Extended Graduation Rate					
2S1: Academic Proficiency in Reading Language Arts					
2S2: Academic Proficiency in Mathematics					
2S3: Academic Proficiency in Science					
3S1: Postsecondary Placement					
4S1: Non-traditional Program Enrollment					
5S1: Program Quality – Attained Recognized Postsecondary Credential					
5S2: Program Quality – Attained Postsecondary Credits					
5S3: Program Quality – Participated in Work-Based Learning					
5S4: Program Quality – Other					

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Indicators	**Baseline Level**	**Performance Levels**			
		FY 2020	**FY 2021**	**FY 2022**	**FY 2023**
Postsecondary Indicators					
1P1: Postsecondary Retention and Placement					
2P1: Earned Recognized Postsecondary Credential					
3P1: Nontraditional Program Enrollment					

Provide any additional information regarding SDPLs, as necessary:

WYOMING DEPARTMENT OF EDUCATION

JILLIAN BALOW
Superintendent of Public Instruction

DICKY SHANOR
Chief of Staff

MEMORANDUM

TO: State Board of Education (SBE)

FROM: Jillian Balow, State Superintendent of Public Instruction

DATE: March 15, 2019

SUBJECT: Update

First, welcome to the newest board members and congratulations on your appointment. I look forward to working with you as Wyoming's State Superintendent and as a board colleague. I encourage new and seasoned members to attend the board member training provided by the Attorney General's office on Friday, May 3rd, from 8:30 a.m.- 4:30 p.m. at the WYDOT Auditorium in Cheyenne. This will augment your SBE-specific orientation and afford you the opportunity to meet members of other citizen boards across the state.

Recently, we received confirmation that our updated state education plan was approved by the U.S. Department of Education. This plan is in fulfillment of the Every Student Succeeds Act (ESSA).

My staff looks forward to providing updates on important topics during this SBE meeting. This is also the time of year when our teams are coordinating summer training schedules. SBE members are welcome and encouraged to attend events across the state. Information about specific trainings can be found on our website. Also, if you don't already, I encourage you to follow the WDE and SBE on Facebook and Twitter for updates and news.

WYOMING
STATE BOARD
OF EDUCATION

Date: March 14, 2019

To: State Board of Education

From: Tom Sachse, Coordinator

Subject: Legislative Update

Issue: The General Session of the Legislature has now adjourned and a number of bills address topics of relevance to the state board. In this memo, several bills are summarized that may require board action or may be of interest to the board.

Background: The state board directs the coordinator to attend the state legislature and present information to Senate and House Education committees on bills where the board has expressed a consensus position. The coordinator declines to comment on bills where the board has not taken a position. In expressing comments to the committees, the coordinator tries to strike a balance between getting the point across and too much detail.

Status: Two bills are of considerable importance to the state board. House Bill 22 (now Enrolled Act 61 on Teacher Accountability) originally came from the Joint Interim Education Committee (JEIC). This bill essentially repealed the Phase 2 Accountability requirements for a single teacher evaluation system approved by the state board. (I am your representative on the department's Certified Personnel Evaluation System (CPES) committee and you will receive a report from Dr. Ballard later in the meeting.)

This bill requires the state board to promulgate rules "of a *comprehensive* school district teacher performance evaluation system" by establishing "*general* criteria for school district teacher performance evaluation systems that provide school districts flexibility in designing teacher evaluations to improve classroom instruction." The board has asked its attorney for guidance on the issue of balancing comprehensive with general. In particular, is the matter on how Chapter 29 might be revised to meet legislative intent.

House Bill 23 (now Enrolled Act 43 on Education Accountability) includes some minor technical clean-up, like detailing under what circumstances the state board could conduct an informal hearing (essentially computational errors by the department) and under what circumstances the state board could give schools an exemption from state accountability (essentially when schools could not administer the state assessment). The bill also maintains language that the state board is to convene a Professional Judgment Panel (PJP) to set targets for the state accountability system when major changes occur.

Several other bills may be of interest to the state board. House Bill 24 (now Enrolled Act 120 on National Board Teacher Certification) is a clean-up bill that codifies the relationship between WDE and the Ellbogen Foundation that strongly supports national board certification. Wyoming is second only to North Carolina in the percent of teachers with such certification. House Bill 297 (now Enrolled Act 98 on K-3 Literacy) allows districts local control in selecting a reading screener and deletes the requirement for mandated K-2 WY-TOPP interim testing. It does require the WDE to support districts in improving reading performance and directs the department to collect district data to create longitudinal data. Senate File 43 (now Enrolled Act 20 on Hathaway Success Curriculum) created more opportunities for students to take Career and Technical Education (C&TE) courses. It does so by maintaining the four years of electives (for the top two tiers) but by eliminating the need for two of those four to be in foreign language.

Kylie and I will be happy to summarize any other bills of interest to board members.

To: State Board of Education

From: Tom Sachse, Coordinator

Date: March 14, 2019

Subject: Basket Implications

Issue: At the February meeting of the state board, the coordinator presented the report of the survey on the basket of goods and services. Following a preliminary discussion of the implications and action possibilities, the board asked the coordinator to frame the issues and suggest possible courses of action. A paper on those issues is attached.

Background: The board conducted a survey of various education stakeholders including teachers, administrators, and parents to inquire of their feelings regarding the total of all board-approved content standards and whether new additions should be made to the basket at a time of declining state funds. The survey results suggest there is a gap between the legislature and the public on the breadth and depth of expectations for students' education.

Over the past six years the board, through the department, has approved rigorous and expansive standards in a variety of subjects. The overarching issue is whether when viewed as a whole, the standards encourage both excellence and equity.

Status: At this meeting, the board will take additional time to reflect on the standards promulgation process and consider whether and how to move forward given the system as it currently stands. Note: The Legislative Service Office website was down at the time of the report's writing. A second version of the report will be constructed with links to key statutes.

Section 1: STATE BOARD OF EDUCATION MEMBERSHIP

The Wyoming State Board of Education was created by the Wyoming State Legislature in 1917 and is composed of 14 members, 11 of whom are appointed by the Governor and can vote, while three are *ex officio* (one of whom can vote). The *ex officio* members are the State Superintendent of Public Instruction (the voting *ex officio* member), a designee of the President of the University of Wyoming, and the Executive Director of the Wyoming Community College Commission.

Among the gubernatorial appointments, seven appointees are chosen from different appointment districts of which there must be one certified classroom teacher at the time of appointment, one certified school administrator at the time of appointment, two from the private business or industry community, and one local school board member at the time of appointment (W.S. 21-2-301(a) and W.S. 9-1-218). Not more than 75% of the appointed members may be registered for the same political party. The appointments are typically six-year terms and are confirmed by the state senate. If a board member is appointed to complete a term, an additional six-year term is possible, if the governor reappoints that person to the position.

The current membership of the Wyoming State Board of Education is presented here. Biographical sketches are presented here. A map of the board members' geographical representations are presented here.

SECTION 3: STATE BOARD BUDGET AND BUDGETING PROCEDURES

The state board, like all state agencies, receives a biennial budget. The board's budget is in the budget of the Department of Education and the budget summary presented to the board is organized into two sets of line items. The top set of line items includes expenditures for the state board and the bottom set of line items includes expenditures for the state board's coordinator position. A copy of the current state board budget is presented here.

Some funds may be moved between line items, others may not. The 100 series includes salaries and benefits; funds can move into this line item, but can't be moved out. The 200 series item can be used for travel reimbursement and supplies; funds can be moved into or out of this line item. Since state board members are neither part-time or full-time employees of the state, no monies are initially placed into the 100 series item. The department's business office typically moves $30,000 from 200 into 100 two times during the biennium. The board should plan to have at least $60,000 available in the 200 series to pay for board salaries for the biennium. The 400 series pays for technology support from the Department of Enterprise Technology Services. Funds can be moved into or out of this series. The 900 series is for professional services, typically consultant services like the consultant who facilitated the Professional Judgment Panel. Funds can be moved into or out of this series. While the board's funding was originally all General Fund, when the legislature added accountability-related duties in 2011 additional funds were added from the School Foundation Program Fund.

The line items for the coordinator position parallel those for the board expenditures. The 100 series includes salary and benefits for the board coordinator for the biennium. This At-Will Employee Contract (AWEC) position is a ¾-time appointment consisting of 1500 hours per year, (but has no holidays, sick days, or vacation days). A monthly timesheet is approved by the chairman of the Administrative Committee and signed off by the WDE Liaison to the state board.

The state board budget is monitored by the board's treasurer who gives Treasurer's Reports to the full board at each regular board meeting. The board begins by preparing a biennial budget request in parallel with the rest of the department's units. The board chair creates an *ad hoc* Budget Development Committee comprised of the board officers, two voting members of the board, and the board's coordinator. Based on previous year budget (and using the same budget structure), the *ad hoc* committee uses information from its legislative duties along with its goals and priorities (established at the board retreat) to present a budget request that allows them to conduct business and achieve its goals for the next biennium.

In March, the year before the biennium, the board has an opportunity to update the unit budget narrative and the unit budget request. Sometime between March and July, the State Budget Office takes a "snapshot" of the board's AWEC position and sends the WDE a worksheet that has the estimate for the AWEC position salary and related benefits. Negotiations for the board's budget request can go back and forth for a period of approximately six weeks, though the AWEC position salary and benefits are non-negotiable unless the WDE finds an error in the budget office calculations. The WDE sends its final budget request to the State Budget Office usually in August. The WDE presents its biennial budget to the Joint Appropriations Committee of the state legislature usually in December. The board's treasurer and/or coordinator can attend this meeting.

Section 4: BOARD MEMBER COMPENSATION, EXPENSES, AND PROFESSIONAL DEVELOPMENT

All appointed members of the state board shall receive compensation, per diem, and mileage for actual time spent in performance of their duties and traveling expenses while in attendance, and going to and from board meetings in the same manner and amount as members of the Wyoming legislature. Wyo. Stat. Ann. § 21-2-303.

The Wyoming Department of Education uses this form for reimbursing compensation and travel.

The state board uses this form to request professional development or training opportunities involving state board funds.

Administrative Committee Summary

March 8, 2019

Members Present: Walt Wilcox, Robin Schamber, Ryan Fuhrman, Max Mickelson, Sue Belish, Tom Sachse, Kylie Taylor, Julie Magee, Michelle Panos, Mackenzie Williams, Randall Lockyear, and Laurie Hernandez.

1. March 21, Meeting Agenda and Logistics
   a. There was a great deal of discussion about the agenda items. Anticipating that the discussion on standards and the basket of goods survey, as well as the presentation on the Computer Science Standards, would both be topics of interest to the public, the Committee decided to create discussion and action items for the morning session and discussion and action items for the afternoon. Our agenda will clearly state when those discussions will take place. We will break for a short time for lunch between the two sessions.
   b. The Committee reiterated that we are trying to adhere to the practice of discussing an item at one meeting but not bring the matter up for action until the next meeting. The rationale is to give board members adequate time to learn about issues, ask questions, gather additional information, and think about the issue prior to making a decision. This means that presenters and timelines may need to be adjusted in the future. We may also need to categorize certain decisions to determine if they could effectively be handled with both discussion and action occurring during the same meeting.
2. SBE Items
   a. We discussed the orientation session for our two new members which will be held on Wednesday, March 20th beginning at 1:00. Tom, Walt, Max, Sue and Mackenzie will be present to assist with orientation. Julie indicated that she will try to join us later in the afternoon and she or Paula Smith would be on hand to meet with the new members to provide them with technology support. We will ask each of our new members to give a brief introduction at the beginning of our meeting on Thursday. Tom will organize the agenda and documents for the orientation session.
   b. Dan McGlade has invited all board members and WDE staff to dinner at his house on Wednesday evening so we can get together on an informal basis prior to the official meeting. Tom will send invitations out to folks with the details.
   c. Basket of Goods Survey (Wyoming Content and Performance Standards)
      i. Since we received an enormous number of responses to our survey on “the Basket of Goods” (including standards) the committee feels that it is important to follow through and use the results to move forward. Tom will be sharing the compiled survey results (the SBE received them in the February Board Packet) with the directors of the various groups who participated (Wyoming School Boards Association, Curriculum Directors, Wyoming School Administrators Association, etc.) Mackenzie provided some thoughts concerning the SBE’s authority regarding standards. The legislature is responsible for the “Basket of Goods” and defines that in statute. The SBE is responsible for the K-12 standards in collaboration with the WDE and with the SBE relying on the expertise of the department to complete standards tasks. The Committee asked Tom to prepare some suggestions for the next steps in using or exploring the survey results. Below is a list of questions that might help frame our future discussions:
         1. What do the survey results indicate? (Big concepts)
         2. Are the 10 content areas currently used in Wyoming the most critical areas for Wyoming students?
         3. Are all 10 content areas necessary at all grade levels K-12?
         4. Should all standards be written at the same level of specificity?
         5. What are the implications for teaching and learning once standards are established? (curriculum design, instructional materials, remediation and enrichment, assessments, credentials to be able to teach the standards)

6. Could some of the content areas (foreign language, career and technical, computer science, health, physical education, fine and performing arts) be developed at the local level vs. the state level?
7. Could some of the standards be written as "exploratory" or "emerging" (such as elementary fine and performing arts, computer science, career and technical education) vs. developmentally required for all?
8. How does having state standards contribute to equity among districts and schools?
9. How should these questions be explored?
10. What should happen as a result of these deeper discussions?
    a. Establish a framework for future standards committees (pose questions that need to be addressed before diving into writing standards)
    b. Revise our approach to writing standards
    c. Maintain the current process

d. Currently the SBE has three permanent committees – Communications, Legislative, Administrative – as well as additional opportunities for representing the Board. For the March Board Packet Tom will prepare the descriptions for each of the committees and explain the process for assigning members and choosing a chairman. Walt has a historical list of committee assignments that will also be provided in the packet so that board members are aware of previous participation. Board members will be asked to declare their interest in serving on committees.
e. Several questions were raised concerning the State System of Support (SSOS) due to Governor Gordon's recent comments concerning the Principal Academy that was proposed by Sheridan County School District #2. These questions focus on SBE and WDE roles and responsibilities in relationship to the SSOS. The Committee decided that this topic would be placed on the April agenda for discussion and requested that Tom and Julie work together to prepare materials for the Board to review prior to the April meeting (Guidebook, Governor's comments, WAEA statute, appropriations, etc.)
   i. Is the SBE responsible for formally approving the SSOS?
   ii. When should this be accomplished each year?
   iii. What information will the SBE want to know before approving a plan?
f. Looking ahead, there are several Department of Education Administrative Rules which we generally refer to as "chapters" that may need SBE attention this year. This will be a topic of discussion at the April meeting. It will be important to develop a workplan for tackling some of these chapters.
   i. Chapter 3 - Practice and Procedures for Contested Case Proceedings
   ii. Chapter 21 – Alternative Schedules
   iii. Chapter 22 - School Day
   iv. Chapter 29 – Leader and Teacher Evaluation Systems
   v. Chapter 40 – Statewide College Entrance and Job Skills Test (which should have been repealed)
   vi. Chapter ??- Accountability WAEA

3. WDE Items – no additional items from the department.
4. April Meeting Items – (teleconference)
   a. Standards discussion
   b. State System of Support
   c. Administrative Procedures Part 2
   d. Approval of Perkins Transition Plan
   e. Time frame for handling routine approvals (accreditation, alternative schedules, etc.)
   f. Chapter work plan

Draft State Board Committee Overviews

Administrative Committee

Objective: To provide to oversight of SBE administrative functions

Roles and responsibilities:

Review and approve the next month's agenda items

Monitor the Coordinator contract (include approving travel and timesheets)

Monitor other contracts (e.g. NASBE Year 2)

Review and approve all reports to the legislature

Desired outcomes:

Meet State Board of Education legislative duties

Advocate the State Board of Education agenda

Execute and manage all state board contracts

Communications Committee

Objective: To articulate the roles and responsibilities of the State Board of Education

Roles and responsibilities:

Manage the State Board website

Contribute to pre-post-press release items

Collect information and ideas about state board functions

Desired outcomes:

Promote the functions of the State Board as a key policy lever in the oversight of public schooling in Wyoming

Provide a variety of communication vehicles to communicate the work of the State Board

Legislative Committee

Objective: To advise the coordinator (and legislators, more generally) on the level of support for pending, proposed legislation

Roles and responsibilities:

Set state board legislative priorities (in August and September)

Convene at the request of the chairman or the coordinator to advise on pending legislation

Respond to legislative requests for information and action

Desired outcomes:

Advocate (without lobbying) for the positions and priorities of the State Board of Education

Budget Committee

Objective: To monitor the State Board of Education budget

Roles and responsibilities:

Collaborate with WDE on the review of budget postings

Assist and review the treasurer's work in preparing monthly reports

Develop a broader understanding of the State Board budget and expenditures

Propose the biannual budget requests to the WDE and JAC

Desired outcomes:

Budget monitoring and oversight

Communicating budgetary needs to other state agencies

Maintain fiduciary responsibilities for budgetary expenditures

*	No more than six SBE voting members,	CH	Chairperson	C	Coordinator		
	in bold voting members & supt proxy	VC	Vice Chairperson	DE	Department of Education		
	SBE Communications Committee		**SBE Legislative Committee**		**SBE Administrative Committee**		**SBE AdHoc Finance Committee**
CH	Furhman, Ryan	CoCH	Breen, Nate	CH	Belish, Sue		~~Rathbun, Kenny~~
	~~Ratliff, Scotty~~		Furhman, Ryan		Breen, Nate	**CH**	Mickelson, Max
	Sessions, Kathryn		McGlade, Dan		Mickleson, Max		Sessions, Kathryn
	Schamber, Robin	CoCH	Sessions, Kathryn		~~Rathbun, Kenny~~		Wilcox, Walt
	Smith, Forrest	C	Sachse, Tom		Schamber, Robin	C	Sachse, Tom
C	Sachse, Tom	DE	~~State Supt/WDE - Degenfelder, M~~		Wilcox, Walt	DE	WDE - Taylor, Kylie
DE	State Supt/WDE - Eakins, Kari	DE	WDE - Taylor, Kylie	C	Sachse, Tom	DE	WDE - ________, Trent
DE	WDE - Taylor, Kylie			DE	~~State Supt/WDE - Degenfelder, M~~		
			*Does this disolve into Equity and Early Childhood?	DE	WDE - Magee, Julie		
				DE	WDE - Taylor, Kylie		
	SBE Professional Judgement Panel (3 Reps)		~~**JEC Select Advisory Committee (1 Rep)**~~		**WDE Internal Design Team (1 Rep)**		~~**WDE RFP Assessment Committee**~~
	Belish, Sue		~~Belish, Sue~~		Sessions, Kathryn		~~Sessions, Kathryn (WYTOPP) (Disolved Spring 2017)~~
	Sessions, Kathryn						~~Wilcox, Walt (HS ACT & WKEYS) (Disolved Spring 2017)~~
	Wilcox, Walt						
	Alternative Schools - Smith, Forrest		**NASBE Awards Committee (1 Rep)**		~~**Collaborative Council**~~		
	Alternative Schools - _______,________		Breen, Nate		~~Sessions, Kathryn (Disolved? 9.2017)~~		**Wyoming School University Partnerships**
C	Sachse, Tom			~~C~~	~~Sachse, Tom~~		Wilcox, Walt (NCSD Membership)
	NASBE Public Education Positions (1 Rep)		~~**SBE RFP Professional Judgement Panel**~~		~~**WDE Accreditation Task Force (1 Rep)**~~		~~**SBE Ch 31 Task Force (2 Reps)**~~
	Breen, Nate		~~Belish, Sue~~		~~Sessions, Kathryn~~		~~Belish, Sue~~
			~~Furman, Ryan~~				~~Wilcox, Walt~~
	~~**APA Recalibration Visits August 2017**~~		~~Sessions, Kathyrn~~		~~**WACC (Dr. Dvorak) (1 Rep)**~~		
	~~Breen, Nate (Disolved Aug 2017)~~		~~Wilcox, Walt~~		~~Belish, Sue~~		~~**Tech Advisory for Aleternative Schools (1 Rep)**~~
	~~Mickelson, Max (Disolved Aug 2017)~~	~~DE~~	~~WDE - Magee, Julie~~		~~Breen, Nate~~		~~Sachse, Tom~~
	~~Sessions, Kathryn (Disolved Aug 2017)~~						
	~~Wilcox, Walt (Disolved Aug 2017)~~						~~**Certified Evaluation Instrucments (1 Rep)**~~
							~~Sachse, Tom~~

CREATING OPPORTUNITIES FOR STUDENTS TO KEEP WYOMING STRONG

JILLIAN BALOW
Superintendent of Public Instruction

DICKY SHANOR
Chief of Staff

SHELLEY HAMEL
Chief Academic Officer

KARI EAKINS
Chief Policy Officer

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WYOMING DEPARTMENT OF EDUCATION

MEMORANDUM

To: State Board of Education

From: Kari Eakins, Chief Policy Officer

Date: March 14, 2019

Subject: Alternative Schedule Requests for 2019-20 & 2020-21

Meeting Date: March 21, 2019

Item Type: Action: __xx__ Informational: _____

Background:
Wyoming Statutes 21-2-304(b)(viii) and 21-4-301 allow school districts to apply for a waiver from the 175 student-teacher contact day requirement. Districts may request approval for an alternative schedule for up to two school years by submitting to the WDE an application that includes educational objectives, a description of the proposed schedule and copy of the proposed calendar, a description of the methods to be used to evaluate improved student achievement, evidence of two advertised public meetings, public comment records, and evidence of meeting required hours for each grade level. Districts that are initially approved for two years must submit a letter of intent to continue their alternative schedule for the second year. No district may be approved for an alternative schedule for more than two years at a time.

Section 4 of the Chapter 21 Education Rules (Alternative Schedules) requires districts to submit a request to the State Board between January 1 and May 1 of each year. On December 17, 2018, districts were invited to submit their application materials by March 4, 2019 in order to be heard and approved by the State Board during the March meeting. This timeline was set in order to notify districts of the State Board's approval or disapproval in time to finalize their school calendars for the following school year. Districts still have the option to submit their application by the May 1st deadline, and those requests will be presented to the State Board at the May meeting.

Statutory Reference (if applicable):
- W.S. 21-2-304(b)(viii) and 21-4-301
- Education Rules, Chapter 21: Alternative Schedules

Supporting Documents/Attachments: (click on hyperlink to see each requesting district's application)

New Requests: The following school districts have submitted all required materials and are requesting approval from the State Board of Education to implement an alternative school schedule:

District Name	Length of Waiver	School Names	CONTACT Days For 2019-2020	CONTACT Days For 2020-2021	Teacher CONTRACT Days For 2019-2020	Teacher CONTRACT Days For 2020-2021	4 day school week
Campbell #1	2 year	Westwood High School	148	149.5	158	159.5	Yes
Campbell #1	2 year	Recluse School 4J Cottonwood Elementary Wright JSHS	150	150	164	164	Yes
Carbon #1	2 year	Little Snake River Valley	150	150	169	169	Yes
Carbon #2	2 year	All Schools	159	159	170	170	Yes
Crook #1	2 year	All Schools	152	152	176	173	Yes
Johnson #1	2 year	Meadowlark Elementary Cloud Peak Elementary Clear Creek Middle Buffalo High	175	173	183	183	No
Laramie #2	2 year	All Schools	152	152	185	185	Yes

Niobrara #1	2 year	Lusk Elementary Lusk Middle School Niobrara County High School	148	148	176	176	Yes
Niobrara #1	2 year	Lance Creek Elementary	137	137	176	176	Yes
Sheridan #1	2 year	All Schools	148	146	164	164	Yes
Sheridan #3	2 year	All Schools	148	148	163	163	Yes
Sublette #1	2 year	All Schools	173	173	185	185	No

Information Only: The following school districts have submitted their intent to continue their previously approved alternative schedule for 2019-2020:

- Converse #2 – All Schools

Proposed Motions:
"I move that the March requests for alternative schedules be approved for the 2019-20 and 2020-21 school years."

CREATING OPPORTUNITIES FOR STUDENTS TO KEEP WYOMING STRONG

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WYOMING DEPARTMENT OF EDUCATION

MEMORANDUM

To: State Board of Education
From: Laurel Ballard, Supervisor, Student and Teacher Resources Team
Date: March 14, 2019
Subject: Leader and Teacher Evaluation Systems

Meeting Date: March 21, 2019

Item Type: Action: X Informational: _____

Background:
The Wyoming Department of Education (WDE) worked with districts to implement the requirements of Chapter 29 associated with leader evaluations. As required by the Chapter 29 Rules, districts choosing to adopt evaluation systems in alignment with the locally-designed evaluation standards must receive approval of their systems before implementation. To facilitate this process and ensure statutory and regulatory compliance, districts have submitted general information about their evaluation systems to receive conditional approval of their leader evaluation systems. On June 1, 2019, districts will provide detailed information on their evaluation systems to receive full approval from the SBE.

Approving District Leader Evaluation Systems

Districts choosing to adopt evaluation systems based on the state-defined evaluation standards do not need evaluation system approval from the SBE. Only districts electing to adopt an evaluation system based locally-designed evaluation standards require approval from the SBE. February 1, 2019, districts provided the WDE with general information about their leader evaluation systems.

By June 1, 2019, districts electing to use leader evaluation evaluations based on locally-designed standards will submit additional information about their evaluation system to the WDE by June 1, 2019. This information will include:

- The purpose and goals of the evaluation system.
- A description of the extent to which those standards are the same as or similar to the standards that are part of the state-defined system.
- Evidence that the district's standards reflect best practice

- Evidence of system quality as demonstrated by adherence with the comprehensive system component requirements.

Leader Evaluation Systems

The attached documents provide detailed information about which district leader evaluation systems districts selected. It is broken into 4 areas: superintendent, other district leaders, principals, and other school leaders. Given that many districts were still working to determine which evaluation systems they were intending to use next school year, they were only asked to identify if they were going to choose a system aligned with state-defined or locally-designed evaluations systems. They were also asked to provide details on the other district and school leaders to be evaluated using systems covered by Chapter 29 Rules.

Superintendent Evaluation:

- State-Defined Model - 45 Districts
- Locally-Designed Model - 3 Districts

Principal Evaluation:

- State-Defined Model - 31 Districts
- Locally-Designed Model - 16 Districts
- There is also one district whose superintendent is also the school principal and will be using the superintendent evaluation instead of a principal evaluation.

Other District Leaders: Typically assistant superintendents and directors

- 27 Districts chose not to submit any other district leaders.
- 21 Districts chose to evaluate other district leaders as defined in Chapter 29.
- 16 Districts are choosing to adopt evaluations systems aligned with the state-defined evaluation standards.
- 6 Districts are requesting conditional approval to adopt evaluations systems aligned with the locally-defined evaluation standards.

Other School Leaders: Typically special education directors and assistant principals.

- 28 Districts chose not to submit any other school leaders.
- 20 Districts chose to evaluate other school leaders as defined in Chapter 29.
- 15 Districts are choosing to adopt evaluations systems aligned with the state-defined evaluation standards.
- 5 Districts are requesting conditional approval to adopt evaluations systems aligned with the locally-defined evaluation standards for other school leaders.

Charter Schools:

- 5 Charter schools do not have a superintendent outside of the district superintendent
- 3 Charter schools chose not to submit any other district leaders.
- 2 Charter schools are requesting conditional approval to adopt evaluations systems aligned with the locally-defined evaluation standards for other district leaders.

- 3 Charter schools are choosing to adopt principal evaluations systems aligned with the state-defined evaluation standards.
- 2 Districts are requesting conditional approval to adopt principal evaluations systems aligned with the locally-defined evaluation standards for other school leaders.
- 0 Charter schools chose to evaluate other school leaders as defined in Chapter 29.

Statutory Reference (if applicable):

- W.S. 21-2-304(b)(xv)
- Board Rules, Chapter 29: Evaluation Systems For District And School Leaders And Other Certified Personnel

Supporting Documents/Attachments:

- State Board of Education Conditional Approval of District and School Leader Evaluation Systems
- State Board of Education Conditional Approval of Charter School Leader Evaluation Systems

Proposed Motions:

“I move to conditionally approve the leader evaluations from districts and charter schools who based their systems on locally-designed evaluation standards.”

State Board of Education Conditional Approval of District and School Leader Evaluation Systems

School District	Superintendent Evaluation	Other District Leader Evaluation	Principal Evaluation	Other School Leader Evaluation
Albany #1	State	Assistant Superintendent, Directors - State	Local	None
Big Horn #1	State	All District Leaders - State	State	All School leaders - State
Big Horn #2	State	Curriculum Director and Special Services Director - State	State	None
Big Horn #3	State	None	Local	None
Big Horn #4	State	Special Education Director - State	State	None
Campbell #1	State	None	State	None
Carbon #1	State	None	State	Directors - State
Carbon #2	State	None	State	None
Converse #1	State	Assistant Superintendent, Director of Special Education - State	State	Assistant Principals - State
Converse #2	State	Special Education Director - State	State	Assistant Principals - State
Crook #1	State	None	State	None
Fremont #1	Local	None	Local	None
Fremont #2	State	None	State	None

School District	Superintendent Evaluation	Other District Leader Evaluation	Principal Evaluation	Other School Leader Evaluation
Fremont #6	State	Special Education Director - State	State	Director of Student Services - State
Fremont #14	State	Director of Special Education - State; Assistant Superintendents - Local	State	None
Fremont #21	State	None	State	Principal, Assistant Principal and Special Education Director - State
Fremont #24	State	None	State	Special Education Director - State
Fremont #25	State	Assistant Superintendent - State	State	Building Administrators - State
Fremont #38	State	All District Leaders - State	State	All School Leaders - State
Goshen #1	State	None	State	None
Hot Springs #1	State	None	Local	None
Johnson #1	State	None	Local	None
Laramie #1	State	Local	Local	Local
Laramie #2	State	Special Ed Director - Local	Local	None
Lincoln #1	State	None	State	None

School District	Superintendent Evaluation	Other District Leader Evaluation	Principal Evaluation	Other School Leader Evaluation
Lincoln #2	State	Director of Elementary, Director of Secondary and Special Services Director - State	State	None
Natrona #1	State	Associate Superintendents, Executive Directors, All district level administrators holding a PTSB issued standard license with a principal/director endorsement - State	State	All administrators holding a PTSB issued standard license with a principal/director endorsement - State
Niobrara #1	State	Special Education Director - State	State	None
Park #1	State	Assistant Superintendent, Special Education Director - State Transportation, Maintenance, and Business Coordinators - Local	Local	Assistant Principals - Local
Park #6	State	Assistant Superintendent and Student Support Services Director - State	State	Assistant Principals - State
Park #16	State	None	State	None
Platte #1	Local	Administration - Local	Local	None

School District	Superintendent Evaluation	Other District Leader Evaluation	Principal Evaluation	Other School Leader Evaluation
Platte #2	State	None	State	None
Sheridan #1	State	Curriculum Director, Special Education Director, and Business Manager - Local	State	None
Sheridan #2	Local	None	Local	None
Sheridan #3	State	None	N/A	None
Sublette #1	State	None	State	Assistant Principals - State
Sublette #9	State	None	Local	None
Sweetwater #1	State	None	State	Academic Directors - State
Sweetwater #2	State	None	Local	None
Teton #1	State	Assistant Superintendent, Curriculum Director, Special Education Director, Educational Coordinators - State	State	Vice-principals - State
Uinta #1	State	Assistant Superintendents - State	Local	Assistant Principal - Local
Uinta #4	State	None	Local	Special Education Director - Local
Uinta #6	State	None	State	Special Education Director - State
Washakie #1	State	None	State	None

School District	Superintendent Evaluation	Other District Leader Evaluation	Principal Evaluation	Other School Leader Evaluation
Washakie #2	State	None	State	None
Weston #1	State	None	Local	None
Weston #7	State	None	Local	Special Education Director - Local

State Board of Education Conditional Approval of Charter School Evaluation Systems

School District	Charter School	Superintendent Evaluation	Other District Leader Evaluation	Principal Evaluation	Other School Leader Evaluation
Albany #1	Snowy Range Academy	N/A	N/A	Local	None
Albany #1	Laramie Montessori	N/A	N/A	Local	None
Fremont #38	Arapaho Charter High School	N/A	N/A	State	None
Laramie #1	PODER Academy	N/A	CEO, COO, Office Administrator - Local	State	None
Laramie #1	PODER Academy Secondary School	N/A	CEO, COO, Office Administrator - Local	State	None

To: State Board of Education

From: Tom Sachse, Coordinator

Date: March 14, 2019

Subject: Action Item on Administrative Procedures--Part 1

Background: The state board having completed the revision of the Policies of Governance is now working on a companion document that assembles a variety of board processes and standard operating procedures. Ths draft sections are reviewed by the Administrative Committee before bringing them to the full board for information and then action. This is the first part with three different sections.

Changes since Information: There were slight changes to the section on the board's budgeting process as recommended by WDE staff, Trent Carroll.

Recommendation: I recommend the board adopt these procedures with conforming changes to Policy of Governance Section 1, as presented.

WYOMING STATE BOARD OF EDUCATION

To: State Board of Education

From: Tom Sachse, Coordinator

Date: March 14, 2019

Subject: Action Item on Early Learning Resolution

Background: This resolution was created following the board's retreat last September as an actionable item in the Equity discussion. Early Childhood Education may become an Interim Topic for the education committees this year.

Changes since Information: There was clarification replacing universal preschool to expanded preschool opportunities since the information edition.

Recommendation: I recommend the board adopt this resolution, as presented.

January 29, 2019

(Revised) Resolution on State Board Support for Early Childhood Education

Whereas, the Wyoming State Board of Education "shall ensure that the educational programs provide students an opportunity to acquire sufficient knowledge and skills at a minimum, to enter the University of Wyoming and Wyoming community colleges, to prepare students for the job market or postsecondary vocational and technical training, and to achieve the general purposes of education that equip students for the role as a citizen and participant in the political system and to have the opportunity to compete both intellectually and economically in society." WSS:201-2-304 (a)(ii)

Whereas, the Equality State would surely support improving equity of opportunity in schooling and the world of work.

Whereas, the period of birth through age five are critically important to brain development leading to cognitive and academic growth, it is also clear that the same time period provides unique opportunities for social and emotional development.

Whereas, a scholarly body of work (Bagdi and Vacca, 2005; Campbell et.al. 2002; Alper 2013) supports the assertion that high-quality early childhood education intervention yields significant improvements in profound metrics, such as graduation rate and academic achievement.

Whereas, citations of economic return on investment (Heckman 2006; Rolnick and Grunewald, 2013; O'Doyle et. al. 2009) are estimated as a ratio of eight to one.

Whereas, the Wyoming State Board of Education has articulated its legislative priority to support optional, universal high quality early learning programs that are available to every child in Wyoming.

Whereas, it is evident that a better coordinated, more coherent state policy leads to better programming at the local level.

Be it therefore resolved, that Wyoming State Board of Education supports unifying all early childhood learning programs within one agency, such as the Wyoming Department of Education. The Wyoming State Board of Education advocates for expanded, high quality early childhood education opportunities throughout Wyoming, especially in rural communities. As part of an emergent set of high quality programs, the state board envisions programs that leads to professionalism among preschool staff, including strong preservice and professional development programs.

Be it further resolved, that the Wyoming State Board of Education supports, as a long-term goal, an array of service providers leading to broadly available, voluntary preschool throughout the state.

March 14, 2019

Thoughts on the Basket of Goods and Services: Finding Equity and Quality in Wyoming's Public School Content Standards

Preliminary thoughts and Definitions: This brief paper is written at the direction of the state board and is designed to frame some of the issues and alternatives the board may wish to consider. Recent additions (including Indian Education for All and Computer Science) by the state legislature prompted the state board to conduct a survey of education stakeholders to gauge their views on the current status of content standards requirements. Recent legislation regarding content standards and the results of the board's survey combined to cause this reconsideration of the entire set of standards contained in Chapter 10. It seems prudent now for the state board to evaluate how the state defines and refines content standards. Is the process working as it is or are there some facets of the process that might be reconsidered?

There is a critical statutory obligation the state board operates within. W.S. 21-2-304 (a)iii states, "By rule and regulation and in consultation and coordination with local school districts, prescribe uniform student content and performance standards for educational programs prescribed under W.S. 21-9-101 and 21-9-102 ... The board shall ensure that educational programs offered by public schools in accordance with these standards provide students an opportunity to acquire sufficient knowledge and skills, at a minimum, to enter the University of Wyoming and Wyoming community colleges, to prepare students for the job market or post-secondary vocational and technical training and to achieve the general purposes of education that equip students for their role as a citizen and participant in the political system and to have the opportunity to compete both intellectually and economically in society.

It may be useful to start with some general definitions, partly because there are new board members and partly because it is likely this paper will be sent to others, beyond state board members who may not be familiar with some of these distinctions.

Uniform Student Content and Performance Standards—this is the actual term used in legislation to capture the standards and benchmarks promulgated as part of the Chapter 10 rules. For shorthand, we'll use the term content standards or content.

Core subjects—these are typically referred to as including English language arts, mathematics, science, and social studies because these are the four areas where the state legislature has set graduation requirements--W.S. 21-2-304(a) iii (A)(B)(C)(D).

"*Elective*" *subjects*—these are typically referred to as including career and technical education, foreign language, fine and performing arts, health, and physical education.

These are not actually electives in districts. By law, all students must be given the opportunity to take courses in all nine subject areas.

Standards—these are significant aspects of study within a content area that are iterative across grade levels. For example, writing is a standard in English/language arts that plays out from grades K through 12 with ever deepening expectations for sophisticated expression of ideas.

Benchmarks—these are more specific explications of standards for grade levels or grade level spans. For example, within the writing standard a benchmark for 11^{th} and 12^{th} grade students reads as follows: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience,

The basket of goods and services—this is the entirety of the Common Core of Knowledge and Common Core of Skills as stipulated in statute. The basket of goods and services takes on a special meaning given the four Campbell County decisions by the Wyoming Supreme Court. Essentially, the Campbell decisions suggest that the state legislature is responsible for identifying what's in the entire basket and then paying for it. It is important to note that the Wyoming state legislature has the power to mandate additions or changes to the Common Core of Knowledge or the Common Core of Skills. The State Board of Education, through the department, and in consultation with school districts has the responsibility for promulgating Chapter 10 rules that contain the uniform student content and performance standards.

Unpacking standards—this is the process districts use to implement new sets of standards as they are approved. Many districts use a Professional Learning Communities (PLC) process that has four questions to be answered at the school site, the first of which is "What do we want students to learn and be able to do?" Other districts typically form committees to frame a scope and sequence for a subject for grades K-12. Oftentimes, districts will identify priority standards or power standards that become the organizers for the scope and sequence. This can get quite complex, because in addition to identifying what gets taught when these groups also have to identify instructional resources, software, other forms of media, as well as assessments to gauge how well students have learned a particular standard and its associated benchmarks. This becomes even more complicated when some subjects are integrated with others. Expository writing can be integrated with social studies or science topics. Statistics can be linked to social studies or health. Many districts use a formalized process called curriculum mapping to ensure that there are not gaps or redundancies.

Curriculum—this is the entire constellation of instructional resources and techniques the teachers use to help students learn. While a number of other states identify curriculum that districts can and cannot use, Wyoming is expressly prohibited from selecting textbooks or other curricular resources that are used to deliver instruction.

What was learned: The Wyoming State Board of Education undertook a broad survey of (606) practitioners to gauge their impressions about the current and growing requirements for content standards in Wyoming public schools. A majority of respondents felt that additional content should not be mandated at a time when funding of public schools is stagnant or declining. The core subjects—English, math, science, and social studies—were well supported by a majority of respondents. At the elementary level, "elective" subjects like the arts and foreign language were seen as "nice to have" by half or more of respondents. And for the new subject area, computer science, half of respondents found it to be essential and the other half found it "nice to have." At the secondary level the general mood of respondents was to make content requirements as flexible as possible and give students and parents more opportunities to choose.

What the issues are: It could be that the basket of goods survey (hereinafter referred to as the survey) raises more questions than it answers. But for simplicity sake, these questions could be clustered into four issue areas. These include: content, deployment, implementation, and dissemination.

The issue about the **content** of the standards might be framed by questions such as: Are the 10 content areas currently used in Wyoming the most critical areas for all Wyoming students? Are the 10 content areas necessary at all grade levels?

The issue about **deployment** of the standards might be framed by questions such as: Should all standards be written at the same level of specificity? Could the "elective" content areas be developed at the local level versus the state level? Could some of the standards be written as exploratory in nature?

The issue about **implementation** of the standards might be framed by questions such as: What are the implications for teaching and learning once standards are established? How does having state standards contribute to equity among districts and schools?

The issue about **dissemination** of the survey results might be framed by questions such as: Do these results create a call to action by the state board? What should the state board do with these results? Should the state board (through the department) establish a framework for future standards committees? Is the state board the correct agency to be answering questions about the nature and specificity of state standards?

Once again, the overriding issue for consideration by the state board is whether the entirety of the standards is adequate for addressing the balance of excellence and equity. Do the state standards as a whole elevate districts' ambition and ability to create programs that offer Wyoming students an opportunity to be successful in their chosen life path? Do the state standards as a whole contribute to all Wyoming students receiving approximately the same basket of goods and service regardless of zip code? This matter really does get to the heart of what education Wyoming students actually receive in school.

Related content standards issues: The last two general sessions of the Wyoming State Legislature saw the submission of several bills with the intention of changing the content standards requirements. A civics examination bill would have required passing the naturalization citizenship test as a condition of graduation. A CPR bill would have required students to receive instruction on basic CPR technique as a condition of graduation. A bill to have made the K-2 foreign language requirement permissive was introduced twice. Yet another bill would have added a requirement of four years of mathematics as a condition of the graduation. These bills all failed, but clearly there is a feeling that legislative mandate is the primary route to define K-12 content standards requirements. The state board has recently acted to provide a “trigger mechanism” to allow members of the public to petition the state board to reconsider rules promulgation on what comprises the basket of goods and services.

What the status is: There are currently nine defined subject areas that represent the Common Core of Knowledge, including English/language arts, mathematics, science, social studies, foreign language, fine and performing arts, career and technical education, health, and physical education. The Wyoming State Board of Education has a statutory mandate to add a tenth subject to the Common Core of Knowledge—computer science by January 2022.

In reviewing the standards and benchmarks, it becomes quite obvious that the level of specificity differs significantly in the different content areas. Those areas that are tested on the statewide assessment: English/language arts, mathematics, and science are grade level specific, rigorous, and detailed. Here’s a sample benchmark from science: “Analyze data to support the claim that Newton’s second law of motion describes a mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.”

Those subjects that are not tested on the statewide assessment, include social studies, foreign language, fine and performing arts, career and technical education, health, and physical education. These subjects’ standards are represented in grade level bands and more generally phrased. Here’s a sample benchmark from health: “Describe situations or circumstances that help or hinder healthy decision-making.”

There appears to be some level of uncertainty regarding students’ level of civic understanding and engagement. Some have suggested that the very general benchmarks under the civics content standard could be the source of that assumed lack of civics understanding. A quick examination of those civic benchmarks reveals they are rather general. Some would argue that this gives districts broad flexibility in defining those standards and benchmarks; others would argue that civics education deserves a level of specificity like those of the tested subjects. Here are several examples: By the end of grade five, students should “understand the purposes of the three branches of government.” By the end of grade eight, students should “understand the basic structures of various political systems (e.g., tribal, local, national, and world).” (Yes, there is no mention of state government.) And by the end of grade twelve, students should “demonstrate an understanding of the structures of both the Wyoming and US constitutions (e.g., Articles, Bill of Rights, amendments)”.

Given this pattern, it seems curious that the proposed standards for computer science look much more like the tested subjects than the non-tested subjects. Here’s a sample benchmark from computer science that students should “master” by the end of eighth grade: Apply multiple methods of encryption to model the secure transmission of data. In addition, there are grade specific benchmarks, leading up to that eighth grade mastery. At grade six, the benchmark is to: “explain the importance of cybersecurity and describe how one method of encryption works.” At grade seven, the benchmark is to: “identify and explain two or more methods of encryption used to ensure and secure the transmission of information.”

Elementary foreign language as an illustrative example: The State Board of Education (supported by a series of state supreme court decisions) genuinely supports the twin aspirations of quality and equity of educational opportunity throughout Wyoming schools. It is their intention that children from Sundance receive the same high quality education as those in Laramie.

Wyoming has for years now, had a requirement for foreign language instruction in kindergarten through second grade. Currently, four districts offer a robust and intensive language immersion program to some students in some schools. These programs are offered in grades kindergarten through second but are expanded to later grades as well. Students enrolled in these programs are found to develop foreign language proficiency, cultural sensitivity, and significant progress in English/language arts as well.

In the board’s basket survey, approximately 17% of the respondents felt that elementary foreign language was essential, while 61% found it “nice to have”, and 21% found it unnecessary. It appears that support for foreign language, despite the legislative mandate, is soft at best. And yet four districts have taken it upon themselves to design and implement a world-class foreign language instructional program beginning in the earliest grades. Despite the same general foreign language standards, the interpretation and implementation of those standards differs significantly depending on the school a student happens to attend. So the equity issue exists not only between school districts, but between schools within a district.

Options for the board’s consideration: The Wyoming State Board of Education is in a curious position. It has the authority, through the Department of Education, to promulgate rules that establishes the curricular requirements for all schools in Wyoming. It also does so “in consultation with school districts” and the basket survey results suggest they prefer more flexibility.

On the big issue of equity and quality the state board could:

1. Establish a committee of practitioners to study and discuss the issues proposed above and develop a framework for future work in regard to Wyoming content standards. That committee might consist of three trustees, superintendents, curriculum directors, secondary principals, elementary principals, and six teachers. It could also have parents, community leaders, etc. This committee could meet during the interim and present recommendations to the WDE, state board, and to the Joint Interim Education Committee (JEIC) in the fall.
2. Make the determination that future "elective" subjects' standards will be exploratory at the elementary grades. Of course, it would do well to have an operational definition (or perhaps a sample format) that illustrates what exactly exploratory means.
3. Clarify and refer the matter to the JEIC. The larger issue of balancing equity and quality is to some extent the role of the state legislature. Surely the four Campbell cases that went before the Wyoming Supreme Court would suggest that the legislature was responsible for determining what is in the basket of goods and services and how much that costs to deliver.

These are challenging issues to be sure. But now that the state board has the results of the survey, it is better able to see options that relate directly to the standards they adopt. The board will no doubt benefit from the analysis and expertise of leadership and staff from the WDE.

CREATING OPPORTUNITIES FOR STUDENTS TO KEEP WYOMING STRONG

JILLIAN BALOW
Superintendent of Public Instruction

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WYOMING DEPARTMENT OF EDUCATION

MEMORANDUM

Date: March 15**,** 2019

To: State Board of Education

From: Kari Eakins, Chief Policy Officer Laurie Hernandez, Standards/Assessment Director

Subject: Proposed 2019 Computer Science Standards Review

Meeting Date: March 21, 2018

Item Type: Action: _____ Informational: __X__.

Background: The Board is charged with evaluating and reviewing the uniformity and quality of the educational standards imposed under W.S. 21-9-101 including the student content and performance standards. HEA 48 was signed by Governor Mead on March 14, 2018, which required the addition of Computer Science Standards and changes to W.S. 21-9- 101(b), as outlined below.

(i) Common Core of Knowledge

(M) ~~Applied technology~~ (repealed)

(O) Computer science (added)

(iii) Common Core of Skills

(C) ~~Keyboarding~~ Computational thinking (added) and computer applications (remained)

Section 3 of the bill requires the state board of education to promulgate uniform content and performance standards for computer science by January 1, 2022, to be effective beginning with the 2022-23 school year.

Statutory Reference:

- SEA 48 (SF0029)
- W.S. 21-2-304(c)

Educator Input Collection: At the January 17, 2019 virtual meeting, the State Board of Education (SBE) requested input from educators to identify possible impacts of the Proposed 2019

Wyoming Computer Science Content and Performance Standards on curriculum and instruction. A Superintendent's Memo was sent on January 22, 2019 to collect input from educators through an educator online survey through March 3, 2019. On the Educator Survey, 212 responses were collected. There were 16 school districts that responded and the role breakout is as follows: 21 computer science teachers, 116 elementary teachers, 65 middle school teachers, 4 high school teachers, 5 Instructional Facilitators, 4 Principals, 1 Superintendent, and 16 other district personnel.

Public Input Collection*:* The draft 2019 Wyoming Computer Science Content and Performance Standards document was submitted for stakeholder review. Input was given through an online survey which opened on January 22, 2019 and closed on March 5, 2019. Input was also collected at five regional meetings. There were 151 responses collected, 128 were through the online survey and 23 were during the regional hearings. A total of 50 people attended the regional hearings, of which 14 gave verbal comments and 12 provided written comment.

Public input meetings were held **6:00-7:30 p.m.** at the following locations:

- **February 25**, Green River - SCSD #2 Central Admin. Office, 351 Monroe Avenue
- **February 25,** Buffalo - JCSD#1 Buffalo High School, 29891 Old Hwy 87
- **February 26**, Meeteetse - PCSD #16 School Building, 2107 Idaho Street
- **February 26**, Douglas - CCSD #1, Admin. Building, 615 Hamilton Street
- **February 28**, Cheyenne - LCSD #1, Storey Gym, 2811 House Avenue

All comments collected, from both surveys and the regional hearings, will be presented during the presentation to the Board.

Supporting Documents / Attachments:

- PPT Presentation: Update on Proposed 2019 Wyoming Computer Science Content & Performance Standards
- PDF Document: Proposed 2019 Wyoming Computer Science Standards
- CS Implementation Plan
- CS Communication Plan
- CS Professional Development Plan

WYOMING
DEPARTMENT OF EDUCATION

Update on Proposed 2019 Wyoming Computer Science Content & Performance Standards

State Board of Education
March 21, 2019

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WDE Consultants

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Overview

WYOMING DEPARTMENT OF EDUCATION

- Review of the Computer Science Standards Process
- Results of Public Input
- Results of Educators' Survey
- Implementation, Communication, and Professional Development Plans

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Overview of the 2019 Computer Science Standards Review Process

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Public Input Meetings

WYOMING
DEPARTMENT OF EDUCATION

Date & Time	Location & Address	Room
February 25, 2019 6-7:30 p.m.	Green River - SCSD #2 Central Admin. Office 351 Monroe Avenue	Boardroom
February 25, 2019 6-7:30 p.m.	Buffalo - JCSD #1 Buffalo High School 29891 Old Hwy 87	Commons Area
February 26, 2019 6-7:30 p.m.	Meeteetse - PCSD #16 School Building 2107 Idaho Street	Cafeteria
February 26, 2019 6-7:30 p.m.	Douglas - CCSD #1 Admin. Building 615 Hamilton Street	Central Boardroom
February 28, 2019 6-7:30 p.m.	Cheyenne - LCSD #1 Storey Gym 2811 House Avenue	Boardroom

New Wyoming Computer Science Standards

WYOMING DEPARTMENT OF EDUCATION

SEA 48 was signed by Governor Mead on March 14, 2018, requiring the addition of Computer Science Standards and the following changes to the Basket of Goods in W.S. 21-9-101(a)(i).

(i)Common Core of Knowledge

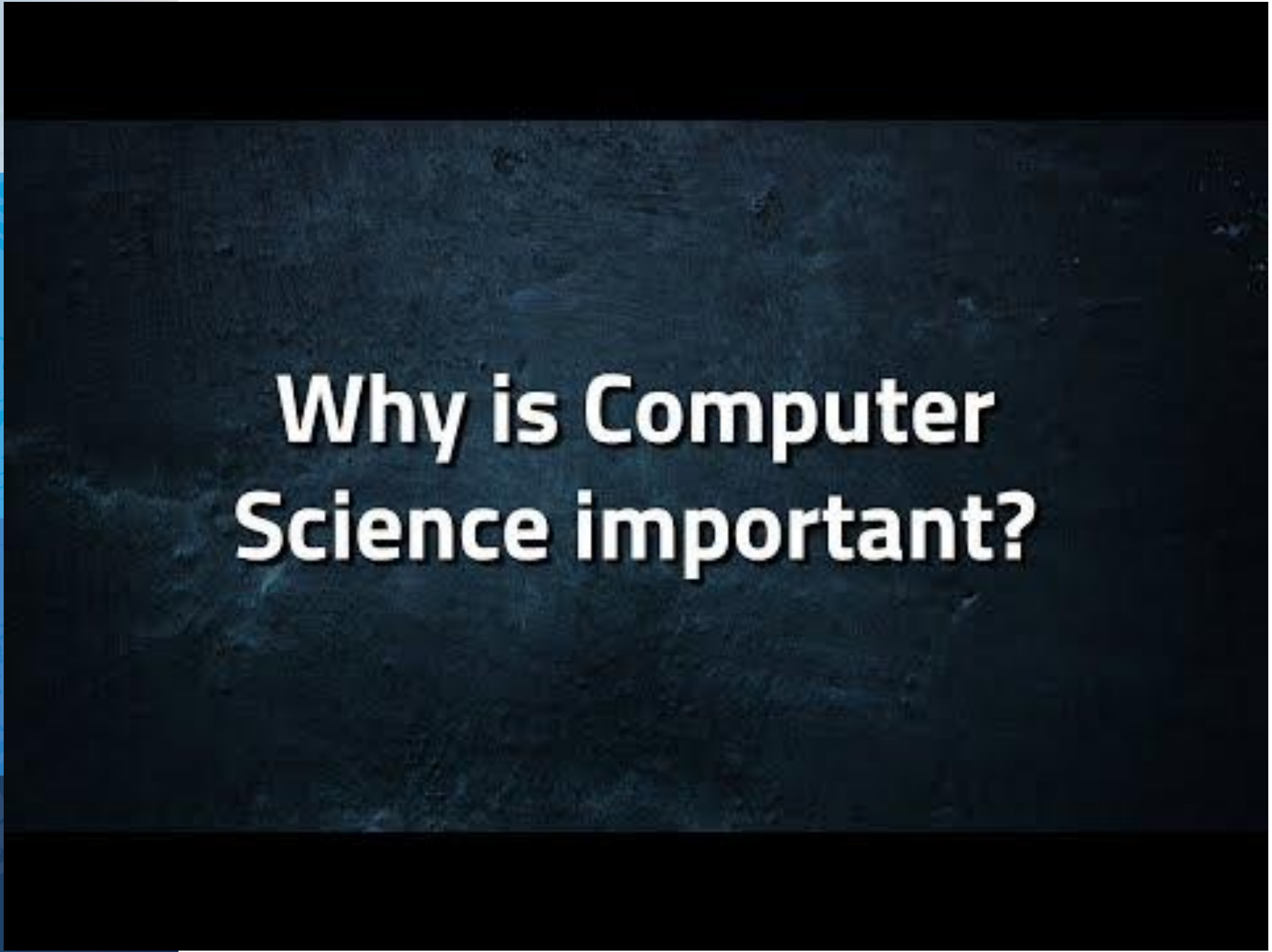
(M) ~~Applied technology~~ (repealed)

(O) Computer science (added)

(iii) Common Core of Skills

(C) ~~Keyboarding~~ Computational thinking and computer applications

Section 3 of the bill requires the state board of education to promulgate uniform content and performance standards for computer science by January 1, 2022, to be effective beginning with the 2022-23 school year.



Video Message

https://www.youtube.com/watch?v=29fWyFyPvzQ

Community Input Meetings (prior to Committee Mtgs.)

WYOMING DEPARTMENT OF EDUCATION

2018 Regional Community Input for Wyoming Computer Science Standards		
Date & Time	**Location & Address**	**Room**
May 14, 2018 6-8 PM	Pinedale - Central Admin. Building 665 North Tyler Street	Boardroom
May 15, 2018 6-8 PM	Powell - Park #1 Support Services Building 245 N. Evarts Street	Boardroom
May 15, 2018 6-8 PM	Rock Springs - Central Admin. Office 3500 Foothill Blvd.	Boardroom
May 16, 2018 6-8 PM	Sheridan - Central Admin. Office 201 N. Connor Street	Boardroom
May 16, 2018 6-8 PM	Cheyenne - LCSD #1 Storey Gym 2811 House Avenue	Boardroom 130

Questions:

1) Why is computer science education important?
2) What do you want the committee to know as they develop computer science standards?

Content Committee Selection

WYOMING DEPARTMENT OF EDUCATION

Number of Members (40-44)

- Content Area Considerations (Computer Science)
- Ensure Diversity of Content Committees
  - Large school / Small school
  - Veteran / Rookie educators
  - All corners of the state + central
  - Grade levels – alignment throughout K-12 education
- Content Experts
  - School district personnel
  - University and community college personnel
- Wyoming Citizens
  - Parents / grandparents
  - Business & industry members
  - Retired & community members

Computer Science Review Committee Members

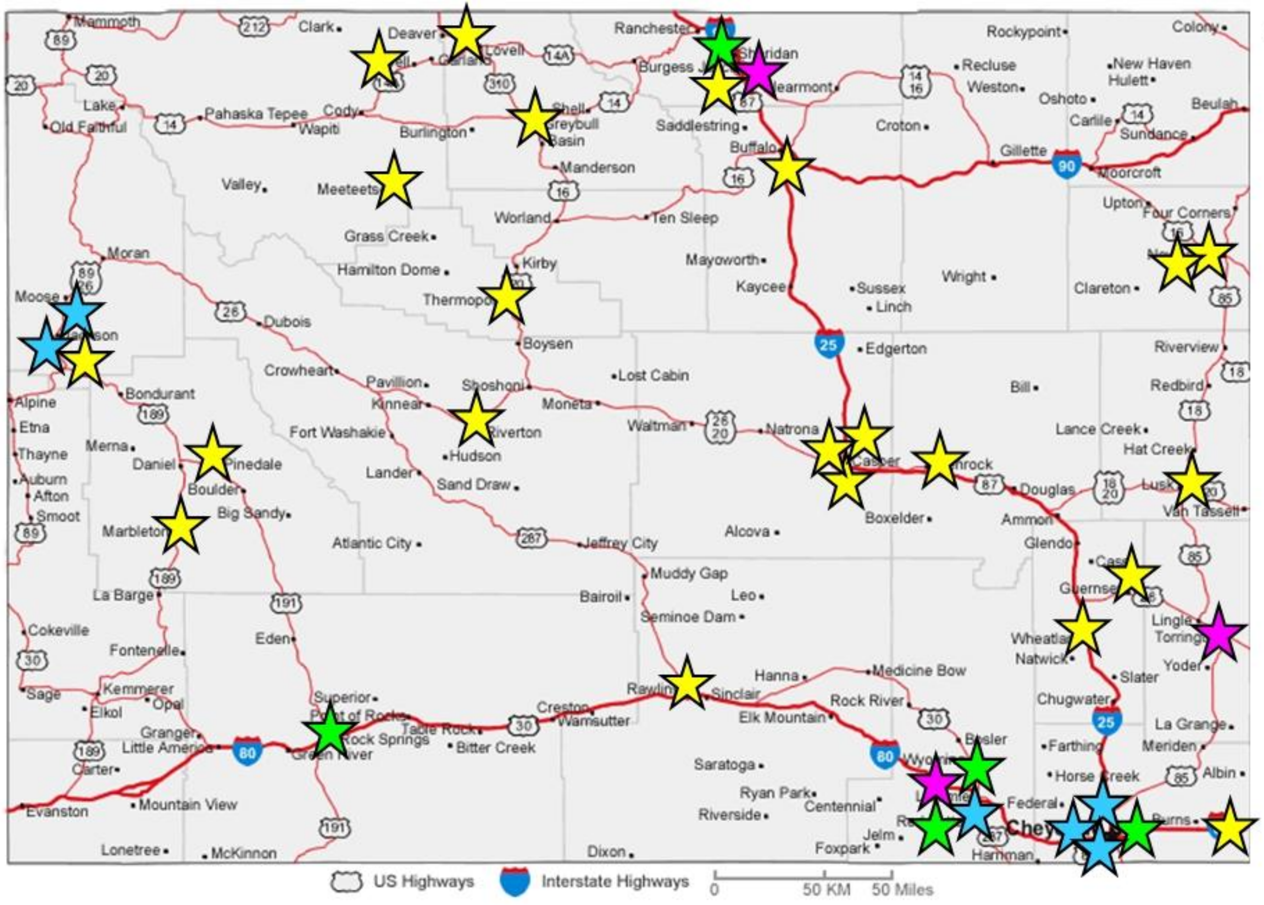
KEY

22 Educator

5 Higher-Ed

3 Parent

10 Business Owner/ Community Member



Out of State

Standards Review Meetings

WYOMING DEPARTMENT OF EDUCATION

Meeting Type	Date	Length of Meeting	Location
Webinar	May 29, 2018	3 hours	Video Conference
Face-to-Face	July 15-17, 2018	3 days	Casper
Face-to-Face	October 25-27, 2018	3 days	Casper
Webinars (4)	November 2018	2-4 hours	Video Conference
Webinars (3)	December 2018	2-4 hours	Video Conference
Webinar (CSSRC)	December 13, 2018	6 hours	Video Conference

Committee Process

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The work started with whole group discussion on the direction of the committee. Working in grade-band groups & in full committee, members of the CSSRC did the following:

- Reviewed compilation of comments from community input
- Reviewed and evaluated other state and national CS standards
- Decided direction (chose to use standards from OK and CSTA as a framework from which to build the WY CS Standards)

Committee Options & Decision

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1) Adopt standards from a different state
2) Revise standards from a different state (revised from OK)
3) Use multiple pieces from different states
4) Adopt or revise CSTA or ISTE national standards (revised from CSTA)
5) Create own set of standards

2019 Computer Science Domains & Standards

WYOMING DEPARTMENT OF EDUCATION

DOM.	Computing Systems	Networks & The Internet	Data Analysis	Algorithms & Programming	Impacts of Computing
STANDARD	CS.D—Devices CS.HS—Hardware & Software CS.T—Troubleshooting	NI.NCO—Network Communication & Organization NI.C—Cybersecurity	DA.S—Storage DA.CVT—Collection, Visualization, & Transformation DA.IM—Inference & Models	AP.A—Algorithms AP.V—Variables AP.C—Control AP.M—Modularity AP.PD—Program Development	IC.C—Culture IC.SI—Social Interactions IC.SLE—Safety, Law, & Ethics

Key: Computing Systems

CS.D—Devices

Snapshot of the Proposed 2019 Computer Science (CS) Standards

There are two parts to this document, the Snapshot and the Proposed CS Standards document. The Snapshot is found on the first 14 pages and is designed to give the reader a quick overview of the standards and benchmarks K-12. The CS Standards document that follows is intended to provide further guidance for teachers as they implement these standards.

There are five domains (core concepts), 16 standards, and 130 benchmarks broken out as follows:

- Grades K-2 (18)
- Grades 3-5 (23)
- Grades 6-8 (25)
- HS Level 1 (35)
- HS Level 2 (29)

Computer Science, as defined in the CS Standards document, is the study of computing principles, design, and applications (hardware & software); the creation, access, and use of information through algorithms and problem solving, and the impact of computing on society.

WYOMING 2019 COMPUTER SCIENCE DOMAINS & STANDARDS

Computing Systems	Networks & The Internet	Data Analysis	Algorithms & Programming	Impacts of Computing
CS.D—Devices **CS.HS—Hardware & Software** **CS.T—Troubleshooting**	**NI.NCO—Network Communication & Organization** **NI.C—Cybersecurity**	**DA.S—Storage** **DA.CVT—Collection, Visualization, & Transformation** **DA.IM—Inference & Models**	**AP.A—Algorithms** **AP.V—Variables** **AP.C—Control** **AP.M—Modularity** **AP.PD—Program Development**	**IC.C—Culture** **IC.SI—Social Interactions** **IC.SLE—Safety, Law, & Ethics**

Computing Systems: Devices

K-2	3-5	6-8	9-12 (Level 1)	9-12 (Level 2)
2.CS.D.01 Independently select and use a computing device to perform a variety of tasks for an intended outcome (e.g., create an artifact).	5.CS.D.01 Independently, describe how internal and external parts of computing devices function to form a system.	8.CS.D.01 Recommend improvements to the design of computing devices based on an analysis of how a variety of users interact with the device.	L1.CS.D.01 Explain how abstractions hide the underlying implementation details of computing systems embedded in everyday objects.	

Computing Systems: Hardware & Software

K-2	3-5	6-8	9-12 (Level 1)	9-12 (Level 2)
2.CS.HS.01 Demonstrate and describe the function of common components of computing systems (hardware and software) (e.g. use a browser, search engine).	5.CS.HS.01 Model how information is translated, transmitted, and processed in order to flow through hardware and software to accomplish tasks.	8.CS.HS.01 Design and refine a project that combines hardware and software components to collect and exchange data.	L1.CS.HS.01 Explain the interactions between application software, system software, and hardware layers.	L2.CS.HS.01 Categorize the roles of operating system software.

How to Read This Document (Grades K-8)

Domain
Cluster related to the standard.

Content Standards
Content standards define what students are expected to know and be able to do throughout their study of computer science. They do not dictate what methodology or instructional materials should be used, nor how the material is delivered.

Benchmarks
Benchmarks are the skills students must master in order to demonstrate proficiency of the content standards throughout the grade band.

Clarification Statement
Statements provide further explanation or examples to support educators.

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2019 Wyoming Computer Science Standards

Grade Band: 6-8

Domain: Algorithms & Programming	Practice(s): 1.1, 2.3

By end of Grade 8

Standard: Program Development			
Standard: Program Development	**6.AP.PD.01** Using grade appropriate content and complexity, seek and incorporate feedback from team members and users to refine a solution to a problem.	**7.AP.PD.01** Using grade appropriate content and complexity, seek and incorporate feedback from team members and users to refine a solution to a problem.	**8.AP.PD.01** Using grade appropriate content and complexity, seek and incorporate feedback from team members and users to refine a solution to a problem.

Clarification Statement: Development teams that employ user-centered design create solutions (e.g., programs and devices) that can have a large societal impact, such as an app that allows people with speech difficulties to translate hard-to-understand pronunciation into understandable language. Students should begin to seek diverse perspectives throughout the design process to improve their computational artifacts. Considerations of the end-user may include usability, accessibility, age-appropriate content, respectful language, user perspective, pronoun use, color contrast, and ease of use.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	MS-ETS1-1, MS-ETS1-2, MS-ETS1-3, MS-ETS1-4	CV8.2.1, CV8.4.1	7b - Global Collaborator
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
W.8.7			PE 8.3.3 HE8.2.1

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Grade Band

Computer Practices
There are seven (7) CS Practices that are to be embedded in curriculum and instruction as the standards and benchmarks are taught and measured.

Benchmark Labeling
8.AP.PD.01
8 (Grade Level)
AP (Domain - Algorithms & Programming)
PD (Standard - Program Development)
01 (Benchmark #1 in the Standard)

Gold Benchmark
In this standards document, you will find end-of-grade band benchmarks for grades K-8, along with suggested progressions for meeting the end-of-grade band benchmark, highlighted in gold. In grades 9-12, benchmarks are organized by levels.

Cross-Disciplinary Connections
Connections to real-world concepts and standards. These are intended to be suggestions and may be relevant depending on the curriculum and instruction.

2016 ISTE Standards / WY DL Guidelines
The ISTE Standards for Students are designed to empower student voice and ensure that learning is a student-driven process. Wyoming Digital Learning Guidelines assist educators in what education technology should be used at each grade level to best prepare students.

How to Read This Document (Grades 9-12)

Domain
Cluster related to the standard.

Content Standards
Content standards define what students are expected to know and be able to do throughout their study of computer science. They do not dictate what methodology or instructional materials should be used, nor how the material is delivered.

Benchmarks
Benchmarks are the skills students must master in order to demonstrate proficiency of the content standards throughout the grade band.

Clarification Statement
Statements provide further explanation or examples to support educators.

BOOT UP WYOMING

2019 Wyoming Computer Science Standards

Grade Band: 9-12

Domain: Algorithms & Programming		Practice(s): Level 1: 5.2; Level 2: 4.2
		By end of Grade 12
Standard: Algorithms	**L1.AP.A.01** Create a prototype that uses algorithms (e. g., searching, sorting, finding shortest distance) to provide a possible solution for a real-world problem relevant to the student.	**L2.AP.A.01** Critically examine and trace classic algorithms. Use and adapt classic algorithms to solve computational problems (e.g., selection sort, insertion sort, binary search, linear search).
Clarification Statement:	**Level 1**: The process of developing computational artifacts embraces both creative expression and the exploration of ideas to create prototypes and solve computational problems. Students create artifacts that are personally relevant or beneficial to their community and beyond. Students should develop artifacts in response to a task or a computational problem that demonstrate the performance, reusability, and ease of implementation of an algorithm. A prototype is a computational artifact that demonstrates the core functionality of a product or process. Prototypes are useful for getting early feedback in the design process, and can yield insight into the feasibility of a product.	

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
L1—F.IF.A.1 L2—F.IF.A.1, F.IF.A.3, F.IF.C.9		L1—CV12.3.1, CV12.4.4, CV12.5.1, CV12.5.2, CV12.5.4 L2—CV12.4.4, CV12.5.1, CV12.5.2, CV12.5.4	L1—4a, 4d - Innovative Designer L2—4a - Innovative Designer
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Page 145 2019 Computer Science Standards edu.wyoming.gov/standards

Grade Band

Computer Practices
There are seven (7) CS Practices that are to be embedded in curriculum and instruction as the standards and benchmarks are taught and measured.

Benchmark Labeling
L2.AP.A.01
L2 (HS Level #2)
AP (Domain - Algorithms & Programming)
PD (Standard - Algorithms)
01 (Benchmark #1 in the Standard)

Gold Benchmarks
In grades 9-12, benchmarks are organized into **2 levels**. Mostly, Level 1 is intended to be at the introductory level, and Level 2 reaches at a deeper level.

Cross-Disciplinary Connections
Connections to real-world concepts and standards. These are intended to be suggestions and may be relevant depending on the curriculum and instruction.

2016 ISTE Standards / WY DL Guidelines
The ISTE Standards for Students are designed to empower student voice and ensure that learning is a student-driven process. Wyoming Digital Learning Guidelines assist educators in what education technology should be used at each grade level to best prepare students.

CSSRC Rationale

WYOMING
DEPARTMENT OF EDUCATION

"The committee's (CSSRC) vision is that **every student in every school has the opportunity to learn computer science.** We believe that computing is fundamental to understanding and participating in an **increasingly technological society,** and it is essential for every Wyoming student to learn as part of a modern education. We see computer science as a subject that provides students with a **critical lens for interpreting the world around them** and challenges them to explore how computing and technology can expand Wyoming's impact on the world. The standards we (CSSRC) present here provide the necessary foundation for local school district decisions about curriculum, assessment, and instruction. Implementation of these standards will better prepare Wyoming high school graduates for the **rigors of college and/or career.** In turn, Wyoming employers will be able to hire workers with a strong foundation in Computer Science— both in **specific content areas and in critical thinking and inquiry-based problem solving.**"

Collecting Public Input

WYOMING DEPARTMENT OF EDUCATION

Per W.S. 21-2-304(c)

"The state board, in consultation with the state superintendent, shall establish a process to receive input or concerns related to the student content and performance standards from stakeholders, including but not limited to parents, teachers, school and district administrators and members of the public at large, at any time prior to the formal review by the state board."

3 Ways to Submit Public Input

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DEPARTMENT OF EDUCATION

1. Turn in your written response tonight
2. Verbally give your input tonight
3. Give it online at edu.wyoming.gov

CS Standards Review Timeline

WYOMING
DEPARTMENT OF EDUCATION

Apr-May 2018	•Call for Participants to serve on Computer Science Standards Review Committee (CSSRC) •Collect Community Input (5 locations around state + online for 55 days) •CSSRC Webinar - Understanding the Standards Review Process and Homework Assignment
July 2018	•CSSRC 3-day Face-to-Face Meeting in Casper [July 15-17, 2018]
Oct-Dec	•CSSRC 3-day Face-to-Face Meeting in Casper [October 25-27, 2018] •4 Webinars - subgroup work to finalize grade band PLDs and Clarification Statements •3 Webinars - subgroup work on Introduction, Appendices, and Cross-Disciplinary Connections •1 Webinar - whole committee to review and finalize Computer Science Standards Document
January 2019	•Present Proposed 2019 CS Standards to SBE •Press Release and Superintendent's Memo announcing Public Input on the Proposed 2019 Computer Science Standards •Opened Public Input online (1/22-3/5) •Opened Educator Survey (1/22-3/3)
Feb. - Mar.	•Collect Public Input (5 locations + online for 45 days) [February 25-28, 2019] •Presented Memo updating the SBE at their Feb. mtg. on the Public Input process to date •Present Public Input to the SBE at March meeting
Apr. - May	•Proposed Ch. 10 Rules Promulgation - Press Release and Superintendent's Memo •Collect Public Comment online (for 46 days 4/16-5/31)
June - Aug.	•LSO and Governor's Review of Proposed 2019 Computer Science Standards & Ch. 10 Rules (up to 75 days)

Concerns Outside of Standards

Topic of Concern	Point of Contact
Professional Development	• WDE, Colleges, Districts, • Professional Teacher Resources • Professional Organizations (Code.org, BootUp)
Funding	• Grants • Legislature • District
Certification	• Professional Teaching Standards Board
Instructional Time	• School District
Technology	• School District

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Public Input Results from the Survey and Regional Hearings

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Public Input Received for CS Online and at Public Hearings

Type	#
Online	128
Verbal	13
Written	10
TOTAL	151

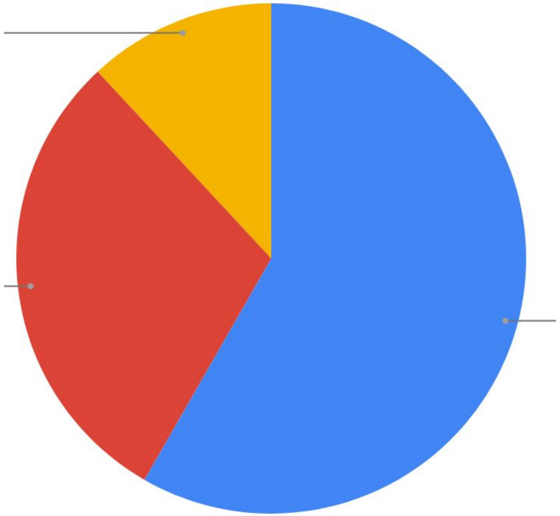
Date	Location	# in Attendance	# of Verbal Comments	# of Written Comments
2/25/19	Green River	13	1	4
2/25/19	Buffalo	10	4	1
2/26/19	Meeteetse	5	3	0
2/26/19	Douglas	4	1	1
2/28/19	Cheyenne	18	4	4
	TOTAL	50	13	10

Public Input (Jan. 22 - Mar. 5)

WYOMING DEPARTMENT OF EDUCATION

151 submissions were collected during the public input window

- 88 submissions are in favor of the proposed document (58.28%)
- 45 submissions are not in favor of the proposed document (29.80%)
- 18 submissions were neutral or included positive and negative comments (11.92%)



Public Input (cont.)

WYOMING DEPARTMENT OF EDUCATION

Public Input Responses	NE Region	NW Region	SE Region	SW Region	Out of State
Number of Responses	56	31	33	28	3
Total Input	151	151	151	151	151
Percent (%) Responses	37.09%	20.53%	21.85%	18.54%	0.02%

Public Input Responses	Public	Educator
Number of Responses	73	78
Total Input	151	151
Percent (%) Responses	48.34%	51.66%

Public Input (cont.)

Public Input Responses	Request SBE to Adopt	Recommend Minor Edits	Identify Concerns
Number of Responses	79	6	33
Total Responses	118	118	118
Percent (%) Responses	66.95%	5.08%	27.97%

Public Input - Concerns

Public Input Responses	Appropriate-ness of elementary standards	Not rigorous enough	Too difficult for teachers to understand	Too difficult for public to understand	Does not approve standards as written
Number of Responses	17	1	7	1	7
Total Responses	33	33	33	33	33
Percent (%) Responses	51.52%	3.03%	21.21%	3.03%	21.21%

Public Input - Implementation Concerns/Needs

Public Input Responses	Funding	Tech-nology / Re-sources	Time	Teacher Certi-fication	Profess-ional Develop-ment	Grad-uation Require-ment & Hath-away	CS should not be included in the BOG
Number of Responses	17	4	6	15	20	6	14
Total Responses	82	82	82	82	82	82	82
Percent (%) Responses	20.7%	4.9%	7.3%	18.3%	24.4%	7.3%	17.1%

Online Public Input Support Adoption

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"...seem very thorough and intensive. I like it! …"

"…. our goal is to teach students how to create technology through studying the academic subject of computer science..."

"Very thorough standards, helpful and informative supplemental material."

"These standards appear to incorporate the necessary learning K-12. Children are already conversant with computer at home..."

Online Public Input Support Adoption

WYOMING DEPARTMENT OF EDUCATION

"I am a parent and professional in the community... I am pleased to see of these standards are being considered and I'm in extreme favor."

"...Wyoming needs to join the 21st century!"

"Computer Science Standards are a MUST, and should be implemented in our schools. These standards need to be APPROVED, but should be taught across the curricula and should not be limited to just one content area."

Public Input at Hearings Support Adoption

WYOMING DEPARTMENT OF EDUCATION

"I think I have the same reaction to the doc that most folks would have. It seems enormous and overwhelming, but when I look at individual pages and think about how they can be used, the content of the doc comes back into focus. It's a big list all at once. But one standard at a time, I think it is useful and implementable."

"I really like the layout of the standards document and I think that the cross discipline connections…"

Public Input at Hearings Support Adoption

“I am currently a junior at Laramie. I think that there should be computer science standards across all grade levels because it ensures that all students in Wyoming will have an education in computer science...”

“ Computer science is critical and our employers are in dire need of workforce who have the these skills..”

Online Public Input
Not in Favor

WYOMING
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"As a parent I feel that the presentation of the standards is daunting...My main concern is for students to not spend an inordinate amount of time in front of computer screens..."

"...I feel as if these are not realistic expectations in elementary school unless speciality computer science instructors can be used..."

"...This set of standards is deep and wide K-12...These standards need to be reconsidered as to the scope and sequence especially in the K-2 and 3-5 span."

Online Public Input
Not in Favor

WYOMING DEPARTMENT OF EDUCATION

"The amount of information in these standards is immense. I don't know where this will fit into school years that are already packed beyond what can be adequately taught..."

"The Standards are extremely challenging and will be difficult to embed in existing middle school courses... Students and their families would be opposed to giving up those electives..."

"The proposed standards are not rigorous enough and are not really geared carefully towards job acquisition..."

Public Input at Hearings Not in Favor

WYOMING DEPARTMENT OF EDUCATION

"I Express concern to train from an HR standpoint. Hiring a mass amount of CS teachers K-5, MS, HS, keeping employees happy and satisfied using our salary standards."

"Should we expect any funding from the state to help assess some of the standards. The 9-R Domain for Networking and the Internet is one that I would like to have some support from the state. This would help purchase the materials to teach and assess these standards."

Public Input at Hearings Not in Favor

WYOMING DEPARTMENT OF EDUCATION

“... 6 points I want to make on CS 1) When it comes to developing monitoring benchmarks, WDE needs to be flexible with districts in doing that... 6) WDE and SBE to keep in mind the concern school districts have in the availability of trained CS teachers....We fear that it's going to be a massive gap, a significant workforce does not exist today, patience and flexibility are essential...”

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Results from Educator Input Survey

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Composition of Educator Survey

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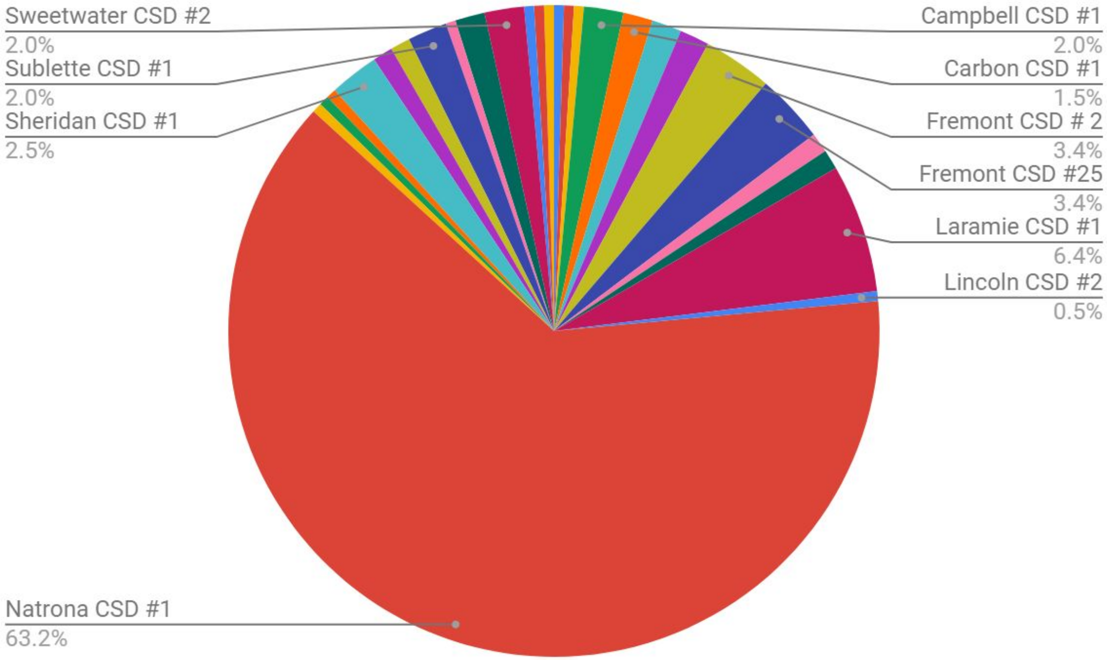
- Educators
  - 21 Computer Science
  - 116 Elementary
  - 65 Middle School
  - 4 High School
  - 5 Instructional Facilitators
  - 4 Principals
  - 1 Superintendent
  - 16 Other District Personnel

Composition of Educator Survey

WYOMING DEPARTMENT OF EDUCATION

- 27 School Districts (11 districts had 1 response)



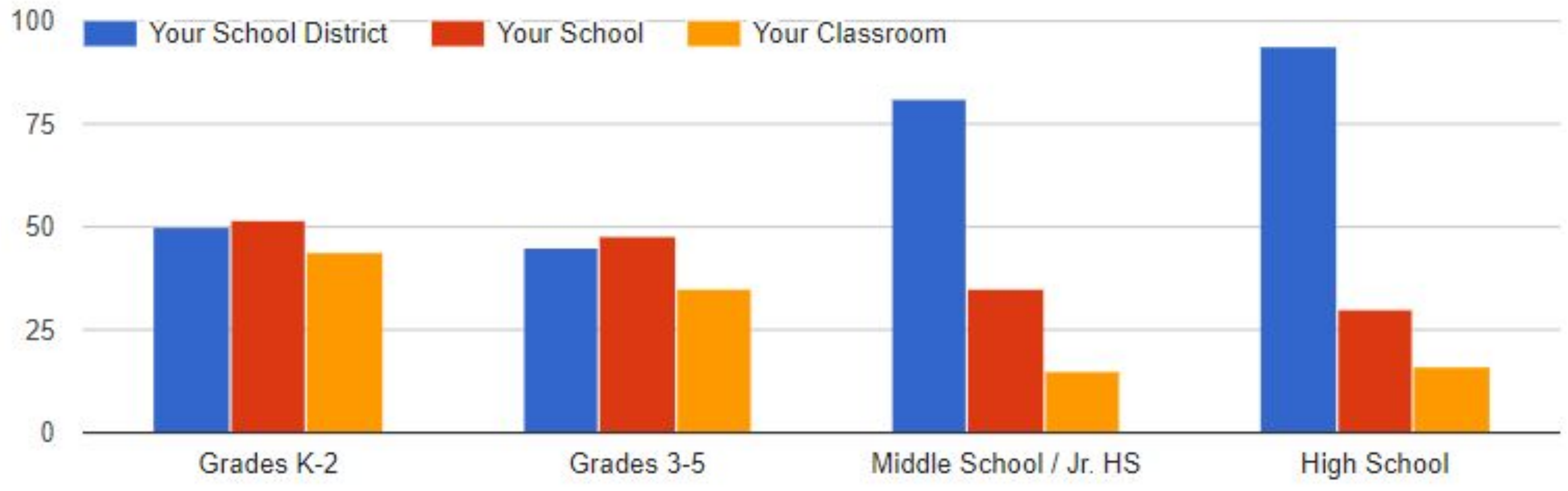
Educator Input Results
January 22 – March 3, 2019

WYOMING DEPARTMENT OF EDUCATION

Educator Responses	NE Region	NW Region	SE Region	SW Region	Private School
Number of Responses	145	21	28	16	2
Total Input	212	212	212	212	212
Percent (%) Responses	68.40%	9.91%	13.21%	7.55%	0.93%

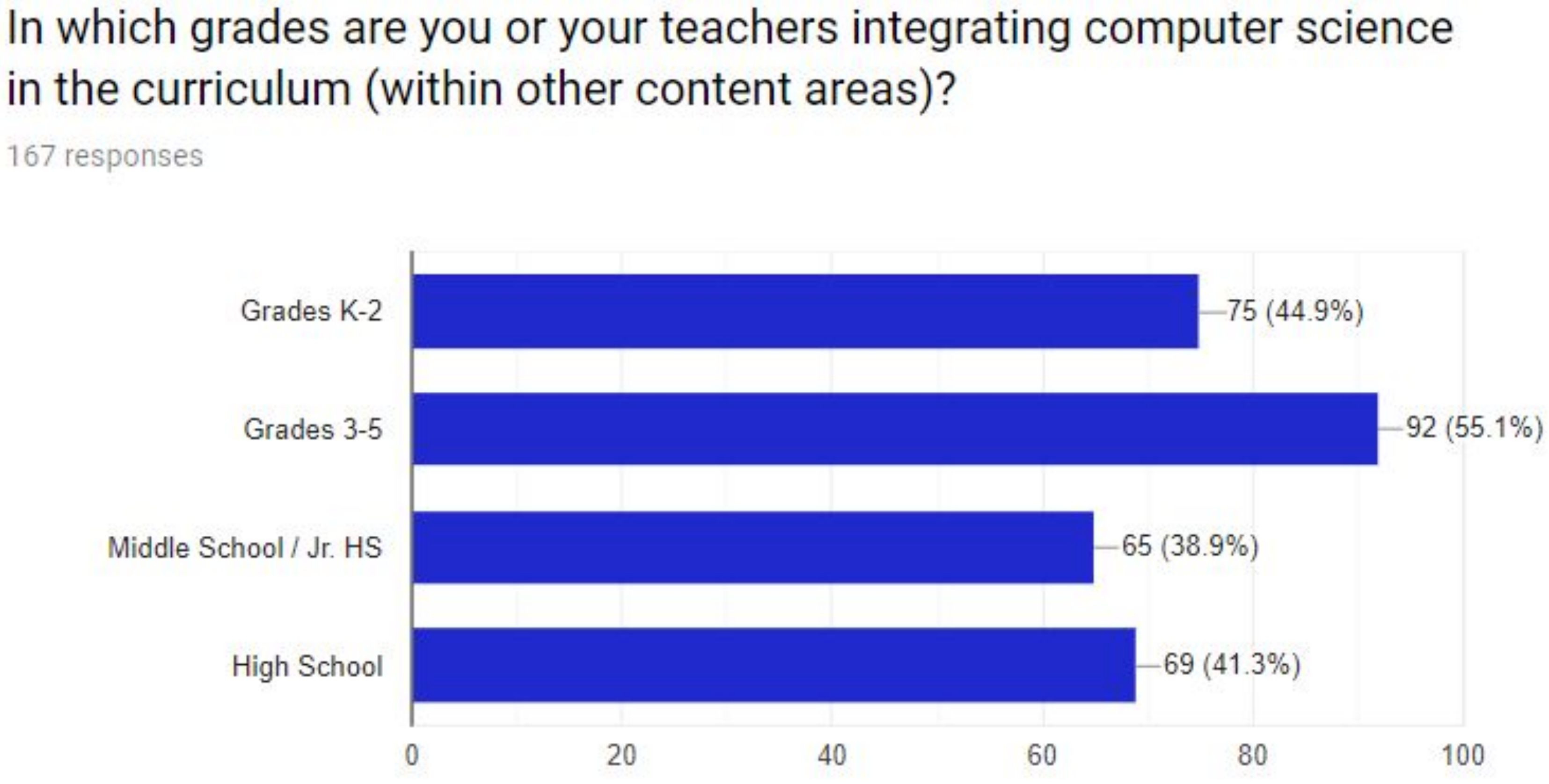
Grade Bands - CS Currently Taught

In which grade band(s) is computer science taught?



Integrating CS in Curriculum

WYOMING DEPARTMENT OF EDUCATION



Supporting Pieces

WYOMING DEPARTMENT OF EDUCATION

- 61% Clarification Statements (130)
- 38% CS Practices (80)
- 54% Benchmark Progressions (114)
- 49% Cross-Disciplinary Connections (104)
- 33% ISTE/Digital Learning Guidelines (71)

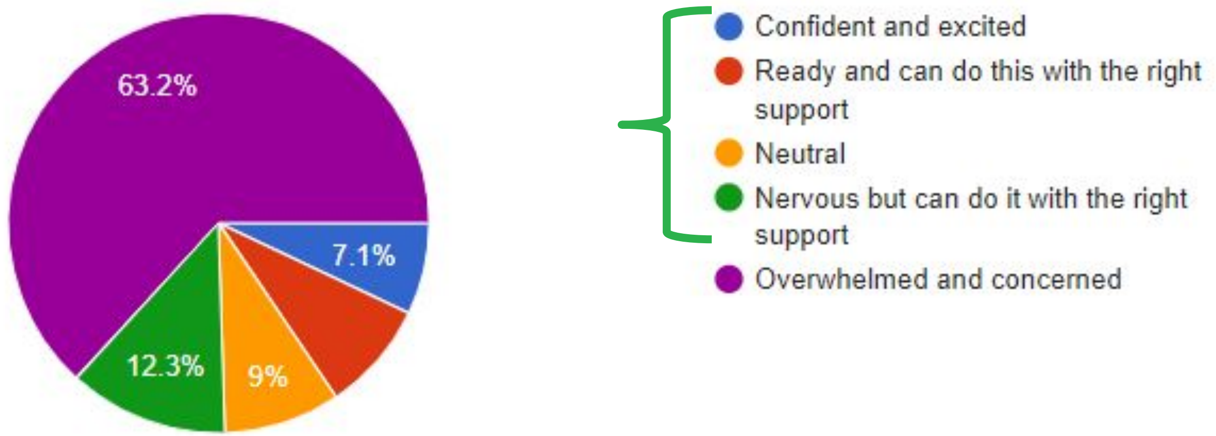
*Respondents had the option to select all that applied.

Comfort Level

WYOMING
DEPARTMENT OF EDUCATION

What is your comfort level on implementing these new CS Standards?

212 responses



37% Ready with Support +
63% Overwhelmed/Concerned

Comfort Level - Breakout

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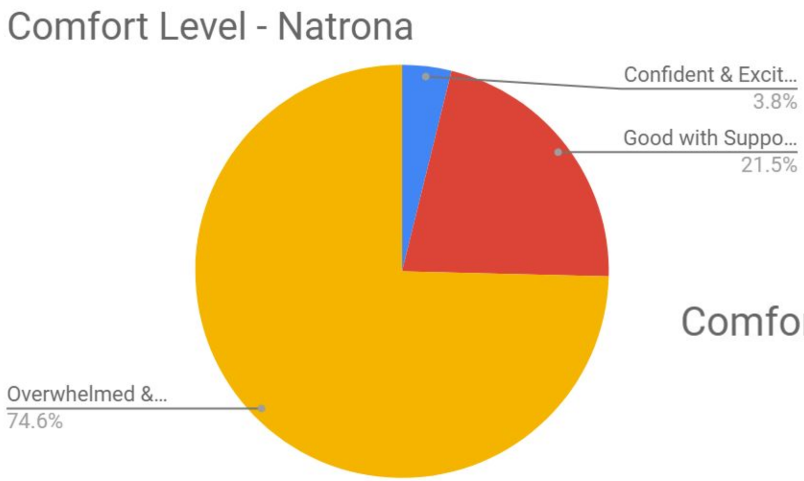

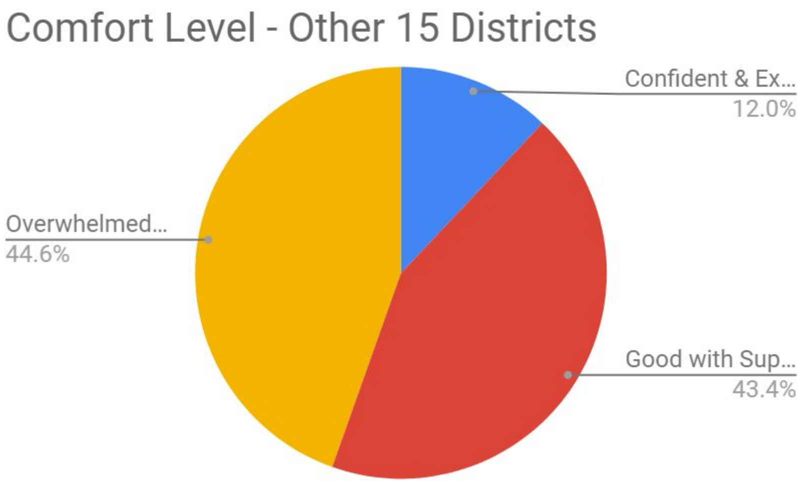

Legend

Confident & Excited

Good with Support / Neutral

Overwhelmed & Concerned

Clear Learning Progressions

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67.5 % YES   32.5% NO

"It is nice to have the Standard Devices that show basically when something would be introduced (and "with guidance")..."

"Progression is logical ... We need Professional Development as well as the technical equipment required."

"Although the progressions are clear, the logistics...(without significant negative impact on other tested content areas) is not."

43/99 (43%)

Those who marked No had the opportunity to comment on their concerns. Most of these comments did not relate to the question.

Clear Learning Progressions (cont.)

WYOMING
DEPARTMENT OF EDUCATION

"The standards are complicated and hard to understand."

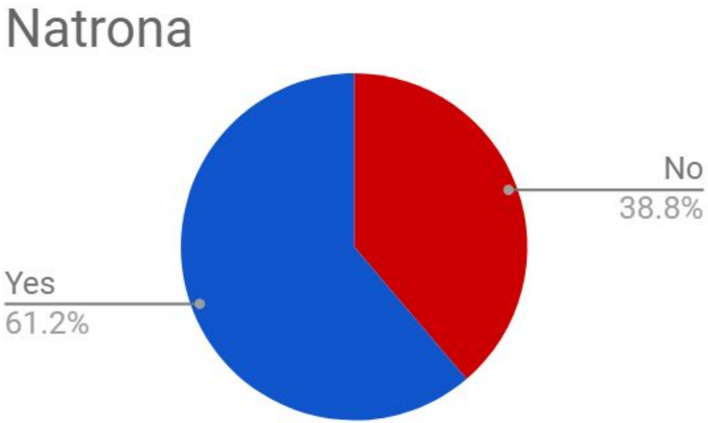
". . . there are some very high expectations for elementary... unreasonable for our younger students -- with or without assistance."

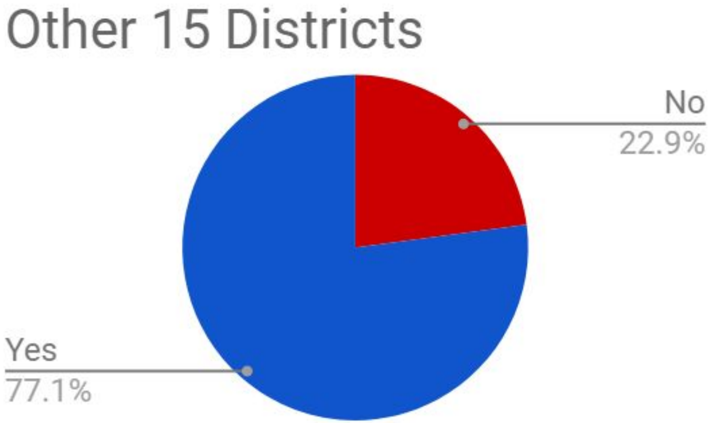
". . . not every student needs all of this!"

"The(y) do not seem to align without gaps."

" We need Professional Development as well as the technical equipment required."

Clear Learning Progressions - Breakout





Legend
Yes
No

Learning Progression Concerns

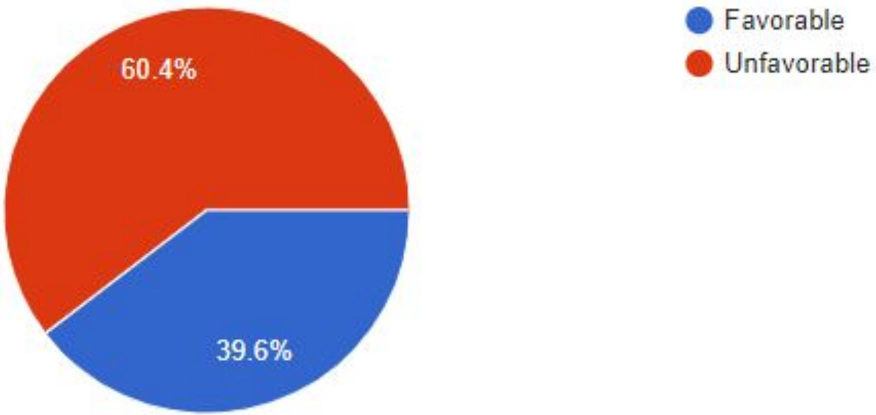
WYOMING DEPARTMENT OF EDUCATION

Concerns	Not Age Appro-priate	Scope is too Large	Needs Grade Level Break-down	Too Complex	Lack of Teacher-Friendly Language	Other
# of Responses	9	10	6	15	6	10
Total Input	56	56	56	56	56	56
Percent (%) Responses	16.07%	17.86%	10.71%	26.79%	10.71%	17.86%

Structure of CS Standards for Instruction

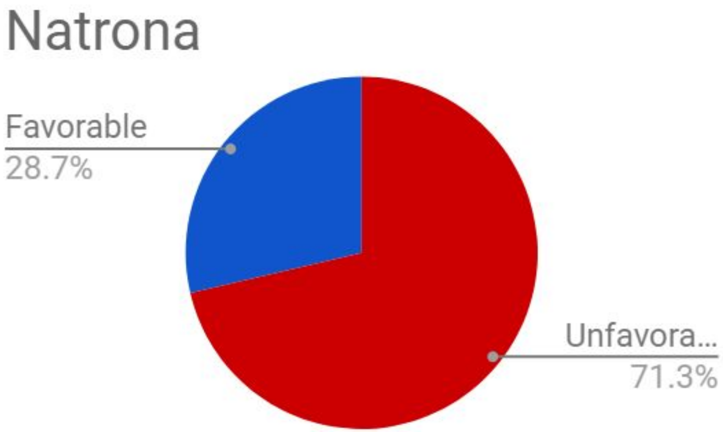
What is your feedback on the overall structure of the CS Standards with regard to instruction?

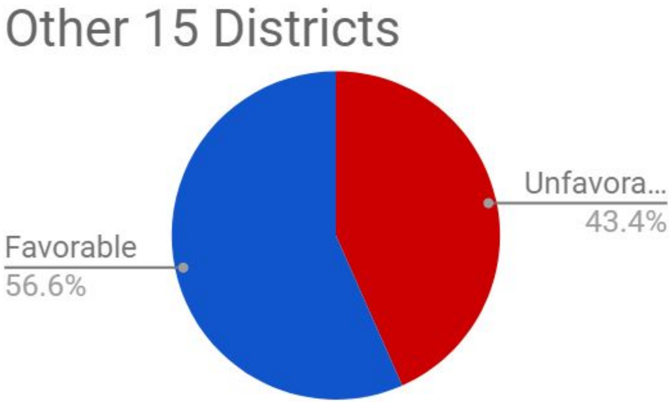
212 responses



We hadn't left a spot to comment on this question, so we don't know what were their concerns.

Structure of CS Standards for Instruction



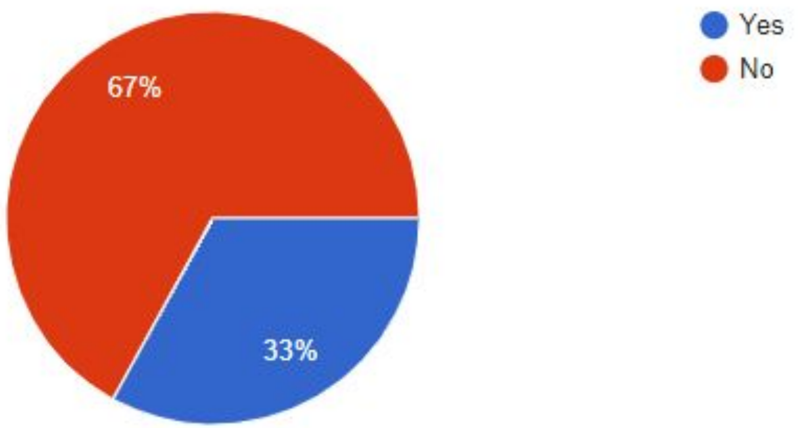


Legend
Favorable
Unfavorable

Appropriately Challenging

Are the expectations of the CS Standards appropriately challenging, yet accessible for students?

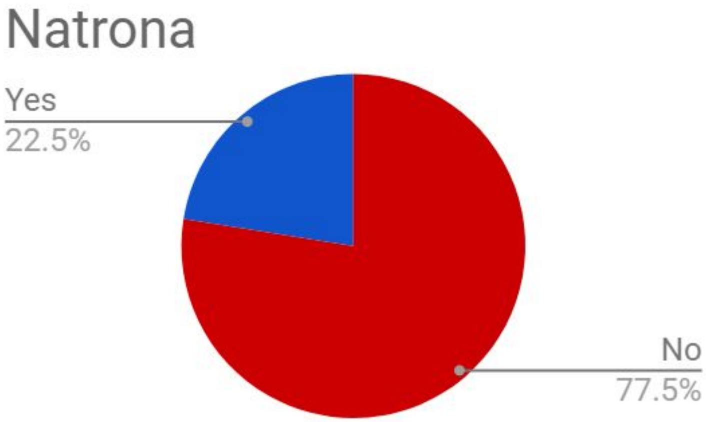
212 responses

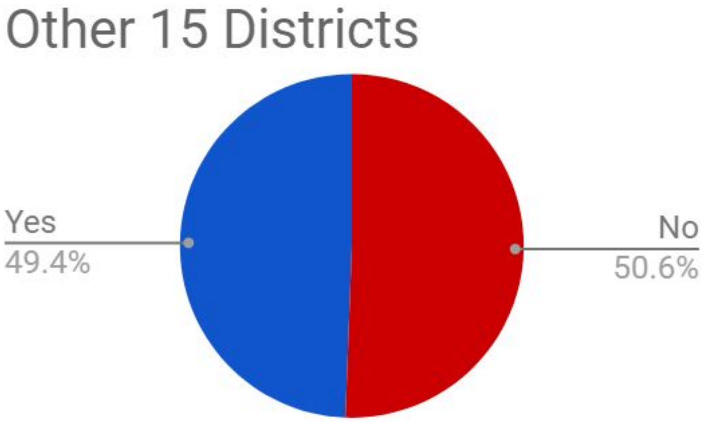


103/176 (59%)

Those who marked No had the opportunity to comment on their concerns. Most of these comments did not relate to the question.

Appropriately Challenging





Legend
Yes
No

Appropriately Challenging Concerns

WYOMING DEPARTMENT OF EDUCATION

Concern	Not Age Appropriate	More Details Needed	Too Complex	Lack of Teacher Friendly Language	Other
Number of Responses	45	3	12	4	9
Total Input	73	73	73	73	73
Percent (%) Responses	61.64%	4.11%	16.44%	5.48%	12.33%

Comments on Appropriately Challenging

"... too ambitious and in many cases not developmentally appropriate."

"The elementary standards are far too complex and not developmentally appropriate for what the younger students are able to do."

"“I don't feel that children with learning difficulties will do well with these new standards."

"We do not have that kind of updated technology."

Comments on Appropriately Challenging

WYOMING DEPARTMENT OF EDUCATION

"It is a specialty that I have no knowledge about, I am not comfortable teaching without some sort of training."

"It is not possible to fit all the expectations from the standards in my school day . . ."

" . . .already too much on the K-2 plate and K-2 standards make it hard to know what to teach."

"When will this fit into the day and who will be expected to teach this new standards?"

Do the CS Standards Prepare Students for the Future?

WYOMING DEPARTMENT OF EDUCATION

67.9 %YES 32.1% NO

56/88 (64%)

Those who marked No had the opportunity to comment on their concerns. Most of these comments did not relate to the question.

Prepare Student for the Future?

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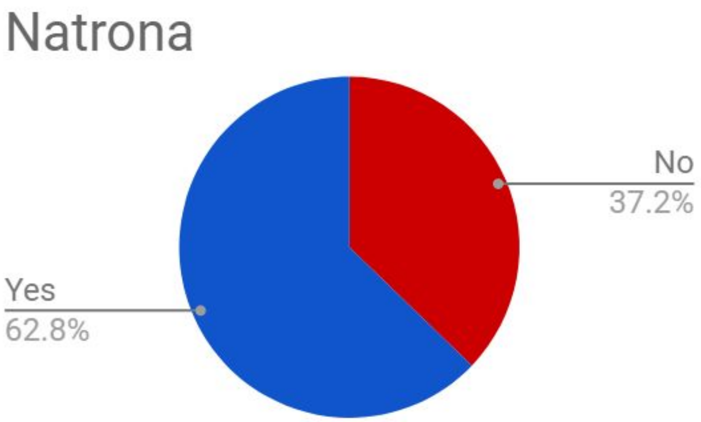

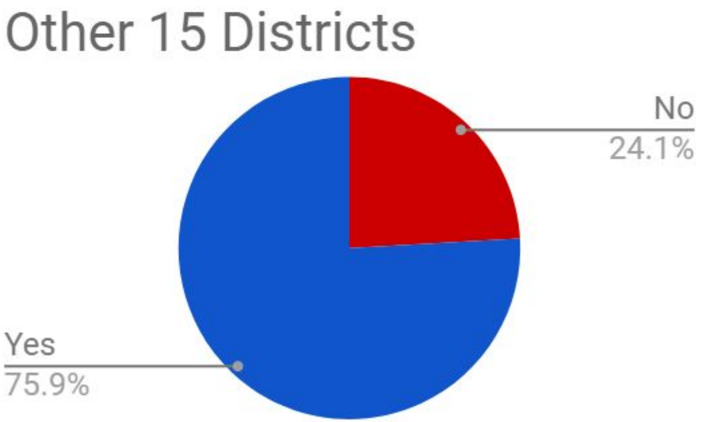

Legend
Yes
No

Educators’ Survey - Additional Questions

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- What does your **district need** to implement the CS Standards (e.g., instructional materials, technologies, professional development)?
- What does a **teacher need** to implement the CS Standards at the classroom level (e.g., instructional materials, technologies, professional development)?
- How might the **WDE support** districts and teachers through the CS Standards implementation process?

Input for the SBE

WYOMING DEPARTMENT OF EDUCATION

Question Posed:

Is there anything else you would like the State Board of Education to know about your review of the CS Standards?

Support Input for the SBE

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DEPARTMENT OF EDUCATION

“I am very excited about having these standards. We have needed them for awhile. I truly believe it will help prepare our students for the future.”

“It's definitely a step in the right direction.”

“I love the idea of implementing these standards as a state requirement. Wyoming needs to stay with the growing fields that this type of curriculum can provide.”

“The seem closely aligned to other states who have implemented.”

Unfavorable Input for the SBE

WYOMING
DEPARTMENT OF EDUCATION

“I believe that students will suffer in Math and LA if these standards are not simplified.”

“I think of my peers that only use technology to check their email. We have a lot of work to do to implement these standards.”

“Finding instructional time K-5 will be a real struggle. The practices aren't that difficult, but how will they be measured?”

“This is a joke. All I've seen over the past 6 years is budget cuts and lack of funding for what we are already expected to teach. This doesn't seem well thought through at all.”

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Plans for Implementation, Communication, and Professional Development

BOOT UP WYOMING

Implementation Plan

WYOMING
DEPARTMENT OF EDUCATION

2019 Wyoming Computer Science Content and Performance Standards			
State Support - WDE	Phase 1: Awareness / Planning [2018-2020]	Phase 2: Transition / Implementation [2020-2022]	Phase 3: Full Implementation [2022-2023]
	❑ Conduct Educators survey to determine implementation needs ❑ Provide Updates through Superintendent's Memo, Edmodo, Facebook, Twitter, state Conferences ❑ Follow Updates on states working with implementation standards similar to the proposed 2019 WY CS Standards ❑ Membership in CSTA and ISTE to remain current on CS standards related issues ❑ Develop communication plan for the 2019 WY CS Standards	❑ Develop toolkit on WDE website with resources for the 2019 WY CS Standards ❑ Develop and provide professional development focused on the 2019 WY CS Standards ❑ Update website with resources ❑ Maintain membership to professional organizations focused on computer science education ❑ Maintain statewide communication regarding implementation for the 2019 WY CS Standards	❑ Maintain membership to professional organizations focused on computer science education ❑ Maintain statewide communication regarding implementation for the 2019 WY CS Standards ❑ Continue to develop and maintain resources and toolkit on the WDE website ❑ Develop and provide professional development on the 2019 WY CS Standards ❑ Collect feedback from districts on standards implementation
Recommended District Support	Phase 1: Awareness / Planning [2018-2020]	Phase 2: Transition / Implementation [2020-2022]	Phase 3: Full Implementation [2022-2023]
	❑ Review standards and contact WDE with questions or to clarify the standards' document ❑ Consider possible impacts of the computer science standards on curriculum, district assessments and instruction	❑ Develop an implementation plan for the maintain statewide communication regarding implementation for the 2019 WY CS Standards ❑ Review alignment of potential curricular resources	❑ Provide feedback to WDE on implementation of the of the 2019 WY CS Standards ❑ Evaluate implementation of the 2019 WY CS Standards ❑ Review curriculum district assessments and instructional practices

Communication Plan

WYOMING DEPARTMENT OF EDUCATION

<table>
<tr><th colspan="4">2019 Wyoming Computer Science Content and Performance Standards</th></tr>
<tr><th>State Support - WDE</th><th>Phase 1: Awareness / Planning
[2018-2020]</th><th>Phase 2: Transition
[2020-2022]</th><th>Phase 3: Implementation
[2022-2023]</th></tr>
<tr><td></td><td>❑ Gather contact information for individuals interested in serving on the Computer Science Standards Committee:
• Educators (K-12, Administrators, Higher Education)
• Parents, Community
• Business/Industry
• Students
❑ Provide information about the standards process and invite members of the public to serve on the committee
❑ Press release – announcing open public comment timeframe and hearings
❑ Add resources and supporting documents to the WDE website / toolkit as needed</td><td>❑ Inform districts and the public of the computer science standards on the WDE website
❑ Provide updates at content conferences in Wyoming
❑ Educate school districts on the structure and layout of the proposed standards
❑ Gather district feedback
❑ Create of a professional development plan
❑ Create of an implementation plan</td><td>❑ Inform school districts and public of 2019 WY CS Standards and available online resources
❑ Send communication through media streams including Edmodo / WDE newsletter / WDE social media
❑ Maintain communication regarding statewide implementation
❑ Updated professional development opportunities</td></tr>
<tr><th>Modes of Communication</th><th>Primary</th><th>Secondary</th><th>Supporting</th></tr>
<tr><td></td><td>• WDE Website
• Superintendent's Memo
• WDE Press Release
• WDE Standards Newsletter</td><td>• FAQs
• Social Media – Facebook, Twitter
• Professional Learning Communities - Edmodo</td><td>• NPR Radio</td></tr>
</table>

Professional Development Plan

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DEPARTMENT OF EDUCATION

2019 Wyoming Computer Science Content and Performance Standards			
State Support - WDE	Phase 1: Awareness / Planning [2018-2020]	Phase 2: Transition [2020-2022]	Phase 3: Implementation [2022-2023]
	❑ When adopted, post 2019 WY CS Standards on WDE website ❑ Survey districts on PD needs and develop PD plan ❑ Educate on the structure and layout of the 2019 WY CS Standards ❑ Provide updates at conferences within the state ❑ Create resources / documents/ videos on the WDE website / toolkit ❑ Present standard's timeline and computer science processes to the State Board of Education, WCDA, and other PD events	❑ Monitor district needs and collect feedback on implementation of the 2019 WY CS Standards ❑ Respond to individual district's questions ❑ Provide professional development through WDE newsletter ❑ Develop and facilitate professional development opportunities on the 2019 WY CS Standards ❑ Update and maintain resources on the WDE website ❑ Update and share new information at statewide events(e.g., WCDA, SBE, STEAM, Innovations) ❑ Provide resources and PD opportunities on Edmodo	❑ Assess districts progress on implementation of the 2019 WY CS Standards ❑ Respond to individual district questions ❑ Update and maintain professional development through memos, Edmodo, and WDE Standards' newsletter ❑ Prepare and share best practices through professional development around implementing the 2019 WY CS Standards ❑ Facilitate professional development opportunities on the 2019 WY CS Standards ❑ Update and maintain resources on the WDE website ❑ Update and share new information at statewide events ❑ Provide resources and PD opportunities on Edmodo

Clarification on Proposed 2019 Computer Science Standards

BOOT UP WYOMING

Computing Systems Concerns

WYOMING DEPARTMENT OF EDUCATION

- 91/130 benchmarks (70%) can be met through unplugged learning opportunities.

Grade Band	K-2	3-5	6-8	HS - L1	HS - L2
Benchmarks Requiring Technology (Software, Hardware)	7, 5	7	7	10	8
Total Benchmarks	18	23	25	35	29
Percent (%)	39%, 28%	30%	28%	29%	28%

Algorithms & Programming Concerns

WYOMING
DEPARTMENT OF EDUCATION

K-2, 3-5 grade bands:

- 40/41 (98%) benchmarks can be met by a combination of Math and Science Cross Disciplinary Connections.
- 37/41 (90%) benchmarks can be accomplished through unplugged activities.
    - Of the remaining 4, which require technology (hardware and/or software), all 4 benchmarks can be met through an Hour of Code activity.

BOOT UP WYOMING

WYOMING DEPARTMENT OF EDUCATION

Laurie Hernandez, M.Ed.
Standards & Assessment Director

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2019 WYOMING COMPUTER SCIENCE

CONTENT AND PERFORMANCE STANDARDS

BOOT UP WYOMING

Effective MONTH XX, 2019

TO BE FULLY IMPLEMENTED IN DISTRICTS BY THE BEGINNING OF SCHOOL YEAR 2022-23

ACKNOWLEDGEMENT

The Wyoming State Board of Education would like to thank the Wyoming Department of Education, as well as educators, parents and community members, business and industry representatives, community college representatives, and the University of Wyoming representatives for their help with the development of these computer science standards.

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Wyoming Department of Education

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BOOT UP WYOMING

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INTRODUCTION:

The Wyoming Computer Science Content and Performance Standards (WYCPS) were developed in accordance with Wyoming State Statute W.S. 21-2-304(c). The 2019 Wyoming Computer Science Standards were developed collaboratively through the contributions of the Computer Science Standards Review Committee (CSSRC) which included Wyoming parents, educators, and community members, as well as business members from across the state and nation. The committee's work was informed and guided by initial public input through community forums, as well as input solicited from specific stakeholder groups.

RATIONALE:

The committee's (CSSRC) vision is that every student in every school has the opportunity to learn computer science. We believe that computing is fundamental to understanding and participating in an increasingly technological society, and it is essential for every Wyoming student to learn as part of a modern education. We see computer science as a subject that provides students with a critical lens for interpreting the world around them and challenges them to explore how computing and technology can expand Wyoming's impact on the world.

The standards we (CSSRC) present here provide the necessary foundation for local school district decisions about curriculum, assessment, and instruction. Implementation of these standards will better prepare Wyoming high school graduates for the rigors of college and/or career. In turn, Wyoming employers will be able to hire workers with a strong foundation in Computer Science—both in specific content areas and in critical thinking and inquiry-based problem solving.

In grades K-8, the committee (CSSRC) provides suggested progressions embedded within each grade band. The purpose is to show how each grade level could address the standard in a sequential and logical manner as well as to emphasize the importance of repetition of specific skills. Assessments should align to the end-of-grade-band benchmark, highlighted in gold on the right-hand side of the document.

In grades 9-12, the committee provides level 1 and level 2 benchmarks. Level 1 benchmarks include introductory skills. The level 2 benchmarks are intended for students who wish to advance their study of Computer Science. All level 1 and level 2 benchmarks are intended to be assessed for students taking courses covering the skills described in the benchmark.

ORGANIZATION OF THE COMPUTER SCIENCE (CS) STANDARDS:

Content Standards

Content standards define what students are expected to know and be able to do throughout their study of computer science. They do not dictate what methodology or instructional materials should be used, nor how the material is delivered.

Benchmarks

Benchmarks are the skills students must master in order to demonstrate proficiency of the content standards throughout the grade band. In this standards document, you will find end-of-grade band benchmarks for grades K-8, along with suggested progressions for meeting the end-of-grade band benchmark, highlighted in gold. In grades 9-12, benchmarks are organized into 2 levels. Mostly, Level 1 is intended to represent the introductory level while Level 2 reaches a deeper level.

Performance Level Descriptors (PLDs)

Performance Level Descriptors (PLDs) describe the performance expectations of students for each of the four (4) performance level categories: advanced, proficient, basic, and below basic.

Clarification Statement

Statements which provide further explanation or examples to support teachers in instruction.

Domain

The core concepts to be studied in computer science are as follows: 1) Computing Systems; 2) Networks and the Internet; 3) Data and Analysis; 4) Algorithms and Programming; and 5) Impacts of Computing.

WYOMING 2019 COMPUTER SCIENCE DOMAINS & STANDARDS

Computing Systems	Networks & The Internet	Data Analysis	Algorithms & Programming	Impacts of Computing
CS.D—Devices **CS.HS—Hardware & Software** **CS.T—Troubleshooting**	**NI.NCO—Network Communication & Organization** **NI.C—Cybersecurity**	**DA.S—Storage** **DA.CVT—Collection, Visualization, & Transformation** **DA.IM—Inference & Models**	**AP.A—Algorithms** **AP.V—Variables** **AP.C—Control** **AP.M—Modularity** **AP.PD—Program Development**	**IC.C—Culture** **IC.SI—Social Interactions** **IC.SLE—Safety, Law, & Ethics**

COMPUTER SCIENCE (CS) PRACTICES:

There are seven (7) CS Practices that are to be embedded in curriculum and instruction as the standards and benchmarks are taught and measured. The seven (7) CS Practices are listed below, and are more deeply explored on the next several pages. These CS Practices are also displayed on the introductory pages in front of each grade-band set of standards. For each grade-band, only the CS Practices that relate are in black text and the others are grayed so the reader can still see them as a set, but will know which ones apply to that particular set of standards.

Practice 1. Fostering an Inclusive Computing Culture

Practice 2. Collaborating Around Computing

Practice 3. Recognizing and Defining Computational Problems

Practice 4. Developing and Using Abstractions

Practice 5. Creating Computational Artifacts

Practice 6. Testing and Refining Computational Artifacts

Practice 7. Communicating About Computing

WYOMING CROSS-DISCIPLINARY CONNECTIONS

At the bottom of each standard's page, you will find where these computer science standards tie in with other content areas, such as the following:

Math	**Science**
Career & Vocational Education	**ELA**
Social Studies	**P.E.**
Fine & Performing Arts	**Health**

These standards can be found on the WDE website at http://edu.wyoming.gov/standards.

INTERNATIONAL SOCIETY FOR TECHNOLOGY IN EDUCATION (ISTE) STANDARDS / WY DIGITAL LEARNING (DL) GUIDELINES

The Committee suggests educators use the following ISTE Standards for Students in their computer science curriculum, instruction, and activities, where appropriate. A committee was convened and developed the Wyoming Digital Learning Guidelines to assist educators in what education technology should be used at each grade level to best prepare students. (see Appendix B)

2016 ISTE STANDARDS FOR STUDENTS

1. **Empowered Learner**
2. **Digital Citizen**
3. **Knowledge Constructor**
4. **Innovative Designer**
5. **Computational Thinker**
6. **Creative Communicator**
7. **Global Collaborator**

COMPUTER SCIENCE:

Computer Science is the study of computing principles, design, and applications (hardware & software); the creation, access, and use of information through algorithms and problem solving, and the impact of computing on society.

COMPUTATIONAL THINKING:

Computational thinking is a necessary and meaningful 21st century skill. Computational thinking is defined as the thought processes involved in formulating a problem and expressing its solutions in such a way that a computer (human or machine) can effectively carry them out. Computational thinking develops into competencies in problem solving, critical thinking, productivity, and creativity. Over time, engaging in computational thought builds a student's capacity to persevere, work efficiently, gain confidence, recognize and resolve ambiguity, generalize concepts, and communicate effectively. In order to adapt to global advancements in technology, students will need to use their computational thinking skills to formulate, articulate, and discuss solutions in a meaningful manner.

APPENDICES

APPENDIX A: GLOSSARY

APPENDIX B: WYOMING DIGITAL LEARNING GUIDELINES (based on the 2016 ISTE Standards for Students)

RESOURCES / REFERENCES

K-12 Computer Science Framework, (2016). Retrieved from http://k12cs.org/. [Ch. 5 Practices].

International Society for Technology in Education (ISTE) Standards for Students, (2016). Retrieved from http://www.iste.org/.

Computer Science Teachers Association (CSTA), (2017). Retrieved from http://www.csteachers.org/page/standards.

How to Read This Document (Grades K-8)

Domain
Cluster related to the standard.

Content Standards
Content standards define what students are expected to know and be able to do throughout their study of computer science. They do not dictate what methodology or instructional materials should be used, nor how the material is delivered.

Benchmarks
Benchmarks are the skills students must master in order to demonstrate proficiency of the content standards throughout the grade band.

Clarification Statement
Statements provide further explanation or examples to support educators.

BOOT UP WYOMING

2019 Wyoming Computer Science Standards

Grade Band: 6-8

Domain: Algorithms & Programming	Practice(s): 1.1, 2.3

By end of Grade 8

Standard: Program Development			
	6.AP.PD.01 Using grade appropriate content and complexity, seek and incorporate feedback from team members and users to refine a solution to a problem.	**7.AP.PD.01** Using grade appropriate content and complexity, seek and incorporate feedback from team members and users to refine a solution to a problem.	**8.AP.PD.01** Using grade appropriate content and complexity, seek and incorporate feedback from team members and users to refine a solution to a problem.

Clarification Statement: Development teams that employ user-centered design create solutions (e.g., programs and devices) that can have a large societal impact, such as an app that allows people with speech difficulties to translate hard-to-understand pronunciation into understandable language. Students should begin to seek diverse perspectives throughout the design process to improve their computational artifacts. Considerations of the end-user may include usability, accessibility, age-appropriate content, respectful language, user perspective, pronoun use, color contrast, and ease of use.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	MS-ETS1-1, MS-ETS1-2, MS-ETS1-3, MS-ETS1-4	CV8.2.1, CV8.4.1	7b - Global Collaborator
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
W.8.7			PE 8.3.3 HE8.2.1

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Grade Band

Computer Practices
There are seven (7) CS Practices that are to be embedded in curriculum and instruction as the standards and benchmarks are taught and measured.

Benchmark Labeling
8.AP.PD.01
8 (Grade Level)
AP (Domain - Algorithms & Programming)
PD (Standard - Program Development)
01 (Benchmark #1 in the Standard)

Gold Benchmark
In this standards document, you will find end-of-grade band benchmarks for grades K-8, along with suggested progressions for meeting the end-of-grade band benchmark, highlighted in gold. In grades 9-12, benchmarks are organized by levels.

Cross-Disciplinary Connections
Connections to real-world concepts and standards. These are intended to be suggestions and may be relevant depending on the curriculum and instruction.

2016 ISTE Standards / WY DL Guidelines
The ISTE Standards for Students are designed to empower student voice and ensure that learning is a student-driven process. Wyoming Digital Learning Guidelines assist educators in what education technology should be used at each grade level to best prepare students.

How to Read This Document (Grades 9-12)

Domain
Cluster related to the standard.

Content Standards
Content standards define what students are expected to know and be able to do throughout their study of computer science. They do not dictate what methodology or instructional materials should be used, nor how the material is delivered.

Benchmarks
Benchmarks are the skills students must master in order to demonstrate proficiency of the content standards throughout the grade band.

Clarification Statement
Statements provide further explanation or examples to support educators.

BOOT UP WYOMING

2019 Wyoming Computer Science Standards

Grade Band: 9-12

Domain: Algorithms & Programming	**Practice(s): Level 1: 5.2; Level 2: 4.2**

By end of Grade 12

Standard: Algorithms	**L1.AP.A.01** Create a prototype that uses algorithms (e. g., searching, sorting, finding shortest distance) to provide a possible solution for a real-world problem relevant to the student.	**L2.AP.A.01** Critically examine and trace classic algorithms. Use and adapt classic algorithms to solve computational problems (e.g., selection sort, insertion sort, binary search, linear search).
Clarification Statement:	**Level 1:** The process of developing computational artifacts embraces both creative expression and the exploration of ideas to create prototypes and solve computational problems. Students create artifacts that are personally relevant or beneficial to their community and beyond. Students should develop artifacts in response to a task or a computational problem that demonstrate the performance, reusability, and ease of implementation of an algorithm. A prototype is a computational artifact that demonstrates the core functionality of a product or process. Prototypes are useful for getting early feedback in the design process, and can yield insight into the feasibility of a product.	

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
L1—F.IF.A.1 L2—F.IF.A.1, F.IF.A.3, F.IF.C.9		L1—CV12.3.1, CV12.4.4, CV12.5.1, CV12.5.2, CV12.5.4 L2—CV12.4.4, CV12.5.1, CV12.5.2, CV12.5.4	L1—4a, 4d - Innovative Designer L2—4a - Innovative Designer
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

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Grade Band

Computer Practices
There are seven (7) CS Practices that are to be embedded in curriculum and instruction as the standards and benchmarks are taught and measured.

Benchmark Labeling
L2.AP.A.01
L2 (HS Level #2)
AP (Domain - Algorithms & Programming)
PD (Standard - Algorithms)
01 (Benchmark #1 in the Standard)

Gold Benchmarks
In grades 9-12, benchmarks are organized into **2 levels**. Mostly, Level 1 is intended to be at the introductory level, and Level 2 reaches at a deeper level.

Cross-Disciplinary Connections
Connections to real-world concepts and standards. These are intended to be suggestions and may be relevant depending on the curriculum and instruction.

2016 ISTE Standards / WY DL Guidelines
The ISTE Standards for Students are designed to empower student voice and ensure that learning is a student-driven process. Wyoming Digital Learning Guidelines assist educators in what education technology should be used at each grade level to best prepare students.

DESCRIPTION OF COMPUTER SCIENCE (CS) PRACTICES

CS Practice 1. Fostering an Inclusive Computing Culture

Overview: Building an inclusive and diverse computing culture requires strategies for incorporating perspectives from people of different genders, ethnicities, and abilities. Incorporating these perspectives involves understanding the personal, ethical, social, economic, and cultural contexts in which people operate. Considering the needs of diverse users during the design process is essential to producing inclusive computational products.

By the end of Grade 12, students should be able to:

1.1 Include the unique perspectives of others and reflect on one's own perspectives when designing and developing computational products.

At all grade levels, students should recognize that the choices people make when they create artifacts are based on personal interests, experiences, and needs. Young learners should begin to differentiate their technology preferences from the technology preferences of others. Initially, students should be presented with perspectives from people with different backgrounds, ability levels, and points of view. As students progress, they should independently seek diverse perspectives throughout the design process for the purpose of improving their computational artifacts. Students who are well-versed in fostering an inclusive computing culture should be able to differentiate backgrounds and skill sets and know when to call upon others, such as to seek out knowledge about potential end users or intentionally seek input from people with diverse backgrounds.

1.2 Address the needs of diverse end users during the design process to produce artifacts with broad accessibility and usability.

At any level, students should recognize that users of technology have different needs and preferences and that not everyone chooses to use, or is able to use, the same technology products. For example, young learners, with teacher guidance, might compare a touchpad and a mouse to examine differences in usability. As students progress, they should consider the preferences of people who might use their products. Students should be able to evaluate the accessibility of a product to a broad group of end users, such as people with various disabilities. For example, they may notice that allowing an end user to change font sizes and colors will make an interface usable for people with low vision. At the higher grades, students should become aware of professionally accepted accessibility standards and should be able to evaluate computational artifacts for accessibility. Students should also begin to identify potential bias during the design process to maximize accessibility in product design. For example, they can test an app and recommend to its designers that it respond to verbal commands to accommodate users who are blind or have physical disabilities.

1.3 Employ self- and peer-advocacy to address bias in interactions, product design, and development methods.

After students have experience identifying diverse perspectives and including unique perspectives (P1.1), they should begin to employ self-advocacy strategies, such as speaking for themselves if their needs are not met. As students progress, they should advocate for their peers when accommodations, such as an assistive-technology peripheral device, are needed for someone to use a computational artifact. Eventually, students should regularly advocate for both themselves and others.

CS Practice 2. Collaborating Around Computing

Overview: Collaborative computing is the process of performing a computational task by working in pairs and on teams. Because it involves asking for the contributions and feedback of others, effective collaboration can lead to better outcomes than working independently. Collaboration requires individuals to navigate and incorporate diverse perspectives, conflicting ideas, disparate skills, and distinct personalities. Students should use collaborative tools to effectively work together and to create complex artifacts.

By the end of Grade 12, students should be able to:

2.1 Cultivate working relationships with individuals possessing diverse perspectives, skills, and personalities.

At any grade level, students should work collaboratively with others. Early on, they should learn strategies for working with team members who possess varying individual strengths. For example, with teacher support, students should begin to give each team member opportunities to contribute and to work with each other as co-learners. Eventually, students should become more sophisticated at applying strategies for mutual encouragement and support. They should express their ideas with logical reasoning and find ways to reconcile differences cooperatively. For example, when they disagree, they should ask others to explain their reasoning and work together to make respectful, mutual decisions. As they progress, students should use methods for giving all group members a chance to participate. Older students should strive to improve team efficiency and effectiveness by regularly evaluating group dynamics. They should use multiple strategies to make team dynamics more productive. For example, they can ask for the opinions of quieter team members, minimize interruptions by more talkative members, and give individuals credit for their ideas and their work.

2.2 Create team norms, expectations, and equitable workloads to increase efficiency and effectiveness.

After students have had experience cultivating working relationships within teams (P2.1), they should gain experience working in particular team roles. Early on, teachers may help guide this process by providing collaborative structures. For example, students may take turns in different roles on the project, such as note taker, facilitator, or “driver” of the computer. As students progress, they should become less dependent on the teacher assigning roles and become more adept at assigning roles within their teams. For example, they should decide together how to take turns in different roles. Eventually, students should independently organize their own teams and create common goals, expectations, and equitable workloads. They should also manage project workflow using agendas and timelines and should evaluate workflow to identify areas for improvement.

2.3 Solicit and incorporate feedback from, and provide constructive feedback to, team members and other stakeholders.

At any level, students should ask questions of others and listen to their opinions. Early on, with teacher scaffolding, students should seek help and share ideas to achieve a particular purpose. As they progress in school, students should provide and receive feedback related to computing in constructive ways. For example, pair programming is a collaborative process that promotes giving and receiving feedback. Older students should engage in active listening by using questioning skills and should respond empathetically to others. As they progress, students should be able to receive feedback from multiple peers and should be able to differentiate opinions. Eventually, students should seek contributors from various environments. These contributors may include end users, experts, or general audiences from online forums.

2.4 Evaluate and select technological tools that can be used to collaborate on a project.

At any level, students should be able to use tools and methods for collaboration on a project. For example, in the early grades, students could collaboratively brainstorm by writing on a white-board. As students progress, they should use technological collaboration tools to manage team-work, such as knowledge-sharing tools and online project spaces. They should also begin to make decisions about which tools would be best to use and when to use them. Eventually, students should use different collaborative tools and methods to solicit input from not only team members and classmates but also others, such as participants in online forums or local communities.

CS Practice 3. Recognizing and Defining Computational Problems

Overview: The ability to recognize appropriate and worthwhile opportunities to apply computation is a skill that develops over time and is central to computing. Solving a problem with a computational approach requires defining the problem, breaking it down into parts, and evaluating each part to

determine whether a computational solution is appropriate.

By the end of Grade 12, students should be able to:

3.1 Identify complex, interdisciplinary, real-world problems that can be solved computationally.

At any level, students should be able to identify problems that have been solved computationally. For example, young students can discuss a technology that has changed the world, such as email or mobile phones. As they progress, they should ask clarifying questions to understand whether a problem or part of a problem can be solved using a computational approach. For example, identify real-world problems that span multiple disciplines, such as increasing bike safety with new helmet technology, and can be solved computationally.

3.2 Decompose complex real-world problems into manageable sub-problems that could integrate existing solutions or procedures.

At any grade level, students should be able to break problems down into their component parts. In the early grade levels, students should focus on breaking down simple problems. For example, in a visual programming environment, students could break down (or decompose) the steps needed to draw a shape. As students progress, they should decompose larger problems into manageable smaller problems. For example, young students may think of an animation as multiple scenes and thus create each scene independently. Students can also break down a program into subgoals: getting input from the user, processing the data, and displaying the result to the user. Eventually, as students encounter complex real-world problems that span multiple disciplines or social systems, they should decompose complex problems into manageable subproblems that could potentially be solved with programs or procedures that already exist. For example, students could create an app to solve a community problem that connects to an online database through an application programming interface (API).

3.3 Evaluate whether it is appropriate and feasible to solve a problem computationally.

After students have had some experience breaking problems down (P3.2) and identifying subproblems that can be solved computationally (P3.1), they should begin to evaluate whether a computational solution is the most appropriate solution for a particular problem. For example, students might question whether using a computer to determine whether someone is telling the truth would be advantageous. As students progress, they should systematically evaluate the feasibility of using computational tools to solve given problems or subproblems, such as through a cost-benefit analysis. Eventually, students should include more factors in their evaluations, such as how efficiency affects feasibility or whether a proposed approach raises ethical concerns.

CS Practice 4. Developing and Using Abstractions

Overview: Abstractions are formed by identifying patterns and extracting common features from specific examples to create generalizations. Using generalized solutions and parts of solutions designed for broad reuse simplifies the development process by managing complexity.

By the end of Grade 12, students should be able to:

4.1 Extract common features from a set of interrelated processes or complex phenomena.

Students at all grade levels should be able to recognize patterns. Young learners should be able to identify and describe repeated sequences in data or code through analogy to visual patterns or physical sequences of objects. As they progress, students should identify patterns as opportunities for abstraction, such as recognizing repeated patterns of code that could be more efficiently implemented as a loop. Eventually, students should extract common features from more complex phenomena or processes. For example, students should be able to identify common features in multiple segments of code and substitute a single segment that uses variables to account for the differences. In a procedure, the variables would take the form of parameters. When working with data, students should be able to identify important aspects and find patterns in related data sets such as crop output, fertilization methods, and climate conditions.

4.2 Evaluate existing technological functionalities and incorporate them into new designs.

At all levels, students should be able to use well-defined abstractions that hide complexity. Just as a car hides operating details, such as the mechanics of the engine, a computer program's "move" command relies on hidden details that cause an object to change location on the screen. As they progress, students should incorporate predefined functions into their designs, understanding that they do not need to know the underlying implementation details of the abstractions that they use. Eventually, students should understand the advantages of, and be comfortable using, existing functionalities (abstractions) including technological resources created by other people, such as libraries and application programming interfaces (APIs). Students should be able to evaluate existing abstractions to determine which should be incorporated into designs and how they should be incorporated. For example, students could build powerful apps by incorporating existing services, such as online databases that return geolocation coordinates of street names or food nutrition information.

4.3 Create modules and develop points of interaction that can apply to multiple situations and reduce complexity.

After students have had some experience identifying patterns (P4.1), decomposing problems (P3.2), using abstractions (P4.2), and taking advantage of existing resources (P4.2), they should begin to develop their own abstractions. As they progress, students should take advantage of opportunities to develop generalizable modules. For example, students could write more efficient programs by designing procedures that are used multiple times in the program. These procedures can be generalized by defining parameters that create different outputs for a wide range of inputs. Later on, students should be able to design systems of interacting modules, each with a well-defined role, that coordinate to accomplish a common goal. Within an object-oriented programming context, module design may include defining interactions among objects. At this stage, these modules, which combine both data and procedures, can be designed and documented for reuse in other programs. Additionally, students can design points of interaction, such as a simple user interface, either text or graphical, that reduces the complexity of a solution and hides lower-level implementation details.

4.4 Model phenomena and processes and simulate systems to understand and evaluate potential outcomes.

Students at all grade levels should be able to represent patterns, processes, or phenomena. With guidance, young students can draw pictures to describe a simple pattern, such as sunrise and sunset, or show the stages in a process, such as brushing your teeth. They can also create an animation to model a phenomenon, such as evaporation. As they progress, students should understand that computers can model real-world phenomena, and they should use existing computer simulations to learn about real-world systems. For example, they may use a preprogrammed model to explore how parameters affect a system, such as how rapidly a disease spreads. Older students should model phenomena as systems, with rules governing the interactions within the system. Students should analyze and evaluate these models against real-world observations. For example, students might create a simple producer–consumer ecosystem model using a programming tool. Eventually, they could progress to creating more complex and realistic interactions between species, such as predation, competition, or symbiosis, and evaluate the model based on data gathered from nature.

CS Practice 5. Creating Computational Artifacts

Overview: The process of developing computational artifacts embraces both creative expression and the exploration of ideas to create prototypes and solve computational problems. Students create artifacts that are personally relevant or beneficial to their community and beyond. Computational artifacts can be created by combining and modifying existing artifacts or by developing new artifacts. Examples of computational artifacts include programs, simulations, visualizations, digital animations, robotic systems, and apps.

By the end of Grade 12, students should be able to:

5.1 Plan the development of a computational artifact using an iterative process that includes reflection on and modification of the plan, taking into account key features, time and resource constraints, and user expectations.

At any grade level, students should participate in project planning and the creation of brainstorming documents. The youngest students may do so with the help of teachers. With scaffolding, students should gain greater independence and sophistication in the planning, design, and evaluation of artifacts. As learning progresses, students should systematically plan the development of a program or artifact and intentionally apply computational techniques, such as decomposition and abstraction, along with knowledge about existing approaches to artifact design. Students should be capable of reflecting on and, if necessary, modifying the plan to accommodate end goals.

5.2 Create a computational artifact for practical intent, personal expression, or to address a societal issue.

Students at all grade levels should develop artifacts in response to a task or a computational problem. At the earliest grade levels, students should be able to choose from a set of given commands to create simple animated stories or solve pre-existing problems. Younger students should focus on artifacts of personal importance. As they progress, student expressions should become more complex and of increasingly broader significance. Eventually, students should engage in independent, systematic use of design processes to create artifacts that solve problems with social significance by seeking input from broad audiences.

5.3 Modify an existing artifact to improve or customize it.

At all grade levels, students should be able to examine existing artifacts to understand what they do. As they progress, students should attempt to use existing solutions to accomplish a desired goal. For example, students could attach a programmable light sensor to a physical artifact they have created to make it respond to light. Later on, they should modify or remix parts of existing programs to develop something new or to add more advanced features and complexity. For example, students could modify prewritten code from a single-player game to create a two-player game with slightly different rules.

CS Practice 6. Testing and Refining Computational Artifacts

Overview: Testing and refinement is the deliberate and iterative process of improving a computational artifact. This process includes debugging (identifying and fixing errors) and comparing actual outcomes to intended outcomes. Students also respond to changing needs and expectations of end users and improve the performance, reliability, usability, and accessibility of artifacts.

By the end of Grade 12, students should be able to:

6.1 Systematically test computational artifacts by considering all scenarios and using test cases.

At any grade level, students should be able to compare results to intended outcomes. Young students should verify whether given criteria and constraints have been met. As students progress, they should test computational artifacts by considering potential errors, such as what will happen if a user enters invalid input. Eventually, testing should become a deliberate process that is more iterative, systematic, and proactive. Older students should be able to anticipate errors and use that knowledge to drive development. For example, students can test their program with inputs associated with all potential scenarios.

6.2 Identify and fix errors using a systematic process.

At any grade level, students should be able to identify and fix errors in programs (debugging) and use strategies to solve problems with computing systems (troubleshooting). Young students could use trial and error to fix simple errors. For example, a student may try reordering the sequence of commands in a program. In a hardware context, students could try to fix a device by resetting it or checking whether it is connected to a network. As students progress, they should become more adept at debugging programs and begin to consider logic errors: cases in which a program works, but not as desired. In this way, students will examine and correct their own thinking. For

example, they might step through their program, line by line, to identify a loop that does not terminate as expected. Eventually, older students should progress to using more complex strategies for identifying and fixing errors, such as printing the value of a counter variable while a loop is running to determine how many times the loop runs.

6.3 Evaluate and refine a computational artifact multiple times to enhance its performance, reliability, usability, and accessibility.

After students have gained experience testing (P6.2), debugging, and revising (P6.1), they should begin to evaluate and refine their computational artifacts. As students progress, the process of evaluation and refinement should focus on improving performance and reliability. For example, students could observe a robot in a variety of lighting conditions to determine that a light sensor should be less sensitive. Later on, evaluation and refinement should become an iterative process that also encompasses making artifacts more usable and accessible (P1.2). For example, students can incorporate feedback from a variety of end users to help guide the size and placement of menus and buttons in a user interface.

CS Practice 7. Communicating About Computing

Overview: Communication involves personal expression and exchanging ideas with others. In computer science, students communicate with diverse audiences about the use and effects of computation and the appropriateness of computational choices. Students write clear comments, document their work, and communicate their ideas through multiple forms of media. Clear communication includes using precise language and carefully considering possible audiences.

By the end of Grade 12, students should be able to:

7.1 Select, organize, and interpret large data sets from multiple sources to support a claim.

At any grade level, students should be able to refer to data when communicating an idea. Early on, students should, with guidance, present basic data through the use of visual representations, such as storyboards, flowcharts, and graphs. As students progress, they should work with larger data sets and organize the data in those larger sets to make interpreting and communicating it to others easier, such as through the creation of basic data representations. Eventually, students should be able to select relevant data from large or complex data sets in support of a claim or to communicate the information in a more sophisticated manner.

7.2 Describe, justify, and document computational processes and solutions using appropriate terminology consistent with the intended audience and purpose.

At any grade level, students should be able to talk about choices they make while designing a computational artifact. Early on, they should use language that articulates what they are doing and identifies devices and concepts they are using with correct terminology (e.g., program, input, and debug). Younger students should identify the goals and expected outcomes of their solutions. Along the way, students should provide documentation for end users that explains their artifacts and how they function, and they should both give and receive feedback. For example, students could provide a project overview and ask for input from users. As students progress, they should incorporate clear comments in their product and document their process using text, graphics, presentations, and demonstrations.

7.3 Articulate ideas responsibly by observing intellectual property rights and giving appropriate attribution.

All students should be able to explain the concepts of ownership and sharing. Early on, students should apply these concepts to computational ideas and creations. They should identify instances of remixing, when ideas are borrowed and iterated upon, and give proper attribution. They should also recognize the contributions of collaborators. Eventually, students should consider common licenses that place limitations or restrictions on the use of computational artifacts. For example, a downloaded image may have restrictions that prohibit modification of an image or using it for commercial purposes.

Computer Science | K-2 Introduction

K-2 Students may be most familiar with touch devices. These students may not yet understand the use of computing devices beyond playing games. They may have emerging problem-solving skills and introductory level sequencing abilities, but their understanding of programming concepts may be limited.

By the end of 2nd grade, students can:

- Select appropriate programs for appropriate tasks
- Understand the relationship between hardware and software
- Identify, deconstruct, and troubleshoot problems
- Connect and use devices and peripherals
- Begin developing keyboarding skills and utilizing other input devices
- Protect and safeguard their information
- Collect, organize, and present information through creating a computational artifact
- Organize files and analyze data
- Follow and write step-by-step instructions
- Understand that real-world circumstances can be represented using computer programs
- Understand the steps involved in the iterative process
- Understand that computer technology has positive and negative effects
- Work respectfully and responsibly with others in an online environment

WYOMING 2019 COMPUTER SCIENCE DOMAINS & STANDARDS

Computing Systems	Networks & The Internet	Data Analysis	Algorithms & Programming	Impacts of Computing
CS.D—Devices CS.HS—Hardware & Software CS.T—Troubleshooting	NI.NCO—Network Communication & Organization NI.C—Cybersecurity	DA.S—Storage DA.CVT—Collection, Visualization, & Transformation DA.IM—Inference & Models	AP.A—Algorithms AP.V—Variables AP.C—Control AP.M—Modularity AP.PD—Program Development	IC.C—Culture IC.SI—Social Interactions IC.SLE—Safety, Law, & Ethics

K-2 Computer Science Practices

There are seven (7) CS Practices that are to be embedded in curriculum and instruction as the standards and benchmarks are taught and measured. The seven (7) CS Practices are listed below, and are more deeply explored on the next several pages. For each grade-band, only the CS Practices that relate are in black text and the others are grayed so the reader can still see them as a set, but will know which ones apply to that particular set of standards.

Practice 1. Fostering an Inclusive Computing Culture

Practice 2. Collaborating Around Computing

Practice 3. Recognizing and Defining Computational Problems

Practice 4. Developing and Using Abstractions

Practice 5. Creating Computational Artifacts

Practice 6. Testing and Refining Computational Artifacts

Practice 7. Communicating About Computing

DESCRIPTION OF K-2 COMPUTER SCIENCE (CS) PRACTICES

CS Practice 1. Fostering an Inclusive Computing Culture

Overview: Building an inclusive and diverse computing culture requires strategies for incorporating perspectives from people of different genders, ethnicities, and abilities. Incorporating these perspectives involves understanding the personal, ethical, social, economic, and cultural contexts in which people operate. Considering the needs of diverse users during the design process is essential to producing inclusive computational products.

By the end of Grade 12, students should be able to:

1.1 Include the unique perspectives of others and reflect on one's own perspectives when designing and developing computational products.

At all grade levels, students should recognize that the choices people make when they create artifacts are based on personal interests, experiences, and needs. Young learners should begin to differentiate their technology preferences from the technology preferences of others. Initially, students should be presented with perspectives from people with different backgrounds, ability levels, and points of view. As students progress, they should independently seek diverse perspectives throughout the design process for the purpose of improving their computational artifacts. Students who are well-versed in fostering an inclusive computing culture should be able to differentiate backgrounds and skill sets and know when to call upon others, such as to seek out knowledge about potential end users or intentionally seek input from people with diverse backgrounds.

1.2 Address the needs of diverse end users during the design process to produce artifacts with broad accessibility and usability.

At any level, students should recognize that users of technology have different needs and preferences and that not everyone chooses to use, or is able to use, the same technology products. For example, young learners, with teacher guidance, might compare a touchpad and a mouse to examine differences in usability. As students progress, they should consider the preferences of people who might use their products. Students should be able to evaluate the accessibility of a product to a broad group of end users, such as people with various disabilities. For example, they may notice that allowing an end user to change font sizes and colors will make an interface usable for people with low vision. At the higher grades, students should become aware of professionally accepted accessibility standards and should be able to evaluate computational artifacts for accessibility. Students should also begin to identify potential bias during the design process to maximize accessibility in product design. For example, they can test an app and recommend to its designers that it respond to verbal commands to accommodate users who are blind or have physical disabilities.

1.3 Employ self- and peer-advocacy to address bias in interactions, product design, and development methods.

After students have experience identifying diverse perspectives and including unique perspectives (P1.1), they should begin to employ self-advocacy strategies, such as speaking for themselves if their needs are not met. As students progress, they should advocate for their peers when accommodations, such as an assistive-technology peripheral device, are needed for someone to use a computational artifact. Eventually, students should regularly advocate for both themselves and others.

CS Practice 2. Collaborating Around Computing

Overview: Collaborative computing is the process of performing a computational task by working in pairs and on teams. Because it involves asking for the contributions and feedback of others, effective collaboration can lead to better outcomes than working independently. Collaboration requires individuals to navigate and incorporate diverse perspectives, conflicting ideas, disparate skills, and distinct personalities. Students should use collaborative tools to effectively work together and to create complex artifacts.

By the end of Grade 12, students should be able to:

2.1 Cultivate working relationships with individuals possessing diverse perspectives, skills, and personalities.

At any grade level, students should work collaboratively with others. Early on, they should learn strategies for working with team members who possess varying individual strengths. For example, with teacher support, students should begin to give each team member opportunities to contribute and to work with each other as co-learners. Eventually, students should become more sophisticated at applying strategies for mutual encouragement and support. They should express their ideas with logical reasoning and find ways to reconcile differences cooperatively. For example, when they disagree, they should ask others to explain their reasoning and work together to make respectful, mutual decisions. As they progress, students should use methods for giving all group members a chance to participate. Older students should strive to improve team efficiency and effectiveness by regularly evaluating group dynamics. They should use multiple strategies to make team dynamics more productive. For example, they can ask for the opinions of quieter team members, minimize interruptions by more talkative members, and give individuals credit for their ideas and their work.

2.2 Create team norms, expectations, and equitable workloads to increase efficiency and effectiveness.

After students have had experience cultivating working relationships within teams (P2.1), they should gain experience working in particular team roles. Early on, teachers may help guide this process by providing collaborative structures. For example, students may take turns in different roles on the project, such as note taker, facilitator, or "driver" of the computer. As students progress, they should become less dependent on the teacher assigning roles and become more adept at assigning roles within their teams. For example, they should decide together how to take turns in different roles. Eventually, students should independently organize their own teams and create common goals, expectations, and equitable workloads. They should also manage project workflow using agendas and timelines and should evaluate workflow to identify areas for improvement.

2.3 Solicit and incorporate feedback from, and provide constructive feedback to, team members and other stakeholders.

At any level, students should ask questions of others and listen to their opinions. Early on, with teacher scaffolding, students should seek help and share ideas to achieve a particular purpose. As they progress in school, students should provide and receive feedback related to computing in constructive ways. For example, pair programming is a collaborative process that promotes giving and receiving feedback. Older students should engage in active listening by using questioning skills and should respond empathetically to others. As they progress, students should be able to receive feedback from multiple peers and should be able to differentiate opinions. Eventually, students should seek contributors from various environments. These contributors may include end users, experts, or general audiences from online forums.

2.4 Evaluate and select technological tools that can be used to collaborate on a project.

At any level, students should be able to use tools and methods for collaboration on a project. For example, in the early grades, students could collaboratively brainstorm by writing on a white-board. As students progress, they should use technological collaboration tools to manage team-work, such as knowledge-sharing tools and online project spaces. They should also begin to make decisions about which tools would be best to use and when to use them. Eventually, students should use different collaborative tools and methods to solicit input from not only team members and classmates but also others, such as participants in online forums or local communities.

CS Practice 3. Recognizing and Defining Computational Problems

Overview: The ability to recognize appropriate and worthwhile opportunities to apply computation is a skill that develops over time and is central to computing. Solving a problem with a computational approach requires defining the problem, breaking it down into parts, and evaluating each part to

determine whether a computational solution is appropriate.

By the end of Grade 12, students should be able to:

3.1 Identify complex, interdisciplinary, real-world problems that can be solved computationally.

At any level, students should be able to identify problems that have been solved computationally. For example, young students can discuss a technology that has changed the world, such as email or mobile phones. As they progress, they should ask clarifying questions to understand whether a problem or part of a problem can be solved using a computational approach. For example, identify real-world problems that span multiple disciplines, such as increasing bike safety with new helmet technology, and can be solved computationally.

3.2 Decompose complex real-world problems into manageable sub-problems that could integrate existing solutions or procedures.

At any grade level, students should be able to break problems down into their component parts. In the early grade levels, students should focus on breaking down simple problems. For example, in a visual programming environment, students could break down (or decompose) the steps needed to draw a shape. As students progress, they should decompose larger problems into manageable smaller problems. For example, young students may think of an animation as multiple scenes and thus create each scene independently. Students can also break down a program into subgoals: getting input from the user, processing the data, and displaying the result to the user. Eventually, as students encounter complex real-world problems that span multiple disciplines or social systems, they should decompose complex problems into manageable subproblems that could potentially be solved with programs or procedures that already exist. For example, students could create an app to solve a community problem that connects to an online database through an application programming interface (API).

3.3 Evaluate whether it is appropriate and feasible to solve a problem computationally.

After students have had some experience breaking problems down (P3.2) and identifying subproblems that can be solved computationally (P3.1), they should begin to evaluate whether a computational solution is the most appropriate solution for a particular problem. For example, students might question whether using a computer to determine whether someone is telling the truth would be advantageous. As students progress, they should systematically evaluate the feasibility of using computational tools to solve given problems or subproblems, such as through a cost-benefit analysis. Eventually, students should include more factors in their evaluations, such as how efficiency affects feasibility or whether a proposed approach raises ethical concerns.

CS Practice 4. Developing and Using Abstractions

Overview: Abstractions are formed by identifying patterns and extracting common features from specific examples to create generalizations. Using generalized solutions and parts of solutions designed for broad reuse simplifies the development process by managing complexity.

By the end of Grade 12, students should be able to:

4.1 Extract common features from a set of interrelated processes or complex phenomena.

Students at all grade levels should be able to recognize patterns. Young learners should be able to identify and describe repeated sequences in data or code through analogy to visual patterns or physical sequences of objects. As they progress, students should identify patterns as opportunities for abstraction, such as recognizing repeated patterns of code that could be more efficiently implemented as a loop. Eventually, students should extract common features from more complex phenomena or processes. For example, students should be able to identify common features in multiple segments of code and substitute a single segment that uses variables to account for the differences. In a procedure, the variables would take the form of parameters. When working with data, students should be able to identify important aspects and find patterns in related data sets such as crop output, fertilization methods, and climate conditions.

4.2 Evaluate existing technological functionalities and incorporate them into new designs.

At all levels, students should be able to use well-defined abstractions that hide complexity. Just as a car hides operating details, such as the mechanics of the engine, a computer program's "move" command relies on hidden details that cause an object to change location on the screen. As they progress, students should incorporate predefined functions into their designs, understanding that they do not need to know the underlying implementation details of the abstractions that they use. Eventually, students should understand the advantages of, and be comfortable using, existing functionalities (abstractions) including technological resources created by other people, such as libraries and application programming interfaces (APIs). Students should be able to evaluate existing abstractions to determine which should be incorporated into designs and how they should be incorporated. For example, students could build powerful apps by incorporating existing services, such as online databases that return geolocation coordinates of street names or food nutrition information.

4.3 Create modules and develop points of interaction that can apply to multiple situations and reduce complexity.

After students have had some experience identifying patterns (P4.1), decomposing problems (P3.2), using abstractions (P4.2), and taking advantage of existing resources (P4.2), they should begin to develop their own abstractions. As they progress, students should take advantage of opportunities to develop generalizable modules. For example, students could write more efficient programs by designing procedures that are used multiple times in the program. These procedures can be generalized by defining parameters that create different outputs for a wide range of inputs. Later on, students should be able to design systems of interacting modules, each with a well-defined role, that coordinate to accomplish a common goal. Within an object-oriented programming context, module design may include defining interactions among objects. At this stage, these modules, which combine both data and procedures, can be designed and documented for reuse in other programs. Additionally, students can design points of interaction, such as a simple user interface, either text or graphical, that reduces the complexity of a solution and hides lower-level implementation details.

4.4 Model phenomena and processes and simulate systems to understand and evaluate potential outcomes.

Students at all grade levels should be able to represent patterns, processes, or phenomena. With guidance, young students can draw pictures to describe a simple pattern, such as sunrise and sunset, or show the stages in a process, such as brushing your teeth. They can also create an animation to model a phenomenon, such as evaporation. As they progress, students should understand that computers can model real-world phenomena, and they should use existing computer simulations to learn about real-world systems. For example, they may use a preprogrammed model to explore how parameters affect a system, such as how rapidly a disease spreads. Older students should model phenomena as systems, with rules governing the interactions within the system. Students should analyze and evaluate these models against real-world observations. For example, students might create a simple producer–consumer ecosystem model using a programming tool. Eventually, they could progress to creating more complex and realistic interactions between species, such as predation, competition, or symbiosis, and evaluate the model based on data gathered from nature.

CS Practice 5. Creating Computational Artifacts

Overview: The process of developing computational artifacts embraces both creative expression and the exploration of ideas to create prototypes and solve computational problems. Students create artifacts that are personally relevant or beneficial to their community and beyond. Computational artifacts can be created by combining and modifying existing artifacts or by developing new artifacts. Examples of computational artifacts include programs, simulations, visualizations, digital animations, robotic systems, and apps.

By the end of Grade 12, students should be able to:

5.1 Plan the development of a computational artifact using an iterative process that includes reflection on and modification of the plan, taking into account key features, time and resource constraints, and user expectations.

At any grade level, students should participate in project planning and the creation of brainstorming documents. The youngest students may do so with the help of teachers. With scaffolding, students should gain greater independence and sophistication in the planning, design, and evaluation of artifacts. As learning progresses, students should systematically plan the development of a program or artifact and intentionally apply computational techniques, such as decomposition and abstraction, along with knowledge about existing approaches to artifact design. Students should be capable of reflecting on and, if necessary, modifying the plan to accommodate end goals.

5.2 Create a computational artifact for practical intent, personal expression, or to address a societal issue.

Students at all grade levels should develop artifacts in response to a task or a computational problem. At the earliest grade levels, students should be able to choose from a set of given commands to create simple animated stories or solve pre-existing problems. Younger students should focus on artifacts of personal importance. As they progress, student expressions should become more complex and of increasingly broader significance. Eventually, students should engage in independent, systematic use of design processes to create artifacts that solve problems with social significance by seeking input from broad audiences.

5.3 Modify an existing artifact to improve or customize it.

At all grade levels, students should be able to examine existing artifacts to understand what they do. As they progress, students should attempt to use existing solutions to accomplish a desired goal. For example, students could attach a programmable light sensor to a physical artifact they have created to make it respond to light. Later on, they should modify or remix parts of existing programs to develop something new or to add more advanced features and complexity. For example, students could modify prewritten code from a single-player game to create a two-player game with slightly different rules.

CS Practice 6. Testing and Refining Computational Artifacts

Overview: Testing and refinement is the deliberate and iterative process of improving a computational artifact. This process includes debugging (identifying and fixing errors) and comparing actual outcomes to intended outcomes. Students also respond to changing needs and expectations of end users and improve the performance, reliability, usability, and accessibility of artifacts.

By the end of Grade 12, students should be able to:

6.1 Systematically test computational artifacts by considering all scenarios and using test cases.

At any grade level, students should be able to compare results to intended outcomes. Young students should verify whether given criteria and constraints have been met. As students progress, they should test computational artifacts by considering potential errors, such as what will happen if a user enters invalid input. Eventually, testing should become a deliberate process that is more iterative, systematic, and proactive. Older students should be able to anticipate errors and use that knowledge to drive development. For example, students can test their program with inputs associated with all potential scenarios.

6.2 Identify and fix errors using a systematic process.

At any grade level, students should be able to identify and fix errors in programs (debugging) and use strategies to solve problems with computing systems (troubleshooting). Young students could use trial and error to fix simple errors. For example, a student may try reordering the sequence of commands in a program. In a hardware context, students could try to fix a device by resetting it or checking whether it is connected to a network. As students progress, they should become more adept at debugging programs and begin to consider logic errors: cases in which a program works, but not as desired. In this way, students will examine and correct their own thinking. For

example, they might step through their program, line by line, to identify a loop that does not terminate as expected. Eventually, older students should progress to using more complex strategies for identifying and fixing errors, such as printing the value of a counter variable while a loop is running to determine how many times the loop runs.

6.3 Evaluate and refine a computational artifact multiple times to enhance its performance, reliability, usability, and accessibility.

After students have gained experience testing (P6.2), debugging, and revising (P6.1), they should begin to evaluate and refine their computational artifacts. As students progress, the process of evaluation and refinement should focus on improving performance and reliability. For example, students could observe a robot in a variety of lighting conditions to determine that a light sensor should be less sensitive. Later on, evaluation and refinement should become an iterative process that also encompasses making artifacts more usable and accessible (P1.2). For example, students can incorporate feedback from a variety of end users to help guide the size and placement of menus and buttons in a user interface.

CS Practice 7. Communicating About Computing

Overview: Communication involves personal expression and exchanging ideas with others. In computer science, students communicate with diverse audiences about the use and effects of computation and the appropriateness of computational choices. Students write clear comments, document their work, and communicate their ideas through multiple forms of media. Clear communication includes using precise language and carefully considering possible audiences.

By the end of Grade 12, students should be able to:

7.1 Select, organize, and interpret large data sets from multiple sources to support a claim.

At any grade level, students should be able to refer to data when communicating an idea. Early on, students should, with guidance, present basic data through the use of visual representations, such as storyboards, flowcharts, and graphs. As students progress, they should work with larger data sets and organize the data in those larger sets to make interpreting and communicating it to others easier, such as through the creation of basic data representations. Eventually, students should be able to select relevant data from large or complex data sets in support of a claim or to communicate the information in a more sophisticated manner.

7.2 Describe, justify, and document computational processes and solutions using appropriate terminology consistent with the intended audience and purpose.

At any grade level, students should be able to talk about choices they make while designing a computational artifact. Early on, they should use language that articulates what they are doing and identifies devices and concepts they are using with correct terminology (e.g., program, input, and debug). Younger students should identify the goals and expected outcomes of their solutions. Along the way, students should provide documentation for end users that explains their artifacts and how they function, and they should both give and receive feedback. For example, students could provide a project overview and ask for input from users. As students progress, they should incorporate clear comments in their product and document their process using text, graphics, presentations, and demonstrations.

7.3 Articulate ideas responsibly by observing intellectual property rights and giving appropriate attribution.

All students should be able to explain the concepts of ownership and sharing. Early on, students should apply these concepts to computational ideas and creations. They should identify instances of remixing, when ideas are borrowed and iterated upon, and give proper attribution. They should also recognize the contributions of collaborators. Eventually, students should consider common licenses that place limitations or restrictions on the use of computational artifacts. For example, a downloaded image may have restrictions that prohibit modification of an image or using it for commercial purposes.

2019 Wyoming Computer Science Standards

Grade Band: K-2

Domain: Computing Systems	Practice(s): 1.1

By end of Grade 2

Standard: Devices	**K.CS.D.01** With guidance, follow directions and start to make appropriate choices to use computing devices to perform a variety of tasks (e.g., turn on, select, open and close programs, logon and logoff).	**1.CS.D.01** With guidance, select and use a computing device to perform a variety of tasks for an intended outcome (e.g., turn on, select, open and close programs, logon and logoff).	**2.CS.D.01** Independently select and use a computing device to perform a variety of tasks for an intended outcome (e.g., create an artifact).

Clarification Statement: People use computing devices to perform a variety of tasks accurately and quickly. Students should be able to select the appr opriate app/program to use for tasks they are required to complete. For example, if students are asked to draw a picture, they should be able to open and use a drawing app/program to complete this task, or if they are asked to create a presentation, they should be able to open and use presentation software. In addition, with teacher guidance, students should compare and discuss preferences for software with the same primary functionality. Students could compare different programs (e.g., web browsers, word processing, presentation, or drawing).

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	K-2-ETS1-3		1d - Empowered Learner
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
	SS2.6.3	FPA4.1.D.6	

2019 Wyoming Computer Science Standards

Grade Band: K-2

Domain: Computing Systems	**Practice(s): 7.2**

By end of Grade 2

Standard: Hardware & Software	**K.CS.HS.01** Use appropriate terminology to identify and use common computing devices, components, and software in a variety of environments (e.g., desktop computer, laptop computer, tablet device, monitor, keyboard, mouse, or printer).	**1.CS.HS.01** Use appropriate terminology in naming and demonstrate the function of common computing devices, components, and software (e.g., use of a printer, appropriate input device use, or common operating system features).	**2.CS.HS.01** Demonstrate and describe the function of common components of computing systems (hardware and software) (e.g. use a browser, search engine).

Clarification Statement: A computing system is composed of hardware and software. Hardware consists of physical components. Software consists of the programs and applications that run on the hardware. Students should be able to identify and describe the function of external hardware, such as desktop computers, laptop computers, tablet devices, monitors, keyboards, mice, and printers. Students should understand the relationship between hardware and software. Software consists of the programs that give the hardware useful functionality.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
			1d - Empowered Learner
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
W.2.2, L.2.1, L.2.2, L.2.3, L.2.4, L.2.5, L.2.6			

Domain: Computing Systems	Practice(s): 6.2, 7.2

By end of Grade 2

Standard: Troubleshooting	**K.CS.T.01** Recognize computing systems might not work as expected and identify and effectively communicate simple hardware or software problems. Implement solutions with guidance (e.g., volume turned down on headphones, monitor turned off).	**1.CS.T.01** Recognize computing systems might not work as expected and identify and effectively communicate simple hardware or software problems. Implement solutions with guidance (e.g., app or program is not working as expected, no sound is coming from the device, caps lock turned on).	**2.CS.T.01** Recognize computing systems might not work as expected and identify and effectively communicate simple hardware or software problems. Implement solutions with guidance (e.g., app or program is not working as expected, no sound is coming from the device, caps lock turned on) and discuss problems with peers and adults.

Clarification Statement: Problems with computing systems have different causes. Students at this level do not need to understand those causes, but they should be able to communicate a problem with accurate terminology (e.g., when an app or program is not working as expected, a device will not turn on, the sound does not work, etc.). Ideally, students would be able to use simple troubleshooting strategies, including turning a device off and on to reboot it, closing and reopening an app, turning on speakers, or plugging in headphones.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV5.3.3, CV5.4.3	1c, 1d - Empowered Learner
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
L.2.3, L.2.6			HE2.2.2

Domain: Networks & the Internet	Practice(s): 6.2

By end of Grade 2

Standard: Network Communication & Organization	K.NI.NCO.01 Recognize and discuss that computing devices can be connected together.	1.NI.NCO.01 Identify and describe that by connecting computing devices together they can share information (e.g., remote storage, printing, the internet).	2.NI.NCO.01 Identify and describe that computing devices can be connected in a variety of ways (e.g., Bluetooth, Wi-Fi, home and school networks, the internet).

Clarification Statement: Computing devices are connected in a variety of ways. Students at this level need to understand that connectivity is part of the overall computing environment and that different protocols (e.g., wired, wireless, Wi-Fi, Bluetooth) are used depending on the device purpose.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV5.4.3	1d - Empowered Learner
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
W.2.2, L.2.1, L.2.2, L.2.3, L.2.4, L.2.5, L.2.6			

Domain: Networks & the Internet	Practice(s): 7.3

By end of Grade 2

Standard: Cybersecurity	**K.NI.C.01** Discuss what authentication factors are and why we do not share them with others. With guidance, use them to access technological devices, apps, etc.	**1.NI.C.01** Identify what authentication factors are, explain why they are not shared, and discuss what makes authentication effective. Independently use them to access technological devices, apps, etc.	**2.NI.C.01** Explain what authentication factors are, why we use them, and apply authentication to protect devices and information (personal and private) from unauthorized access.

Clarification Statement: Learning to protect one's device or information from unwanted use by others is an essential first step in learning about cybe rsecurity. Students should appropriately use and protect the authentication methods that are required.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV5.4.3	2d - Digital Citizen
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
W.2.2, L.2.1, L.2.2, L.2.3, L.2.4, L.2.5, L.2.6			

Domain: Data Analysis	Practice(s): 4.2

By end of Grade 2

Standard: Storage	**K.DA.S.01** With guidance, locate, open, modify and save an existing file with a computing device.	**1.DA.S.01** With guidance, locate, open, modify and save an existing file, and use appropriate file-naming conventions. Recognize that the file exists within an organizational structure (drive, folder, file).	**2.DA.S.01** With guidance, develop and modify an organizational structure by creating, copying, moving, and deleting files and folders.

Clarification Statement: All information stored and processed by a computing device is referred to as data. Data can be images, text documents, audio files, software programs or apps, video files, etc. As students use software to complete tasks on a computing device, they will be manipulating data in files. They will be organizing that information in folders and a file structure.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV5.1.4	1d - Empowered Learner
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Data Analysis	Practice(s): 4.4, 7.1

By end of Grade 2

Standard: **Collection, Visualization, & Transformation**	**K.DA.CVT.01** With guidance, collect data and present it visually.	**1.DA.CVT.01** With guidance, collect data and present it in more than one way (e.g. written and visual presentation).	**2.DA.CVT.01** With guidance, collect data and independently present the same data in various visual formats.

Clarification Statement: The collection and use of data about the world around them is a routine part of life and influences how people live. Students could collect data on the weather, such as sunny days versus rainy days, the temperature at the beginning of the school day and end of the school day, or the inches of rain over the course of a storm. Students could count the number of pieces of each color of candy in a bag of candy, such as Skittles or M&Ms. Students could create surveys of things that interest them, such as favorite foods, pets, or TV shows, and collect answers to their surveys from their peers and others. The data collected could then be organized into two or more visualizations, such as a bar graph, pie chart, or pictograph.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
1.MD.J.4, 2.MD.I.10a	K-2-ETS1-3, K-PS2-1, K-PS2-2, K-PS3-1, K-LS1-1, K-ESS2-1, K-ESS2-2	CV5.4.1	3c - Knowledge Constructor
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
	SS2.5.1		

Domain: Data Analysis	Practice(s): 4.1

By end of Grade 2

Standard: **Inference & Models**	**K.DA.IM.01** With guidance, draw conclusions and make predictions based on picture graphs or patterns with or without a computing device (e.g., make predictions based on weather data presented in a picture graph or complete a pattern).	**1.DA.IM.01** With guidance, identify and interpret data from a chart or graph (visualization) in order to make a prediction, with or without a computing device.	**2.DA.IM.01** With guidance, interpret data and present it in a chart or graph (visualization) in order to make a prediction, with or without a computing device.

Clarification Statement: Data can be used to make inferences or predictions about the world. Students could analyze a graph or pie chart of the colors in a bag of candy or the averages for colors in multiple bags of candy, identify the patterns for which colors are most and least represented, and then make a prediction as to which colors will have most and least in a new bag of candy. Students could analyze graphs of temperatures taken at the beginning of the school day and end of the school day, identify the patterns of when temperatures rise and fall, and predict if they think the temperature will rise or fall at a particular time of the day, based on the patterns observed.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
1.MD.J.4, 2.MD.I.10a	K-2-ETS1-3, K-PS2-1, K-PS3-1, K-LS1-1, K-ESS3-3	CV5.4.1, CV5.4.4	6c - Creative Communicator
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
RI.2.7	SS2.5.1		

Domain: Algorithms & Programming	Practice(s): 4.4

By end of Grade 2

Standard: Algorithms	**K.AP.A.01** With guidance, model daily processes and follow algorithms (sets of step-by-step instructions) to complete tasks (e.g., verbally, kinesthetically, with robot devices, or a programing language).	**1.AP.A.01** With guidance, identify and model daily processes and follow algorithms (sets of step-by-step instructions) to complete tasks (e.g., verbally, kinesthetically, with robot devices, or a programing language).	**2.AP.A.01** With guidance, identify and model daily processes by creating and following algorithms (sets of step-by- step instructions) to complete tasks (e.g., verbally, kinesthetically, with robot devices, or a programing language).

Clarification Statement: Students model daily processes by creating and following algorithms (sets of step-by-step instructions) to complete tasks. Students could create and follow algorithms for making simple foods, brushing their teeth, getting ready for school, or participating in clean-up time.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
K.G.H.1, 2.G.J.3a, 2.G.J.3b, 2.G.J.3c, 2.NBT.E.9	K-2-ETS1-1, K-LS1-1, K-ESS3-3	CV5.4.1	4a - Innovative Designer
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
RI.2.3, W.2.6, SL.2.5, RI.2.7		FPA4.1.A.1, FPA4.1.A.2, FPA4.1.D.5, FPA4.1.M.4, FPA4.1.T.1, FPA4.1.T.2	

Domain: Algorithms & Programming	Practice(s): 4.1

By end of Grade 2

Standard:			
Standard: Variables	**K.AP.V.01** With guidance, demonstrate that data may be represented by symbols (e.g., thumbs up/down as representations of yes/no, arrows when writing algorithms to represent direction, or encode and decode words using numbers, pictographs, or other symbols to represent letters or words).	**1.AP.V.01** With guidance, demonstrate that computers represent data using numbers, letters, words, or other symbols (e.g., thumbs up/down as representations of yes/no, arrows when writing algorithms to represent direction, or encode and decode words using numbers, pictographs, or other symbols to represent letters or words).	**2.AP.V.01** Model the way programs store and manipulate data by using numbers or other symbols to represent information (e.g., thumbs up/down as representations of yes/no, arrows when writing algorithms to represent direction, or encode and decode words using numbers, pictographs, or other symbols to represent letters or words).

Clarification Statement: Information in the real world can be represented in computer programs. Students could use thumbs up/down as representations of yes/no, use arrows when writing algorithms to represent direction, or encode and decode words using numbers, pictographs, or other symbols to represent letters or words.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
K.G.H.1, K.CC.B.4, K.CC.B.4a, K.CC.B.4b, K.CC.B.4c, 1.MD.J.4, 1.OA.A.1, 1.OA.C.5, 1.OA.C.6, 1.G.K.1, 1.G.K.2, 2.G.J.2, 2.OA.A.1, 2.G.J.3a, 2.G.J.3b, 2.G.J.3c	K-PS3-1, K-LS1-1, K-ESS3-1, K-ESS3-3		
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
RI.2.7			

Domain: Algorithms & Programming	Practice(s): 5.2

By end of Grade 2

Standard: Control	**K.AP.C.01** With guidance, independently or collaboratively create programs to accomplish tasks using sequencing (emphasizing the beginning, middle, and end).	**1.AP.C.01** With guidance, independently or collaboratively create programs to accomplish tasks using sequencing, conditionals, and repetition (e.g., program a robot device, or algorithmically describe an unplugged activity).	**2.AP.C.01** With guidance, independently and collaboratively create programs to accomplish tasks using a programming language, robot device, or unplugged activity that includes sequencing, conditionals, and repetition.

Clarification Statement: Programming is used as a tool to create products that reflect a wide range of interests. Control structures specify the order in which instructions are executed within a program. Sequences are the order of instructions in a program. For example, if dialogue is not sequenced correctly when programming a simple animated story, the story will not make sense. If the commands to program a robot are not in the correct order, the robot will not complete the task desired. Loops allow for the repetition of a sequence of code multiple times. For example, in a program to show an animation of a butterfly, a loop could be combined with move commands to allow continual but controlled movement of the character.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
K.G.H.1, 1.MD.J.4, 1.OA.A.1, 1.G.K.1, 1.G.K.2, 2.OA.A.1	K-2-ETS1-3, K-PS2-1, K-PS2-2	CV5.4.1	4a - Innovative Designer
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
RI.2.3, W.2.6, SL.2.5		FPA4.1.A.1, FPA4.1.A.2, FPA4.1.D.5, FPA4.1.M.4, FPA4.1.T.1, FPA4.1.T.2	

Domain: Algorithms & Programming	Practice(s): 3.2

By end of Grade 2

Standard: Modularity	**K.AP.M.01** Using grade appropriate content and complexity, decompose (breakdown) the steps needed to solve a problem into a precise sequence of instructions (e.g., to show the life cycle of a plant - plant seed in dirt, water dirt, plant begins to grow with sunlight).	**1.AP.M.01** Using grade appropriate content and complexity, decompose (breakdown) the steps needed to solve a problem into a precise sequence of instructions (e.g., given a deck of cards, have students sort them by multiple methods - color, suit, or rank).	**2.AP.M.01** Using grade appropriate content and complexity, decompose (breakdown) the steps needed to solve a problem into a precise sequence of instructions (e.g., develop a set of instructions on how to play your favorite game).

Clarification Statement: Learning to program in modules first involves learning to break problems into steps. Decomposition is the act of breaking dow n tasks into simpler tasks. Students could break down the steps needed to make a peanut butter and jelly sandwich, to brush their teeth, to draw a shape, to move a character across the screen, or to solve a level of a coding app.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
K.G.I.5, K.MD.F.1, K.CC.B.4, K.CC.B.4a, K.CC.B.4b, K.CC.B.4c, 1.MD.H.2, 1.MD.J.4, 1.OA.A.1, 1.OA.C.5, 1.OA.C.6, 1.G.K.1, 1.G.K.2, 2.MD.F.1, 2.G.J.2, 2.G.J.3a, 2.G.J.3b, 2.G.J.3c, 2.OA.A.1	K-2-ETS1-1, K-2-ETS1-2, K-PS3-2	CV5.4.3	5c - Computational Thinker
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
W.2.5		FPA4.1.A.3	

Domain: Algorithms & Programming	Practice(s): 5.1, 7.2

By end of Grade 2

Standard: Program Development	**K.AP.PD.01** With guidance, develop plans that describe a program's sequence of events, goals, and expected outcomes.	**1.AP.PD.01** Independently or with guidance, develop plans that describe a program's sequence of events, goals, and expected outcomes.	**2.AP.PD.01** Develop plans that describe a program's sequence of events, goals, and expected outcomes.

Clarification Statement: Creating a plan for what a program will do clarifies the steps that will be needed to create a program and can be used to check if a program is correct. Students could create a planning document, such as a story map, a storyboard, or a sequential graphic organizer, to illustrate what their program will do. Students at this stage may complete the planning process with help from their teachers.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	K-2-ETS1-1, K-PS2-1, K-PS3-2, K-ESS3-3	CV5.4.3	4a - Innovative Designer
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
W.2.2		FPA4.1.A.3, FPA4.1.T.5	

Domain: Algorithms & Programming	Practice(s): 7.3

By end of Grade 2

Standard: Program Development	**K.AP.PD.02** Independently or with guidance, give credit to ideas, creations, and solutions of others while developing algorithms.	**1.AP.PD.02** Independently or with guidance, give credit to ideas, creations, and solutions of others while writing and/or developing programs.	**2.AP.PD.02** Give credit to ideas, creations, and solutions of others while writing and developing programs.

Clarification Statement: Using computers comes with a level of responsibility. Students should credit artifacts that were created by others, such as pictures, music, and code. Credit could be given orally, if presenting their work to the class, or in writing or orally, if sharing work on a class blog or website. Proper attribution at this stage does not require a formal citation, such as in a bibliography or works cited document.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	K-ESS2-2, K-ESS3-1		2c - Digital Citizen
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
W.2.2, W.2.5			

2019 Wyoming Computer Science Standards

Grade Band: K-2

Domain: Algorithms & Programming	Practice(s): 6.2

By end of Grade 2

Standard: Program Development	**K.AP.PD.03** With guidance, independently or collaboratively debug (identify and fix errors) algorithms using a programming language and/or unplugged activity.	**1.AP.PD.03** With guidance, independently or collaboratively debug (identify and fix errors) programs using a programming language and/or unplugged activity.	**2.AP.PD.03** Independently and collaboratively debug (identify and fix errors) programs using a programming language.

Clarification Statement: Algorithms or programs may not always work correctly. Students should be able to use various strategies, such as changing the sequence of the steps, following the algorithm in a step-by-step manner, or trial and error to fix problems in algorithms and programs.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
K.G.H.1, 1.MD.J.4, 1.OA.A.1, 1.G.K.1, 2.G.J.2, 2.OA.A.1		CV5.4.2, CV5.4.3	4c - Innovative Designer
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Algorithms & Programming	Practice(s): 7.2

By end of Grade 2

Standard: Program Development	**K.AP.PD.04** Use correct terminology (beginning, middle, end) in the development of an algorithm.	**1.AP.PD.04** Use correct terminology (first step, second step, third step) and explain the choices made in the development of an algorithm.	**2.AP.PD.04** Use correct terminology (debug, program input/output, code) to explain the development of a program or an algorithm (e.g., in an unplugged activity, hands on manipulatives, or a programming language).

Clarification Statement: At this stage, students should be able to talk or write about the goals and expected outcomes of the programs they create and the choices that they made when creating programs. This could be done using coding journals, discussions with a teacher, class presentations, or blogs.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV5.4.2, CV5.4.3	3d - Knowledge Constructor
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
L.2.4, L.2.6			

2019 Wyoming Computer Science Standards

BOOT UP WYOMING

Grade Band: K-2

Domain: Impacts of Computing	Practice(s): 3.1

By end of Grade 2

Standard: Culture	**K.IC.C.01** Discuss different ways in which technology is used in your daily life.	**1.IC.C.01** Identify how people use different types of technologies in their daily work and personal lives.	**2.IC.C.01** Describe how people use different types of technologies in their daily work and personal lives.

Clarification Statement: Computing technology has positively and negatively changed the way people live and work. In the past, if students wanted to read about a topic, they needed access to a library to find a book about it. Today, students can view and read information on the Internet about a topic or they can download e-books about it directly to a device. Such information may be available in more than one language and could be read to a student, allowing for greater accessibility.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	K-2-ETS1-1, K-ESS3-2, K-ESS3-3		
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
W.2.2, L.2.1, L.2.2, L.2.3, L.2.4, L.2.5, L.2.6	SS2.3.3, SS2.4.2		HE2.4.8

BOOT UP WYOMING

2019 Wyoming Computer Science Standards

Grade Band: K-2

Domain: Impacts of Computing	**Practice(s): 2.1**

By end of Grade 2

Standard: Social Interactions	**K.IC.SI.01** With guidance, identify appropriate manners while participating in an online environment.	**1.IC.SI.01** With guidance, identify appropriate and inappropriate behavior. Act responsibly while participating in an online community and know how to report concerns.	**2.IC.SI.01** Practice grade-level appropriate behavior and responsibilities while participating in an online community. Identify and report inappropriate behavior.

Clarification Statement: Online communication facilitates positive interactions, such as sharing ideas with many people, but the public and anonymous nature of online communication also allows intimidating and inappropriate behavior in the form of cyberbullying. Students could share their work on blogs or in other collaborative spaces online, taking care to avoid sharing information that is inappropriate or that could personally identify them to others. Students could provide feedback to others on their work in a kind and respectful manner and could tell an adult if others are sharing things they should not share or are treating others in an unkind or disrespectful manner on online collaborative spaces.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV5.2.3, CV5.2.4, CV5.5.3, CV5.5.4	2b - Digital Citizen
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
SL.2.1.a		FPA4.1.A.5, FPA4.4.M.1, FPA4.4.T.2	PE 2.3.1 HE2.3.3

Performance Level Descriptors (PLDs)

Grade Band: K-2

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Devices: 2.CS.D.01 Independently select and use a computing device to perform a variety of tasks for an intended outcome (e.g., create an artifact).	provides little to no evidence in addressing the expectation(s).	with guidance, uses a computing device to complete assignments or teacher led activities.	regularly uses a computing device to independently - power on and off devices. - authenticate, when applicable. - open appropriate programs. - complete assignments or teacher led activities.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., can recognize capabilities of multiple devices and can perform similar tasks with them).
Hardware & Software: 2.CS.HS.01 Demonstrate and describe the function of common components of computing systems (hardware and software) (e.g. use a browser, search engine).	provides little to no evidence in addressing the expectation(s).	with guidance: - identifies hardware components and software applications. - utilizes hardware components and software applications.	can identify and utilize: - a variety of hardware components (e.g., input devices, printers). - software applications (e.g., browsers, apps). - navigation to browser search engines and applications.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., justifies hardware and software choices).
Troubleshooting: 2.CS.T.01 Recognize that computing systems might not work as expected and identify and effectively communicate simple hardware or software problems and implement solutions (e.g., app or program is not working as expected, no sound is coming from the device, caps lock turned on) and discuss problems with peers and adults.	provides little to no evidence in addressing the expectation(s).	- can recognize that computing systems may not work as expected. - with guidance, identifies and effectively communicates simple hardware and software problems. - with guidance, implements solutions to simple hardware or software issues.	- can recognize that computing systems may not work as expected. - identifies and effectively communicates simple hardware and software problems. - implements solutions to simple hardware or software issues.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., helps others in troubleshooting issues, can troubleshoot more complex issues like connectivity or advanced software features).

Performance Level Descriptors (PLDs)

Grade Band: K-2

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Network Communication & Organization: 2.NI.NCO.01 Identify and describe that computing devices can be connected in a variety of ways (e.g., Bluetooth, Wi-Fi, home and school networks, the internet).	provides little to no evidence in addressing the expectation(s).	- can identify that computing devices can be connected in a variety of ways. - with guidance, can describe a connectivity option (e.g., Wi-Fi or Bluetooth).	- can identify that computing devices can be connected in a variety of ways. - can describe different connectivity options (e.g., Bluetooth, internet).	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., evaluates the appropriateness of different connectivity options for a variety of tasks).
Cybersecurity: 2.NI.C.01 Explain what authentication factors are, why we use them, and apply authentication to protect devices and information (personal and private) from unauthorized access.	provides little to no evidence in addressing the expectation(s).	-identifies what authentication factors are. - with guidance, applies authentication factors to appropriate apps and devices.	- explains what authentication factors are and why we use them. - applies authentication factors to appropriate apps and devices.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., can compare authentication methods, one factor versus two factors).
Storage: 2.DA.S.01 With guidance, develop and modify an organizational structure by creating, copying, moving, and deleting files and folders.	provides little to no evidence in addressing the expectation(s).	while working with a computing device and with guidance: - locates existing files. - opens existing files. - modifies existing files. - saves changes to a file.	with guidance, develops and modifies an organizational structure by: - creating folders. - copying existing folders and files. - moving existing folders and files. - deleting folders and files.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., can independently create organizational structure).

Performance Level Descriptors (PLDs)

Grade Band: K-2

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Collection, Visualization, & Transformation: 2.DA.CVT.01 With guidance, collect data and independently present the same data in various visual formats.	provides little to no evidence in addressing the expectation(s).	with guidance: - creates a data set, **and** - presents that data.	- with guidance, creates a data set, **and** - independently presents that data in multiple formats (e.g., as a table and graph or as a table and chart).	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., independently creates and presents their own data sets).
Inference & Models: 2.DA.IM.01 With guidance, interpret data and present it in a chart or graph (visualization) in order to make a prediction, with or without a computing device.	provides little to no evidence in addressing the expectation(s).	with guidance: - interprets data, **and** - presents it in a chart or graph (visualization).	with guidance: - interprets data. - presents it in a chart or graph (visualization). - makes a prediction based on the data.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., independently perform any of the proficient student steps).
Algorithms: 2.AP.A.01 With guidance, identify and model daily processes by creating and following algorithms (sets of step-by- step instructions) to complete tasks (e.g., verbally, kinesthetically, with robot devices, or a programing language).	provides little to no evidence in addressing the expectation(s).	with guidance: - follows algorithms to complete tasks.	with guidance: - follows algorithms to complete tasks. - creates algorithms to complete tasks.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., independently creates algorithms via one or more of the following techniques: verbally, kinesthetically, with robot devices, or a programing language).

Performance Level Descriptors (PLDs)

Grade Band: K-2

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Variables: 2.AP.V.01 Model the way programs store and manipulate data by using numbers or other symbols to represent information (e.g. thumbs up/ down as representations of yes/no, arrows when writing algorithms to represent direction, or encode and decode words using numbers, pictographs, or other symbols to represent letters or words).	provides little to no evidence in addressing the expectation(s).	with guidance: - uses symbols to represent information. - understands that inferred meanings of the symbols can change or can represent missing information. - creates expressions with symbols to convey data, information, or processes.	- uses symbols to represent information. - understands that inferred meanings of the symbols can change or can represent missing information. - creates expressions with symbols to convey data, information, or processes.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., creates complex expressions with symbols).
Control: 2.AP.C.01 With guidance, independently and collaboratively create programs to accomplish tasks using a programming language, robot device, or unplugged activity that includes sequencing, conditionals, and repetition.	provides little to no evidence in addressing the expectation(s).	with guidance, create: - programs that include sequencing, conditionals, or repetition. - tasks that include sequencing, contidionals, or repetition.	with guidance: - individually create programs or tasks that include sequencing, conditionals, and repetition. - collaboratively create programs that include sequencing, conditionals, and repetition.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., independently creates programs that include sequencing, conditionals, and repetition).
Modularity: 2.AP.M.01 Using grade appropriate content and complexity, decompose (breakdown) the steps needed to solve a problem into a precise sequence of instructions (e.g., develop a set of instructions on how to play your favorite game).	provides little to no evidence in addressing the expectation(s).	with guidance: - decomposes a problem. - creates a precise sequence of instructions to solve that problem.	- decomposes a problem. - creates a precise sequence of instructions to solve that problem.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., can create different instruction sets that accomplish the same task).

Performance Level Descriptors (PLDs)

Grade Band: K-2

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Program Development: **2.AP.PD.01** Develop plans that describe a program's sequence of events, goals, and expected outcomes. **Program Development:** **2.AP.PD.02** Give credit to ideas, creations, and solutions of others while writing and developing programs. **Program Development:** **2.AP.PD.03** Independently and collaboratively debug (identify and fix errors) programs using a programming language. **Program Development:** **2.AP.PD.04** Use correct terminology (debug, program input/output, code) to explain the development of a program or an algorithm (e.g., in an unplugged activity, hands on manipulatives, or a programming language).	provides little to no evidence in addressing the expectation(s).	with guidance, demonstrates program development by: - creating a plan for a program. - writing the program. - giving credit for the resources used. - debugging the program.	demonstrates program development by: - creating a plan for a program. - writing the program. - giving credit for the resources used. - debugging the program.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., demonstrates the development process on different platforms, languages, or mediums).

Performance Level Descriptors (PLDs)

Grade Band: K-2

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Culture: 2.IC.C.01 Describe how people use different types of technologies in their daily work and personal lives.	provides little to no evidence in addressing the expectation(s).	identifies how people use different types of technologies (e.g., cell phones, computers) in their daily work and personal lives.	describes how people use different types of technologies (e.g., cell phones, computers) in their daily work and personal lives.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., identifies and describes the potential impacts of different technologies).
Social Interactions: 2.IC.SI.01 Practice grade-level appropriate behavior and responsibilities while participating in an online community. Identify and report inappropriate behavior.	provides little to no evidence in addressing the expectation(s).	with guidance: - makes appropriate choices when participating in an online community. - identifies inappropriate behavior and reporting procedures.	- makes appropriate choices when participating in an online community. - identifies inappropriate behavior and reporting procedures.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.

Computer Science | 3-5 Introduction

Throughout grades 3-5, students engage in creative applications of Computer Science concepts and practices introduced in K-2. By the end of fifth grade, students will be able to model and discuss internal and external computing systems, as well as troubleshoot problems that may occur. Students will be able to explore and discuss real-world problems and processes related to networks and the internet. In addition, students will also be able to collect and analyze data to support inferences and models. Building on their previous understanding of algorithms and programming (coding), students will work collaboratively and independently to create and modify increasing complex programs for a variety of purposes. Students will be able explain cultural, social, and ethical impacts of computing.

By the end of 5th grade, students can:

- Describe how internal and external parts of computing devices function to form a system
- Model hardware and software information translation, transmission, and processing
- Develop, apply, and explain strategies for troubleshooting problems
- Model and explain how information is sent and received over physical or wireless paths
- Identify and implement strategies for protecting personal information
- Justify the format and location for storing different data
- Use data to highlight or propose relationships, predict outcomes, communicate an idea, or support a claim
- Collaboratively and independently create and modify (remix) programs through an iterative process
- Describe both design and debugging choices made during program development
- Explain cultural impacts of computing technologies
- Seek diverse perspectives when developing, testing, and refining digital artifacts or devices
- Work respectfully and responsibly with others in an online environment and discuss the social impact of violating intellectual property rights

WYOMING 2019 COMPUTER SCIENCE DOMAINS & STANDARDS

Computing Systems	Networks & The Internet	Data Analysis	Algorithms & Programming	Impacts of Computing
CS.D—Devices **CS.HS—Hardware & Software** **CS.T—Troubleshooting**	**NI.NCO—Network Communication & Organization** **NI.C—Cybersecurity**	**DA.S—Storage** **DA.CVT—Collection, Visualization, & Transformation** **DA.IM—Inference & Models**	**AP.A—Algorithms** **AP.V—Variables** **AP.C—Control** **AP.M—Modularity** **AP.PD—Program Development**	**IC.C—Culture** **IC.SI—Social Interactions** **IC.SLE—Safety, Law, & Ethics**

3-5 Computer Science Practices

There are seven (7) CS Practices that are to be embedded in curriculum and instruction as the standards and benchmarks are taught and measured. The seven (7) CS Practices are listed below, and are more deeply explored on the next several pages. For each grade-band, only the CS Practices that relate are in black text and the others are grayed so the reader can still see them as a set, but will know which ones apply to that particular set of standards.

Practice 1. Fostering an Inclusive Computing Culture

Practice 2. Collaborating Around Computing

Practice 3. Recognizing and Defining Computational Problems

Practice 4. Developing and Using Abstractions

Practice 5. Creating Computational Artifacts

Practice 6. Testing and Refining Computational Artifacts

Practice 7. Communicating About Computing

DESCRIPTION OF 3-5 COMPUTER SCIENCE (CS) PRACTICES

CS Practice 1. Fostering an Inclusive Computing Culture

Overview: Building an inclusive and diverse computing culture requires strategies for incorporating perspectives from people of different genders, ethnicities, and abilities. Incorporating these perspectives involves understanding the personal, ethical, social, economic, and cultural contexts in which people operate. Considering the needs of diverse users during the design process is essential to producing inclusive computational products.

By the end of Grade 12, students should be able to:

1.1 Include the unique perspectives of others and reflect on one's own perspectives when designing and developing computational products.

At all grade levels, students should recognize that the choices people make when they create artifacts are based on personal interests, experiences, and needs. Young learners should begin to differentiate their technology preferences from the technology preferences of others. Initially, students should be presented with perspectives from people with different backgrounds, ability levels, and points of view. As students progress, they should independently seek diverse perspectives throughout the design process for the purpose of improving their computational artifacts. Students who are well-versed in fostering an inclusive computing culture should be able to differentiate backgrounds and skill sets and know when to call upon others, such as to seek out knowledge about potential end users or intentionally seek input from people with diverse backgrounds.

1.2 Address the needs of diverse end users during the design process to produce artifacts with broad accessibility and usability.

At any level, students should recognize that users of technology have different needs and preferences and that not everyone chooses to use, or is able to use, the same technology products. For example, young learners, with teacher guidance, might compare a touchpad and a mouse to examine differences in usability. As students progress, they should consider the preferences of people who might use their products. Students should be able to evaluate the accessibility of a product to a broad group of end users, such as people with various disabilities. For example, they may notice that allowing an end user to change font sizes and colors will make an interface usable for people with low vision. At the higher grades, students should become aware of professionally accepted accessibility standards and should be able to evaluate computational artifacts for accessibility. Students should also begin to identify potential bias during the design process to maximize accessibility in product design. For example, they can test an app and recommend to its designers that it respond to verbal commands to accommodate users who are blind or have physical disabilities.

1.3 Employ self- and peer-advocacy to address bias in interactions, product design, and development methods.

After students have experience identifying diverse perspectives and including unique perspectives (P1.1), they should begin to employ self-advocacy strategies, such as speaking for themselves if their needs are not met. As students progress, they should advocate for their peers when accommodations, such as an assistive-technology peripheral device, are needed for someone to use a computational artifact. Eventually, students should regularly advocate for both themselves and others.

CS Practice 2. Collaborating Around Computing

Overview: Collaborative computing is the process of performing a computational task by working in pairs and on teams. Because it involves asking for the contributions and feedback of others, effective collaboration can lead to better outcomes than working independently. Collaboration requires individuals to navigate and incorporate diverse perspectives, conflicting ideas, disparate skills, and distinct personalities. Students should use collaborative tools to effectively work together and to create complex artifacts.

By the end of Grade 12, students should be able to:

2.1 Cultivate working relationships with individuals possessing diverse perspectives, skills, and personalities.

At any grade level, students should work collaboratively with others. Early on, they should learn strategies for working with team members who possess varying individual strengths. For example, with teacher support, students should begin to give each team member opportunities to contribute and to work with each other as co-learners. Eventually, students should become more sophisticated at applying strategies for mutual encouragement and support. They should express their ideas with logical reasoning and find ways to reconcile differences cooperatively. For example, when they disagree, they should ask others to explain their reasoning and work together to make respectful, mutual decisions. As they progress, students should use methods for giving all group members a chance to participate. Older students should strive to improve team efficiency and effectiveness by regularly evaluating group dynamics. They should use multiple strategies to make team dynamics more productive. For example, they can ask for the opinions of quieter team members, minimize interruptions by more talkative members, and give individuals credit for their ideas and their work.

2.2 Create team norms, expectations, and equitable workloads to increase efficiency and effectiveness.

After students have had experience cultivating working relationships within teams (P2.1), they should gain experience working in particular team roles. Early on, teachers may help guide this process by providing collaborative structures. For example, students may take turns in different roles on the project, such as note taker, facilitator, or "driver" of the computer. As students progress, they should become less dependent on the teacher assigning roles and become more adept at assigning roles within their teams. For example, they should decide together how to take turns in different roles. Eventually, students should independently organize their own teams and create common goals, expectations, and equitable workloads. They should also manage project workflow using agendas and timelines and should evaluate workflow to identify areas for improvement.

2.3 Solicit and incorporate feedback from, and provide constructive feedback to, team members and other stakeholders.

At any level, students should ask questions of others and listen to their opinions. Early on, with teacher scaffolding, students should seek help and share ideas to achieve a particular purpose. As they progress in school, students should provide and receive feedback related to computing in constructive ways. For example, pair programming is a collaborative process that promotes giving and receiving feedback. Older students should engage in active listening by using questioning skills and should respond empathetically to others. As they progress, students should be able to receive feedback from multiple peers and should be able to differentiate opinions. Eventually, students should seek contributors from various environments. These contributors may include end users, experts, or general audiences from online forums.

2.4 Evaluate and select technological tools that can be used to collaborate on a project.

At any level, students should be able to use tools and methods for collaboration on a project. For example, in the early grades, students could collaboratively brainstorm by writing on a white-board. As students progress, they should use technological collaboration tools to manage team-work, such as knowledge-sharing tools and online project spaces. They should also begin to make decisions about which tools would be best to use and when to use them. Eventually, students should use different collaborative tools and methods to solicit input from not only team members and classmates but also others, such as participants in online forums or local communities.

CS Practice 3. Recognizing and Defining Computational Problems

Overview: The ability to recognize appropriate and worthwhile opportunities to apply computation is a skill that develops over time and is central to computing. Solving a problem with a computational approach requires defining the problem, breaking it down into parts, and evaluating each part to

determine whether a computational solution is appropriate.

By the end of Grade 12, students should be able to:

3.1 Identify complex, interdisciplinary, real-world problems that can be solved computationally.

At any level, students should be able to identify problems that have been solved computationally. For example, young students can discuss a technology that has changed the world, such as email or mobile phones. As they progress, they should ask clarifying questions to understand whether a problem or part of a problem can be solved using a computational approach. For example, identify real-world problems that span multiple disciplines, such as increasing bike safety with new helmet technology, and can be solved computationally.

3.2 Decompose complex real-world problems into manageable sub-problems that could integrate existing solutions or procedures.

At any grade level, students should be able to break problems down into their component parts. In the early grade levels, students should focus on breaking down simple problems. For example, in a visual programming environment, students could break down (or decompose) the steps needed to draw a shape. As students progress, they should decompose larger problems into manageable smaller problems. For example, young students may think of an animation as multiple scenes and thus create each scene independently. Students can also break down a program into subgoals: getting input from the user, processing the data, and displaying the result to the user. Eventually, as students encounter complex real-world problems that span multiple disciplines or social systems, they should decompose complex problems into manageable subproblems that could potentially be solved with programs or procedures that already exist. For example, students could create an app to solve a community problem that connects to an online database through an application programming interface (API).

3.3 Evaluate whether it is appropriate and feasible to solve a problem computationally.

After students have had some experience breaking problems down (P3.2) and identifying subproblems that can be solved computationally (P3.1), they should begin to evaluate whether a computational solution is the most appropriate solution for a particular problem. For example, students might question whether using a computer to determine whether someone is telling the truth would be advantageous. As students progress, they should systematically evaluate the feasibility of using computational tools to solve given problems or subproblems, such as through a cost-benefit analysis. Eventually, students should include more factors in their evaluations, such as how efficiency affects feasibility or whether a proposed approach raises ethical concerns.

CS Practice 4. Developing and Using Abstractions

Overview: Abstractions are formed by identifying patterns and extracting common features from specific examples to create generalizations. Using generalized solutions and parts of solutions designed for broad reuse simplifies the development process by managing complexity.

By the end of Grade 12, students should be able to:

4.1 Extract common features from a set of interrelated processes or complex phenomena.

Students at all grade levels should be able to recognize patterns. Young learners should be able to identify and describe repeated sequences in data or code through analogy to visual patterns or physical sequences of objects. As they progress, students should identify patterns as opportunities for abstraction, such as recognizing repeated patterns of code that could be more efficiently implemented as a loop. Eventually, students should extract common features from more complex phenomena or processes. For example, students should be able to identify common features in multiple segments of code and substitute a single segment that uses variables to account for the differences. In a procedure, the variables would take the form of parameters. When working with data, students should be able to identify important aspects and find patterns in related data sets such as crop output, fertilization methods, and climate conditions.

4.2 Evaluate existing technological functionalities and incorporate them into new designs.

At all levels, students should be able to use well-defined abstractions that hide complexity. Just as a car hides operating details, such as the mechanics of the engine, a computer program's "move" command relies on hidden details that cause an object to change location on the screen. As they progress, students should incorporate predefined functions into their designs, understanding that they do not need to know the underlying implementation details of the abstractions that they use. Eventually, students should understand the advantages of, and be comfortable using, existing functionalities (abstractions) including technological resources created by other people, such as libraries and application programming interfaces (APIs). Students should be able to evaluate existing abstractions to determine which should be incorporated into designs and how they should be incorporated. For example, students could build powerful apps by incorporating existing services, such as online databases that return geolocation coordinates of street names or food nutrition information.

4.3 Create modules and develop points of interaction that can apply to multiple situations and reduce complexity.

After students have had some experience identifying patterns (P4.1), decomposing problems (P3.2), using abstractions (P4.2), and taking advantage of existing resources (P4.2), they should begin to develop their own abstractions. As they progress, students should take advantage of opportunities to develop generalizable modules. For example, students could write more efficient programs by designing procedures that are used multiple times in the program. These procedures can be generalized by defining parameters that create different outputs for a wide range of inputs. Later on, students should be able to design systems of interacting modules, each with a well-defined role, that coordinate to accomplish a common goal. Within an object-oriented programming context, module design may include defining interactions among objects. At this stage, these modules, which combine both data and procedures, can be designed and documented for reuse in other programs. Additionally, students can design points of interaction, such as a simple user interface, either text or graphical, that reduces the complexity of a solution and hides lower-level implementation details.

4.4 Model phenomena and processes and simulate systems to understand and evaluate potential outcomes.

Students at all grade levels should be able to represent patterns, processes, or phenomena. With guidance, young students can draw pictures to describe a simple pattern, such as sunrise and sunset, or show the stages in a process, such as brushing your teeth. They can also create an animation to model a phenomenon, such as evaporation. As they progress, students should understand that computers can model real-world phenomena, and they should use existing computer simulations to learn about real-world systems. For example, they may use a preprogrammed model to explore how parameters affect a system, such as how rapidly a disease spreads. Older students should model phenomena as systems, with rules governing the interactions within the system. Students should analyze and evaluate these models against real-world observations. For example, students might create a simple producer–consumer ecosystem model using a programming tool. Eventually, they could progress to creating more complex and realistic interactions between species, such as predation, competition, or symbiosis, and evaluate the model based on data gathered from nature.

CS Practice 5. Creating Computational Artifacts

Overview: The process of developing computational artifacts embraces both creative expression and the exploration of ideas to create prototypes and solve computational problems. Students create artifacts that are personally relevant or beneficial to their community and beyond. Computational artifacts can be created by combining and modifying existing artifacts or by developing new artifacts. Examples of computational artifacts include programs, simulations, visualizations, digital animations, robotic systems, and apps.

By the end of Grade 12, students should be able to:

5.1 Plan the development of a computational artifact using an iterative process that includes reflection on and modification of the plan, taking into account key features, time and resource constraints, and user expectations.

At any grade level, students should participate in project planning and the creation of brainstorming documents. The youngest students may do so with the help of teachers. With scaffolding, students should gain greater independence and sophistication in the planning, design, and evaluation of artifacts. As learning progresses, students should systematically plan the development of a program or artifact and intentionally apply computational techniques, such as decomposition and abstraction, along with knowledge about existing approaches to artifact design. Students should be capable of reflecting on and, if necessary, modifying the plan to accommodate end goals.

5.2 Create a computational artifact for practical intent, personal expression, or to address a societal issue.

Students at all grade levels should develop artifacts in response to a task or a computational problem. At the earliest grade levels, students should be able to choose from a set of given commands to create simple animated stories or solve pre-existing problems. Younger students should focus on artifacts of personal importance. As they progress, student expressions should become more complex and of increasingly broader significance. Eventually, students should engage in independent, systematic use of design processes to create artifacts that solve problems with social significance by seeking input from broad audiences.

5.3 Modify an existing artifact to improve or customize it.

At all grade levels, students should be able to examine existing artifacts to understand what they do. As they progress, students should attempt to use existing solutions to accomplish a desired goal. For example, students could attach a programmable light sensor to a physical artifact they have created to make it respond to light. Later on, they should modify or remix parts of existing programs to develop something new or to add more advanced features and complexity. For example, students could modify prewritten code from a single-player game to create a two-player game with slightly different rules.

CS Practice 6. Testing and Refining Computational Artifacts

Overview: Testing and refinement is the deliberate and iterative process of improving a computational artifact. This process includes debugging (identifying and fixing errors) and comparing actual outcomes to intended outcomes. Students also respond to changing needs and expectations of end users and improve the performance, reliability, usability, and accessibility of artifacts.

By the end of Grade 12, students should be able to:

6.1 Systematically test computational artifacts by considering all scenarios and using test cases.

At any grade level, students should be able to compare results to intended outcomes. Young students should verify whether given criteria and constraints have been met. As students progress, they should test computational artifacts by considering potential errors, such as what will happen if a user enters invalid input. Eventually, testing should become a deliberate process that is more iterative, systematic, and proactive. Older students should be able to anticipate errors and use that knowledge to drive development. For example, students can test their program with inputs associated with all potential scenarios.

6.2 Identify and fix errors using a systematic process.

At any grade level, students should be able to identify and fix errors in programs (debugging) and use strategies to solve problems with computing systems (troubleshooting). Young students could use trial and error to fix simple errors. For example, a student may try reordering the sequence of commands in a program. In a hardware context, students could try to fix a device by resetting it or checking whether it is connected to a network. As students progress, they should become more adept at debugging programs and begin to consider logic errors: cases in which a program works, but not as desired. In this way, students will examine and correct their own thinking. For

example, they might step through their program, line by line, to identify a loop that does not terminate as expected. Eventually, older students should progress to using more complex strategies for identifying and fixing errors, such as printing the value of a counter variable while a loop is running to determine how many times the loop runs.

6.3 Evaluate and refine a computational artifact multiple times to enhance its performance, reliability, usability, and accessibility.

After students have gained experience testing (P6.2), debugging, and revising (P6.1), they should begin to evaluate and refine their computational artifacts. As students progress, the process of evaluation and refinement should focus on improving performance and reliability. For example, students could observe a robot in a variety of lighting conditions to determine that a light sensor should be less sensitive. Later on, evaluation and refinement should become an iterative process that also encompasses making artifacts more usable and accessible (P1.2). For example, students can incorporate feedback from a variety of end users to help guide the size and placement of menus and buttons in a user interface.

CS Practice 7. Communicating About Computing

Overview: Communication involves personal expression and exchanging ideas with others. In computer science, students communicate with diverse audiences about the use and effects of computation and the appropriateness of computational choices. Students write clear comments, document their work, and communicate their ideas through multiple forms of media. Clear communication includes using precise language and carefully considering possible audiences.

By the end of Grade 12, students should be able to:

7.1 Select, organize, and interpret large data sets from multiple sources to support a claim.

At any grade level, students should be able to refer to data when communicating an idea. Early on, students should, with guidance, present basic data through the use of visual representations, such as storyboards, flowcharts, and graphs. As students progress, they should work with larger data sets and organize the data in those larger sets to make interpreting and communicating it to others easier, such as through the creation of basic data representations. Eventually, students should be able to select relevant data from large or complex data sets in support of a claim or to communicate the information in a more sophisticated manner.

7.2 Describe, justify, and document computational processes and solutions using appropriate terminology consistent with the intended audience and purpose.

At any grade level, students should be able to talk about choices they make while designing a computational artifact. Early on, they should use language that articulates what they are doing and identifies devices and concepts they are using with correct terminology (e.g., program, input, and debug). Younger students should identify the goals and expected outcomes of their solutions. Along the way, students should provide documentation for end users that explains their artifacts and how they function, and they should both give and receive feedback. For example, students could provide a project overview and ask for input from users. As students progress, they should incorporate clear comments in their product and document their process using text, graphics, presentations, and demonstrations.

7.3 Articulate ideas responsibly by observing intellectual property rights and giving appropriate attribution.

All students should be able to explain the concepts of ownership and sharing. Early on, students should apply these concepts to computational ideas and creations. They should identify instances of remixing, when ideas are borrowed and iterated upon, and give proper attribution. They should also recognize the contributions of collaborators. Eventually, students should consider common licenses that place limitations or restrictions on the use of computational artifacts. For example, a downloaded image may have restrictions that prohibit modification of an image or using it for commercial purposes.

Domain: Computing Systems	Practice(s): 7.2

By end of Grade 5

Standard: Devices			
	3.CS.D.01 With guidance and following directions, identify how internal and external parts of computing devices function to form a system.	**4.CS.D.01** With guidance, describe how internal and external parts of computing devices function to form a system.	**5.CS.D.01** Independently, describe how internal and external parts of computing devices function to form a system.

Clarification Statement: Computing devices often depend on other devices or components. For example, a robot depends on a physically attached light sensor to detect changes in brightness, whereas the light sensor depends on the robot for power. Keyboard input or a mouse click could cause an action to happen or information to be displayed on a screen; this could only happen because the computer has a processor to evaluate what is happening externally and produce corresponding responses. Students should describe how devices and components interact using correct terminology.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV5.4.2, CV5.4.3	1d - Empowered Learner
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
RI.5.4, RI.5.7, W.5.2, W.5.4, W.5.7, W.5.8, W.5.9, SL.5.4, SL.5.5, SL.5.6, L.5.1, L.5.2, L.5.3, L.5.4, L.5.5, L.5.6			

Domain: Computing Systems	Practice(s): 4.4

By end of Grade 5

Standard: **Hardware & Software**	**3.CS.HS.01** Model how information flows through hardware and software to accomplish tasks.	**4.CS.HS.01** Model how computer hardware and software work together as a system to accomplish tasks.	**5.CS.HS.01** Model how information is translated, transmitted, and processed in order to flow through hardware and software to accomplish tasks.

Clarification Statement: In order for a person to accomplish tasks with a computer, both hardware and software are needed. At this stage, a model should only include the basic elements of a computer system, such as input, output, processor, sensors, and storage. Students could draw a model on paper or in a drawing program, program an animation to demonstrate it, or demonstrate it by acting this out in some way.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV5.4.3	1d - Empowered Learner
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

2019 Wyoming Computer Science Standards

Grade Band: 3-5

Domain: Computing Systems	**Practice(s): 6.2**

By end of Grade 5

Standard: Troubleshooting	**3.CS.T.01** Identify hardware and software problems that may occur during everyday use, then develop, apply, and explain strategies for solving these problems (e.g., refresh the screen, closing and reopening an application or file, unmuting or adjusting the volume on headphones).	**4.CS.T.01** Identify hardware and software problems that may occur during everyday use, then develop, apply, and explain strategies for solving these problems (e.g., rebooting the device, checking the power, force shut down of an application).	**5.CS.T.01** Identify hardware and software problems that may occur during everyday use, then develop, apply, and explain strategies for solving these problems.

Clarification Statement: Although computing systems may vary, common troubleshooting strategies can be used on all of them. Students should be able to identify solutions to problems such as the device not responding, no power, no network, app crashing, no sound, or password entry not working. Should errors occur at school, the goal would be that students would use various strategies, such as rebooting the device, checking for power, checking network availability, closing and reopening an app, making sure speakers are turned on or headphones are plugged in, and making sure that the caps lock key is not on, to solve these problems, when possible.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	3-5-ETS1-3	CV5.3.3, CV5.4.3	1d - Empowered Learner
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
SL5.6			

Domain: Networks & the Internet	Practice(s): 4.4

By end of Grade 5

Standard: Network Communication & Organization	**3.NI.NCO.01** Use observations of everyday situations to illustrate that information is sent and received over physical or wireless paths.	**4.NI.NCO.01** Discuss how information is sent and received across physical or wireless path (i.e., It is broken down into smaller pieces called packets and transmitted from one location to another).	**5.NI.NCO.01** Model and explain how information is broken down into smaller pieces, transmitted as packets through multiple devices over networks and the internet, and reassembled at the destination.

Clarification Statement: Information is sent and received over physical or wireless paths. It is broken down into smaller pieces called packets, which are sent independently and reassembled at the destination. Students should demonstrate their understanding of this flow of information by, for instance, drawing a model of the way packets are transmitted, programming an animation to show how packets are transmitted, or demonstrating this through an unplugged activity which has them act it out in some way.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	4-PS4-3	CV5.4.2, CV5.4.3	5c - Computational Thinker
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
SL5.6			

Domain: Networks & the Internet	Practice(s): 3.1

By end of Grade 5

Standard: Cybersecurity	**3.NI.C.01** Identify cybersecurity problems that relate to inappropriate use of computing devices and networks.	**4.NI.C.01** Identify and explain cybersecurity issues related to responsible use of technology and information, and describe personal consequences of inappropriate use.	**5.NI.C.01** Discuss real-world cybersecurity problems and identify and implement appropriate strategies for how personal information can be protected.

Clarification Statement: Just as we protect our personal property offline, we also need to protect our devices and the information stored on them. Information can be protected using various security measures. These measures can be physical and/or digital. Students could discuss or use a journaling or blogging activity to explain, orally or in writing, topics that relate to personal cybersecurity issues. Discussion topics could be based on current events related to cybersecurity or topics that are applicable to students, such as the necessity of backing up data to guard against loss, how to create strong passwords and the importance of not sharing passwords, or why we should install and keep anti-virus software updated to protect data and systems.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV5.4.3	2d - Digital Citizen
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
SL 5.1			

Domain: Data Analysis	Practice(s): 4.2

By end of Grade 5

Standard: Storage	**3.DA.S.01** Demonstrate that different types of information are stored in different formats that have associated programs (e.g., documents open in a word processor) and different storage requirements.	**4.DA.S.01** Choose different storage locations (physical, shared, or cloud) based on the type of file, storage requirements (e.g., file size, availability, or available memory), and sharing requirements.	**5.DA.S.01** Justify the format and location for storing data based on sharing requirements and the type of information (e.g., images, videos, text).

Clarification Statement: Data may be stored locally on a computer in the classroom, on a school network, or "in the cloud." Each location affects how easily the data may be shared and how secure, or not, it is. Different types of data such as photos or documents each have their own variety of file formats which affect file size and the number and types of programs that can access that data. Students should understand and be able to explain/justify why a particular location or format is appropriate for the data they are creating or using.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV5.4.2, CV5.4.3	
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
RI 5.7			

Domain: Data Analysis	**Practice(s): 7.1**

By end of Grade 5

Standard: Collection, Visualization, & Transformation	**3.DA.CVT.01** Independently collect and present data in various visual formats.	**4.DA.CVT.01** Organize and present collected data in a variety of ways (e.g., sonification, visualization) to highlight relationships.	**5.DA.CVT.01** Organize and present collected data to highlight relationships and support a claim.

Clarification Statement: Raw data has little meaning on its own. Data is often sorted or grouped to provide additional clarity. Organizing data can make interpreting and communicating it to others easier. Data points can be clustered by a number of commonalities. The same data could be manipulated in different ways to emphasize particular aspects or parts of the data set. For example, a data set of sports teams could be sorted by wins, points scored, or points allowed, and a data set of weather information could be sorted by high temperatures, low temperatures, or precipitation. As another example, seismographic data of an earthquake can be presented through sonification (i.e., the audible representation of data) of an earthquake's size, strength, and duration to highlight relationships and support a claim.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
3.MD.H.3	3-5-ETS1-3, 3-PS2-2, 3-LS1-1, 3-LS2-1, 3-LS3-1, 3-LS3-2, 3-LS4-1, 3-LS4-3, 3-LS4-4, 3-ESS2-1, 3-ESS3-1, 4-LS1-1, 4-ESS1-1	CV5.4.1, CV5.4.2	6a, 6c - Creative Communicator
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
W 5.5	SS5.4.2		

Domain: Data Analysis	Practice(s): 7.1

By end of Grade 5

Standard: Inference & Models	**3.DA.IM.01** With guidance, use data to make predictions and discuss whether there is adequate data to make reliable predictions.	**4.DA.IM.01** Determine how the accuracy of conclusions is influenced by the amount of data collected.	**5.DA.IM.01** Use data to highlight or propose relationships, predict outcomes, or communicate an idea.

Clarification Statement: The accuracy of data analysis is related to how realistically data is represented. Inferences or predictions based on data are less likely to be accurate if the data is not sufficient or if the data is incorrect in some way. Students should be able to refer to data when communicating an idea (e.g., in order to explore the relationship between speed, time, and distance, students could operate a robot at uniform speed, and at increasing time intervals to predict how far the robot travels at that speed. In order to make an accurate prediction, one or two attempts of differing times would not be enough. The robot may also collect temperature data from a sensor, but that data would not be relevant for the task. Students must also make accurate measurements of the distance the robot travels in order to develop a valid prediction. Another example, students could record the temperature at noon each day as a basis to show that temperatures are higher in certain months of the year. If temperatures are not recorded on non-school days or are recorded incorrectly or at different times of the day, the data would be incomplete and the ideas being communicated could be inaccurate. Students may also record the day of the week on which the data was collected, but this would have no relevance to whether temperatures are higher or lower. In order to have sufficient and accurate data on which to communicate the idea, students might want to use data provided by a governmental weather agency.).

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	3-5-ETS1-1, 3-5-ETS1-2, 3-5-ETS1-3, 3-PS2-1, 3-PS2-3, 3-PS2-4, 3-LS1-1, 3-LS2-1, 3-LS3-1, 3-LS3-2, 3-LS4-1, 3-LS4-2, 3-LS4-3, 3-LS4-4, 3-ESS2-2, 4-PS4-1, 4-PS4-2, 4-PS4-3, 4-LS1-1, 4-LS1-2, 4-ESS2-1, 4-ESS2-2, 4-ESS3-1, 4-ESS3-2	CV5.4.2, CV5.4.4	6c, 6d - Creative Communicator
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
W 5.5	SS5.4.2		

Domain: Algorithms & Programming	Practice(s): 3.3, 6.3

By end of Grade 5

Standard: Algorithms	**3.AP.A.01** Using grade appropriate content and complexity, compare and refine multiple algorithms for the same task and determine which is the most appropriate.	**4.AP.A.01** Using grade appropriate content and complexity, compare and refine multiple algorithms for the same task and determine which is the most appropriate.	**5.AP.A.01** Using grade appropriate content and complexity, compare and refine multiple algorithms for the same task and determine which is the most appropriate.

Clarification Statement: Different algorithms can achieve the same result, though sometimes one algorithm might be most appropriate for a specific situation. Students should be able to look at different ways to solve the same task and decide which would be the best solution. For example, students could use a map and plan multiple algorithms to get from one point to another. They could look at routes suggested by mapping software and change the route to something that would be better, based on which route is shortest or fastest or would avoid a problem. Students might compare algorithms that describe how to get ready for school. Another example might be to write different algorithms to draw a regular polygon and determine which algorithm would be the easiest to modify or repurpose to draw a different polygon.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
3.NBT.E.2, 4.NBT.E.4, 4.NBT.E.5, 4.NBT.E.5a, 4.NBT.E.5b, 4.NBT.E.5c, 4.NBT.E.6, 4.MD.I.3, 4.MD.K.7, 5.NBT.D.5, 5.NBT.D.6, 5.NBT.D.7, 5.MD.I.5a, 5.MD.I.5b	3-5-ETS1-2, 3-5-ETS1-3, 3-PS2-1, 4-PS4-3		4a - Innovative Designer
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
		FPA4.1.A.2, FPA4.1.D.5, FPA4.1.T.1	

Domain: Algorithms & Programming	Practice(s): 5.2

By end of Grade 5

Standard: Variables	**3.AP.V.01** Using grade appropriate content and complexity, create programs that use variables to store and modify data.	**4.AP.V.01** Using grade appropriate content and complexity, create programs that use variables to store and modify data.	**5.AP.V.01** Using grade appropriate content and complexity, create programs that use variables to store and modify data.

Clarification Statement: Variables are used to store and modify data. At this level, understanding how to use variables is sufficient. For example, students may use mathematical operations to add to the score of a game or subtract from the number of lives available in a game. The use of a variable as a countdown timer is another example.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
3.OA.D.8, 3.OA.D.8a, 4.OA.A.3, 4.OA.A.3a		CV5.4.1	4a - Innovative Designer
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

BOOT UP WYOMING

2019 Wyoming Computer Science Standards

Grade Band: 3-5

Domain: Algorithms & Programming	**Practice(s): 5.2**

By end of Grade 5

Standard: Control	**3.AP.C.01** Using grade appropriate content and complexity, create programs that include sequences, events, loops, and conditionals, both individually and collaboratively.	**4.AP.C.01** Using grade appropriate content and complexity, create programs that include sequences, events, loops, and conditionals, both individually and collaboratively.	**5.AP.C.01** Using grade appropriate content and complexity, create programs that include sequences, events, loops, and conditionals, both individually and collaboratively.

Clarification Statement: Control structures specify the order (sequence) in which instructions are executed within a program and can be combined to support the creation of more complex programs. Events allow portions of a program to run based on a specific action. For example, students could write a program to explain the water cycle and when a specific component is clicked (event), the program would show information about that part of the water cycle. Conditionals allow for the execution of a portion of code in a program when a certain condition is true. For example, students could write a math game that asks multiplication fact questions and then uses a conditional to assign a point if the answer that was entered is correct. Loops allow for the repetition of a sequence of code multiple times. For example, in a program that produces an animation about a famous historical character, students could use a loop to have the character walk across the screen as they introduce themself.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
3.OA.D.9, 4.OA.C.5	3-5-ETS1-2, 4-PS3-4, 4-ESS3-2	CV5.4.1	4a - Innovative Designer
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Algorithms & Programming	Practice(s): 3.2

By end of Grade 5

Standard: Modularity	**3.AP.M.01** Using grade appropriate content and complexity, decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process.	**4.AP.M.01** Using grade appropriate content and complexity, decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process.	**5.AP.M.01** Using grade appropriate content and complexity, decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process.

Clarification Statement: Decomposition is the act of breaking down tasks into simpler tasks. For example, students could create an animation by separating a story into different scenes. For each scene, they would select a background, position of characters, and program actions.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
3.G.K.1, 3.G.K.2, 3.OA.A.3, 4.NBT.E.4, 4.NBT.E.5, 4.NBT.E.5a, 4.NBT.E.5b, 4.NBT.E.5c, 4.MD.I.3, 4.MD.K.7, 5.G.K.3, 5.G.K.4, 5.NBT.D.5, 5.NBT.D.6, 5.NBT.D.7, 5.OA.A.1, 5.OA.A.2	3-5-ETS1-1, 3-5-ETS1-2, 3-5-ETS1-3, 3-PS2-1, 3-PS2-3, 3-PS2-4, 3-LS1-1, 3-LS3-1, 3-LS4-3, 4-PS3-4, 4-PS4-1, 4-PS4-2, 4-ESS1-1, 4-ESS2-1, 4-ESS3-1, 4-ESS3-2		5c - Computational Thinker
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Algorithms & Programming	Practice(s): 5.3

By end of Grade 5

Standard: Modularity			
Standard: **Modularity**	**3.AP.M.02** Using grade appropriate content and complexity, modify, remix, or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features.	**4.AP.M.02** Using grade appropriate content and complexity, modify, remix, or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features.	**5.AP.M.02** Using grade appropriate content and complexity, modify, remix, or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features.

Clarification Statement: Programs can be created or modified using parts from existing programs (i.e. the process of remixing). For example, students could modify prewritten code from a single-player game to create a two-player game with slightly different rules, remix and add another scene to an animated story, use code from another program to a make a ball bounce in a new basketball game, or modify an image created by another student.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	3-PS2-1, 3-PS2-2, 3-PS2-3, 3-PS2-4, 4-PS3-4		6b - Creative Communicator
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Algorithms & Programming	Practice(s): 6.2

By end of Grade 5

Standard: **Program Development**	**3.AP.PD.01** Use an iterative process to plan the development of a program.	**4.AP.PD.01** Use an iterative process to plan the development of a program that includes user preferences.	**5.AP.PD.01** Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences.

Clarification Statement: Planning is an important part of the iterative process of program development. Students could outline key features, time and resource constraints, and user expectations. Students could document the plan (e.g., as a storyboard, flowchart, pseudocode, or story map).

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	3-PS2-1, 3-PS2-2, 3-PS2-4		4c - Innovative Designer
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

BOOT UP WYOMING

2019 Wyoming Computer Science Standards

Grade Band: 3-5

Domain: Algorithms & Programming	**Practice(s): 5.2, 7.3**

By end of Grade 5

Standard: Program Development	**3.AP.PD.02** Using grade appropriate content and complexity, observe intellectual property rights and give appropriate credit when creating or remixing programs.	**4.AP.PD.02** Using grade appropriate content and complexity, observe intellectual property rights and give appropriate credit when creating or remixing programs.	**5.AP.PD.02** Using grade appropriate content and complexity, observe intellectual property rights and give appropriate credit when creating or remixing programs.

Clarification Statement: Intellectual property rights can vary by country, but copyright laws give the creator of a work a set of rights that limits how others may use the work. Students should identify instances of remixing, when ideas are borrowed and iterated upon, and credit the original creator. Students should also consider common licenses that place limitations or restrictions on the use of computational artifacts, such as images and music downloaded from the Internet. At this stage, attribution should be written in the format required by the teacher and should always be included in any programs shared online.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	**2016 SCIENCE**	**2014 C&VE**	**2016 ISTE / WY DL GUIDELINES**
	3-ESS2-1, 4-ESS3-1, 4-ESS3-2		2c - Digital Citizen
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
		FPA4.1.A.5	

Domain: Algorithms & Programming	Practice(s): 6.1, 6.2

By end of Grade 5

Standard: Program Development	**3.AP.PD.03** Using grade appropriate content and complexity, test and debug (i.e., identify and fix errors) a program or algorithm to ensure it runs as intended.	**4.AP.PD.03** Using grade appropriate content and complexity, test and debug (i.e., identify and fix errors) a program or algorithm to ensure it runs as intended.	**5.AP.PD.03** Using grade appropriate content and complexity, test and debug (i.e., identify and fix errors) a program or algorithm to ensure it runs as intended.

Clarification Statement: As students develop programs, they should continuously test those programs (to see that they do what was expected) and fix (d ebug) any errors. Students should also be able to successfully debug simple errors in programs created by others.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	3-5-ETS1-2, 3-5-ETS1-3, 3-PS2-1, 3-PS2-2, 3-5-ETS1-1, 4-PS3-4, 4-PS4-1, 4-PS4-3		4a - Innovative Designer
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
RI.5.7			

BOOT UP WYOMING

2019 Wyoming Computer Science Standards

Grade Band: 3-5

Domain: Algorithms & Programming	**Practice(s): 7.2**

By end of Grade 5

Standard: Program Development	**3.AP.PD.04** Using grade appropriate content and complexity, describe choices made during program development using code comments, presentations, and demonstrations.	**4.AP.PD.04** Using grade appropriate content and complexity, describe choices made during program development using code comments, presentations, and demonstrations.	**5.AP.PD.04** Using grade appropriate content and complexity, describe choices made during program development using code comments, presentations, and demonstrations.

Clarification Statement: People communicate about their code to help others understand and use their programs. Another purpose of communicating one's design choices is to show an understanding of one's work. These explanations could manifest themselves as in-line code comments for collaborators and assessors, or as part of a summative presentation, such as a code walk-through or coding journal.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	3-5-ETS1-1, 3-5-ETS1-2, 3-5-ETS1-3, 3-PS2-1, 3-PS2-4, 4-PS3-4, 4-PS4-1, 4-PS4-3	CV5.4.2, CV5.4.3	3d - Knowledge Constructor
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
RI.5.3, W.5.6		FPA4.1.A.6	

Domain: Algorithms & Programming	Practice(s): 2.2

By end of Grade 5

Standard: **Program Development**	**3.AP.PD.05** Using grade appropriate content and complexity, with teacher guidance, perform varying roles when collaborating with peers during the design, implementation, and review stages of program development.	**4.AP.PD.05** Using grade appropriate content and complexity, with teacher guidance, perform varying roles when collaborating with peers during the design, implementation, and review stages of program development.	**5.AP.PD.05** Using grade appropriate content and complexity, with teacher guidance, perform varying roles when collaborating with peers during the design, implementation, and review stages of program development.

Clarification Statement: Collaborative computing is the process of performing a computational task by working in pairs or on teams. Because it involves asking for the contributions and feedback of others, effective collaboration can lead to better outcomes than working independently. Students should take turns in different roles during program development, such as note taker, facilitator, program tester, or "driver" of the computer.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	3-5-ETS1-2, 3-5-ETS1-3, 3-PS2-1, 3-PS2-2, 3-PS2-3, 3-LS1-1		7a - Global Collaborator
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
W.5.6		FPA4.1.A.4, FPA4.1.A.6, FPA4.1.T.4	

Domain: Impacts of Computing	Practice(s): 3.1

By end of Grade 5

Standard: Culture	**3.IC.C.01** Identify computing technologies that have changed the world and express how those technologies influence and are influenced by cultural practices.	**4.IC.C.01** Give examples of computing technologies that have changed the world and express how those technologies influence and are influenced by cultural practices.	**5.IC.C.01** Give examples and explain how computing technologies have changed the world and express how those technologies influence and are influenced by cultural practices.

Clarification Statement: New computing technology is created and existing technologies are modified for many reasons (e.g., increasing their benefits, decreasing their risks, and meeting societal needs). With guidance, students could discuss topics that relate to the history of technology and the changes in the world due to technology. Topics could be based on current news content, such as robotics, wireless Internet, mobile computing devices, GPS systems, wearable computing, artificial intelligence, or how social media has influenced social and political changes.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	3-5-ETS1-1	CV5.4.2	7a - Global Collaborator
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
RI.5.9, W.5.1	SS5.3.3, SS5.4.2	FPA4.3.A.3, FPA4.3.M.3	

Domain: Impacts of Computing	Practice(s): 1.2

By end of Grade 5

Standard: Culture	**3.IC.C.02** Identify possible problems and propose how computing devices could have built-in features for increasing accessibility to all users.	**4.IC.C.02** Brainstorm problems and ways to improve computing devices to increase accessibility to all users.	**5.IC.C.02** Develop, test, and refine digital artifacts or devices to improve accessibility and usability for diverse end users.

Clarification Statement: The development and modification of computing technologies are driven by people's needs and wants and can affect groups differently. Anticipating the needs and wants of diverse end users requires students to purposefully consider potential perspectives of users with different backgrounds, ability levels, points of view, and disabilities. For example, students may consider using both speech and text when they wish to convey information in a game. They could also vary the types of programs they create, knowing that not everyone shares their own tastes or (dis)abilities.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
			4c - Innovative Designer
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Impacts of Computing	Practice(s): 1.1

By end of Grade 5

Standard: Social Interactions	**3.IC.SI.01** Identify how computational products may be, or have been, improved to incorporate diverse perspectives.	**4.IC.SI.01** As a team or individually, consider other perspectives on improving a computational product.	**5.IC.SI.01** Seek diverse perspectives for the purpose of improving computational artifacts.

Clarification Statement: Computing provides the possibility for collaboration and sharing of ideas and allows the benefit of diverse perspectives. For example, students could seek feedback from other groups in their class or students at another grade level. With guidance, students could use video conferencing tools or other online collaborative spaces (e.g., blogs, wikis, forums, or website comments) to gather feedback from individuals and groups about programming projects.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
			7a - Global Collaborator
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
			PE 5.3.2

Domain: Impacts of Computing	Practice(s): 2.1

By end of Grade 5

Standard: Social Interactions	**3.IC.SI.02** Practice grade-level appropriate behavior and responsibilities while participating in an online community. Identify and report inappropriate behavior.	**4.IC.SI.02** Practice grade-level appropriate behavior and responsibilities while participating in an online community. Identify and report inappropriate behavior.	**5.IC.SI.02** Practice grade-level appropriate behavior and responsibilities while participating in an online community. Identify and report inappropriate behavior.

Clarification Statement: Examples of "online communities" can be small and simple, such as using a shared hard drive or thumb drive within the classroom. They can also extend to sharing folders in cloud-based storage, writing for a school-wide blog, or collaborating with another classroom across the country or around the world using video conferencing. Examples of inappropriate behavior might include sharing another person's private data, providing inappropriate feedback on another person's project, or posting content under another person's name or account.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV5.2.3, CV5.2.4, CV5.5.3, CV5.5.4	2b - Digital Citizen
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
		FPA4.1.A.5, FPA4.4.A.4, FPA4.4.M.1, FPA4.4.T.2	PE 5.3.2 HE4.4.9

Domain: Impacts of Computing	Practice(s): 7.3

By end of Grade 5

Standard: Safety, Law, & Ethics	**3.IC.SLE.01** Identify types of digital data that may have intellectual property rights that prevent copying or require attribution.	**4.IC.SLE.01** Recognize and appropriately use public domain and/or creative commons media and discuss the social impact of violating intellectual property rights.	**5.IC.SLE.01** Recognize and appropriately use public domain and creative commons media and discuss the social impact of violating intellectual property rights.

Clarification Statement: Ethical complications arise from the opportunities provided by computing. The ease of sending and receiving copies of media on the Internet, such as video, photos, and music, creates the opportunity for unauthorized use, such as online piracy and the disregard of copyrights. Students should consider the licenses on computational artifacts that they wish to use. For example, the license on a downloaded image or audio file may have restrictions that prohibit modification, require attribution, or prohibit use entirely.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV5.2.4, CV5.5.3, CV5.5.4	2c - Digital Citizen
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Performance Level Descriptors (PLDs)

Grade Band: 3-5

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Devices: 5.CS.D.01 Independently, describe how internal and external parts of computing devices function to form a system.	provides little to no evidence in addressing the expectation(s).	with guidance, describes with some errors how internal and external parts of computing devices function to form a system.	independently describes with few to no errors how internal and external parts of computing devices function to form a system.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., demonstrates on different types of devices).
Hardware & Software: 5.CS.HS.01 Model how information is translated, transmitted, and processed in order to flow through hardware and software to accomplish tasks.	provides little to no evidence in addressing the expectation(s).	partially models how information is translated, transmitted, and processed in order to flow through hardware and software to accomplish tasks.	accurately models how information is translated, transmitted, and processed in order to flow through hardware and software to accomplish tasks.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., compare and contrast different devices).
Troubleshooting: 5.CS.T.01 Identify hardware and software problems that may occur during everyday use, then develop, apply, and explain strategies for solving these problems.	provides little to no evidence in addressing the expectation(s).	partially: - identifies hardware and software problems that may occur during everyday use. - attempts to solve identified problems, when applicable.	accurately: - identifies hardware and software problems that may occur during everyday use. - develops, applies, and explains strategies for solving identified problems, when applicable.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., develops a troubleshooting guide, helps others with troubleshooting issues efficiently, suggests preventative measures).

Performance Level Descriptors (PLDs)

Grade Band: 3-5

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Network Communication Organization: 5.NI.NCO.01 Model and explain how information is broken down into smaller pieces, transmitted as packets through multiple devices over networks and the internet, and reassembled at the destination.	provides little to no evidence in addressing the expectation(s).	partially models and explains how information is: - broken down into smaller pieces, **and** - transmitted as packets through multiple devices over networks and the internet, **and/or** - reassembled at the destination.	accurately models and explains how information is: - broken down into smaller pieces. - transmitted as packets through multiple devices over networks and the internet. - reassembled at the destination.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., compares and contrasts different connection types).
Cybersecurity: 5.NI.C.01 Discuss real-world cybersecurity problems and identify and implement appropriate strategies for how personal information can be protected.	provides little to no evidence in addressing the expectation(s).	- generally discusses real-world cybersecurity problems, **and/or** - identifies appropriate strategies for how personal information can be protected.	- discusses with specificity real-world cybersecurity problems. - discusses personal consequences of inappropriate use. - identifies and implements appropriate strategies for how personal information can be protected.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., compares and contrasts a variety of approaches to authentication, evaluates current practices).

Performance Level Descriptors (PLDs)

Grade Band: 3-5

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Storage: 5.DA.S.01 Justify the format and location for storing data based on sharing requirements and the type of information (e.g., images, videos, text).	provides little to no evidence in addressing the expectation(s).	describes the format, location, sharing requirements, or the type of information when storing data.	justifies the format and location for storing data based on sharing requirements and the type of information.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., determines the best file type for a given purpose, suggests strategies to solve a problem, creates a document in a variety of formats, converts files).
Collection, Visualization, & Transformation: 5.DA.CVT.01 Organize and present collected data to highlight relationships and support a claim.	provides little to no evidence in addressing the expectation(s).	organizes and presents collected data.	organizes and presents collected data to: - highlight comparisons. - highlight relationships. - to support a claim.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., helps others organize collected data, suggests improvements on how to organize collected data to a specific audience).
Inference & Models: 5.DA.IM.01 Use data to highlight or propose relationships, predict outcomes, or communicate an idea.	provides little to no evidence in addressing the expectation(s).	with guidance, uses data to: - highlight relationships, **and/or** - communicate an idea.	independently uses data to: - highlight or propose relationships, **and/or** - predict outcomes, **and/or** - communicate an idea.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., proposes alternative models, proposes additional factors that could affect a relationship).

Performance Level Descriptors (PLDs)

Grade Band: 3-5

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Algorithms: 5.AP.A.01 Using grade appropriate content and complexity, compare and refine multiple algorithms for the same task and determine which is the most appropriate.	provides little to no evidence in addressing the expectation(s).	compares simple algorithms for the same task.	- compares and refines multiple algorithms for the same task. - determines which algorithm is the most appropriate for the same task.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., develop alternative algorithms).
Variables: 5.AP.V.01 Using grade appropriate content and complexity, create programs that use variables to store and modify data.	provides little to no evidence in addressing the expectation(s).	modifies programs that use variables to: - store data. - modify data.	creates programs that use variables to: - store data. - modify data.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., uses a variety of variable types).
Control: 5.AP.C.01 Using grade appropriate content and complexity, create programs that include sequences, events, loops, and conditionals, both individually and collaboratively.	provides little to no evidence in addressing the expectation(s).	- independently, create programs that include sequences and events. - collaboratively, create programs that include sequences and events.	- independently, create programs that include combinations of sequences, events, loops, and conditionals. - collaboratively, create programs that include combinations of sequences, events, loops, and conditionals.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., incorporating nested loops and complex conditionals).

Performance Level Descriptors (PLDs)

Grade Band: 3-5

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Modularity: 5.AP.M.01 Using grade appropriate content and complexity, decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process. **Modularity: 5.AP.M.02** Using grade appropriate content and complexity, modify, remix, or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features.	provides little to no evidence in addressing the expectation(s).	- decomposes (breaks down) problems into smaller, manageable subproblems to facilitate the program development process, **and/or** - modifies, remixes, or incorporates portions of an existing program into one's own work.	- decomposes (breaks down) problems into smaller, manageable subproblems to facilitate the program development process. - modifies, remixes, or incorporates portions of an existing program into one's own work to develop something new or add more advanced features.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., helps others modify code, incorporates portions of multiple programs).

Performance Level Descriptors (PLDs)

Grade Band: 3-5

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Program Development: 5.AP.PD.01 Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. **Program Development: 5.AP.PD.02** Using grade appropriate content and complexity, observe intellectual property rights and give appropriate credit when creating or remixing programs. **Program Development: 5.AP.PD.03** Using grade appropriate content and complexity, test and debug (i.e., identify and fix errors) a program or algorithm to ensure it runs as intended. **Program Development: 5.AP.PD.04** Using grade appropriate content and complexity, describe choices made during program development using code comments, presentations, and demonstrations. **Program Development: 5.AP.PD.05** Using grade appropriate content and complexity, with teacher guidance, perform varying roles when collaborating with peers during the design, implementation, and review stages of program development.	provides little to no evidence in addressing the expectation(s).	- observes intellectual property rights and gives appropriate credit when creating or remixing programs, **and** - uses an iterative process to plan the development of a program by including other perspectives and considers user preferences, **and/or** - tests and debugs (identify and fix errors) a program or algorithm to ensure it runs as intended, **and/or** - describes choices made during program development using code comments, presentations, and demonstrations, **and/or** - with teacher guidance, performs varying roles when collaborating with peers during the design, implementation, and review stages of program development.	- observes intellectual property rights and gives appropriate credit when creating or remixing programs. - uses an iterative process to plan the development of a program by including other perspectives and considers user preferences. - tests and debugs (identify and fix errors) a program or algorithm to ensure it runs as intended. - describes choices made during program development using code comments, presentations, and demonstrations. - with teacher guidance, performs varying roles when collaborating with peers during the design, implementation, and review stages of program development.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard. By way of examples, - justifies their own copyright on their work; -explains the different types of copyrights and the process of getting permission; - provides guidance to other students when testing and debugging a program or algorithm; - proposes alternatives and justifies why they went with their current code.

Performance Level Descriptors (PLDs)

Grade Band: 3-5

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Culture: 5.IC.C.01 Give examples and explain how computing technologies have changed the world and express how those technologies influence and are influenced by cultural practices. **Culture: 5.IC.C.02** Develop, test, and refine digital artifacts or devices to improve accessibility and usability for diverse end users.	provides little to no evidence in addressing the expectation(s).	- gives examples of how computing technologies have changed the world, **and/or** - expresses how technologies interact with cultural practices, **and/or** - tests digital artifacts or devices for accessibility and usability for diverse end users.	- gives examples and explains how computing technologies have changed the world. - expresses how technologies influence and are influenced by cultural practices. - develops, tests, and refines digital artifacts or devices to improve accessibility and usability for diverse end users.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., makes and justifies predictions based on historical patterns, incorporates multiple forms of accessibility in one artifact).
Social Interactions: 5.IC.SI.01 Seek diverse perspectives for the purpose of improving computational artifacts. **Social Interactions: 5.IC.SI.02** Practice grade-level appropriate behavior and responsibilities while participating in an online community. Identify and report inappropriate behavior.	provides little to no evidence in addressing the expectation(s).	- practices grade-level appropriate behavior and responsibilities while participating in an online community. - identifies and reports inappropriate behavior, when applicable.	- seeks diverse perspectives for the purpose of improving computational artifacts. - practices grade-level appropriate behavior and responsibilities while participating in an online community. - identifies and reports inappropriate behavior, when applicable.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., creates resources that models or explains to peers how to participate in online communities or independently uses video conferencing tools or other online collaborative spaces, such as blogs, wikis, forums, or website comments, to gather feedback from individuals and groups).

Performance Level Descriptors (PLDs)

Grade Band: 3-5

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Safety, Law, & Ethics: 5.IC.SLE.01 Recognize and appropriately use public domain and creative commons media and discuss the social impact of violating intellectual property rights.	provides little to no evidence in addressing the expectation(s).	identifies types of digital data that may have intellectual property rights that prevent copying or require attribution.	- recognizes and appropriately uses public domain and creative commons media. - discusses the social impact of violating intellectual property rights.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., explain the process of contributing to a public domain or creative commons media, create and use a custom intellectual property rights system used by members of the class).

Computer Science | 6-8 Introduction

Throughout grades 6-8, students continue to develop their understanding of algorithms and programming (coding). Students work collaboratively and independently to create and modify increasingly complex programs for a variety of purposes introduced in grades 3-5.

By the end of 8th grade, students can:

- Systematically identify, recommend, resolve, and document increasingly complex software and hardware problems with computing devices and their components
- Model the role of protocols in transmitting data across networks and the internet
- Critique physical and digital procedures that could be implemented to protect electronic data/information
- Use and refine computational tools to transform collected data in order to make it more useful and reliable
- Create flowcharts and pseudocode to design algorithms to solve complex problems
- Create clearly named variables that represent different data types and perform operations on their values
- Design and iteratively develop programs that combine control structures, including nested loops and compound conditionals
- Decompose problems into parts to facilitate the design, implementation, and review of programs
- Create procedures with parameters to organize code and make it easier to reuse
- Seek and incorporate feedback from team members and users to refine a solution to a problem
- Describe impacts associated with computing technologies that affect people's everyday activities and career options along with issues of bias and accessibility in the design of technologies
- Practice grade-level appropriate behavior and responsibilities while participating in an online community, including identifying and reporting inappropriate behavior
- Describe tradeoffs between allowing information to be public and keeping information private and secure
- Discuss the legal, social, and ethical impacts associated with software development and use, including both positive and malicious intent

WY 2019 COMPUTER SCIENCE DOMAINS & STANDARDS

Computing Systems	Networks & The Internet	Data Analysis	Algorithms & Programming	Impacts of Computing
CS.D—Devices CS.HS—Hardware & Software CS.T—Troubleshooting	NI.NCO—Network Communication & Organization NI.C—Cybersecurity	DA.S—Storage DA.CVT—Collection, Visualization, & Transformation DA.IM—Inference & Models	AP.A—Algorithms AP.V—Variables AP.C—Control AP.M—Modularity AP.PD—Program Development	IC.C—Culture IC.SI—Social Interactions IC.SLE—Safety, Law, & Ethics

6-8 Computer Science Practices

There are seven (7) CS Practices that are to be embedded in curriculum and instruction as the standards and benchmarks are taught and measured. The seven (7) CS Practices are listed below, and are more deeply explored on the next several pages. For each grade-band, only the CS Practices that relate are in black text and the others are grayed so the reader can still see them as a set, but will know which ones apply to that particular set of standards.

Practice 1. Fostering an Inclusive Computing Culture

Practice 2. Collaborating Around Computing

Practice 3. Recognizing and Defining Computational Problems

Practice 4. Developing and Using Abstractions

Practice 5. Creating Computational Artifacts

Practice 6. Testing and Refining Computational Artifacts

Practice 7. Communicating About Computing

DESCRIPTION OF 6-8 COMPUTER SCIENCE (CS) PRACTICES

CS Practice 1. Fostering an Inclusive Computing Culture

Overview: Building an inclusive and diverse computing culture requires strategies for incorporating perspectives from people of different genders, ethnicities, and abilities. Incorporating these perspectives involves understanding the personal, ethical, social, economic, and cultural contexts in which people operate. Considering the needs of diverse users during the design process is essential to producing inclusive computational products.

By the end of Grade 12, students should be able to:

1.1 Include the unique perspectives of others and reflect on one's own perspectives when designing and developing computational products.

At all grade levels, students should recognize that the choices people make when they create artifacts are based on personal interests, experiences, and needs. Young learners should begin to differentiate their technology preferences from the technology preferences of others. Initially, students should be presented with perspectives from people with different backgrounds, ability levels, and points of view. As students progress, they should independently seek diverse perspectives throughout the design process for the purpose of improving their computational artifacts. Students who are well-versed in fostering an inclusive computing culture should be able to differentiate backgrounds and skill sets and know when to call upon others, such as to seek out knowledge about potential end users or intentionally seek input from people with diverse backgrounds.

1.2 Address the needs of diverse end users during the design process to produce artifacts with broad accessibility and usability.

At any level, students should recognize that users of technology have different needs and preferences and that not everyone chooses to use, or is able to use, the same technology products. For example, young learners, with teacher guidance, might compare a touchpad and a mouse to examine differences in usability. As students progress, they should consider the preferences of people who might use their products. Students should be able to evaluate the accessibility of a product to a broad group of end users, such as people with various disabilities. For example, they may notice that allowing an end user to change font sizes and colors will make an interface usable for people with low vision. At the higher grades, students should become aware of professionally accepted accessibility standards and should be able to evaluate computational artifacts for accessibility. Students should also begin to identify potential bias during the design process to maximize accessibility in product design. For example, they can test an app and recommend to its designers that it respond to verbal commands to accommodate users who are blind or have physical disabilities.

1.3 Employ self- and peer-advocacy to address bias in interactions, product design, and development methods.

After students have experience identifying diverse perspectives and including unique perspectives (P1.1), they should begin to employ self-advocacy strategies, such as speaking for themselves if their needs are not met. As students progress, they should advocate for their peers when accommodations, such as an assistive-technology peripheral device, are needed for someone to use a computational artifact. Eventually, students should regularly advocate for both themselves and others.

CS Practice 2. Collaborating Around Computing

Overview: Collaborative computing is the process of performing a computational task by working in pairs and on teams. Because it involves asking for the contributions and feedback of others, effective collaboration can lead to better outcomes than working independently. Collaboration requires individuals to navigate and incorporate diverse perspectives, conflicting ideas, disparate skills, and distinct personalities. Students should use collaborative tools to effectively work together and to create complex artifacts.

By the end of Grade 12, students should be able to:

2.1 Cultivate working relationships with individuals possessing diverse perspectives, skills, and personalities.

At any grade level, students should work collaboratively with others. Early on, they should learn strategies for working with team members who possess varying individual strengths. For example, with teacher support, students should begin to give each team member opportunities to contribute and to work with each other as co-learners. Eventually, students should become more sophisticated at applying strategies for mutual encouragement and support. They should express their ideas with logical reasoning and find ways to reconcile differences cooperatively. For example, when they disagree, they should ask others to explain their reasoning and work together to make respectful, mutual decisions. As they progress, students should use methods for giving all group members a chance to participate. Older students should strive to improve team efficiency and effectiveness by regularly evaluating group dynamics. They should use multiple strategies to make team dynamics more productive. For example, they can ask for the opinions of quieter team members, minimize interruptions by more talkative members, and give individuals credit for their ideas and their work.

2.2 Create team norms, expectations, and equitable workloads to increase efficiency and effectiveness.

After students have had experience cultivating working relationships within teams (P2.1), they should gain experience working in particular team roles. Early on, teachers may help guide this process by providing collaborative structures. For example, students may take turns in different roles on the project, such as note taker, facilitator, or "driver" of the computer. As students progress, they should become less dependent on the teacher assigning roles and become more adept at assigning roles within their teams. For example, they should decide together how to take turns in different roles. Eventually, students should independently organize their own teams and create common goals, expectations, and equitable workloads. They should also manage project workflow using agendas and timelines and should evaluate workflow to identify areas for improvement.

2.3 Solicit and incorporate feedback from, and provide constructive feedback to, team members and other stakeholders.

At any level, students should ask questions of others and listen to their opinions. Early on, with teacher scaffolding, students should seek help and share ideas to achieve a particular purpose. As they progress in school, students should provide and receive feedback related to computing in constructive ways. For example, pair programming is a collaborative process that promotes giving and receiving feedback. Older students should engage in active listening by using questioning skills and should respond empathetically to others. As they progress, students should be able to receive feedback from multiple peers and should be able to differentiate opinions. Eventually, students should seek contributors from various environments. These contributors may include end users, experts, or general audiences from online forums.

2.4 Evaluate and select technological tools that can be used to collaborate on a project.

At any level, students should be able to use tools and methods for collaboration on a project. For example, in the early grades, students could collaboratively brainstorm by writing on a white-board. As students progress, they should use technological collaboration tools to manage team-work, such as knowledge-sharing tools and online project spaces. They should also begin to make decisions about which tools would be best to use and when to use them. Eventually, students should use different collaborative tools and methods to solicit input from not only team members and classmates but also others, such as participants in online forums or local communities.

CS Practice 3. Recognizing and Defining Computational Problems

Overview: The ability to recognize appropriate and worthwhile opportunities to apply computation is a skill that develops over time and is central to computing. Solving a problem with a computational approach requires defining the problem, breaking it down into parts, and evaluating each part to

determine whether a computational solution is appropriate.

By the end of Grade 12, students should be able to:

3.1 Identify complex, interdisciplinary, real-world problems that can be solved computationally.

At any level, students should be able to identify problems that have been solved computationally. For example, young students can discuss a technology that has changed the world, such as email or mobile phones. As they progress, they should ask clarifying questions to understand whether a problem or part of a problem can be solved using a computational approach. For example, identify real-world problems that span multiple disciplines, such as increasing bike safety with new helmet technology, and can be solved computationally.

3.2 Decompose complex real-world problems into manageable sub-problems that could integrate existing solutions or procedures.

At any grade level, students should be able to break problems down into their component parts. In the early grade levels, students should focus on breaking down simple problems. For example, in a visual programming environment, students could break down (or decompose) the steps needed to draw a shape. As students progress, they should decompose larger problems into manageable smaller problems. For example, young students may think of an animation as multiple scenes and thus create each scene independently. Students can also break down a program into subgoals: getting input from the user, processing the data, and displaying the result to the user. Eventually, as students encounter complex real-world problems that span multiple disciplines or social systems, they should decompose complex problems into manageable subproblems that could potentially be solved with programs or procedures that already exist. For example, students could create an app to solve a community problem that connects to an online database through an application programming interface (API).

3.3 Evaluate whether it is appropriate and feasible to solve a problem computationally.

After students have had some experience breaking problems down (P3.2) and identifying subproblems that can be solved computationally (P3.1), they should begin to evaluate whether a computational solution is the most appropriate solution for a particular problem. For example, students might question whether using a computer to determine whether someone is telling the truth would be advantageous. As students progress, they should systematically evaluate the feasibility of using computational tools to solve given problems or subproblems, such as through a cost-benefit analysis. Eventually, students should include more factors in their evaluations, such as how efficiency affects feasibility or whether a proposed approach raises ethical concerns.

CS Practice 4. Developing and Using Abstractions

Overview: Abstractions are formed by identifying patterns and extracting common features from specific examples to create generalizations. Using generalized solutions and parts of solutions designed for broad reuse simplifies the development process by managing complexity.

By the end of Grade 12, students should be able to:

4.1 Extract common features from a set of interrelated processes or complex phenomena.

Students at all grade levels should be able to recognize patterns. Young learners should be able to identify and describe repeated sequences in data or code through analogy to visual patterns or physical sequences of objects. As they progress, students should identify patterns as opportunities for abstraction, such as recognizing repeated patterns of code that could be more efficiently implemented as a loop. Eventually, students should extract common features from more complex phenomena or processes. For example, students should be able to identify common features in multiple segments of code and substitute a single segment that uses variables to account for the differences. In a procedure, the variables would take the form of parameters. When working with data, students should be able to identify important aspects and find patterns in related data sets such as crop output, fertilization methods, and climate conditions.

4.2 Evaluate existing technological functionalities and incorporate them into new designs.

At all levels, students should be able to use well-defined abstractions that hide complexity. Just as a car hides operating details, such as the mechanics of the engine, a computer program's "move" command relies on hidden details that cause an object to change location on the screen. As they progress, students should incorporate predefined functions into their designs, understanding that they do not need to know the underlying implementation details of the abstractions that they use. Eventually, students should understand the advantages of, and be comfortable using, existing functionalities (abstractions) including technological resources created by other people, such as libraries and application programming interfaces (APIs). Students should be able to evaluate existing abstractions to determine which should be incorporated into designs and how they should be incorporated. For example, students could build powerful apps by incorporating existing services, such as online databases that return geolocation coordinates of street names or food nutrition information.

4.3 Create modules and develop points of interaction that can apply to multiple situations and reduce complexity.

After students have had some experience identifying patterns (P4.1), decomposing problems (P3.2), using abstractions (P4.2), and taking advantage of existing resources (P4.2), they should begin to develop their own abstractions. As they progress, students should take advantage of opportunities to develop generalizable modules. For example, students could write more efficient programs by designing procedures that are used multiple times in the program. These procedures can be generalized by defining parameters that create different outputs for a wide range of inputs. Later on, students should be able to design systems of interacting modules, each with a well-defined role, that coordinate to accomplish a common goal. Within an object-oriented programming context, module design may include defining interactions among objects. At this stage, these modules, which combine both data and procedures, can be designed and documented for reuse in other programs. Additionally, students can design points of interaction, such as a simple user interface, either text or graphical, that reduces the complexity of a solution and hides lower-level implementation details.

4.4 Model phenomena and processes and simulate systems to understand and evaluate potential outcomes.

Students at all grade levels should be able to represent patterns, processes, or phenomena. With guidance, young students can draw pictures to describe a simple pattern, such as sunrise and sunset, or show the stages in a process, such as brushing your teeth. They can also create an animation to model a phenomenon, such as evaporation. As they progress, students should understand that computers can model real-world phenomena, and they should use existing computer simulations to learn about real-world systems. For example, they may use a preprogrammed model to explore how parameters affect a system, such as how rapidly a disease spreads. Older students should model phenomena as systems, with rules governing the interactions within the system. Students should analyze and evaluate these models against real-world observations. For example, students might create a simple producer–consumer ecosystem model using a programming tool. Eventually, they could progress to creating more complex and realistic interactions between species, such as predation, competition, or symbiosis, and evaluate the model based on data gathered from nature.

CS Practice 5. Creating Computational Artifacts

Overview: The process of developing computational artifacts embraces both creative expression and the exploration of ideas to create prototypes and solve computational problems. Students create artifacts that are personally relevant or beneficial to their community and beyond. Computational artifacts can be created by combining and modifying existing artifacts or by developing new artifacts. Examples of computational artifacts include programs, simulations, visualizations, digital animations, robotic systems, and apps.

By the end of Grade 12, students should be able to:

5.1 Plan the development of a computational artifact using an iterative process that includes reflection on and modification of the plan, taking into account key features, time and resource constraints, and user expectations.

At any grade level, students should participate in project planning and the creation of brainstorming documents. The youngest students may do so with the help of teachers. With scaffolding, students should gain greater independence and sophistication in the planning, design, and evaluation of artifacts. As learning progresses, students should systematically plan the development of a program or artifact and intentionally apply computational techniques, such as decomposition and abstraction, along with knowledge about existing approaches to artifact design. Students should be capable of reflecting on and, if necessary, modifying the plan to accommodate end goals.

5.2 Create a computational artifact for practical intent, personal expression, or to address a societal issue.

Students at all grade levels should develop artifacts in response to a task or a computational problem. At the earliest grade levels, students should be able to choose from a set of given commands to create simple animated stories or solve pre-existing problems. Younger students should focus on artifacts of personal importance. As they progress, student expressions should become more complex and of increasingly broader significance. Eventually, students should engage in independent, systematic use of design processes to create artifacts that solve problems with social significance by seeking input from broad audiences.

5.3 Modify an existing artifact to improve or customize it.

At all grade levels, students should be able to examine existing artifacts to understand what they do. As they progress, students should attempt to use existing solutions to accomplish a desired goal. For example, students could attach a programmable light sensor to a physical artifact they have created to make it respond to light. Later on, they should modify or remix parts of existing programs to develop something new or to add more advanced features and complexity. For example, students could modify prewritten code from a single-player game to create a two-player game with slightly different rules.

CS Practice 6. Testing and Refining Computational Artifacts

Overview: Testing and refinement is the deliberate and iterative process of improving a computational artifact. This process includes debugging (identifying and fixing errors) and comparing actual outcomes to intended outcomes. Students also respond to changing needs and expectations of end users and improve the performance, reliability, usability, and accessibility of artifacts.

By the end of Grade 12, students should be able to:

6.1 Systematically test computational artifacts by considering all scenarios and using test cases.

At any grade level, students should be able to compare results to intended outcomes. Young students should verify whether given criteria and constraints have been met. As students progress, they should test computational artifacts by considering potential errors, such as what will happen if a user enters invalid input. Eventually, testing should become a deliberate process that is more iterative, systematic, and proactive. Older students should be able to anticipate errors and use that knowledge to drive development. For example, students can test their program with inputs associated with all potential scenarios.

6.2 Identify and fix errors using a systematic process.

At any grade level, students should be able to identify and fix errors in programs (debugging) and use strategies to solve problems with computing systems (troubleshooting). Young students could use trial and error to fix simple errors. For example, a student may try reordering the sequence of commands in a program. In a hardware context, students could try to fix a device by resetting it or checking whether it is connected to a network. As students progress, they should become more adept at debugging programs and begin to consider logic errors: cases in which a program works, but not as desired. In this way, students will examine and correct their own thinking. For

example, they might step through their program, line by line, to identify a loop that does not terminate as expected. Eventually, older students should progress to using more complex strategies for identifying and fixing errors, such as printing the value of a counter variable while a loop is running to determine how many times the loop runs.

6.3 Evaluate and refine a computational artifact multiple times to enhance its performance, reliability, usability, and accessibility.

After students have gained experience testing (P6.2), debugging, and revising (P6.1), they should begin to evaluate and refine their computational artifacts. As students progress, the process of evaluation and refinement should focus on improving performance and reliability. For example, students could observe a robot in a variety of lighting conditions to determine that a light sensor should be less sensitive. Later on, evaluation and refinement should become an iterative process that also encompasses making artifacts more usable and accessible (P1.2). For example, students can incorporate feedback from a variety of end users to help guide the size and placement of menus and buttons in a user interface.

CS Practice 7. Communicating About Computing

Overview: Communication involves personal expression and exchanging ideas with others. In computer science, students communicate with diverse audiences about the use and effects of computation and the appropriateness of computational choices. Students write clear comments, document their work, and communicate their ideas through multiple forms of media. Clear communication includes using precise language and carefully considering possible audiences.

By the end of Grade 12, students should be able to:

7.1 Select, organize, and interpret large data sets from multiple sources to support a claim.

At any grade level, students should be able to refer to data when communicating an idea. Early on, students should, with guidance, present basic data through the use of visual representations, such as storyboards, flowcharts, and graphs. As students progress, they should work with larger data sets and organize the data in those larger sets to make interpreting and communicating it to others easier, such as through the creation of basic data representations. Eventually, students should be able to select relevant data from large or complex data sets in support of a claim or to communicate the information in a more sophisticated manner.

7.2 Describe, justify, and document computational processes and solutions using appropriate terminology consistent with the intended audience and purpose.

At any grade level, students should be able to talk about choices they make while designing a computational artifact. Early on, they should use language that articulates what they are doing and identifies devices and concepts they are using with correct terminology (e.g., program, input, and debug). Younger students should identify the goals and expected outcomes of their solutions. Along the way, students should provide documentation for end users that explains their artifacts and how they function, and they should both give and receive feedback. For example, students could provide a project overview and ask for input from users. As students progress, they should incorporate clear comments in their product and document their process using text, graphics, presentations, and demonstrations.

7.3 Articulate ideas responsibly by observing intellectual property rights and giving appropriate attribution.

All students should be able to explain the concepts of ownership and sharing. Early on, students should apply these concepts to computational ideas and creations. They should identify instances of remixing, when ideas are borrowed and iterated upon, and give proper attribution. They should also recognize the contributions of collaborators. Eventually, students should consider common licenses that place limitations or restrictions on the use of computational artifacts. For example, a downloaded image may have restrictions that prohibit modification of an image or using it for commercial purposes.

2019 Wyoming Computer Science Standards

Grade Band: 6-8

Domain: Computing Systems	**Practice(s): 3.3**

By end of Grade 8

Standard: Devices	**6.CS.D.01** Recommend improvements to the design of computing devices based on analysis of personal interaction with the device.	**7.CS.D.01** Recommend improvements to the design of computing devices based on analysis of how peers interact with the device.	**8.CS.D.01** Recommend improvements to the design of computing devices based on an analysis of how a variety of users interact with the device.

Clarification Statement: The study of human–computer interaction (HCI) can improve the design of devices, including both hardware and software. Students should make recommendations for existing devices (e.g., a laptop, phone, or tablet) or design their own components or interface (e.g., create their own controllers). Teachers can guide students to consider usability through several lenses, including accessibility, ergonomics, and ease of use. For example, assistive devices provide capabilities such as scanning written information and converting it to speech.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	MS-ETS1-4	CV8.2.1, CV8.5.3	
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
SL 8.1			

Domain: Computing Systems	Practice(s): 5.1

By end of Grade 8

Standard: Hardware & Software	**6.CS.HS.01** Identify ways that hardware and software are combined to collect and exchange data.	**7.CS.HS.01** Recommend improvements to software and hardware combinations used to collect and exchange data.	**8.CS.HS.01** Design and refine a project that combines hardware and software components to collect and exchange data.

Clarification Statement: Collecting and exchanging data involves input, output, storage, and processing. When possible, students should select the hardware and software components for their project designs by considering factors such as functionality, cost, size, speed, accessibility, and aesthetics. For example, components for a mobile app could include accelerometer, GPS, and speech recognition. The choice of a device that connects wirelessly through a Bluetooth connection versus a physical USB connection involves a tradeoff between mobility and the need for an additional power source for the wireless device.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	MS-ETS1-3	CV8.4.4, CV8.5.3, CV8.5.4	4c - Innovative Designer 5b - Computational Thinker
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
			PE 8.3.3

Domain: Computing Systems	Practice(s): 6.2

By end of Grade 8

Standard: Troubleshooting	**6.CS.T.01** Identify and determine potential solutions for increasingly complex software and hardware problems with computing devices and their components.	**7.CS.T.01** Identify and resolve increasingly complex software and hardware problems with computing devices and their components.	**8.CS.T.01** Systematically identify, resolve, and document increasingly complex software and hardware problems with computing devices and their components.

Clarification Statement: Since a computing device may interact with interconnected devices within a system, problems may not be due to the specific computing device itself but to devices connected to it. Just as pilots use checklists to troubleshoot problems with aircraft systems, students should use a similar, structured process to troubleshoot problems with computing systems and ensure that potential solutions are not overlooked. Examples of troubleshooting strategies include following a troubleshooting flow diagram, making changes to software to see if hardware will work, checking connections and settings, and swapping in working components.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	MS-ETS1-1, MS-ETS1-4, MS-ETS2-1	CV8.2.1, CV8.3.1, CV8.4.3, CV8.5.3, CV8.5.4	3d - Knowledge Constructor
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
			PE 8.3.3

Domain: Networks & the Internet	Practice(s): 4.4

By end of Grade 8

Standard: Network Communication & Organization	**6.NI.NCO.01** Model the role of protocols in transmitting data across networks and the internet (e.g., model a simple protocol for transferring information using packets).	**7.NI.NCO.01** Model the role of protocols in transmitting data across networks and the internet (e.g., explain how a system responds when a packet is lost and the effect it has on the transferred information).	**8.NI.NCO.01** Model the role of protocols in transmitting data across networks and the internet (e.g., explain protocols and their importance to data transmission; model how packets are broken down into smaller pieces and how they are delivered).

Clarification Statement: Protocols are rules that define how messages between computers are sent. They determine how information is transmitted across networks and the Internet, as well as how to handle errors in transmission. Students should model how data is sent using protocols to choose the fastest path, to deal with missing information, and to deliver sensitive data securely. For example, students could devise a plan for resending lost information or for interpreting a picture that has missing pieces. The priority at this grade level is understanding the purpose of protocols and how they enable secure and errorless communication. Knowledge of the details of how specific protocols work is not expected.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	MS-PS4-3	CV8.2.1, CV8.4.3, CV8.5.3	5c - Computational Thinker
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Networks & the Internet	Practice(s): 7.2

By end of Grade 8

Standard:			
Standard: Cybersecurity	**6.NI.C.01** Identify existing cybersecurity concerns with the internet.	**7.NI.C.01** Explain how to protect electronic information, both physical and digital. Identify cybersecurity concerns and options to address issues.	**8.NI.C.01** Critique physical and digital procedures that could be implemented to protect electronic data/information.

Clarification Statement: Information that is stored online is vulnerable to unwanted access. Examples of physical security measures to protect data in clude keeping passwords hidden, locking doors, making backup copies on external storage devices, and erasing a storage device before it is reused. Examples of digital security measures include secure router admin passwords, firewalls that limit access to private networks, and the use of a protocol such as HTTPS to ensure secure data transmission.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	MS-PS4-3	CV8.2.1, CV8.3.1, CV8.4.3, CV8.5.3	
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
RI.8.7			PE 8.3.3

2019 Wyoming Computer Science Standards

Grade Band: 6-8

Domain: Networks & the Internet	**Practice(s): 4.4**

By end of Grade 8

Standard: Cybersecurity	**6.NI.C.02** Explain the importance of cybersecurity and describe how one method of encryption works.	**7.NI.C.02** Identify and explain two or more methods of encryption used to ensure and secure the transmission of information.	**8.NI.C.02** Apply multiple methods of encryption to model the secure transmission of data.

Clarification Statement: Encryption can be as simple as letter substitution or as complicated as modern methods used to secure networks and the Internet. Students should encode and decode messages using a variety of encryption methods, and they should understand the different levels of complexity used to hide or secure information. For example, students could secure messages using methods such as Caesar cyphers or steganography (e.g., hiding messages inside a picture or other data). They can also model more complicated methods, such as public key encryption, through unplugged activities.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
7.NS.B.1, 7.NS.B.3	MS-PS4-3	CV8.5.3, CV8.5.4	
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

BOOT UP WYOMING

2019 Wyoming Computer Science Standards

Grade Band: 6-8

Domain: Data Analysis	**Practice(s): 4.4**

By end of Grade 8

Standard: Storage	**6.DA.S.01** Represent data using multiple encoding schemes (e.g., images are stored in multiple formats: .jpeg, .png, .gif).	**7.DA.S.01** Represent data using multiple encoding schemes (e.g., color names, RGB coding and hexadecimal).	**8.DA.S.01** Represent data using multiple encoding schemes (e.g., ASCII, binary).

Clarification Statement: Data representations occur at multiple levels of abstraction, from the physical storage of bits to the arrangement of information into organized formats (e.g., tables). Students should represent the same data in multiple ways. For example, students could represent the same color using binary, RGB values, hex codes (low-level representations), as well as forms understandable by people, including words, symbols, and digital displays of the color (high-level representations).

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
6.NS.D.7, 6.EE.E.2c, 7.NS.B.1, 7.NS.B.1a, 7.NS.B.1c, 7.NS.B.1d, 7.NS.B.1e, 7.NS.B.3		CV8.2.1, CV8.5.3, CV8.5.4	
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Data Analysis	Practice(s): 6.3

By end of Grade 8

Standard: Collection, Visualization, & Transformation	**6.DA.CVT.01** Explore a variety of computational tools and the content of their data.	**7.DA.CVT.01** Collect data using computational tools.	**8.DA.CVT.01** Using computational tools, transform collected data to make it more useful and reliable.

Clarification Statement: As students continue to build on their ability to organize and present data visually to support a claim, they will need to understand when and how to transform data for this purpose. Students should transform data to remove errors, highlight or expose relationships, and/or make it easier for computers to process. The cleaning of data is an important transformation for ensuring consistent format and reducing noise and errors (e.g., removing irrelevant responses in a survey). An example of a transformation that highlights a relationship is representing males and females as percentages of a whole instead of as individual counts.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	MS-PS3-1, MS-LS2-1, MS-ESS1-3, MS-ESS2-5, MS-ESS3-2	CV8.4.4, CV8.5.4	5b - Computational Thinker
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
	SS8.6.3		PE 8.3.3

BOOT UP WYOMING

2019 Wyoming Computer Science Standards

Grade Band: 6-8

Domain: Data Analysis	Practice(s): 4.4, 5.3

By end of Grade 8

Standard: Inference & Models	**6.DA.IM.01** Use models and simulations to formulate, refine, and test hypotheses.	**7.DA.IM.01** Test and analyze the effects of changing variables while using computational models.	**8.DA.IM.01** Refine computational models based on generated data.

Clarification Statement: A model may be a programmed simulation of events or a representation of how various data is related. In order to refine a model, students need to consider which data points are relevant, how data points relate to each other, and if the data is accurate. For example, students may make a prediction about how far a ball will travel based on a table of data related to the height and angle of a track. The students could then test and refine their model by comparing predicted versus actual results and considering whether other factors are relevant (e.g., size and mass of the ball). Additionally, students could refine game mechanics based on test outcomes in order to make the game more balanced or fair.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
7.SP.I.6	MS-ESS2-5, MS-ESS3-2, MS-ETS1-3	CV8.5.3, CV8.5.4	4c - Innovative Designer
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
			PE 8.3.3

Domain: Algorithms & Programming	Practice(s): 4.1, 4.4

By end of Grade 8

Standard: Algorithms			
Standard: **Algorithms**	**6.AP.A.01** Use existing algorithms in natural language, flowcharts, or pseudocode to solve complex problems.	**7.AP.A.01** Select and modify existing algorithms in flowcharts or pseudocode to solve complex problems.	**8.AP.A.01** Create flowcharts and pseudocode to design algorithms to solve complex problems.

Clarification Statement: Complex problems are problems that would be difficult for students to solve computationally. Students should use pseudocode and/or flowcharts to organize and sequence an algorithm that addresses a complex problem, even though they may not actually program the solutions. For example, students might express an algorithm that produces a recommendation for purchasing sneakers based on inputs such as size, colors, brand, comfort, and cost. Testing the algorithm with a wide range of inputs and users allows students to refine their recommendation algorithm and to identify other inputs they may have initially excluded.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	MS-PS1-2, MS-PS1-4, MS-PS3-3	CV8.4.1, CV8.4.3, CV8.4.4	6c - Creative Communicator
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
		FPA8.1.A.1, FPA8.1.A.2, FPA8.1.D.5, FPA8.1.M.4, FPA8.1.D.6	

2019 Wyoming Computer Science Standards

Grade Band: 6-8

Domain: Algorithms & Programming	Practice(s): 5.1, 5.2

By end of Grade 8

Standard: Variables			
Standard: **Variables**	**6.AP.V.01** Using grade appropriate content and complexity, create clearly named variables that represent different data types and perform operations on their values.	**7.AP.V.01** Using grade appropriate content and complexity, create clearly named variables that represent different data types and perform operations on their values.	**8.AP.V.01** Using grade appropriate content and complexity, create clearly named variables that represent different data types and perform operations on their values.

Clarification Statement: A variable is like a container with a name, in which the contents may change, but the name (identifier) does not. When planning and developing programs, students should decide when and how to declare and name new variables. Students should use naming conventions to improve program readability. Examples of operations include adding points to the score, combining user input with words to make a sentence, changing the size of a picture, or adding a name to a list of people.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
6.EE.E.2, 6.EE.E.2a, 6.EE.G.9, 6.EE.F.6, 7.EE.D.4, 7.EE.C.2, 8.EE.D.7, 8.F.E.1	MS-PS1-2, MS-LS2-1, MS-ESS1-3, MS-ETS1-3	CV8.5.3, CV8.5.4	
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

2019 Wyoming Computer Science Standards

Grade Band: 6-8

Domain: Algorithms & Programming	**Practice(s): 5.1, 5.2**

By end of Grade 8

Standard: Control	**6.AP.C.01** Using grade appropriate content and complexity, design and iteratively develop programs that combine control structures, including nested loops and compound conditionals.	**7.AP.C.01** Using grade appropriate content and complexity, design and iteratively develop programs that combine control structures, including nested loops and compound conditionals.	**8.AP.C.01** Using grade appropriate content and complexity, design and iteratively develop programs that combine control structures, including nested loops and compound conditionals.

Clarification Statement: Control structures can be combined in many ways. Nested loops are loops placed within loops. Compound conditionals combine tw o or more conditions in a logical relationship (e.g., using AND, OR, NOT), and nesting conditionals within one another allows the result of one conditional to lead to another. For example, when programming an interactive story, students could use a compound conditional within a loop to unlock a door only if a character has a key AND is touching the door.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
6.EE.E.2, 6.EE.E.4, 6.EE.F.8, 6.EE.G.9, 7.NS.B.3, 8.EE.D.7	MS-ETS1-4		4a - Innovative Designer 5a - Computational Thinker
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
			PE 8.3.3

2019 Wyoming Computer Science Standards

Grade Band: 6-8

Domain: Algorithms & Programming	**Practice(s): 3.2**

By end of Grade 8

Standard: Modularity	**6.AP.M.01** Using grade appropriate content and complexity, decompose problems and subproblems into parts to facilitate the design, implementation, and review of programs.	**7.AP.M.01** Using grade appropriate content and complexity, decompose problems and subproblems into parts to facilitate the design, implementation, and review of programs.	**8.AP.M.01** Using grade appropriate content and complexity, decompose problems and subproblems into parts to facilitate the design, implementation, and review of programs.

Clarification Statement: Students should break down problems into subproblems, which can be further broken down to smaller parts. Decomposition facilitates aspects of program development by allowing students to focus on one piece at a time (e.g., getting input from the user, processing the data, and displaying the result to the user). Decomposition also enables different students to work on different parts at the same time. For example, animations can be decomposed into multiple scenes, which can be developed independently.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
6.EE.E.2b, 6.G.H.1, 6.G.H.4, 7.NS.B.3, 8.EE.D.7, 8.EE.D.8	MS-ETS1-1, MS-ETS1-2, MS-ETS2-2	CV8.3.1, CV8.5.4	5c - Computational Thinker
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
			PE 8.3.3

Domain: Algorithms & Programming	Practice(s): 4.1, 4.3

By end of Grade 8

Standard: Modularity	**6.AP.M.02** Using grade appropriate content and complexity, create procedures with parameters to organize code and make it easier to reuse.	**7.AP.M.02** Using grade appropriate content and complexity, create procedures with parameters to organize code and make it easier to reuse.	**8.AP.M.02** Using grade appropriate content and complexity, create procedures with parameters to organize code and make it easier to reuse.

Clarification Statement: Students should create procedures and/or functions that are used multiple times within a program to repeat groups of instructi ons. These procedures can be generalized by defining parameters that create different outputs for a wide range of inputs. For example, a procedure to draw a circle involves many instructions, but all of them can be invoked with one instruction, such as “drawCircle.” By adding a radius parameter, the user can easily draw circles of different sizes.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
6.EE.E.2, 6.EE.G.9, 7.NS.B.3, 8.F.E.1		CV8.3.1, CV8.4.4, CV8.5.3, CV8.5.4	5c - Computational Thinker
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
			PE 8.3.3

2019 Wyoming Computer Science Standards

BOOT UP WYOMING

Grade Band: 6-8

Domain: Algorithms & Programming	**Practice(s): 1.1, 2.3**

By end of Grade 8

Standard: Program Development	**6.AP.PD.01** Using grade appropriate content and complexity, seek and incorporate feedback from team members and users to refine a solution to a problem.	**7.AP.PD.01** Using grade appropriate content and complexity, seek and incorporate feedback from team members and users to refine a solution to a problem.	**8.AP.PD.01** Using grade appropriate content and complexity, seek and incorporate feedback from team members and users to refine a solution to a problem.

Clarification Statement: Development teams that employ user-centered design create solutions (e.g., programs and devices) that can have a large societal impact, such as an app that allows people with speech difficulties to translate hard-to-understand pronunciation into understandable language. Students should begin to seek diverse perspectives throughout the design process to improve their computational artifacts. Considerations of the end-user may include usability, accessibility, age-appropriate content, respectful language, user perspective, pronoun use, color contrast, and ease of use.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	**2016 SCIENCE**	**2014 C&VE**	**2016 ISTE / WY DL GUIDELINES**
	MS-ETS1-1, MS-ETS1-2, MS-ETS1-3, MS-ETS1-4	CV8.2.1, CV8.4.1	7b - Global Collaborator
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
W.8.7			PE 8.3.3 HE8.2.1

2019 Wyoming Computer Science Standards

Grade Band: 6-8

Domain: Algorithms & Programming	Practice(s): 4.2, 5.2, 7.3

By end of Grade 8

Standard: Program Development	6	7	8
	6.AP.PD.02 Incorporate existing code, media, or libraries into original programs and give attribution.	**7.AP.PD.02** Incorporate existing code, media, and/or libraries into original programs of increasing complexity and give attribution.	**8.AP.PD.02** Incorporate existing code, media, and libraries into original programs of increasing complexity and give attribution.

Clarification Statement: Building on the work of others enables students to produce more interesting and powerful creations. Students should use porti ons of code, algorithms, and/or digital media in their own programs and websites. At this level, they may also import libraries and connect to application program interfaces (APIs). For example, when creating a side-scrolling game, students may incorporate portions of code that create a realistic jump movement from another person's game, and they may also import Creative Commons-licensed images to use in the background. Students should give attribution to the original creators to acknowledge their contributions.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV8.2.1, CV8.4.4, CV8.5.3, CV8.5.4	6b - Creative Communicator
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

BOOT UP WYOMING

2019 Wyoming Computer Science Standards

Grade Band: 6-8

Domain: Algorithms & Programming	**Practice(s): 6.1**

By end of Grade 8

Standard: Program Development	**6.AP.PD.03** Test and refine programs using teacher provided inputs.	**7.AP.PD.03** Test and refine programs using a variety of student and peer created inputs.	**8.AP.PD.03** Systematically test and refine programs using a range of test cases.

Clarification Statement: Use cases and test cases are created and analyzed to better meet the needs of users and to evaluate whether programs function as intended. At this level, testing should become a deliberate process that is more iterative, systematic, and proactive than at lower levels. Students should begin to test programs by considering potential errors, such as what will happen if a user enters invalid input (e.g., negative numbers and 0 instead of positive numbers).

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	MS-ETS1-4, MS-LS4-6		4c - Innovative Designer
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
			PE 8.3.3

BOOT UP WYOMING

2019 Wyoming Computer Science Standards

Grade Band: 6-8

Domain: Algorithms & Programming	**Practice(s): 7.2**

By end of Grade 8

Standard: Program Development	**6.AP.PD.04** Using grade appropriate content and complexity, document programs in order to make them easier to follow, test, and debug.	**7.AP.PD.04** Using grade appropriate content and complexity, document programs in order to make them easier to follow, test, and debug.	**8.AP.PD.04** Using grade appropriate content and complexity, document programs in order to make them easier to follow, test, and debug.

Clarification Statement: Documentation allows creators and others to more easily use and understand a program. Students should provide documentation for end users that explains their artifacts and how they function. For example, students could provide a project overview and clear user instructions. They should also incorporate comments in their product and communicate their process using design documents, flowcharts, and presentations.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV8.2.1, CV8.4.1, CV8.4.3, CV8.5.4	
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
			PE 8.3.3

BOOT UP WYOMING

2019 Wyoming Computer Science Standards

Grade Band: 6-8

Domain: Algorithms & Programming	**Practice(s): 2.2**

By end of Grade 8

Standard: Program Development	**6.AP.PD.05** Using a pre-written computational artifact, identify the project timeline tasks necessary for program development.	**7.AP.PD.05** Break down tasks and follow an individual timeline when developing a computational artifact.	**8.AP.PD.05** Distribute tasks and maintain a project timeline when collaboratively developing computational artifacts.

Clarification Statement: Collaboration is a common and crucial practice in programming development. Often, many individuals and groups work on the interdependent parts of a project together. Students should assume pre-defined roles within their teams and manage the project workflow using structured timelines. With teacher guidance, they will begin to create collective goals, expectations, and equitable workloads. For example, students may divide the design stage of a game into planning the storyboard, flowchart, and different parts of the game mechanics. They can then distribute tasks and roles among members of the team and assign deadlines.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	**2016 SCIENCE**	**2014 C&VE**	**2016 ISTE / WY DL GUIDELINES**
		CV8.2.3, CV8.5.2	7c - Global Collaborator
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
			PE 8.3.3 HE8.2.1

Domain: Impacts of Computing	Practice(s): 7.2

By end of Grade 8

Standard: Culture			
Standard: Culture	**6.IC.C.01** Explain how computing impacts people's everyday activities.	**7.IC.C.01** Explain how computing impacts innovation in other fields and career opportunities.	**8.IC.C.01** Describe impacts associated with computing technologies that affect people's everyday activities and career options.

Clarification Statement: Advancements in computer technology are neither wholly positive nor negative. However, the ways that people use computing technologies have tradeoffs. For example, students could compare tradeoffs associated with computing technologies that affect people's everyday activities and career options. Students should consider current events related to broad ideas, including privacy, communication, and automation. For example, driverless cars can increase convenience and reduce accidents, but they are also susceptible to hacking. The emerging industry will reduce the number of taxi and shared-ride drivers, but will create more software engineering and cybersecurity jobs.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	MS-ETS1-1, MS-ETS2-2, MS-PS4-3	CV8.2.1	
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
	SS8.3.3	FPA8.3.M.3	

2019 Wyoming Computer Science Standards

Grade Band: 6-8

Domain: Impacts of Computing	Practice(s): 1.2

By end of Grade 8

Standard: Culture	6–8		
Standard: **Culture**	**6.IC.C.02** Explore issues of bias and accessibility in the design of technologies.	**7.IC.C.02** Discuss issues of bias and accessibility in the design of technologies.	**8.IC.C.02** Describe issues of bias and accessibility in the design of technologies.

Clarification Statement: Students should test and discuss the usability of various technology tools (e.g., apps, games, and devices) with the teacher's guidance. For example, facial recognition software that works better for lighter skin tones was likely developed with a homogeneous testing group and could be improved by sampling a more diverse population. When discussing accessibility, students may notice that allowing a user to change font sizes and colors will not only make an interface usable for people with low vision but also benefits users in various situations, such as in bright daylight or a dark room.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	MS-PS4-3	CV8.2.1	
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Impacts of Computing	Practice(s): 2.4, 5.2

By end of Grade 8

Standard: Social Interactions	**6.IC.SI.01** Using grade appropriate content and complexity, collaborate using tools to connect with peers when creating a computational artifact.	**7.IC.SI.01** Using grade appropriate content and complexity, collaborate using tools to connect with peers when creating a computational artifact.	**8.IC.SI.01** Using grade appropriate content and complexity, collaborate using tools to connect with peers when creating a computational artifact.

Clarification Statement: Crowdsourcing is gathering services, ideas, or content from a large group of people, especially from the online community. It can be done at the local level (e.g., classroom or school) or global level (e.g., age appropriate online communities). For example, a group of students could combine animations to create a digital community mosaic. They could also solicit feedback from many people through use of online communities and electronic surveys. Collaborating soft skills include an ability to function in teams, an understanding of professional and ethical responsibility, and an ability to communicate effectively. Effective conflict management involves attention to resources, objectives, and identify issues.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV8.2.2, CV8.2.3, CV8.3.4, CV8.4.4, CV8.5.2, CV8.5.4	7b - Global Collaborator
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
	SS8.6.3	FPA8.1.A.4, FPA8.1.T.4, FPA8.1.D.5, FPA8.1.D.6	PE 8.3.3

BOOT UP WYOMING

2019 Wyoming Computer Science Standards

Grade Band: 6-8

Domain: Impacts of Computing	Practice(s): 2.1, 7.3

By end of Grade 8

Standard: Social Interactions			
Standard: Social Interactions	**6.IC.SI.02** Practice grade-level appropriate behavior and responsibilities while participating in an online community. Identify and report inappropriate behavior.	**7.IC.SI.02** Practice grade-level appropriate behavior and responsibilities while participating in an online community. Identify and report inappropriate behavior.	**8.IC.SI.02** Practice grade-level appropriate behavior and responsibilities while participating in an online community. Identify and report inappropriate behavior.

Clarification Statement: Students engage in positive, safe, legal and ethical behavior when using technology and follow school district policy for reporting inappropriate behavior. Students can also describe how they would report inappropriate behavior in an online community and/or to law enforcement. Examples of inappropriate behavior might include sharing or modifying another person's private data, providing inappropriate feedback on another person's project, posting content under another person's name or account, or sharing data without permission.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV8.2.4, CV8.3.4, CV8.4.2, CV8.5.1	2b - Digital Citizen
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
	SS8.6.3	FPA8.1.A.5, FPA8.4.A.4, FPA8.4.M.1, FPA8.4.T.2	PE 8.3.3 HE6.4.8, HE6.4.9, HE8.4.9, HE8.4.10

BOOT UP WYOMING

2019 Wyoming Computer Science Standards

Grade Band: 6-8

Domain: Impacts of Computing	**Practice(s): 7.2**

By end of Grade 8

Standard: Safety, Law, & Ethics	**6.IC.SLE.01** Using grade appropriate content and complexity, describe tradeoffs between allowing information to be public and keeping information private and secure.	**7.IC.SLE.01** Using grade appropriate content and complexity, describe tradeoffs between allowing information to be public and keeping information private and secure.	**8.IC.SLE.01** Using grade appropriate content and complexity, describe tradeoffs between allowing information to be public and keeping information private and secure.

Clarification Statement: Sharing information online can help establish, maintain, and strengthen connections between people. For example, it allows artists and designers to display their talents and reach a broad audience. However, security attacks often start with personal information that is publicly available online. Social engineering is based on tricking people into revealing sensitive information and can be thwarted by being wary of attacks, such as phishing and spoofing.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV8.2.1, CV8.2.4	2c - Digital Citizen
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Impacts of Computing	Practice(s): 1.1, 7.2

By end of Grade 8

Standard: Safety, Law, & Ethics			
	6.IC.SLE.02 Using grade level appropriate content and complexity, discuss the legal, social, and ethical impacts associated with software development and use, including both positive and malicious intent.	**7.IC.SLE.02** Using grade level appropriate content and complexity, discuss the legal, social, and ethical impacts associated with software development and use, including both positive and malicious intent.	**8.IC.SLE.02** Using grade level appropriate content and complexity, discuss the legal, social, and ethical impacts associated with software development and use, including both positive and malicious intent.

Clarification Statement: Ethics involves a focus on real-world applications of emerging technology, diverse academic perspectives, discussing existing industry standards for use as ethical guidelines, and developing systematic methods to analyze societal issues. Examples of positive impacts could include writing software or utilities to improve communication for people who have a disability, writing an application that manages money for a bank, or software that handles healthcare records. Examples of negative impacts could include distributing a virus, or writing backdoor code, malware, or ransomware.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV8.2.1, CV8.2.4, CV8.4.2	2a - Digital Citizen
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Performance Level Descriptors (PLDs)

Grade Band: 6-8

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Devices: 8.CS.D.01 Recommend improvements to the design of computing devices based on an analysis of how a variety of users interact with the device.	provides little to no evidence in addressing the expectation(s).	- understands the needs of the users, but is unable to analyze, **and/or** - describes the parts of computing devices, but cannot recommend improvements to the design.	- analyzes the needs of the users. - recommends improvements to the design of computing devices based on that analysis.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., recommend improvements to the design in more than one area (input, output, processing, storage) or group (special populations)).
Hardware & Software: 8.CS.HS.01 Design and refine a project that combines hardware and software components to collect and exchange data.	provides little to no evidence in addressing the expectation(s).	- describes how hardware and software components collect and exchange data, but cannot design a project, **and/or** - creates a project that combines hardware and software components to collect and exchange data but cannot refine.	- designs a project that combines hardware and software components to collect and exchange data. - refines a project that combines hardware and software components to collect and exchange data.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., design a project that combines hardware and software components to collect and exchange data that affects the world around them, refine a project multiple times that combines hardware and software components to collect and exchange data to address real world usage).

Performance Level Descriptors (PLDs)

Grade Band: 6-8

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Troubleshooting: 8.CS.T.01 Systematically identify, resolve, and document increasingly complex software and hardware problems with computing devices and their components.	provides little to no evidence in addressing the expectation(s).	can do some of the following: - identify software problems with computing devices and their components, - identify hardware problems with computing devices and their components, - resolve software problems with computing devices and their components, - resolve hardware problems with computing devices and their components, - document software problems with computing devices and their components, - document hardware problems with computing devices and their components.	can systematically: - identify software problems with computing devices and their components, - identify hardware problems with computing devices and their components, - resolve software problems with computing devices and their components, - resolve hardware problems with computing devices and their components, - document software problems with computing devices and their components, - document hardware problems with computing devices and their components.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., systematically assists others with hardware or software problems, creates a detailed troubleshooting document or tutorial, comes up with novel solutions).

Performance Level Descriptors (PLDs)

Grade Band: 6-8

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Network Communication & Organization: 8.NI.NCO.01 Model the role of protocols in transmitting data across networks and the internet (e.g. explain protocols and their importance to data transmission; model how packets are broken down into smaller pieces and how they are delivered).	provides little to no evidence in addressing the expectation(s).	- identifies protocols used in transmitting data across networks and the internet, **and/or** - explains the role of protocols in transmitting data across networks and the internet.	- models the role of protocols in transmitting data across networks and the internet.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., research and compare/contrast multiple network protocols).
Cybersecurity: 8.NI.C.01 Using grade appropriate content and complexity, create programs that use variables to store and modify data. **Cybersecurity: 8.NI.C.02** Apply multiple methods of encryption to model the secure transmission of data.	provides little to no evidence in addressing the expectation(s).	- lists physical and digital procedures that could be implemented to protect electronic data/ information, **and/or** - describes multiple methods of encryption used to secure data.	- critiques physical and digital procedures that could be implemented to protect electronic data/information. - applies multiple methods of encryption to model the secure transmission of data.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., explain the impacts of hacking, ransomware, scams, and ethical/legal concerns; compare the advantages and disadvantages of multiple methods of encryption to model the secure transmission of information).

Performance Level Descriptors (PLDs)

Grade Band: 6-8

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Storage: 8.DA.S.01 Represent data using multiple encoding schemes (e.g., ASCII, binary).	provides little to no evidence in addressing the expectation(s).	- recognizes data is stored in multiple encoding schemes.	- represents data using multiple encoding schemes.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., convert data between multiple encoding schemes; ASCII to binary, hex to rgb).
Collection, Visualization, & Transformation: 8.DA.CVT.01 Using computational tools, transform collected data to make it more useful and reliable.	provides little to no evidence in addressing the expectation(s).	- explores a variety of computational tools and the content of their data. - uses computational tools to collect data.	determines appropriate computational tools to: - transform data to remove errors. - highlight or expose relationships in the data.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., error checking input during data collection process, export data to another format).
Inference & Models: 8.DA.IM.01 Refine computational models based on generated data.	provides little to no evidence in addressing the expectation(s).	- uses models and simulations to formulate, refine, and test hypotheses, **and/or** - tests and analyzes the effects of changing variables while using computational models.	- refines computational models based on generated data.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., make multiple refinements).

Performance Level Descriptors (PLDs)

Grade Band: 6-8

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Algorithms: 8.AP.A.01 Create flowcharts and pseudocode to design algorithms to solve complex problems.	provides little to no evidence in addressing the expectation(s).	- uses flowcharts to modify existing algorithms, **and/or** - uses pseudocode to modify existing algorithms, **and/or** - uses natural language to modify existing algorithms.	- creates flowcharts to design algorithms to solve complex problems. - writes pseudocode to design algorithms to solve complex problems.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., design algorithms to solve complex problems in multiple ways and determine and use the most effective planning tool).
Variables: 8.AP.V.01 Using grade appropriate content and complexity, create clearly named variables that represent different data types and perform operations on their values.	provides little to no evidence in addressing the expectation(s).	- recognizes that variables can represent different data types, **and/or** - can create a variable, **and/or** - can perform operations on the values of variables.	- clearly names variables. - creates variables that represent different data types. - performs operations on the values of variables.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., explain types of errors that can occur if improper data types are used in operations, understand structures or classes can contain multiple data types).
Control: 8.AP.C.01 Using grade appropriate content and complexity, design and iteratively develop programs that combine control structures, including nested loops and compound conditionals.	provides little to no evidence in addressing the expectation(s).	designs and iteratively develops programs that: - use simple loops. - use simple conditionals.	designs and iteratively develops programs that include: - nested loops. - compound conditionals.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., multiple examples of nested loops and compound conditions in a program, evidence of efficient code, clear documentation).

Performance Level Descriptors (PLDs)

Grade Band: 6-8

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Modularity: 8.AP.M.01 Using grade appropriate content and complexity, decompose problems and subproblems into parts to facilitate the design, implementation, and review of programs. **Modularity: 8.AP.M.02** Using grade appropriate content and complexity, create procedures with parameters to organize code and make it easier to reuse.	provides little to no evidence in addressing the expectation(s).	- recognizes the inefficiency of repetition in programming, **and/or** - recognizes the organizational, readability and labor-saving advantages of code reuse.	- decomposes problems and subproblems into parts. - creates procedures with parameters.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., create procedures with multiple parameters and/or return values).

Performance Level Descriptors (PLDs)

Grade Band: 6-8

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Program Development: 8.AP.PD.01 Using grade appropriate content and complexity, seek and incorporate feedback from team members and users to refine a solution to a problem. **Program Development: 8.AP.PD.02** Incorporate existing code, media, and libraries into original programs of increasing complexity and give attribution. **Program Development: 8.AP.PD.03** Systematically test and refine programs using a range of test cases. **Program Development: 8.AP.PD.04** Using grade appropriate content and complexity, document programs in order to make them easier to follow, test, and debug.	provides little to no evidence in addressing the expectation(s).	- recognizes the advantage of using existing code. - recognizes reasons for testing and refining programs. - recognizes the advantage of documenting programs. - recognizes the role of using feedback.	- incorporates existing code, media, and libraries into original programs. - systematically tests and refines programs. - documents programs. - seeks and incorporates feedback.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., seek open source libraries to include in their program, seek feedback from a wide audience).
Program Development: 8.AP.PD.05 Distribute tasks and maintain a project timeline when collaboratively developing computational artifacts.	provides little to no evidence in addressing the expectation(s).	using a pre-written computational artifact: - identifies the project timeline tasks necessary for program development. - breaks down tasks and follows an individual timeline when developing a computational artifact.	when collaboratively developing computational artifacts: - distributes tasks. - maintains a project timeline.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., adjust the timeline and redistribute tasks to meet the deadline).

Performance Level Descriptors (PLDs)

Grade Band: 6-8

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Culture: 8.IC.C.01 Describe impacts associated with computing technologies that affect people's everyday activities and career options. **Culture: 8.IC.C.02** Describe issues of bias and accessibility in the design of technologies.	provides little to no evidence in addressing the expectation(s).	- lists computing technologies that affect people's everyday activities, **and/or** - lists computing technologies that affect people's career options, **and/or** - identifies an accessibility issue related to technology.	- describes impacts associated with computing technologies that affect people's everyday activities. - describes impacts associated with computing technologies that affect people's career options. - describes issues of bias and accessibility in the design of technologies.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., devise solutions to solve issues of bias in accessibility, reduce negative impacts of computing technology in everyday life).
Social Interactions: 8.IC.SI.01 Using grade appropriate content and complexity, collaborate using tools to connect with peers when creating a computational artifact. **Social Interactions: 8.IC.SI.02** Practice grade-level appropriate behavior and responsibilities while participating in an online community. Identify and report inappropriate behavior.	provides little to no evidence in addressing the expectation(s).	- collaborates with peers using a tool in an attempt to create a computational artifact. - intermittently collaborates and behaves within an online community.	- collaborates using tools to connect with peers when creating a computational artifact. - practices grade-level appropriate behavior and responsibilities while participating in an online community. - identifies and reports inappropriate behavior while participating in an online community, when applicable.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., moderate, model appropriate behavior, and facilitate discussions in an online community).

Performance Level Descriptors (PLDs)

Grade Band: 6-8

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Safety, Law, & Ethics: 8.IC.SLE.01 Using grade appropriate content and complexity, describe tradeoffs between allowing information to be public and keeping information private and secure. **Safety, Law, & Ethics: 8.IC.SLE.02** Using grade appropriate content and complexity, describe tradeoffs between allowing information to be public and keeping information private and secure.	provides little to no evidence in addressing the expectation(s).	- lists reasons for allowing information to be public and keeping information private and secure, **and/or** With regard to positive and/or malicious intent can: - name the legal impacts associated with software development and use, - name the social impacts associated with software development and use, - name the ethical impacts associated with software development and use.	- describes tradeoffs between allowing information to be public and keeping information private and secure, **and** With regard to positive and malicious intent: - discusses the legal impacts associated with software development and use, - discusses the social impacts associated with software development and use, - discusses the ethical impacts associated with software development and use.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., research and report on current legal, social, and ethical worldwide trends in software development; construct an argument for or against the use of personal data by commercial entities or government).

Computer Science | 9-12 Introduction

In high school, students will continue to develop their knowledge of computing systems, their components, and how systems interact. Students will use their understanding about the basic principles of computation, that algorithms describe a step-by-step solution to a problem, that programs are algorithms written in a language that a computer can understand, and that the solution to many problems can be described as a program. A solid foundation of algebraic concepts is important for success in high school computer science courses. Students will expand their ability to identify patterns and create algorithms that can model the observed patterns.

By the end of 12th grade, students can:

- Create a computer program using sequencing, selection, and iteration
- Decompose complex problems into smaller, more manageable sections
- Use tools of coding to create, debug, and document the evolution of an artifact
- Compare and contrast trade-offs in programming techniques
- Develop complex computer program individually and as part of a group
- Recognize how various components of a complex computing system work together
- Use tools to analyze data and know how data is stored
- Explain how cybersecurity issues affect networks and the internet
- Justify how proliferation of computing affects privacy, rights, opportunities, and responsibility

The high school standards are organized into 2 levels. Mostly, Level 1 is intended to be at the introductory level, and Level 2 reaches at a deeper level.

WYOMING 2019 COMPUTER SCIENCE DOMAINS & STANDARDS

Computing Systems	Networks & The Internet	Data Analysis	Algorithms & Programming	Impacts of Computing
CS.D—Devices **CS.HS—Hardware & Software** **CS.T—Troubleshooting**	**NI.NCO—Network Communication & Organization** **NI.C—Cybersecurity**	**DA.S—Storage** **DA.CVT—Collection, Visualization, & Transformation** **DA.IM—Inference & Models**	**AP.A—Algorithms** **AP.V—Variables** **AP.C—Control** **AP.M—Modularity** **AP.PD—Program Development**	**IC.C—Culture** **IC.SI—Social Interactions** **IC.SLE—Safety, Law, & Ethics**

9-12 Computer Science Practices

There are seven (7) CS Practices that are to be embedded in curriculum and instruction as the standards and benchmarks are taught and measured. The seven (7) CS Practices are listed below, and are more deeply explored on the next several pages. For each grade-band, only the CS Practices that relate are in black text and the others are grayed so the reader can still see them as a set, but will know which ones apply to that particular set of standards.

Practice 1. Fostering an Inclusive Computing Culture

Practice 2. Collaborating Around Computing

Practice 3. Recognizing and Defining Computational Problems

Practice 4. Developing and Using Abstractions

Practice 5. Creating Computational Artifacts

Practice 6. Testing and Refining Computational Artifacts

Practice 7. Communicating About Computing

DESCRIPTION OF 9-12 COMPUTER SCIENCE (CS) PRACTICES

CS Practice 1. Fostering an Inclusive Computing Culture

Overview: Building an inclusive and diverse computing culture requires strategies for incorporating perspectives from people of different genders, ethnicities, and abilities. Incorporating these perspectives involves understanding the personal, ethical, social, economic, and cultural contexts in which people operate. Considering the needs of diverse users during the design process is essential to producing inclusive computational products.

By the end of Grade 12, students should be able to:

1.1 Include the unique perspectives of others and reflect on one's own perspectives when designing and developing computational products.

At all grade levels, students should recognize that the choices people make when they create artifacts are based on personal interests, experiences, and needs. Young learners should begin to differentiate their technology preferences from the technology preferences of others. Initially, students should be presented with perspectives from people with different backgrounds, ability levels, and points of view. As students progress, they should independently seek diverse perspectives throughout the design process for the purpose of improving their computational artifacts. Students who are well-versed in fostering an inclusive computing culture should be able to differentiate backgrounds and skill sets and know when to call upon others, such as to seek out knowledge about potential end users or intentionally seek input from people with diverse backgrounds.

1.2 Address the needs of diverse end users during the design process to produce artifacts with broad accessibility and usability.

At any level, students should recognize that users of technology have different needs and preferences and that not everyone chooses to use, or is able to use, the same technology products. For example, young learners, with teacher guidance, might compare a touchpad and a mouse to examine differences in usability. As students progress, they should consider the preferences of people who might use their products. Students should be able to evaluate the accessibility of a product to a broad group of end users, such as people with various disabilities. For example, they may notice that allowing an end user to change font sizes and colors will make an interface usable for people with low vision. At the higher grades, students should become aware of professionally accepted accessibility standards and should be able to evaluate computational artifacts for accessibility. Students should also begin to identify potential bias during the design process to maximize accessibility in product design. For example, they can test an app and recommend to its designers that it respond to verbal commands to accommodate users who are blind or have physical disabilities.

1.3 Employ self- and peer-advocacy to address bias in interactions, product design, and development methods.

After students have experience identifying diverse perspectives and including unique perspectives (P1.1), they should begin to employ self-advocacy strategies, such as speaking for themselves if their needs are not met. As students progress, they should advocate for their peers when accommodations, such as an assistive-technology peripheral device, are needed for someone to use a computational artifact. Eventually, students should regularly advocate for both themselves and others.

CS Practice 2. Collaborating Around Computing

Overview: Collaborative computing is the process of performing a computational task by working in pairs and on teams. Because it involves asking for the contributions and feedback of others, effective collaboration can lead to better outcomes than working independently. Collaboration requires individuals to navigate and incorporate diverse perspectives, conflicting ideas, disparate skills, and distinct personalities. Students should use collaborative tools to effectively work together and to create complex artifacts.

By the end of Grade 12, students should be able to:

2.1 Cultivate working relationships with individuals possessing diverse perspectives, skills, and personalities.

At any grade level, students should work collaboratively with others. Early on, they should learn strategies for working with team members who possess varying individual strengths. For example, with teacher support, students should begin to give each team member opportunities to contribute and to work with each other as co-learners. Eventually, students should become more sophisticated at applying strategies for mutual encouragement and support. They should express their ideas with logical reasoning and find ways to reconcile differences cooperatively. For example, when they disagree, they should ask others to explain their reasoning and work together to make respectful, mutual decisions. As they progress, students should use methods for giving all group members a chance to participate. Older students should strive to improve team efficiency and effectiveness by regularly evaluating group dynamics. They should use multiple strategies to make team dynamics more productive. For example, they can ask for the opinions of quieter team members, minimize interruptions by more talkative members, and give individuals credit for their ideas and their work.

2.2 Create team norms, expectations, and equitable workloads to increase efficiency and effectiveness.

After students have had experience cultivating working relationships within teams (P2.1), they should gain experience working in particular team roles. Early on, teachers may help guide this process by providing collaborative structures. For example, students may take turns in different roles on the project, such as note taker, facilitator, or "driver" of the computer. As students progress, they should become less dependent on the teacher assigning roles and become more adept at assigning roles within their teams. For example, they should decide together how to take turns in different roles. Eventually, students should independently organize their own teams and create common goals, expectations, and equitable workloads. They should also manage project workflow using agendas and timelines and should evaluate workflow to identify areas for improvement.

2.3 Solicit and incorporate feedback from, and provide constructive feedback to, team members and other stakeholders.

At any level, students should ask questions of others and listen to their opinions. Early on, with teacher scaffolding, students should seek help and share ideas to achieve a particular purpose. As they progress in school, students should provide and receive feedback related to computing in constructive ways. For example, pair programming is a collaborative process that promotes giving and receiving feedback. Older students should engage in active listening by using questioning skills and should respond empathetically to others. As they progress, students should be able to receive feedback from multiple peers and should be able to differentiate opinions. Eventually, students should seek contributors from various environments. These contributors may include end users, experts, or general audiences from online forums.

2.4 Evaluate and select technological tools that can be used to collaborate on a project.

At any level, students should be able to use tools and methods for collaboration on a project. For example, in the early grades, students could collaboratively brainstorm by writing on a white-board. As students progress, they should use technological collaboration tools to manage team-work, such as knowledge-sharing tools and online project spaces. They should also begin to make decisions about which tools would be best to use and when to use them. Eventually, students should use different collaborative tools and methods to solicit input from not only team members and classmates but also others, such as participants in online forums or local communities.

CS Practice 3. Recognizing and Defining Computational Problems

Overview: The ability to recognize appropriate and worthwhile opportunities to apply computation is a skill that develops over time and is central to computing. Solving a problem with a computational approach requires defining the problem, breaking it down into parts, and evaluating each part to

determine whether a computational solution is appropriate.

By the end of Grade 12, students should be able to:

3.1 Identify complex, interdisciplinary, real-world problems that can be solved computationally.

At any level, students should be able to identify problems that have been solved computationally. For example, young students can discuss a technology that has changed the world, such as email or mobile phones. As they progress, they should ask clarifying questions to understand whether a problem or part of a problem can be solved using a computational approach. For example, identify real-world problems that span multiple disciplines, such as increasing bike safety with new helmet technology, and can be solved computationally.

3.2 Decompose complex real-world problems into manageable sub-problems that could integrate existing solutions or procedures.

At any grade level, students should be able to break problems down into their component parts. In the early grade levels, students should focus on breaking down simple problems. For example, in a visual programming environment, students could break down (or decompose) the steps needed to draw a shape. As students progress, they should decompose larger problems into manageable smaller problems. For example, young students may think of an animation as multiple scenes and thus create each scene independently. Students can also break down a program into subgoals: getting input from the user, processing the data, and displaying the result to the user. Eventually, as students encounter complex real-world problems that span multiple disciplines or social systems, they should decompose complex problems into manageable subproblems that could potentially be solved with programs or procedures that already exist. For example, students could create an app to solve a community problem that connects to an online database through an application programming interface (API).

3.3 Evaluate whether it is appropriate and feasible to solve a problem computationally.

After students have had some experience breaking problems down (P3.2) and identifying subproblems that can be solved computationally (P3.1), they should begin to evaluate whether a computational solution is the most appropriate solution for a particular problem. For example, students might question whether using a computer to determine whether someone is telling the truth would be advantageous. As students progress, they should systematically evaluate the feasibility of using computational tools to solve given problems or subproblems, such as through a cost-benefit analysis. Eventually, students should include more factors in their evaluations, such as how efficiency affects feasibility or whether a proposed approach raises ethical concerns.

CS Practice 4. Developing and Using Abstractions

Overview: Abstractions are formed by identifying patterns and extracting common features from specific examples to create generalizations. Using generalized solutions and parts of solutions designed for broad reuse simplifies the development process by managing complexity.

By the end of Grade 12, students should be able to:

4.1 Extract common features from a set of interrelated processes or complex phenomena.

Students at all grade levels should be able to recognize patterns. Young learners should be able to identify and describe repeated sequences in data or code through analogy to visual patterns or physical sequences of objects. As they progress, students should identify patterns as opportunities for abstraction, such as recognizing repeated patterns of code that could be more efficiently implemented as a loop. Eventually, students should extract common features from more complex phenomena or processes. For example, students should be able to identify common features in multiple segments of code and substitute a single segment that uses variables to account for the differences. In a procedure, the variables would take the form of parameters. When working with data, students should be able to identify important aspects and find patterns in related data sets such as crop output, fertilization methods, and climate conditions.

4.2 Evaluate existing technological functionalities and incorporate them into new designs.

At all levels, students should be able to use well-defined abstractions that hide complexity. Just as a car hides operating details, such as the mechanics of the engine, a computer program's "move" command relies on hidden details that cause an object to change location on the screen. As they progress, students should incorporate predefined functions into their designs, understanding that they do not need to know the underlying implementation details of the abstractions that they use. Eventually, students should understand the advantages of, and be comfortable using, existing functionalities (abstractions) including technological resources created by other people, such as libraries and application programming interfaces (APIs). Students should be able to evaluate existing abstractions to determine which should be incorporated into designs and how they should be incorporated. For example, students could build powerful apps by incorporating existing services, such as online databases that return geolocation coordinates of street names or food nutrition information.

4.3 Create modules and develop points of interaction that can apply to multiple situations and reduce complexity.

After students have had some experience identifying patterns (P4.1), decomposing problems (P3.2), using abstractions (P4.2), and taking advantage of existing resources (P4.2), they should begin to develop their own abstractions. As they progress, students should take advantage of opportunities to develop generalizable modules. For example, students could write more efficient programs by designing procedures that are used multiple times in the program. These procedures can be generalized by defining parameters that create different outputs for a wide range of inputs. Later on, students should be able to design systems of interacting modules, each with a well-defined role, that coordinate to accomplish a common goal. Within an object-oriented programming context, module design may include defining interactions among objects. At this stage, these modules, which combine both data and procedures, can be designed and documented for reuse in other programs. Additionally, students can design points of interaction, such as a simple user interface, either text or graphical, that reduces the complexity of a solution and hides lower-level implementation details.

4.4 Model phenomena and processes and simulate systems to understand and evaluate potential outcomes.

Students at all grade levels should be able to represent patterns, processes, or phenomena. With guidance, young students can draw pictures to describe a simple pattern, such as sunrise and sunset, or show the stages in a process, such as brushing your teeth. They can also create an animation to model a phenomenon, such as evaporation. As they progress, students should understand that computers can model real-world phenomena, and they should use existing computer simulations to learn about real-world systems. For example, they may use a preprogrammed model to explore how parameters affect a system, such as how rapidly a disease spreads. Older students should model phenomena as systems, with rules governing the interactions within the system. Students should analyze and evaluate these models against real-world observations. For example, students might create a simple producer–consumer ecosystem model using a programming tool. Eventually, they could progress to creating more complex and realistic interactions between species, such as predation, competition, or symbiosis, and evaluate the model based on data gathered from nature.

CS Practice 5. Creating Computational Artifacts

Overview: The process of developing computational artifacts embraces both creative expression and the exploration of ideas to create prototypes and solve computational problems. Students create artifacts that are personally relevant or beneficial to their community and beyond. Computational artifacts can be created by combining and modifying existing artifacts or by developing new artifacts. Examples of computational artifacts include programs, simulations, visualizations, digital animations, robotic systems, and apps.

By the end of Grade 12, students should be able to:

5.1 Plan the development of a computational artifact using an iterative process that includes reflection on and modification of the plan, taking into account key features, time and resource constraints, and user expectations.

At any grade level, students should participate in project planning and the creation of brainstorming documents. The youngest students may do so with the help of teachers. With scaffolding, students should gain greater independence and sophistication in the planning, design, and evaluation of artifacts. As learning progresses, students should systematically plan the development of a program or artifact and intentionally apply computational techniques, such as decomposition and abstraction, along with knowledge about existing approaches to artifact design. Students should be capable of reflecting on and, if necessary, modifying the plan to accommodate end goals.

5.2 Create a computational artifact for practical intent, personal expression, or to address a societal issue.

Students at all grade levels should develop artifacts in response to a task or a computational problem. At the earliest grade levels, students should be able to choose from a set of given commands to create simple animated stories or solve pre-existing problems. Younger students should focus on artifacts of personal importance. As they progress, student expressions should become more complex and of increasingly broader significance. Eventually, students should engage in independent, systematic use of design processes to create artifacts that solve problems with social significance by seeking input from broad audiences.

5.3 Modify an existing artifact to improve or customize it.

At all grade levels, students should be able to examine existing artifacts to understand what they do. As they progress, students should attempt to use existing solutions to accomplish a desired goal. For example, students could attach a programmable light sensor to a physical artifact they have created to make it respond to light. Later on, they should modify or remix parts of existing programs to develop something new or to add more advanced features and complexity. For example, students could modify prewritten code from a single-player game to create a two-player game with slightly different rules.

CS Practice 6. Testing and Refining Computational Artifacts

Overview: Testing and refinement is the deliberate and iterative process of improving a computational artifact. This process includes debugging (identifying and fixing errors) and comparing actual outcomes to intended outcomes. Students also respond to changing needs and expectations of end users and improve the performance, reliability, usability, and accessibility of artifacts.

By the end of Grade 12, students should be able to:

6.1 Systematically test computational artifacts by considering all scenarios and using test cases.

At any grade level, students should be able to compare results to intended outcomes. Young students should verify whether given criteria and constraints have been met. As students progress, they should test computational artifacts by considering potential errors, such as what will happen if a user enters invalid input. Eventually, testing should become a deliberate process that is more iterative, systematic, and proactive. Older students should be able to anticipate errors and use that knowledge to drive development. For example, students can test their program with inputs associated with all potential scenarios.

6.2 Identify and fix errors using a systematic process.

At any grade level, students should be able to identify and fix errors in programs (debugging) and use strategies to solve problems with computing systems (troubleshooting). Young students could use trial and error to fix simple errors. For example, a student may try reordering the sequence of commands in a program. In a hardware context, students could try to fix a device by resetting it or checking whether it is connected to a network. As students progress, they should become more adept at debugging programs and begin to consider logic errors: cases in which a program works, but not as desired. In this way, students will examine and correct their own thinking. For

example, they might step through their program, line by line, to identify a loop that does not terminate as expected. Eventually, older students should progress to using more complex strategies for identifying and fixing errors, such as printing the value of a counter variable while a loop is running to determine how many times the loop runs.

6.3 Evaluate and refine a computational artifact multiple times to enhance its performance, reliability, usability, and accessibility.

After students have gained experience testing (P6.2), debugging, and revising (P6.1), they should begin to evaluate and refine their computational artifacts. As students progress, the process of evaluation and refinement should focus on improving performance and reliability. For example, students could observe a robot in a variety of lighting conditions to determine that a light sensor should be less sensitive. Later on, evaluation and refinement should become an iterative process that also encompasses making artifacts more usable and accessible (P1.2). For example, students can incorporate feedback from a variety of end users to help guide the size and placement of menus and buttons in a user interface.

CS Practice 7. Communicating About Computing

Overview: Communication involves personal expression and exchanging ideas with others. In computer science, students communicate with diverse audiences about the use and effects of computation and the appropriateness of computational choices. Students write clear comments, document their work, and communicate their ideas through multiple forms of media. Clear communication includes using precise language and carefully considering possible audiences.

By the end of Grade 12, students should be able to:

7.1 Select, organize, and interpret large data sets from multiple sources to support a claim.

At any grade level, students should be able to refer to data when communicating an idea. Early on, students should, with guidance, present basic data through the use of visual representations, such as storyboards, flowcharts, and graphs. As students progress, they should work with larger data sets and organize the data in those larger sets to make interpreting and communicating it to others easier, such as through the creation of basic data representations. Eventually, students should be able to select relevant data from large or complex data sets in support of a claim or to communicate the information in a more sophisticated manner.

7.2 Describe, justify, and document computational processes and solutions using appropriate terminology consistent with the intended audience and purpose.

At any grade level, students should be able to talk about choices they make while designing a computational artifact. Early on, they should use language that articulates what they are doing and identifies devices and concepts they are using with correct terminology (e.g., program, input, and debug). Younger students should identify the goals and expected outcomes of their solutions. Along the way, students should provide documentation for end users that explains their artifacts and how they function, and they should both give and receive feedback. For example, students could provide a project overview and ask for input from users. As students progress, they should incorporate clear comments in their product and document their process using text, graphics, presentations, and demonstrations.

7.3 Articulate ideas responsibly by observing intellectual property rights and giving appropriate attribution.

All students should be able to explain the concepts of ownership and sharing. Early on, students should apply these concepts to computational ideas and creations. They should identify instances of remixing, when ideas are borrowed and iterated upon, and give proper attribution. They should also recognize the contributions of collaborators. Eventually, students should consider common licenses that place limitations or restrictions on the use of computational artifacts. For example, a downloaded image may have restrictions that prohibit modification of an image or using it for commercial purposes.

Domain: Computing Systems	Practice(s): 4.1

By end of Grade 12

Standard: Devices	**L1.CS.D.01** Explain how abstractions hide the underlying implementation details of computing systems embedded in everyday objects.
Clarification Statement:	Computing devices are often integrated with other systems, including biological, mechanical, and social systems. A medical device can be embedded inside a person to monitor and regulate his or her health, a hearing aid (a type of assistive device) can filter out certain frequencies and magnify others, a monitoring device installed in a motor vehicle can track a person's driving patterns and habits, and a facial recognition device can be integrated into a security system to identify a person. The creation of integrated or embedded systems is not an expectation at this level. Students might select an embedded device such as a car stereo, identify the types of data (e.g., radio station presets, volume level) and procedures (e.g., increase volume, store/recall saved station, mute) it includes, and explain how the implementation details are hidden from the user.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV12.2.1, CV12.5.2	5c - Computational Thinker
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Computing Systems	Practice(s): Level 1: 4.1; Level 2: 4.1, 7.2

By end of Grade 12

Standard: Hardware & Software	**L1.CS.HS.01** Explain the interactions between application software, system software, and hardware layers.	**L2.CS.HS.01** Categorize the roles of operating system software.
Clarification Statement:	**Level 1:** At its most basic level, a computer is composed of physical hardware and electrical impulses. Multiple layers of software are built upon the hardware and interact with the layers above and below them to reduce complexity. System software manages a computing device's resources so that software can interact with hardware. For example, text editing software interacts with the operating system to receive input from the keyboard, convert the input to bits for storage, and interpret the bits as readable text to display on the monitor. System software is used on many different types of devices, such as smart TVs, assistive devices, virtual components, cloud components, and drones. For example, students may explore the progression from voltage to binary signal to logic gates to adders and so on. Knowledge of specific, advanced terms for computer architecture, such as BIOS, kernel, or bus, is not expected at this level.	**Level 2:** Examples of roles could include memory management, data storage/retrieval, process management, and access control.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		L1—CV12.2.1, CV12.5.2	
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Computing Systems	Practice(s): Level 1: 6.1, 6.2; Level 2: 7.2

By end of Grade 12

Standard: Troubleshooting	**L1.CS.T.01** Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and resolve errors.	**L2.CS.T.01** Identify how hardware components facilitate logic, input, output, and storage in computing systems, and their common malfunctions.
Clarification Statement:	**Level 1:** Systematic troubleshooting strategies could include eliminating variables, gathering background information, reproducing the problem, converging on the problem, looking at past documentation, researching, etc. Examples of guidelines could include a flow chart, a job aid for a help desk employee, or an expert system.	**Level 2:** Examples of components could include logic gates, IO pins, memory, graphics card, CPU, hard drive, internal drive, and motherboard.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	L1—HS-ETS1-2	**L1**—CV12.2.1, CV12.4.1, CV12.4.3, CV12.4.4, CV12.5.2 **L2**—CV12.4.3	**L1 & L2**—3d - Knowledge Constructor
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Networks & the Internet	Practice(s): Level 1: 4.1, 7.2; Level 2: 7.2

By end of Grade 12

Standard: **Network Communication & Organization**	**L1.NI.NCO.01** Evaluate the scalability and reliability of networks, by describing the relationship between routers, switches, servers, topology, and addressing.	**L2.NI.NCO.01** Describe the issues that impact network functionality (e.g., bandwidth, load, latency, topology).
Clarification Statement:	**Level 1:** Each device is assigned an address that uniquely identifies it on the network. Routers function by comparing IP addresses to determine the pathways packets should take to reach their destination. Switches function by comparing MAC addresses to determine which computers or network segments will receive frames. Students could use online network simulators to experiment with these factors.	

Wyoming Cross-Disciplinary Connections & ISTE Standards			
2018 MATH	**2016 SCIENCE**	**2014 C&VE**	**2016 ISTE / WY DL GUIDELINES**
		L1—CV12.2.1, CV12.4.3, CV12.5.2 **L2**—CV12.2.1,	
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Networks & the Internet	Practice(s): Level 1 & 2: 7.2

By end of Grade 12

Standard: Cybersecurity	**L1.NI.C.01** Give examples to illustrate how sensitive data can be affected by malware and other attacks.	**L2.NI.C.01** Compare ways software developers protect devices and information from unauthorized access.
Clarification Statement:	**Level 1:** Network security depends on a combination of hardware, software, and practices that control access to data and systems. The needs of users and the sensitivity of data determine the level of security implemented. Potential security problems, such as denial-of-service attacks, ransomware, viruses, worms, spyware, and phishing, present threats to sensitive data. Students might reflect on case studies or current events in which governments or organizations experienced data leaks or data loss as a result of these types of attacks.	**Level 2:** Examples of security concerns to consider could include encryption and authentication strategies, secure coding, and safeguarding keys.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		L1—CV12.2.1, CV12.5.2 **L2—**CV12.2.1, CV12.3.3	**L1—**2d - Digital Citizen
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Networks & the Internet	Practice(s): 3.3

By end of Grade 12

Standard: Cybersecurity	**L1.NI.C.02** Recommend cybersecurity measures to address various scenarios based on factors such as efficiency, feasibility, and ethical impacts.
Clarification Statement:	**Level 1:** Security measures may include physical security tokens, two-factor authentication, and biometric verification. Potential security problems, such as denial-of-service attacks, ransomware, viruses, worms, spyware, and phishing, exemplify why sensitive data should be securely stored and transmitted. The timely and reliable access to data and information services by authorized users, referred to as availability, is ensured through adequate bandwidth, backups, and other measures. Students should systematically evaluate the feasibility of using computational tools to solve given problems or subproblems, such as through a cost-benefit analysis. Eventually, students should include more factors in their evaluations, such as how efficiency affects feasibility or whether a proposed approach raises ethical concerns.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV12.2.1, CV12.3.3, CV12.3.4, CV12.5.2	
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Networks & the Internet	Practice(s): 6.3

By end of Grade 12

Standard: Cybersecurity	**L1.NI.C.03** Compare various security measures, considering trade-offs between the usability and security of a computing system.
Clarification Statement:	**Level 1:** Security measures may include physical security tokens, two-factor authentication, and biometric verification, but choosing security measures involves tradeoffs between the usability and security of the system. The needs of users and the sensitivity of data determine the level of security implemented. Students might discuss computer security policies in place at the local level that present a tradeoff between usability and security, such as a web filter that prevents access to many educational sites but keeps the campus network safe.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV12.2.1, CV12.3.3, CV12.5.2	
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Networks & the Internet	Practice(s): 7.2

By end of Grade 12

Standard: Cybersecurity	**L1.NI.C.04** Explain trade-offs when selecting and implementing cybersecurity recommendations.
Clarification Statement:	**Level 1:** Network security depends on a combination of hardware, software, and practices that control access to data and systems. The needs of users and the sensitivity of data determine the level of security implemented. Every security measure involves tradeoffs between the accessibility and security of the system. Students should be able to describe, justify, and document choices they make using terminology appropriate for the intended audience and purpose. Students could debate issues from the perspective of diverse audiences, including individuals, corporations, privacy advocates, security experts, and government.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV12.2.1, CV12.3.3	
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Data Analysis	Practice(s): 4.1

By end of Grade 12

Standard: **Storage**	**L1.DA.S.01** Translate between different bit representations of real-world phenomena, such as characters, numbers, and images.
Clarification Statement:	**Level 1:** For example, convert hexadecimal color codes to decimal percentages, ASCII/Unicode representation, and logic gates.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV12.2.1	
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
RI.9-10.7			

Domain: Data Analysis	Practice(s): 3.3

By end of Grade 12

Standard: **Storage**	**L1.DA.S.02** Evaluate the trade-offs in how data elements are organized and where data is stored.
Clarification Statement:	**Level 1:** People make choices about how data elements are organized and where data is stored. These choices affect cost, speed, reliability, accessibility, privacy, and integrity. Students should evaluate whether a chosen solution is most appropriate for a particular problem. Students might consider the cost, speed, reliability, accessibility, privacy, and integrity tradeoffs between storing photo data on a mobile device versus in the cloud.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV12.2.1, CV12.3.3	
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Data Analysis	Practice(s): Level 1: 4.4; Level 2: 4.1, 7.1

By end of Grade 12

Standard: **Collection, Visualization, & Transformation**	**L1.DA.CVT.01** Create interactive data representations using software tools to help others better understand real-world phenomena (e.g., paper surveys and online data sets).	**L2.DA.CVT.01** Use data analysis tools and techniques to identify patterns in data representing complex systems.
Clarification Statement:	**Level 1:** People transform, generalize, simplify, and present large data sets in different ways to influence how other people interpret and understand the underlying information. Examples include visualization, aggregation, rearrangement, and application of mathematical operations. People use software tools or programming to create powerful, interactive data visualizations and perform a range of mathematical operations to transform and analyze data. Students should model phenomena as systems, with rules governing the interactions within the system and evaluate these models against real-world observations. For example, flocking behaviors, queueing, or life cycles. Google Fusion Tables can provide access to data visualization online.	**Level 2:** For example, identify trends in a dataset representing social media interactions, movie reviews, or shopping patterns.

Wyoming Cross-Disciplinary Connections & ISTE Standards			
2018 MATH	**2016 SCIENCE**	**2014 C&VE**	**2016 ISTE / WY DL GUIDELINES**
L1—S.IC.E.4, S.IC.E.5 **L2—**F.TF.I.5, F.LE.F.1, F.IF.B.5, A.CED.G.1, A.CED.G.2, A.CED.G.3	**L1—**HS-ETS1-1, HS-ESS3-5, HS-ESS3-6, HS -ETS1-1, HS-ETS1-4 **L2—**HS-ESS3-6, HS-ESS3-5, HS-ESS3-3	**L1—**CV12.2.1, CV12.3.1, CV12.5.1, CV12.5.2, CV12.5.4 **L2—**CV12.3.2	**L1—**6c - Creative Communicator **L2—**5b - Computational Thinker
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
	L1—SS12.5.1, SS12.5.1.a		

Domain: Data Analysis	Practice(s): 7.1, 7.2

By end of Grade 12

Standard: **Collection, Visualization, & Transformation**	**L2.DA.CVT.02** Select data collection tools and techniques, and use them to generate data sets that support a claim or communicate information.
Clarification Statement:	**Level 2:** Example data collection tools and techniques could include scientific probes, robotics sensors, microcontroller sensors, mobile device applications, etc.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
F.TF.I.5, F.LE.F.1, F.IF.B.5, A.CED.G.1, A.CED.G.2		CV12.5.1, CV12.5.2, CV12.5.4	5b - Computational Thinker
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Computing Systems	Practice(s): Level 1 & 2: 4.4

By end of Grade 12

Standard: Inference & Models	**L1.DA.IM.01** Create computational models that represent the relationships among different elements of data collected from a phenomenon or process.	**L2.DA.IM.01** Formulate, refine, and test scientific hypotheses using models and simulations.
Clarification Statement:	**Level 1:** Computational models make predictions about processes or phenomenon based on selected data and features. The amount, quality, and diversity of data and the features chosen can affect the quality of a model and ability to understand a system. Predictions or inferences are tested to validate models. Students should model phenomena as systems, with rules governing the interactions within the system. Students should analyze and evaluate these models against real world observations. For example, students might create a simple producer–consumer ecosystem model using a programming tool. Eventually, they could progress to creating more complex and realistic interactions between species, such as predation, competition, or symbiosis, and evaluate the model based on data gathered from nature.	

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
L1—F.TF.I.5, F.LE.F.1, F.IF.B.5, A.CED.G.1, A.CED.G.2, A.CED.G.3, S.IC.D.2, S.IC.E.6, S.ID.B.6a **L2—**F.TF.I.5, F.LE.F.1, F.IF.B.5, A.CED.G.1, A.CED.G.2, A.CED.G.3, A.CED.G.4	**L1—**HS-ETS1-1, HS-ESS3-5, HS-ESS3-6, HS-ETS1-1, HS-ETS1-4	**L1—**CV12.2.1, CV12.3.1, CV12.5.2, CV12.5.4 **L2—**CV12.5.2	**L1—**5b - Computational Thinker **L2—**4c - Innovative Designer
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
	L1—SS12.5.1, SS12.5.1.a		

Domain: Algorithms & Programming	Practice(s): Level 1: 5.2; Level 2: 4.2

By end of Grade 12

Standard: Algorithms	**L1.AP.A.01** Create a prototype that uses algorithms (e. g., searching, sorting, finding shortest distance) to provide a possible solution for a real-world problem relevant to the student.	**L2.AP.A.01** Critically examine and trace classic algorithms. Use and adapt classic algorithms to solve computational problems (e.g., selection sort, insertion sort, binary search, linear search).
Clarification Statement:	**Level 1:** The process of developing computational artifacts embraces both creative expression and the exploration of ideas to create prototypes and solve computational problems. Students create artifacts that are personally relevant or beneficial to their community and beyond. Students should develop artifacts in response to a task or a computational problem that demonstrate the performance, reusability, and ease of implementation of an algorithm. A prototype is a computational artifact that demonstrates the core functionality of a product or process. Prototypes are useful for getting early feedback in the design process, and can yield insight into the feasibility of a product.	

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
L1—F.IF.A.1 **L2**—F.IF.A.1, F.IF.A.3, F.IF.C.9		**L1**—CV12.3.1, CV12.4.4, CV12.5.1, CV12.5.2, CV12.5.4 **L2**—CV12.4.4, CV12.5.1, CV12.5.2, CV12.5.4	**L1**—4a, 4d - Innovative Designer **L2**—4a - Innovative Designer
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Algorithms & Programming	Practice(s): Level 1: 7.2; Level 2: 5.2, 5.3

By end of Grade 12

Standard: Algorithms	**L1.AP.A.02** Describe how artificial intelligence algorithms drive many software and physical systems.	**L2.AP.A.02** Develop an artificial intelligence algorithm to play a game against a human opponent or solve a real-world problem.
Clarification Statement:	**Level 1:** Examples include digital ad delivery, self-driving cars, computer vision, text analysis, autonomous robots, pattern recognition, and credit card fraud detection.	**Level 2:** Games do not have to be complex. Simple guessing games, Tic-Tac-Toe, or simple robot commands would be sufficient.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
L2—F.BF.D.1		**L1**—CV12.2.1, CV12.3.3 **L2**—CV12.3.1, CV12.5.1, CV12.5.2, CV12.5.4	**L1**—5d - Computational Thinker **L2**—4d - Innovative Designer
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
			L2—HE12.4.10

Domain: Algorithms & Programming	Practice(s): 4.2

By end of Grade 12

Standard: Algorithms	**L2.AP.A.03** Evaluate algorithms (e.g., sorting, searching) in terms of their efficiency, correctness, and clarity.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
F.IF.C.9, F.IF.B.4, F.LE.F.5		CV12.2.1, CV12.3.3	5a - Computational Thinker
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Algorithms & Programming	Practice(s): Level 1: 4.1; Level 2: 4.2

By end of Grade 12

Standard: **Variables**	**L1.AP.V.01** Use lists to simplify solutions, generalizing computational problems instead of repeatedly using simple variables.	**L2.AP.V.01** Compare and contrast simple data structures and their uses (e.g., lists, stacks, queues).
Clarification Statement:	**Level 1:** Students should be able to identify common features in multiple segments of code and substitute a single segment that uses lists (or arrays) to account for the differences.	**Level 2:** Examples could include lists, arrays, stacks, and queues.

Wyoming Cross-Disciplinary Connections & ISTE Standards			
2018 MATH	**2016 SCIENCE**	**2014 C&VE**	**2016 ISTE / WY DL GUIDELINES**
		L1—CV12.5.1 **L2**—CV12.2.1, CV12.3.3	
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Algorithms & Programming	Practice(s): 5.2

By end of Grade 12

Standard: **Control**	**L1.AP.C.01** Justify the selection of specific control structures when tradeoffs involve implementation, readability, and program performance, and explain the benefits and drawbacks of choices made.
Clarification Statement:	**Level 1:** Implementation includes the choice of programming language, which affects the time and effort required to create a program. Readability refers to how clear the program is to other programmers and can be improved through documentation. The discussion of performance is limited to a theoretical understanding of execution time and storage requirements; a quantitative analysis is not expected. Control structures at this level may include conditional statements, loops, event handlers, and recursion. For example, students might compare the readability and program performance of iterative and recursive implementations of procedures that calculate the Fibonacci sequence. Students may also consider the effects of caching to improve performance.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV12.2.1, CV12.3.3	4a - Innovative Designer
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Algorithms & Programming	Practice(s): Level 1 & 2: 3.2

By end of Grade 12

Standard: Control	**L1.AP.C.02** Trace the execution of loops and conditional statements, illustrating output and changes in values of named variables.	**L2.AP.C.01** Trace the execution of recursion, illustrating output and changes in values of named variables.
Clarification Statement:	**Level 1:** For example, tracing a for loop could include the value of variables and how they change each time through the loop.	**Level 2:** The trace could include the input arguments and the return values of each recursive call. Nesting according to recursive invocation may be used to organize the trace.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
L1 & L2—F.IF.A.1, F.IF.A.3			**L1 & L2—**4a - Innovative Designer **L1 & L2—**5c - Computational Thinker
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Algorithms & Programming	Practice(s): 5.2

By end of Grade 12

Standard: Control	**L1.AP.C.03** Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue by using events to initiate instructions.
Clarification Statement:	**Level 1:** In this context, relevant computational artifacts include programs, mobile apps, or web apps. Events can be user initiated, such as a button press, or system-initiated, such as a timer firing. In L1.AP.M.01, students learn to create and call procedures. In this standard, students design procedures that are called by events. Students might create a mobile app that updates a list of nearby points of interest when the device detects that its location has been changed.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV12.3.4, CV12.5.1, CV12.5.2, CV12.5.4	3d - Knowledge Constructor 4c - Innovative Designer 5a - Computational Thinker
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Algorithms & Programming	Practice(s): Level 1: 3.2; Level 2: 4.3, 5.2

By end of Grade 12

Standard: **Modularity**	**L1.AP.M.01** Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.	**L2.AP.M.01** Construct solutions to problems using student-created components, such as procedures, modules, and/or objects.
Clarification Statement:	**Level 1:** At this level, students should decompose complex problems into manageable subproblems that could potentially be solved with programs or procedures that already exist. For example, students could create an app to solve a community problem by connecting to an online database through an application programming interface (API).	**Level 2:** Object-oriented programming is optional at this level. Problems can be assigned or student-selected.

Wyoming Cross-Disciplinary Connections & ISTE Standards			
2018 MATH	**2016 SCIENCE**	**2014 C&VE**	**2016 ISTE / WY DL GUIDELINES**
	L1—HS-ETS1-2	**L2**—CV12.3.1, CV12.5.1, CV12.5.2, CV12.5.4	**L1**—5c - Computational Thinker **L2**—3d - Knowledge Constructor
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Algorithms & Programming	Practice(s): Level 1: 5.2; Level 2: 4.1

By end of Grade 12

Standard: **Modularity**	**L1.AP.M.02** Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.	**L2.AP.M.02** Analyze a large-scale computational problem and identify generalizable patterns that can be applied to a solution.
Clarification Statement:	**Level 1:** Computational artifacts can be created by combining and modifying existing artifacts or by developing new artifacts. Examples of computational artifacts could include programs, simulations, visualizations, digital animations, robotic systems, and apps. Complex programs are designed as systems of interacting modules, each with a specific role, coordinating for a common overall purpose. Modules allow for better management of complex tasks. The focus at this level is understanding a program as a system with relationships between modules. The choice of implementation, such as programming language or paradigm, may vary. For example, students could incorporate computer vision libraries to increase the capabilities of a robot or leverage open source JavaScript libraries to expand the functionality of a web application.	**Level 2:** As students encounter complex, real-world problems that span multiple disciplines or social systems, they should decompose complex problems into manageable subproblems that could potentially be solved with programs or procedures that already exist. This standard is similar to L1.AP.M.01. The difference is that this standard expects greater complexity in the real-world problem that is being solved.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		L1—CV12.4.4, CV12.5.1, CV12.5.2, CV12.5.4 **L2**—CV12.3.2, CV12.5.2	**L1**—4a - Innovative Designer **L2**—3d - Knowledge Constructor
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Algorithms & Programming	Practice(s): 4.2, 5.3

By end of Grade 12

Standard: Modularity	**L2.AP.M.03** Demonstrate code reuse by creating programming solutions using libraries and APIs.
Clarification Statement:	**Level 2:** Libraries and APIs can be student-created or common graphics libraries or map APIs, for example.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV12.5.1, CV12.5.2, CV12.5.4	5c - Computational Thinker
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Algorithms & Programming	Practice(s): Level 1 & 2: 5.1

By end of Grade 12

Standard: **Program Development**	**L1.AP.PD.01** Plan and develop programs by analyzing a problem and/or process, developing and documenting a solution, testing outcomes, and adapting the program for a variety of users.	**L2.AP.PD.01** Plan and develop programs that will provide solutions to a variety of users using a software life cycle process.
Clarification Statement:		**Level 2:** Processes could include agile, spiral, or waterfall.

Wyoming Cross-Disciplinary Connections & ISTE Standards			
2018 MATH	**2016 SCIENCE**	**2014 C&VE**	**2016 ISTE / WY DL GUIDELINES**
		L1—CV12.5.1, CV12.5.2 **L2**—CV12.3.1, CV12.5.1, CV12.5.2, CV12.5.4	**L1**—4c - Innovative Designer
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
		L1—FPA11.1.A.3, FPA11.1.T.2, FPA11.1.D.7	

Domain: Algorithms & Programming	Practice(s): Level 1: 7.3; Level 2: 2.4

By end of Grade 12

Standard: **Program Development**	**L1.AP.PD.02** Evaluate licenses that limit or restrict use of computational artifacts when using resources such as libraries.	**L2.AP.PD.02** Use version control systems, integrated development environments (IDEs), and collaborative tools and practices (e.g., code documentation) in a group software project.
Clarification Statement:	**Level 1:** Examples of software licenses could include commercial, freeware, and the many open-source licensing schemes. Students should consider licensing implications for their own work, especially when incorporating libraries and other resources. Students might consider two software libraries that address a similar need, justifying their choice based on the library that has the least restrictive license.	**Level 2:** Processes could include agile, spiral, or waterfall.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		L2—CV12.2.3, CV12.5.2	**L1—**2c - Digital Citizen **L2—**7b - Global Collaborator
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
		L2—FL2.IL.1, FL2.IL.2, FL3.IL.1, FL3.IL.2	

Domain: Algorithms & Programming	Practice(s): 6.2

By end of Grade 12

Standard: Program Development	**L1.AP.PD.03** Use debugging tools to identify and fix errors in a program.

Wyoming Cross-Disciplinary Connections & ISTE Standards			
2018 MATH	**2016 SCIENCE**	**2014 C&VE**	**2016 ISTE / WY DL GUIDELINES**
		CV12.5.2	4c - Innovative Designer
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Algorithms & Programming	Practice(s): Level 1: 2.4; Level 2: 5.2

By end of Grade 12

Standard: **Program Development**	**L1.AP.PD.04** Design and develop computational artifacts, working in team roles, using collaborative tools.	**L2.AP.PD.03** Develop programs for multiple computing platforms.
Clarification Statement:	**Level 1:** Collaborative tools could be as complex as source code version control system or as simple as a collaborative word processor. Team roles in pair programming are driver and navigator but could be more specialized in larger teams. As programs grow more complex, the choice of resources that aid program development becomes increasingly important and should be made by the students. Students might work as a team to develop a mobile application that addresses a problem relevant to the school or community, selecting appropriate tools to establish and manage the project timeline; design, share, and revise graphical user interface elements; and track planned, in-progress, and completed components.	**Level 2:** Example platforms could include computer desktop, arduino, robotics, web, or mobile. A student could develop a single program that works on multiple platforms or develop multiple programs that each work on a different platform.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		L1—CV12.2.3, CV12.5.2 **L2**—CV12.5.1, CV12.5.2, CV12.5.4	**L1**—7b - Global Collaborator **L2**—4a - Innovative Designer
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
		L1—FPA11.1.A.4, FPA11.1.T.4, FPA11.1.D.5	

Domain: Algorithms & Programming	**Practice(s): Level 1: 7.2; Level 2: 6.3**

By end of Grade 12

Standard: **Program Development**	**L1.AP.PD.05** Document design decisions using text, graphics, presentations, and/or demonstrations in the development of complex programs.	**L2.AP.PD.04** Evaluate key qualities of a program through a process such as a code review (e.g., qualities could include correctness, usability, readability, efficiency, portability, and scalability).
Clarification Statement:	**Level 1:** Creating a program requires making many decisions about modules, roles, communication, control, etc. These decisions are easy to forget, so it is essential that they be documented for future use. Students may use any tools for documentation, including generic word processors, comments within the program, or specialized tools such as Github Wiki.	

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		L1—CV12.5.1, CV12.5.2 **L2**—CV12.5.2	**L1**—6c - Creative Communicator
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
L1—W.9-10.6			

Domain: Algorithms & Programming	Practice(s): Level 1: 6.3; Level 2: 6.1

By end of Grade 12

Standard: Program Development	**L1.AP.PD.06** Evaluate and refine computational artifacts to make them more usable and accessible.	**L2.AP.PD.05** Develop and use a series of test cases to verify that a program performs according to its design specifications.
Clarification Statement:	**Level 1:** Testing and refinement is the deliberate and iterative process of improving a computational artifact. This process includes debugging (identifying and fixing errors) and comparing actual outcomes to intended outcomes. Students should respond to the changing needs and expectations of end users and improve the performance, reliability, usability, and accessibility of artifacts. For example, students could incorporate feedback from a variety of end users to help guide the size and placement of menus and buttons in a user interface.	**Level 2:** At this level, students are expected to select their own test cases.

Wyoming Cross-Disciplinary Connections & ISTE Standards			
2018 MATH	**2016 SCIENCE**	**2014 C&VE**	**2016 ISTE / WY DL GUIDELINES**
		L1—CV12.2.1, CV12.5.2 **L2—**CV12.5.2	**L1 & L2—**4c - Innovative Designer
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Algorithms & Programming	Practice(s): 7.2

By end of Grade 12

Standard: **Program Development**	**L2.AP.PD.06** Explain security issues that might lead to compromised computer programs.
Clarification Statement:	**Level 2:** For example, common issues include lack of bounds checking, poor input validation, and circular references.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV12.2.1	2d - Digital Citizen
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Algorithms & Programming	Practice(s): 5.3

By end of Grade 12

Standard: **Program Development**	**L2.AP.PD.07** Modify an existing program to add additional functionality and discuss intended and unintended implications (e.g., breaking other functionality).
Clarification Statement:	**Level 2:** For instance, changes made to a method or function signature could break invocations of that method elsewhere in a system.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV12.5.1, CV12.5.2, CV12.5.4	
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Algorithms & Programming	Practice(s): 7.2

By end of Grade 12

Standard: **Program Development**	**L2.AP.PD.08** Compare multiple programming languages and discuss how their features make them suitable for solving different types of problems.
Clarification Statement:	**Level 2:** Examples of features include blocks versus text, indentation versus curly braces, and high-level versus low-level.

Wyoming Cross-Disciplinary Connections & ISTE Standards			
2018 MATH	**2016 SCIENCE**	**2014 C&VE**	**2016 ISTE / WY DL GUIDELINES**
		CV12.2.1, CV12.3.1, CV12.3.3	
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Impacts of Computing	Practice(s): Level 1 & 2: 1.2

By end of Grade 12

Standard: Culture	**L1.IC.C.01** Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.	**L2.IC.C.01** Evaluate the beneficial and harmful effects that computational artifacts and innovations have on society.
Clarification Statement:	**Level 1:** Computing may improve, harm, or maintain practices. Equity deficits, such as minimal exposure to computing, access to education, and training opportunities, are related to larger, systemic problems in society. Students should be able to evaluate the accessibility of a product to a broad group of end users, such as people who lack access to broadband or who have various disabilities. Students should also begin to identify potential bias during the design process to maximize accessibility in product design.	

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
	L1—HS-PS3-1, HS-ESS3-3 **L2—**HS-ETS1-3	**L1—**CV12.2.1, CV12.3.4 **L2—**CV12.2.1, CV12.3.4, CV12.3.3	**L2—**2c - Digital Citizen
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
L1—W.9-10.6		**L2—**FPA11.1.A.5, FPA11.4.A.4, FPA11.4.M.1, FPA11.4.T.2, FPA11.4.D.3, FPA11.3.D.3	

BOOT UP WYOMING

2019 Wyoming Computer Science Standards

Grade Band: 9-12

Domain: Impacts of Computing	**Practice(s): Level 1 & 2: 1.2**

By end of Grade 12

Standard: Culture	**L1.IC.C.02** Test and refine computational artifacts to reduce bias and equity deficits.	**L2.IC.C.02** Evaluate the impact of equity, access, and influence on the distribution of computing resources in a global society.
Clarification Statement:	**Level 1:** Biases could include incorrect assumptions developers have made about their user base. Equity deficits include minimal exposure to computing, access to education, and training opportunities. Students should begin to identify potential bias during the design process to maximize accessibility in product design and become aware of professionally accepted accessibility standards to evaluate computational artifacts for accessibility.	

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		L1—CV12.5.1, CV12.5.2 **L2**—CV12.2.1, CV12.3.4, CV12.5.2	**L1**—4c - Innovative Designer
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
			L2—HE12.4.10

Domain: Impacts of Computing	Practice(s): Level 1: 3.1; Level 2: 5.2

By end of Grade 12

Standard: Culture	**L1.IC.C.03** Demonstrate how a given algorithm applies to problems across disciplines.	**L2.IC.C.03** Predict how computational innovations that have revolutionized aspects of our culture might evolve.
Clarification Statement:	**Level 1:** Computation can share features with disciplines such as art and music by algorithmically translating human intention into an artifact. Students should be able to identify real-world problems that span multiple disciplines, such as increasing bike safety with new helmet technology, and that can be solved computationally.	**Level 2:** Areas to consider might include education, healthcare, art, entertainment, and energy.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
L1—F.LE.F.1, F.IF.A.2, F.IF.B.5	**L1—**HS-ETS1-4	**L2—**CV12.2.1	**L1—**5a - Computational Thinker
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Impacts of Computing	Practice(s): 2.4

By end of Grade 12

Standard: Social Interactions	**L1.IC.SI.01** Use tools and methods for collaboration.
Clarification Statement:	**Level 1:** Many aspects of society, especially careers, have been affected by the degree of communication afforded by computing. The increased connectivity between people in different cultures and in different career fields has changed the nature and content of many careers. Students should explore different collaborative tools and methods used to solicit input from team members, classmates, and others, such as participation in online forums or local communities. For example, students could compare ways different social media tools could help a team become more cohesive.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV12.2.3	7b - Global Collaborator
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
	SS12.6.3	FPA11.1.A.4, FPA11.1.T.4	

Domain: Impacts of Computing	Practice(s): Level 1 & 2: 1.1, 7.3

By end of Grade 12

Standard: Social Interactions	**L1.IC.SI.02** Practice grade-level appropriate behavior and responsibilities while participating in an online community. Identify and report inappropriate behavior.	**L2.IC.SI.01** Practice grade-level appropriate behavior and responsibilities while participating in an online community. Identify and report inappropriate behavior.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		L1 & L2—CV12.2.2, CV12.2.3, CV12.2.4, CV12.5.3	**L1 & L2—**2b - Digital Citizen
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
		L1 & L2—FPA11.1.A.5, FPA11.4.A.4, FPA11.4.M.1, FPA11.4.T.2	**L1 & L2—**HE12.4.11

2019 Wyoming Computer Science Standards

Grade Band: 9-12

Domain: Algorithms & Programming	Practice(s): Level 1: 7.3; Level 2: 3.3, 7.3

By end of Grade 12

Standard: Safety, Law, & Ethics	**L1.IC.SLE.01** Explain the beneficial and harmful effects that intellectual property laws can have on innovation.	**L2.IC.SLE.01** Debate laws and regulations that impact the development and use of software and technology.
Clarification Statement:	**Level 1:** Laws govern many aspects of computing, such as privacy, data, property, information, and identity. These laws can have beneficial and harmful effects, such as expediting or delaying advancements in computing and protecting or infringing upon people's rights. International differences in laws and ethics have implications for computing. For example, laws that mandate the blocking of some file-sharing websites may reduce online piracy but can restrict the right to access information. Firewalls can be used to block harmful viruses and malware but can also be used for media censorship. Students should be aware of intellectual property laws and be able to explain how they are used to protect the interests of innovators and how patent trolls abuse the laws for financial gain.	

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		L1—CV12.2.1, CV12.3.3 **L2—**CV12.2.1, CV12.3.3, CV12.5.3	**L1 & L2—**2c - Digital Citizen
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Impacts of Computing	Practice(s): 7.2

By end of Grade 12

Standard: **Safety, Law, & Ethics**	**L1.IC.SLE.02** Explain the privacy concerns related to the collection and generation of data through automated processes that may not be evident to users.
Clarification Statement:	**Level 1:** Data can be collected and aggregated across millions of people, even when they are not actively engaging with or physically near the data collection devices. This automated and covert collection can raise privacy concerns, such as social media sites mining an account even when the user is not online. Other examples include surveillance video used in a store to track customers for security or information about purchase habits or the monitoring of road traffic to change signals in real time to improve road efficiency without drivers being aware. Methods and devices for collecting data can differ by the amount of storage required, level of detail collected, and sampling rates.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		CV12.2.1, CV12.3.3	2d - Digital Citizen
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**

Domain: Impacts of Computing	Practice(s): 7.3

By end of Grade 12

Standard: **Safety, Law, & Ethics**	**L1.IC.SLE.03** Evaluate the social and economic implications of privacy in the context of safety, law, or ethics.
Clarification Statement:	**Level 1:** Laws govern many aspects of computing, such as privacy, data, property, information, and identity. International differences in laws and ethics have implications for computing. Students might review case studies or current events which present an ethical dilemma when an individual's right to privacy is at odds with the safety, security, or wellbeing of a community.

Wyoming Cross-Disciplinary Connections & ISTE Standards			
2018 MATH	**2016 SCIENCE**	**2014 C&VE**	**2016 ISTE / WY DL GUIDELINES**
		CV12.2.1, CV12.3.3	2b - Digital Citizen
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
			HE12.4.10

Domain: Algorithms & Programming	Practice(s): Level 1 & 2: 7.2

By end of Grade 12

Standard: **Safety, Law, & Ethics**	**L1.IC.SLE.04** Using grade level appropriate content and complexity, discuss the legal, social, and ethical impacts associated with software development and use, including both positive and malicious intent.	**L2.IC.SLE.02** Using grade level appropriate content and complexity, discuss the legal, social, and ethical impacts associated with software development and use, including both positive and malicious intent.
Clarification Statement:	**Level 1:** Examples of positive impacts could include writing software or utilities to improve communication for people who have a disability, writing an application that manages money for a bank, or software that handles healthcare records. Examples of negative impacts could include distributing a virus, or writing backdoor code, malware, or ransomware.	**Level 2:** Examples of positive impacts could include writing software or utilities to improve communication for people who have a disability, writing an application that manages money for a bank, or software that handles healthcare records. Examples of negative impacts could include distributing a virus, or writing backdoor code, malware, or ransomware.

Wyoming Cross-Disciplinary Connections & ISTE Standards

2018 MATH	2016 SCIENCE	2014 C&VE	2016 ISTE / WY DL GUIDELINES
		L1 & L2—CV12.2.1, CV12.2.2, CV12.2.4	**L1 & L2—**2a - Digital Citizen
2012 ELA	**2018 SOCIAL STUDIES**	**2013 FINE & PERFORMING ARTS**	**2014 P.E. / 2012 HEALTH**
			L1 & L2—HE12.4.10

Performance Level Descriptors (PLDs)

Grade Band: 9-12

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Devices: L1.CS.D.01 Explain how abstractions hide the underlying implementation details of computing systems embedded in everyday objects.	provides little to no evidence in addressing the expectation(s).	identifies abstractions that hide the underlying implementation details of computing systems embedded in everyday objects.	explains how abstractions hide the underlying implementation details of computing systems embedded in everyday objects.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.
Hardware & Software: L1.CS.HS.01 Explain the interactions between application software, system software, and hardware layers.	provides little to no evidence in addressing the expectation(s).	- identifies application software, system software, and hardware layers. - defines application software, system software, and hardware layers.	- identifies the interactions between application software, system software, and hardware layers. - defines the interactions between application software, system software, and hardware layers. - explains the interactions between application software, system software, and hardware layers. e.g., text editing software interacts with the operating system to receive input from the keyboard, convert the input to bits for storage, and interpret the bits as readable text to display on the monitor.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., student demonstrates knowledge of specific, advanced terms for computer architecture, such as BIOS, kernel, or bus).
Hardware & Software: L2.CS.HS.01 Categorize the roles of operating system software.	provides little to no evidence in addressing the expectation(s).	categorizes some of the roles of operating system software.	categorizes the roles of the operating system software (e.g., roles could include memory management, data storage/retrieval, process management, and access control).	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.

Performance Level Descriptors (PLDs)

Grade Band: 9-12

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Troubleshooting: L1.CS.T.01 Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and resolve errors.	provides little to no evidence in addressing the expectation(s).	develops guidelines with support that convey systematic troubleshooting strategies that others can use to identify and resolve errors.	develops guidelines independently that convey systematic troubleshooting strategies that others can use to identify and resolve errors (e.g., students could create a flow chart, a job aid for a help desk employee, or an expert system).	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., someone with limited experience or knowledge could follow student developed guidelines).
Troubleshooting: L2.CS.T.01 Identify how hardware components facilitate logic, input, output, and storage in computing systems, and their common malfunctions.	provides little to no evidence in addressing the expectation(s).	identifies how some hardware components: - facilitate logic, input, output, and storage in computing systems, **and/or** - some of their common malfunctions.	identifies: - how hardware components facilitate logic, input, output, and storage in computing systems. - hardware components common malfunctions.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.

Performance Level Descriptors (PLDs)

Grade Band: 9-12

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Network Communication & Organization: L1.NI.NCO.01 Evaluate the scalability and reliability of networks, by describing the relationship between routers, switches, servers, topology, and addressing.	provides little to no evidence in addressing the expectation(s).	- identifies routers, switches, servers, topology, and addressing. - defines routers, switches, servers, topology, and addressing.	by describing the relationship between routers, switches, servers, topology, and addressing, evaluates: - the scalability of networks. - the reliability of networks.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., students can discuss different types of routers, switches, servers and/or topologies).
Network Communication & Organization: L2.NI.NCO.01 Describe the issues that impact network functionality (e.g., bandwidth, load, latency, topology).	provides little to no evidence in addressing the expectation(s).	describes a limited number of issues that impact network functionality (e.g., bandwidth, load, latency, topology).	describes common issues that impact network functionality (e.g., bandwidth, load, latency, topology).	demonstrates an understanding of trade-offs between network functionality and design.
Cybersecurity: L1.NI.C.01 Give examples to illustrate how sensitive data can be affected by malware and other attacks.	provides little to no evidence in addressing the expectation(s).	recalls examples to illustrate how sensitive data can be affected by malware and other attacks.	gives multiple detailed examples to illustrate how sensitive data can be affected by malware and other attacks.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.
Cybersecurity: L2.NI.C.01 Compare ways software developers protect devices and information from unauthorized access.	provides little to no evidence in addressing the expectation(s).	lists ways software developers protect: - devices from unauthorized access. - information from unauthorized access.	compares ways software developers protect: - devices from unauthorized access. - information from unauthorized access.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., encryption strategies, authentication strategies).

Performance Level Descriptors (PLDs)

Grade Band: 9-12

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Cybersecurity: L1.NI.C.02 Recommend cybersecurity measures to address various scenarios based on factors such as efficiency, feasibility, and ethical impacts.	provides little to no evidence in addressing the expectation(s).	identifies cybersecurity measures to address various scenarios.	recommends cybersecurity measures to address various scenarios based on factors such as efficiency, feasibility, and ethical impacts.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.
Cybersecurity: L1.NI.C.03 Compare various security measures, considering trade-offs between the usability and security of a computing system.	provides little to no evidence in addressing the expectation(s).	- identifies various security measures. - defines various security measures.	compares various security measures, considering trade-offs between the usability and security of a computing system.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., discuss security policies that are in place that present a trade-off between usability and security).
Cybersecurity: L1.NI.C.04 Explain trade-offs when selecting and implementing cybersecurity recommendations.	provides little to no evidence in addressing the expectation(s).	when selecting and implementing cybersecurity recommendations, can give an example of trade-offs: - from a single viewpoint, **and/or** - with inappropriate terminology.	explains trade-offs from multiple perspectives using appropriate terminology when selecting and implementing cybersecurity recommendations.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., make a recommendation and justify).

Performance Level Descriptors (PLDs)

Grade Band: 9-12

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Storage: L1.DA.S.01 Translate between different bit representations of real-world phenomena, such as characters, numbers, and images.	provides little to no evidence in addressing the expectation(s).	can translate between a bit representation of real-world phenomena, such as characters, numbers, or images.	translates between different bit representations of real-world phenomena, such as characters, numbers, and images.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.
Storage: L1.DA.S.02 Evaluate the trade-offs in how data elements are organized and where data is stored.	provides little to no evidence in addressing the expectation(s).	- identifies the trade-offs in how data elements are organized and where data is stored. - describes the trade-offs in how data elements are organized and where data is stored.	evaluates the trade-offs in how data elements are organized and where data is stored.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., research emerging technologies for data storage and evaluate trade-off with current technologies).

Performance Level Descriptors (PLDs)

Grade Band: 9-12

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Collection, Visualization, & Transformation: L1.DA.CVT.01 Create interactive data representations using software tools to help others better understand real-world phenomena (e.g., paper surveys and online data sets).	provides little to no evidence in addressing the expectation(s).	creates, with errors, interactive data representations using software tools.	creates, with no or minor errors, appropriate interactive data representations using software tools to help others better understand real-world phenomena.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., research emerging visualization techniques and use them to create new data representations).
Collection, Visualization, & Transformation: L2.DA.CVT.01 Use data analysis tools and techniques to identify patterns in data representing complex systems.	provides little to no evidence in addressing the expectation(s).	uses data analysis tools and techniques to identify patterns in data representing complex systems but draws incorrect conclusions.	uses data analysis tools and techniques to identify correct patterns in data representing complex systems.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., make a plausible predication based on pattern).
Collection, Visualization, & Transformation: L2.DA.CVT.02 Select data collection tools and techniques, and use them to generate data sets that support a claim or communicate information.	provides little to no evidence in addressing the expectation(s).	- selects data collection tools and techniques. - uses data collection tools and techniques to generate data sets but are unable to support a claim or communicate information.	- selects data collection tools and techniques. - uses data collection tools to generate data sets that support a claim or communicate information.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.

Performance Level Descriptors (PLDs)

Grade Band: 9-12

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Inference & Models: L1.DA.IM.01 Create computational models that represent the relationships among different elements of data collected from a phenomenon or process.	provides little to no evidence in addressing the expectation(s).	creates computational models that represent the relationships among different elements of data collected from a phenomenon or process.	creates accurate computational models that represent the relationships among different elements of data collected from a phenomenon or process.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.
Inference & Models: L2.DA.IM.01 Formulate, refine, and test scientific hypotheses using models and simulations.	provides little to no evidence in addressing the expectation(s).	formulates scientific hypotheses using models and simulations.	- formulates scientific hypotheses using models and simulations. - refines scientific hypotheses using models and simulations. - tests scientific hypotheses using models and simulations.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.

Performance Level Descriptors (PLDs)

Grade Band: 9-12

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Algorithms: L1.AP.A.01 Create a prototype that uses algorithms (e. g., searching, sorting, finding shortest distance) to provide a possible solution for a real-world problem relevant to the student.	provides little to no evidence in addressing the expectation(s).	creates a prototype that uses an algorithm (e. g., searching, sorting, finding shortest distance) to provide a possible solution for a real-world problem relevant to the student.	creates a prototype that uses multiple algorithms (e. g., searching, sorting, finding shortest distance) to provide a possible solution for a real-world problem relevant to the student.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., student generated problem).
Algorithms: L2.AP.A.01 Critically examine and trace classic algorithms. Use and adapt classic algorithms to solve computational problems (e.g., selection sort, insertion sort, binary search, linear search).	provides little to no evidence in addressing the expectation(s).	- examines and traces classic algorithms with minor errors. - uses classic algorithms to solve computational problems.	- critically examines and traces classic algorithms. - uses classic algorithms to solve computational problems. - adapts classic algorithms to solve computational problems.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., use and justify why a given algorithm is more efficient than another).

Performance Level Descriptors (PLDs)

Grade Band: 9-12

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Algorithms: L1.AP.A.02 Describe how artificial intelligence algorithms drive many software and physical systems.	provides little to no evidence in addressing the expectation(s).	describes how artificial intelligence algorithms drive a software system or physical system.	describes how artificial intelligence algorithms drive many software and physical systems.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., student discusses different types of artificial intelligence algorithms).
Algorithms: L2.AP.A.02 Develop an artificial intelligence algorithm to play a game against a human opponent or solve a real-world problem.	provides little to no evidence in addressing the expectation(s).	- develops an artificial intelligence algorithm to play a game against a human opponent or solve a real-world problem. - incorrectly captures some rules of the game.	- develops an artificial intelligence algorithm to play a game against a human opponent or solve a real-world problem. - correctly implements all rules of the game.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., uses heuristics to select the moves of the computer).
Algorithms: L2.AP.A.03 Evaluate algorithms (e.g., sorting, searching) in terms of their efficiency, correctness, and clarity.	provides little to no evidence in addressing the expectation(s).	evaluates algorithms in terms of their: - efficiency, **or** - correctness, **or** - clarity.	evaluates algorithms in terms of their: - efficiency. - correctness. - clarity.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.

Performance Level Descriptors (PLDs)

Grade Band: 9-12

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Variables: L1.AP.V.01 Use lists to simplify solutions, generalizing computational problems instead of repeatedly using simple variables.	provides little to no evidence in addressing the expectation(s).	with guidance, uses lists to simplify solutions, generalizing computational problems instead of repeatedly using simple variables.	independently uses lists to simplify solutions, generalizing computational problems instead of repeatedly using simple variables.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., uses standard list operations like filter, map, and reduce).
Variables: L2.AP.V.01 Compare and contrast simple data structures and their uses (e.g., lists, stacks, queues).	provides little to no evidence in addressing the expectation(s).	- identifies simple linear data structures and their uses. - explains simple linear data structures and their uses.	compares and contrasts simple linear data structures and their uses.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., trees).

Performance Level Descriptors (PLDs)

Grade Band: 9-12

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Control: L1.AP.C.01 Justify the selection of specific control structures when tradeoffs involve implementation, readability, and program performance, and explain the benefits and drawbacks of choices made.	provides little to no evidence in addressing the expectation(s).	justifies the selection of specific control structures when tradeoffs involve: - implementation, **or** - readability, **or** - program performance.	- justifies the selection of specific control structures when tradeoffs involve implementation, readability, and program performance. - explains the benefits and drawbacks of choices.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., exception handling).
Control: L1.AP.C.02 Trace the execution of loops and conditional statements, illustrating output and changes in values of named variables.	provides little to no evidence in addressing the expectation(s).	traces the execution of: - loops illustrating output and changes in values of named variables, **or** - conditional statements illustrating output and changes in values of named variables.	traces the execution of: - loops illustrating output and changes in values of named variables, **and** - conditional statements illustrating output and changes in values of named variables.	In addition to the proficient level, student demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.
Control: L2.AP.C.01 Trace the execution of recursion, illustrating output and changes in values of named variables.	provides little to no evidence in addressing the expectation(s).	with guidance: - traces the execution of recursion. - illustrates output and changes in values of name variables.	independently: - traces the execution of linear recursion. - illustrates output and changes in values of name variables (e.g., factorial function).	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., Fibonacci).

Performance Level Descriptors (PLDs)

Grade Band: 9-12

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Control: L1.AP.C.03 Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue by using events to initiate instructions.	provides little to no evidence in addressing the expectation(s).	designs computational artifacts that uses events to initiate instructions.	- designs computational artifacts for practical intent, personal expression, or to address a societal issue by using events to initiate instructions. - iteratively develops computational artifacts for practical intent, personal expression, or to address a societal issue by using events to initiate instructions.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., using multiple user interface components).
Modularity: L1.AP.M.01 Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.	provides little to no evidence in addressing the expectation(s).	decomposes problems into smaller components that are incohesive or tightly coupled.	decomposes problems into smaller components that are highly cohesive and loosely coupled through systematic analysis, using constructs such as procedures, modules, and/or objects.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., an appropriate class hierarchy).
Modularity: L2.AP.M.01 Construct solutions to problems using student-created components, such as procedures, modules, and/or objects.	provides little to no evidence in addressing the expectation(s).	with guidance, constructs solutions to problems using student-created components, such as procedures, modules, and/or objects.	constructs solutions to problems using student-created components, such as procedures, modules, and/ or objects.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.

Performance Level Descriptors (PLDs)

Grade Band: 9-12

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Modularity: L1.AP.M.02 Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.	provides little to no evidence in addressing the expectation(s).	with guidance, creates artifacts by using: - procedures within a program, **or** - combinations of data and procedures, **or** - independent but interrelated programs.	independently, creates artifacts by using: - procedures within a program, **or** - combinations of data and procedures, **or** - independent but interrelated programs.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.
Modularity: L2.AP.M.02 Analyze a large-scale computational problem and identify generalizable patterns that can be applied to a solution.	provides little to no evidence in addressing the expectation(s).	- analyzes a large-scale computational problem and with guidance. - identifies generalizable patterns that can be applied to a solution.	- analyzes a large-scale computational problem. - independently identifies generalizable patterns that can be applied to a solution.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.
Modularity: L2.AP.M.03 Demonstrate code reuse by creating programming solutions using libraries and APIs.	provides little to no evidence in addressing the expectation(s).	with guidance, demonstrates code reuse by creating programming solutions using libraries and APIs.	independently, demonstrates code reuse by creating programming solutions using libraries and APIs.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.

Performance Level Descriptors (PLDs)

Grade Band: 9-12

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Program Development: **L1.AP.PD.01** Plan and develop programs by analyzing a problem and/or process, developing and documenting a solution, testing outcomes, and adapting the program for a variety of users.	provides little to no evidence in addressing the expectation(s).	with instructor support, plans and develops programs by: - analyzing a problem and/or process. - developing and documenting a solution. - testing outcomes.	plans and develops programs by: - analyzing a problem and/or process. - developing and documenting a solution. - testing outcomes. - adapting the program for a variety of users.	independently plans and develops programs by: - analyzing a problem and/or process. - developing and documenting a solution. - testing outcomes. - adapting the program for a variety of users.
Program Development: **L2.AP.PD.01** Plan and develop programs that will provide solutions to a variety of users using a software life cycle process.	provides little to no evidence in addressing the expectation(s).	with instructor support: - plans a program that will provide solutions to a variety of users using a software life cycle process. - develops a program that will provide solutions to a variety of users using a software life cycle process.	- plans a program that will provide solutions to a variety of users using a software life cycle process. - develops a program that will provide solutions to a variety of users using a software life cycle process.	independently: - plans a program that will provide solutions to a variety of users using a software life cycle process. - develops a program that will provide solutions to a variety of users using a software life cycle process.

Performance Level Descriptors (PLDs)

Grade Band: 9-12

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Program Development: L1.AP.PD.02 Evaluate licenses that limit or restrict use of computational artifacts when using resources such as libraries.	provides little to no evidence in addressing the expectation(s).	- identifies licenses that limit or restrict use of computational artifacts when using resources such as libraries. - defines licenses that limit or restrict use of computational artifacts when using resources such as libraries.	evaluates licenses that limit or restrict use of computational artifacts when using resources such as libraries (e.g. students might consider two software libraries that address a similar need, justifying their choice based on the library that has the least restrictive license).	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.
Program Development: L2.AP.PD.02 Use version control systems, integrated development environments (IDEs), and collaborative tools and practices (e.g., code documentation) in a group software project.	provides little to no evidence in addressing the expectation(s).	uses: - integrated development environments (IDEs) in a group software project. - collaborative tools or practices (e.g., code documentation) in a group software project.	uses: - version control systems in a group software project. - integrated development environments (IDEs) in a group software project. - collaborative tools and practices (e.g., code documentation) in a group software project.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.
Program Development: L1.AP.PD.03 Use debugging tools to identify and fix errors in a program.	provides little to no evidence in addressing the expectation(s).	identifies strategies to test and debug (identify and fix errors) a program or algorithm to ensure it runs.	tests and debugs (identify and fix errors) a program or algorithm to ensure it runs as intended.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.

Performance Level Descriptors (PLDs)

Grade Band: 9-12

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Program Development: **L1.AP.PD.04** Design and develop computational artifacts, working in team roles, using collaborative tools.	provides little to no evidence in addressing the expectation(s).	- designs computational artifacts using collaborative tools. - develops computational artifacts using collaborative tools.	designs and develops computational artifacts, working in team roles, using collaborative tools (e.g., team roles in pair programming are driver and navigator but could be more specialized in larger teams).	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard. As programs grow more complex, the choice of resources that aid program development becomes increasingly important and should be made by the students.
Program Development: **L2.AP.PD.03** Develop programs for multiple computing platforms.	provides little to no evidence in addressing the expectation(s).	with instructor support, develops programs for multiple computing platforms.	develops programs for multiple computing platforms (e.g., disparate programs for different platforms: computer desktop, web, or mobile).	develops programs for multiple cross-platform computing platforms (e.g., platforms could include: computer desktop, web, or mobile).
Program Development: **L1.AP.PD.05** Document design decisions using text, graphics, presentations, and/or demonstrations in the development of complex programs.	provides little to no evidence in addressing the expectation(s).	partially documents design decisions using: - text, graphics, presentations, **and/or** - demonstrations in the development of complex programs.	documents design decisions using: - text, graphics, presentations, **and/or** - demonstrations in the development of complex programs.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.

Performance Level Descriptors (PLDs)

Grade Band: 9-12

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Program Development: L2.AP.PD.04 Evaluate key qualities of a program through a process such as a code review (e.g., qualities could include correctness, usability, readability, efficiency, portability, and scalability).	provides little to no evidence in addressing the expectation(s).	identifies key qualities of a program. - defines key qualities of a program (e.g., correctness, usability, readability, efficiency, portability, and scalability).	evaluates key qualities of a program through a process such as a code review (e.g., correctness, usability, readability, efficiency, portability, and scalability).	evaluates key qualities of a program and makes recommendations to improve that program through a process such as a code review (e.g., correctness, usability, readability, efficiency, portability, and scalability).
Program Development: L1.AP.PD.06 Evaluate and refine computational artifacts to make them more usable and accessible.	provides little to no evidence in addressing the expectation(s).	with support: - evaluates computational artifacts to make them more usable and accessible. - refines computational artifacts to make them more usable and accessible.	- evaluates computational artifacts to make them more usable and accessible. - refines computational artifacts to make them more usable and accessible.	supports others as they: - evaluate computational artifacts to make them more usable and accessible. -refine computational artifacts to make them more usable and accessible.

Performance Level Descriptors (PLDs)

Grade Band: 9-12

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Program Development: **L2.AP.PD.05** Develop and use a series of test cases to verify that a program performs according to its design specifications.	provides little to no evidence in addressing the expectation(s).	uses a series of test cases to verify that a program performs according to its design specifications.	develops a series of test cases to verify that a program performs according to its design specifications. - uses a series of test cases to verify that a program performs according to its design specifications. - at this level, students are expected to select their own test cases.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.
Program Development: **L2.AP.PD.06** Explain security issues that might lead to compromised computer programs.	provides little to no evidence in addressing the expectation(s).	- identifies security issues that might lead to compromised computer programs. - describes security issues that might lead to compromised computer programs.	explains security issues that might lead to compromised computer programs (e.g., lack of bounds checking, poor input validation, and circular references).	explains and provides potential solutions for security issues that might lead to compromised computer programs.
Program Development: **L2.AP.PD.07** Modify an existing program to add additional functionality and discuss intended and unintended implications (e.g., breaking other functionality).	provides little to no evidence in addressing the expectation(s).	modifies an existing program to add additional functionality.	- modifies an existing program to add additional functionality. - discusses intended and unintended implications (e.g., breaking other functionality).	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.

Performance Level Descriptors (PLDs)

Grade Band: 9-12

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Program Development: L2.AP.PD.08 Compare multiple programming languages and discuss how their features make them suitable for solving different types of problems.	provides little to no evidence in addressing the expectation(s).	- identifies multiple programming languages. - explains multiple programming languages.	- compares multiple programming languages. - discusses how their features make them suitable for solving different types of problems.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.
Culture: L1.IC.C.01 Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.	provides little to no evidence in addressing the expectation(s).	- identifies the ways computing impacts personal, ethical, social, economic, and cultural practices. - defines the ways computing impacts personal, ethical, social, economic, and cultural practices.	evaluates the ways computing impacts personal, ethical, social, economic, and cultural practices.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.
Culture: L2.IC.C.01 Evaluate the beneficial and harmful effects that computational artifacts and innovations have on society.	provides little to no evidence in addressing the expectation(s).	- identifies the beneficial and harmful effects that computational artifacts and innovations have on society. - defines the beneficial and harmful effects that computational artifacts and innovations have on society.	evaluates the beneficial and harmful effects that computational artifacts and innovations have on society.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.

Performance Level Descriptors (PLDs)

Grade Band: 9-12

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Culture: L1.IC.C.02 Test and refine computational artifacts to reduce bias and equity deficits.	provides little to no evidence in addressing the expectation(s).	identifies how computational artifacts reduce bias and equity deficits.	- tests computational artifacts to reduce bias and equity deficits. - refines computational artifacts to reduce bias and equity deficits.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., student creates a computational artifact that utilizes accepted accessibility standards).
Culture: L2.IC.C.02 Evaluate the impact of equity, access, and influence on the distribution of computing resources in a global society.	provides little to no evidence in addressing the expectation(s).	provides examples for how: - equity impacts the distribution of computing resources in a global society. - access impacts the distribution of computing resources in a global society. - influence impacts the distribution of computing resources in a global society.	evaluates the impact of: - equity on the distribution of computing resources in a global society. - access on the distribution of computing resources in a global society. - influence on the distribution of computing resources in a global society.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.
Culture: L1.IC.C.03 Demonstrate how a given algorithm applies to problems across disciplines.	provides little to no evidence in addressing the expectation(s).	identifies several disciplines a given algorithm applies to.	demonstrates how a given algorithm applies to problems across disciplines.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.
Culture: L2.IC.C.03 Predict how computational innovations that have revolutionized aspects of our culture might evolve.	provides little to no evidence in addressing the expectation(s).	identifies computational innovations that have revolutionized aspects of our culture.	predicts how computational innovations, that have revolutionized aspects of our culture, might evolve.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.

Performance Level Descriptors (PLDs)

Grade Band: 9-12

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Social Interactions: L1.IC.SI.01 Use tools and methods for collaboration.	provides little to no evidence in addressing the expectation(s).	uses basic tools and methods for collaboration.	uses a variety of tools and methods for collaboration.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard (e.g., students could compare and recommend ways different tools could help a team become more cohesive).
Social Interactions: L1.IC.SI.02 Practice grade-level appropriate behavior and responsibilities while participating in an online community. Identify and report inappropriate behavior.	provides little to no evidence in addressing the expectation(s).	generally practices grade-level appropriate behavior and responsibilities while participating in an online community.	- practices grade-level appropriate behavior and responsibilities while participating in an online community. - identifies and reports inappropriate behavior.	models grade-level appropriate behavior and responsibilities while participating in an online community.
Social Interactions: L2.IC.SI.01 Practice grade-level appropriate behavior and responsibilities while participating in an online community. Identify and report inappropriate behavior.	provides little to no evidence in addressing the expectation(s).	generally practices grade-level appropriate behavior and responsibilities while participating in an online community.	- practices grade-level appropriate behavior and responsibilities while participating in an online community. - identifies and reports inappropriate behavior.	models grade-level appropriate behavior and responsibilities while participating in an online community.

Performance Level Descriptors (PLDs)

Grade Band: 9-12

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Safety, Law, & Ethics: L1.IC.SLE.01 Explain the beneficial and harmful effects that intellectual property laws can have on innovation.	provides little to no evidence in addressing the expectation(s).	- identifies a beneficial effect intellectual property laws have had on innovation, **and/or** - identifies a harmful effect intellectual property laws have had on innovation.	- identifies a beneficial effect intellectual property laws have had on innovation. - identifies a harmful effect intellectual property laws have had on innovation.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.
Safety, Law, & Ethics: L2.IC.SLE.01 Debate laws and regulations that impact the development and use of software and technology.	provides little to no evidence in addressing the expectation(s).	- identifies laws and regulations that impact the development and use of software and technology. - defines laws and regulations that impact the development and use of software and technology.	debates laws and regulations that impact the development and use of software and technology.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.

Performance Level Descriptors (PLDs)

Grade Band: 9-12

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Safety, Law, & Ethics: L1.IC.SLE.02 Explain the privacy concerns related to the collection and generation of data through automated processes that may not be evident to users.	provides little to no evidence in addressing the expectation(s).	identifies the privacy concerns related to the collection and generation of data through automated processes that may not be evident to users.	explains the privacy concerns related to the collection and generation of data through automated processes that may not be evident to users.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.
Safety, Law, & Ethics: L1.IC.SLE.03 Evaluate the social and economic implications of privacy in the context of safety, law, or ethics.	provides little to no evidence in addressing the expectation(s).	provides examples of the: - social implications of privacy in the context of safety, law, or ethics. - economic implications of privacy in the context of safety, law, or ethics.	evaluates the: - social implications of privacy in the context of safety, law, or ethics. - economic implications of privacy in the context of safety, law, or ethics.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.

Performance Level Descriptors (PLDs)

Grade Band: 9-12

Standard: Benchmark	The Below Basic student:	The Basic student:	The Proficient student:	In addition to the Proficient Level, the Advanced student:
Safety, Law, & Ethics: L1.IC.SLE.04 Using grade level appropriate content and complexity, discuss the legal, social, and ethical impacts associated with software development and use, including both positive and malicious intent.	provides little to no evidence in addressing the expectation(s).	provides examples of the: - legal impacts associated with software development and use, including both positive and malicious intent, **or** - social impacts associated with software development and use, including both positive and malicious intent, **or** - ethical impacts associated with software development and use, including both positive and malicious intent.	discusses the: - legal impacts associated with software development and use, including both positive and malicious intent. - social impacts associated with software development and use, including both positive and malicious intent. - ethical impacts associated with software development and use, including both positive and malicious intent.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.
Safety, Law, & Ethics: L2.IC.SLE.02 Using grade level appropriate content and complexity, discuss the legal, social, and ethical impacts associated with software development and use, including both positive and malicious intent.	provides little to no evidence in addressing the expectation(s).	provides examples of the: - legal impacts associated with software development and use, including both positive and malicious intent, **or** - social impacts associated with software development and use, including both positive and malicious intent, **or** - ethical impacts associated with software development and use, including both positive and malicious intent.	discusses the: - legal impacts associated with software development and use, including both positive and malicious intent. - social impacts associated with software development and use, including both positive and malicious intent. - ethical impacts associated with software development and use, including both positive and malicious intent.	demonstrates in-depth inferences and applications that go beyond the understanding or context of the standard.

APPENDIX A: GLOSSARY for COMPUTER SCIENCE STANDARDS—page 1 of 5

Abstraction (Process): The process of reducing complexity by focusing on the main idea. By hiding details irrelevant to the question at hand and bringing together related and useful details, abstraction reduces complexity and allows one to focus on the problem. (Product): A new representation of a thing, a system, or a problem that helpfully reframes a problem by hiding details irrelevant to the question at hand. [MDESE, 2016]

Accessibility The design of products, devices, services, or environments for people who experience disabilities. Accessibility standards that are generally accepted by professional groups include the Web Content Accessibility Guidelines (WCAG) 2.0 and Accessible Rich Internet Applications (ARIA) standards. [Wikipedia]

Algorithm A step-by-step process to complete a task.

Analog The defining characteristic of data that is represented in a continuous, physical way. Whereas digital data is a set of individual symbols, analog data is stored in physical media, such as the surface grooves on a vinyl record, the magnetic tape of a VCR cassette, or other non digital media. [Techopedia]

App A type of application software designed to run on a mobile device, such as a smartphone or tablet computer. Also known as a mobile application. [Techopedia]

Artifact Anything created by a human. See computational artifact for the definition used in computer science.

Application Programming Interface (API) A set of subroutine definitions, communication protocols, and tools for building software. [Wikipedia]

Audience Expected end users of a computational artifact or system.

Authentication (verb): The verification of the identity of a person or process. [FOLDOC]

Authentication Factor(s) (noun): may include password, face recognition, fingerprints, PIN numbers, biometrics, smartcard, Virtual Private Networking (VPN) and Remote Access Services (RAS), etc.

Automate To link disparate systems and software so that they become self-acting or self-regulating. [Ross, 2016]

Automation The process of automating.

Boolean A type of data or expression with two possible values: true and false. [FOLDOC]

Bug An error in a software program. It may cause a program to unexpectedly quit or behave in an unintended manner. [Tech Terms] The process of finding and correcting errors (bugs) is called debugging. [Wikipedia]

Code Any set of instructions expressed in a programming language. [MDESE, 2016]

Comment A programmer-readable annotation in the code of a computer program added to make the code easier to understand. Comments are generally ignored by machines. [Wikipedia]

Complexity The minimum amount of resources, such as memory, time, or messages, needed to solve a problem or execute an algorithm. [NIST/ DADS]

Component An element of a larger group. Usually, a component provides a particular service or group of related services. [Tech Terms, TechTarget]

Computational Relating to computers or computing methods.

Computational Artifact Anything created by a human using a computational thinking process and a computing device. A computational artifact can be, but is not limited to, a program, image, audio, video, presentation, or web page file. [College Board, 2016]

Computational Thinking The thought processes involved in formulating a problem and expressing its solutions in such a way that a computer (human or machine) can effectively carry them out.

Computer A machine or device that performs processes, calculations, and operations based on instructions provided by a software or hardware program. [Techopedia]

Computer Science The study of computing principles, design, and applications (hardware & software); the creation, access, and use of information through algorithms and problem solving, and the impact of computing on society.

Computing Any goal-oriented activity requiring, benefiting from, or creating algorithmic processes. [MDESE, 2016]

Computing Device A physical device that uses hardware and software to receive, process, and output information. Computers, mobile phones, and computer chips inside appliances are all examples of computing devices. [CSTA, 2016]

Computing System A collection of one or more computers or computing devices, together with their hardware and software, integrated for the purpose of accomplishing shared tasks. Although a computing system can be limited to a single computer or computing device, it more commonly refers to a collection of multiple connected computers, computing devices, and hardware. [CSTA, 2016]

Conditional A feature of a programming language that performs different computations or actions depending on whether a programmer-specified Boolean condition evaluates to true or false. [MDESE, 2016] (A conditional could refer to a conditional statement, conditional expression, or conditional construct.)

Configuration (process): Defining the options that are provided when installing or modifying hardware and software or the process of creating the configuration (product). [TechTarget] (product): The specific hardware and software details that tell exactly what the system is made up of, especially in terms of devices attached, capacity, or capability. [TechTarget]

Connection A physical or wireless attachment between multiple computing systems, computers, or computing devices. [CSTA]

Connectivity A program's or device's ability to link with other programs and devices. [Webopedia]

Control (in general) The power to direct the course of actions. (in programming) The use of elements of programming code to direct which actions take place and the order in which they take place. [CSTA, 2016]

Control Structure A programming (code) structure that implements control. Conditionals and loops are examples of control structures. [CSTA, 2016]

Culture A human institution manifested in the learned behavior of people, including their specific belief systems, language(s), social relations, technologies, institutions, organizations, and systems for using and developing resources. [NCSS, 2013]

Cultural Practices The displays and behaviors of a culture.

Cybersecurity The protection against access to, or alteration of, computing resources through the use of technology, processes, and training. [TechTarget]

Data Information that is collected and used for reference or analysis. Data can be digital or nondigital and can be in many forms, including numbers, text, show of hands, images, sounds, or video. [CAS, 2013; Tech Terms]

Data Structure A particular way to store and organize data within a computer program to suit a specific purpose so that it can be accessed and worked with in appropriate ways. [TechTarget]

Data Type A classification of data that is distinguished by its attributes and the types of operations that can be performed on it. Some common data types are integer, string, Boolean (true or false), and floating-point. [CSTA, 2016]

Debugging The process of finding and correcting errors (bugs) in programs. [MDESE, 2016]

Decompose To break down into components. [MDESE, 2016]

Decomposition Breaking down a problem or system into components. [MDESE, 2016]

Device A unit of physical hardware that provides one or more computing functions within a computing system. It can provide input to the computer, accept output, or both. [Techopedia]

Document / Documentation written text or illustration that accompanies computer software or is embedded in the source code. It either explains how it operates or how to use it, and may mean different things to people in different roles [Wikipedia]

Digital A characteristic of electronic technology that uses discrete values, generally 0 and 1, to generate, store, and process data. [Techopedia]

Digital Citizenship The norms of appropriate, responsible behavior with regard to the use of technology. [MDESE, 2016]

Efficiency A measure of the amount of resources an algorithm uses to find an answer. It is usually expressed in terms of the theoretical computations, the memory used, the number of messages passed, the number of disk accesses, etc. [NIST/DADS]

Encapsulation The technique of combining data and the procedures that act on it to create a type. [FOLDOC]

Encryption The conversion of electronic data into another form, called ciphertext, which cannot be easily understood by anyone except authorized parties. [TechTarget]

End User (or User) A person for whom a hardware or software product is designed (as distinguished from the developers). [TechTarget]

Event Any identifiable occurrence that has significance for system hardware or software. User-generated events include keystrokes and mouse clicks; system-generated events include program loading and errors. [TechTarget]

Event Handler A procedure that specifies what should happen when a specific event occurs. [CSTA, 2016]

Execute To carry out (or "run") an instruction or set of instructions (program, app, etc.). [FOLDOC]

Execution The process of executing an instruction or set of instructions. [FOLDOC]

Hardware The physical components that make up a computing system, computer, or computing device. [MDESE, 2016]

Hierarchy An organizational structure in which items are ranked according to levels of importance. [TechTarget]

Human-Computer Interaction (HCI) The study of how people interact with computers and to what extent computing systems are or are not developed for successful interaction with human beings. [TechTarget]

Identifier The user-defined, unique name of a program element (such as a variable or procedure) in code. An identifier name should indicate the meaning and usage of the element being named. [Techopedia]

Implementation The process of expressing the design of a solution in a programming language (code) that can be made to run on a computing device.

Inference A conclusion reached on the basis of evidence and reasoning. [Oxford]

Input (verb): The signals or instructions sent to a computer. [Techopedia]; (noun): A device or component that allows information to be given to a computer [code.org]

Integrity The overall completeness, accuracy, and consistency of data. [Techopedia]

Internet The global collection of computer networks and their connections, all using shared protocols to communicate. [CAS, 2013]

Interactive Involving the repeating of a process with the aim of approaching a desired goal, target, or result. [MDESE, 2016]

Loop A programming structure that repeats a sequence of instructions as long as a specific condition is true. [Tech Terms]

Memory Temporary storage used by computing devices. [MDESE, 2016]

Model A representation of some part of a problem or a system. [MDESE, 2016] **Note:** This definition differs from that used in science.

Modularity The characteristic of a software/web application that has been divided (decomposed) into smaller modules. An application might have several procedures that are called from inside its main procedure. Existing procedures could be reused by recombining them in a new application. [Techopedia]

Module A software component or part of a program that contains one or more procedures. One or more independently developed modules make up a program. [Techopedia]

Network A group of computing devices (personal computers, phones, servers, switches, routers, etc.) connected by cables or wireless media for the exchange of information and resources. [CSTA, 2016]

Operation An action, resulting from a single instruction, that changes the state of data. [Free Dictionary]

Output Any device or component that receives information from a computer [Code.org]

Packet The unit of data sent over a network. [Tech Terms]

Password A password is a string of characters used to verify the identity of a user during the authentication process. Password is an example of one authentication factor. [TechTarget]

Parameter A special kind of variable used in a procedure to refer to one of the pieces of data received as input by the procedure. [MDESE, 2016]

Piracy The illegal copying, distribution, or use of software. [TechTarget]

Procedure An independent code module that fulfills some concrete task and is referenced within a larger body of program code. The fundamental role of a procedure is to offer a single point of reference for some small goal or task that the developer or programmer can trigger by invoking the procedure itself. [Techopedia] In this framework, procedure is used as a general term that may refer to an actual procedure or a method, function, or module of any other name by which modules are known in other programming languages.

Process A series of actions or steps taken to achieve a particular outcome. [Oxford]

Program (noun): A set of instructions that the computer executes to achieve a particular objective. [MDESE, 2016]; (verb): To produce a program by programming.

Programming The craft of analyzing problems and designing, writing, testing, and maintaining programs to solve them. [MDESE, 2016]

Protocol The special set of rules used by endpoints in a telecommunication connection when they communicate. Protocols specify interactions between the communicating entities. [TechTarget]

APPENDIX A: GLOSSARY for COMPUTER SCIENCE STANDARDS—page 5 of 5

Prototype A prototype is an early sample, model, or release of a product built to test a concept or process or to act as a thing to be replicated or learned from. [Wikipedia]

Redundancy A system design in which a component is duplicated, so if it fails, there will be a backup. [TechTarget]

Reliability Consistently produces the same results, preferably meeting or exceeding its requirements. [FOLDOC]

Remix The process of creating something new from something old. Originally a process that involved music, remixing involves creating a new version of a program by recombining and modifying parts of existing programs, and often adding new pieces, to form new solutions. [Kafai & Burke, 2014]

Router A device or software that determines the path that data packets travel from source to destination. [TechTarget]

Scalability The capability of a network to handle a growing amount of work or its potential to be enlarged to accommodate that growth. [Wikipedia]

Simulate To imitate the operation of a real-world process or system.

Simulation Imitation of the operation of a real-world process or system. [MDESE, 2016]

Software Programs that run on a computing system, computer, or other computing device.

Storage (noun): A place, usually a device, into which data can be entered, in which the data can be held, and from which the data can be retrieved at a later time. [FOLDOC]
storage (verb): A process through which digital data is saved within a data storage device by means of computing technology. Storage is a mechanism that enables a computer to retain data, either temporarily or permanently. [Techopedia]

String A sequence of letters, numbers, and/or other symbols. A string might represent, for example, a name, address, or song title. Some functions commonly associated with strings are length, concatenation, and substring. [TechTarget]

Structure A general term used in the framework to discuss the concept of encapsulation without specifying a particular programming methodology.

Switch A high-speed device that receives incoming data packets and redirects them to their destination on a local area network (LAN). [Techopedia]

System A collection of elements or components that work together for a common purpose. [TechTarget] See also the definition for computing system.

Test Case A set of conditions or variables under which a tester will determine whether the system being tested satisfies requirements or works correctly. [STF]

Topology The physical and logical configuration of a network; the arrangement of a network, including its nodes and connecting links. A logical topology is the way devices appear connected to the user. A physical topology is the way they are actually interconnected with wires and cables. [PCMag]

Troubleshooting A systematic approach to problem solving that is often used to find and resolve a problem, error, or fault within software or a computing system. [Techopedia, TechTarget]

Variable A symbolic name that is used to keep track of a value that can change while a program is running. Variables are not just used for numbers; they can also hold text, including whole sentences (strings) or logical values (true or false). A variable has a data type and is associated with a data storage location; its value is normally changed during the course of program execution. [CAS, 2013; Techopedia] Note: This definition differs from that used in math.

Implementation Plan

2019 Wyoming Computer Science Content and Performance Standards			
State Support - WDE	**Phase 1: Awareness / Planning [2018-2020]**	**Phase 2: Transition / Implementation [2020-2022]**	**Phase 3: Full Implementation [2022-2023]**
	❑ Conduct Educators survey to determine implementation needs ❑ Provide Updates through Superintendent's Memo, Edmodo, Facebook, Twitter, state Conferences ❑ Follow Updates on states working with implementation standards similar to the proposed 2019 WY CS Standards ❑ Membership in CSTA and ISTE to remain current on CS standards related issues ❑ Develop communication plan for the 2019 WY CS Standards	❑ Develop toolkit on WDE website with resources for the 2019 WY CS Standards ❑ Develop and provide professional development focused on the 2019 WY CS Standards ❑ Update website with resources ❑ Maintain membership to professional organizations focused on computer science education ❑ Maintain statewide communication regarding implementation for the 2019 WY CS Standards	❑ Maintain membership to professional organizations focused on computer science education ❑ Maintain statewide communication regarding implementation for the 2019 WY CS Standards ❑ Continue to develop and maintain resources and toolkit on the WDE website ❑ Develop and provide professional development on the 2019 WY CS Standards ❑ Collect feedback from districts on standards implementation
Recommended District Support	**Phase 1: Awareness / Planning [2018-2020]**	**Phase 2: Transition / Implementation [2020-2022]**	**Phase 3: Full Implementation [2022-2023]**
	❑ Review standards and contact WDE with questions or to clarify the standards' document ❑ Consider possible impacts of the computer science standards on curriculum, district assessments and instruction	❑ Develop an implementation plan for the maintain statewide communication regarding implementation for the 2019 WY CS Standards ❑ Review alignment of potential curricular resources	❑ Provide feedback to WDE on implementation of the of the 2019 WY CS Standards ❑ Evaluate implementation of the 2019 WY CS Standards ❑ Review curriculum district assessments and instructional practices

DRAFT Presented at SBE Meeting March 21, 2019

Developed by WDE Standards Team - Computer Science Consultant Brian Cole 307-777-5036, brian.cole@wyo.gov

Communication Plan

<table>
<tr><th colspan="4">2019 Wyoming Computer Science Content and Performance Standards</th></tr>
<tr><th>State Support - WDE</th><th>Phase 1: Awareness / Planning
[2018-2020]</th><th>Phase 2: Transition
[2020-2022]</th><th>Phase 3: Implementation
[2022-2023]</th></tr>
<tr><td></td><td>❑ Gather contact information for individuals interested in serving on the Computer Science Standards Committee:
• Educators (K-12, Administrators, Higher Education)
• Parents, Community
• Business/Industry
• Students
❑ Provide information about the standards process and invite members of the public to serve on the committee
❑ Press release – announcing open public comment timeframe and hearings
❑ Add resources and supporting documents to the WDE website / toolkit as needed</td><td>❑ Inform districts and the public of the computer science standards on the WDE website
❑ Provide updates at content conferences in Wyoming
❑ Educate school districts on the structure and layout of the proposed standards
❑ Gather district feedback
❑ Create of a professional development plan
❑ Create of an implementation plan</td><td>❑ Inform school districts and public of 2019 WY CS Standards and available online resources
❑ Send communication through media streams including Edmodo / WDE newsletter / WDE social media
❑ Maintain communication regarding statewide implementation
❑ Updated professional development opportunities</td></tr>
<tr><th>Modes of Communication</th><th>Primary</th><th>Secondary</th><th>Supporting</th></tr>
<tr><td></td><td>• WDE Website
• Superintendent’s Memo
• WDE Press Release
• WDE Standards Newsletter</td><td>• FAQs
• Social Media – Facebook, Twitter
• Professional Learning Communities - Edmodo</td><td>• NPR Radio</td></tr>
</table>

DRAFT Presented at SBE Meeting March 21, 2019

Developed by WDE Standards Team - Computer Science Consultant Brian Cole 307-777-5036, brian.cole@wyo.gov

Professional Development Plan

2019 Wyoming Computer Science Content and Performance Standards			
State Support - WDE	**Phase 1: Awareness / Planning [2018-2020]**	**Phase 2: Transition [2020-2022]**	**Phase 3: Implementation [2022-2023]**
	❑ When adopted, post 2019 WY CS Standards on WDE website ❑ Survey districts on PD needs and develop PD plan ❑ Educate on the structure and layout of the 2019 WY CS Standards ❑ Provide updates at conferences within the state ❑ Create resources / documents/ videos on the WDE website / toolkit ❑ Present standard's timeline and computer science processes to the State Board of Education, WCDA, and other PD events	❑ Monitor district needs and collect feedback on implementation of the 2019 WY CS Standards ❑ Respond to individual district's questions ❑ Provide professional development through WDE newsletter ❑ Develop and facilitate professional development opportunities on the 2019 WY CS Standards ❑ Update and maintain resources on the WDE website ❑ Update and share new information at statewide events(e.g., WCDA, SBE, STEAM, Innovations) ❑ Provide resources and PD opportunities on Edmodo	❑ Assess districts progress on implementation of the 2019 WY CS Standards ❑ Respond to individual district questions ❑ Update and maintain professional development through memos, Edmodo, and WDE Standards' newsletter ❑ Prepare and share best practices through professional development around implementing the 2019 WY CS Standards ❑ Facilitate professional development opportunities on the 2019 WY CS Standards ❑ Update and maintain resources on the WDE website ❑ Update and share new information at statewide events ❑ Provide resources and PD opportunities on Edmodo

DRAFT Presented at SBE Meeting March 21, 2019

Developed by WDE Standards Team - Computer Science Consultant Brian Cole 307-777-5036, brian.cole@wyo.gov

		❏ Align selected district curriculum, instruction, district assessments, and professional development ❏ Maintain and develop resources, including resources found on the WDE website ❏ Identify and select aligned instructional practices	❏ Review district assessment data

CREATING OPPORTUNITIES FOR STUDENTS TO KEEP WYOMING STRONG

JILLIAN BALOW
Superintendent of Public Instruction

DICKY SHANOR
Chief of Staff

SHELLEY HAMEL
Chief Academic Officer

KARI EAKINS
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WYOMING DEPARTMENT OF EDUCATION

MEMORANDUM

Date: March 15, 2019

To: State Board of Education

From: Kari Eakins, Chief Policy Officer Laurie Hernandez, Standards/Assessment Director

Subject: Ch. 10 Promulgation of Standards

Meeting Date: March 21, 2018

Item Type: Action: __X___ Informational: ____.

Background:
The Board is charged with evaluating and reviewing the uniformity and quality of the educational standards imposed under W.S. 21-9-101 including the student content and performance standards. The Wyoming Department of Education (WDE) convened a Standards Review Committee to create a set of standards for the newly added content area of Computer Science and to make a recommendation to the State Board of Education.

Implementation: Once these standards are adopted and Ch. 10 Rules are promulgated, the standards will remain in effect until the next review cycle or until directed by the Board to open the review process, whichever comes first. Implementation in school districts is directed to be by the start of the 2022-23 school year, per SEA 48 from the 2018 Legislative Session.

Statutory Reference (if applicable):
- W.S. 21-2-304(c)
- Education Rules, Chapter 10: Wyoming Content and Performance Standards

Supporting Documents/Attachments:
- Ch. 10 Wyoming Content and Performance Standards Statement of Reasons
- Ch. 10 Rules on Wyoming Content and Performance Standards

Proposed Motions:
"I move to promulgate the Chapter 10 Rules for Wyoming Content and Performance Standards."

CHAPTER 10
WYOMING CONTENT AND PERFORMANCE STANDARDS
STATEMENT OF REASONS

Pursuant to Wyo. Stat. § 21-2-304(a)(iii), the Wyoming State Board of Education must prescribe uniform student content and performance standards for the common core of knowledge specified by Wyo. Stat. § 21-9-101(b)(i). Prior to 2018, the common core of knowledge included Reading/Language Arts, Social Studies, Mathematics, Science, Fine and Performing Arts, Physical Education, Health and Safety, Humanities, Career/Vocational Education, Foreign Cultures and Languages, and Government and Civics.

SEA 48 was signed by Governor Mead on March 14, 2018, requiring the addition of Computer Science Standards and the following changes to the Basket of Goods in W.S. 21-9-101(a)(i), as outlined below.

(i) Common Core of Knowledge
(M) ~~Applied technology~~ (repealed)
(O) Computer science (added)
(iii) Common Core of Skills
(C) ~~Keyboarding~~ Computational thinking and computer applications

Section 3 of the bill requires the State Board of Education to promulgate uniform content and performance standards for computer science by January 1, 2022, to be effective beginning with the 2022-23 school year.

After careful consideration, and with support from members of the Standards Review Committee and input from school districts and the public at large, the Wyoming State Board of Education approved the new Computer Science Standards on March 21, 2019.

The Board is promulgating revised rules for the Wyoming Content and Performance Standards for the content area of Computer Science. These standards define the knowledge and skills students should know and be able to do throughout their K-12 education so they can graduate from high school able to succeed in college and career.

In developing the Computer Science Standards, the Wyoming Department of Education, on the Board's behalf, convened a standards review committee composed of 40 members, which included educators, professors, parents, content experts, and business/community members. Prior to the committee's first meeting, the Department collected input online and held five community input meetings, across the state, to inform the public of the upcoming review process and to solicit information for the standards review committees' consideration. Following the work of the committee, the Department also collected input online and held five public input hearings, across the state, to inform the public and gather feedback from the public for the Board's consideration when voting whether to adopt the proposed standards in the content area of Computer Science.

Additional changes to these rules include adding a reference to the 2019 Wyoming Computer Science Content and Performance Standards.

The Board previously revised the process for compiling public comments to more adequately inform the Board of the nature of the comments and the reasons for either adopting or rejecting the comment. This process includes articulating comments separately even if they were part of a single submission that addressed several topics, grouping substantially identical comments together with a single response, and organizing the comments and responses into comment, discussion, and changes sections. These changes should make it easier to understand the comments received and the agency's response to those comments. Comments received in this rulemaking will be addressed accordingly.

These rules meet the minimum substantive state statutory requirements and are within the Board and Department’s statutory authority. No part of this action should be interpreted as any attempt to dictate curriculum at the local or state level.

Wyoming Department of Education
Wyoming Content and Performance Standards

CHAPTER 10

Section 1. Authority. These rules and regulations are promulgated pursuant to W.S. 21-2-304(a)(i), (ii), (iii), ~~and~~ (iv), and (c) .

Section 2. Applicability. These rules and regulations pertain to the uniform student content and performance standards for the common core of knowledge and the common core of skills specified under W.S. 21-9-101(b).

Section 3. Definitions.

(a) "Common Core of Knowledge" means areas of knowledge each student is expected to acquire at levels established by the state board of education. W.S. 21-9-101(b)(i) This includes the ~~nine~~ ten content areas listed in subsection (c) and ~~Health and Safety,~~ Humanities~~, Applied Technology,~~ and Government and Civics.

(b) "Common Core of Skills" means skills each student is expected to demonstrate at levels established by the state board of education. W.S. 21-9-101(b)(iii). These skills may be integrated into the uniform student content and performance standards for the Common Core of Knowledge. This includes Problem Solving, Interpersonal Communications, ~~Keyboarding~~ Computational Thinking and Computer Applications, Critical Thinking, Creativity, and Life Skills, including Personal Financial Management Skills.

(c) "Content and Performance Standards" means standards that include the K-12 content standards, benchmark standards, and the performance standards with performance level descriptors established for the Common Core of Knowledge and Common Core of Skills. W.S. 21-2-304(a)(iii) The ~~nine~~ ten content areas are as follows:

(i) English Language Arts (ELA)

(ii) Mathematics

(iii) Science

(iv) Social Studies

(v) Health

(vi) Physical Education

(vii) Foreign Language

(viii) Career & Vocational Education

(ix) Fine & Performing Arts

(x) Computer Science

(d) "Wyoming Extended Standards" also interchangeable with "Wyoming Standards Extensions" means standards for students with the most significant cognitive disabilities that show a clear link to the content standards for the grade in which the student is enrolled, although the grade-level content may be reduced in complexity or modified to reflect pre-requisite skills.

Section 4. Uniform Student Content and Performance Standards.

(a) Uniform student content and performance standards, including standards for graduation, are hereby incorporated by reference pursuant to W.S. 16-3-103(h) and include the following:

(i) 2012 Wyoming Language Arts Content and Performance Standards as approved by the Wyoming State Board of Education on April 27, 2012;

(A) 2012 Wyoming Language Arts Content and Performance Standards amended on April 27, 2012 shall be fully implemented on or before the first day of the 2015-2016 school year.

(B) The 2014 Language Arts Performance Level Descriptors, as incorporated by reference, shall be the Wyoming Language Arts Performance Standards for the 2012 Wyoming Language Arts Content Standards.

(C) The 2014 Wyoming Language Arts Extended Standards for students with significant cognitive disabilities, as incorporated by reference, shall be fully implemented on or before the first day of the 2017-18 school year.

(D) The Wyoming Language Arts Content and Performance Standards, Performance Level Descriptors, and Extended Standards are available at https://edu.wyoming.gov/educators/standards/language-arts.

(ii) 2018 Wyoming Mathematics Content and Performance Standards available at https://edu.wyoming.gov/educators/standards/mathematics.

(A) The 2014 Mathematics Performance Level Descriptors, as incorporated by reference, shall be the Wyoming Mathematics Performance Standards.

(B) The 2014 Wyoming Mathematics Standards Extensions for students with significant cognitive disabilities, as incorporated by reference, shall be fully implemented on or before the first day of the 2017-18 school year.

(C) The Wyoming Mathematics Content and Performance Standards, Performance Level Descriptors, and Standards Extensions are available at https://edu.wyoming.gov/educators/standards/mathematics.

(iii) 2016 Wyoming Science Content and Performance Standards are available at https://edu.wyoming.gov/educators/standards/science.

(A) The 2018 Wyoming Science Extended Standards for students with significant cognitive disabilities are available at https://edu.wyoming.gov/educators/standards/extended-benchmarks.

(iv) 2014 with 2018 Additions Wyoming Social Studies Content and Performance Standards are available at https://edu.wyoming.gov/educators/standards/social-studies.

(v) 2012 Wyoming Health Content and Performance Standards as approved by the Wyoming State Board of Education on April 27, 2012;

(A) 2012 Wyoming Health Content and Performance Standards amended on April 27, 2012 shall be fully implemented on or before the first day of the 2015-2016 school year.

(B) The Wyoming Health Content and Performance Standards are available at https://edu.wyoming.gov/educators/standards/health-education.

(vi) 2014 Wyoming Physical Education Content and Performance Standards are available at https://edu.wyoming.gov/educators/standards/physical-education.

(vii) 2013 Wyoming Foreign Language Content and Performance Standards as approved by the Wyoming State Board of Education on May 8, 2013;

(A) 2013 Wyoming Foreign Language Content and Performance Standards amended on May 8, 2013 shall be fully implemented on or before the first day of the 2016-2017 school year.

(B) The Wyoming Foreign Language Content and Performance Standards are available at https://edu.wyoming.gov/educators/standards/foreign-language.

(viii) 2014 Wyoming Career/Vocational Education Content and Performance Standards are available at https://edu.wyoming.gov/educators/standards/career-vocational.

(ix) 2013 Wyoming Fine and Performing Arts Content and Performance Standards as approved by the Wyoming State Board of Education on May 8, 2013;

(A) 2013 Wyoming Fine and Performing Arts Content and Performance Standards amended on May 8, 2013 shall be fully implemented on or before the first day of the 2016-2017 school year.

(B) The Wyoming Fine and Performing Arts Content and Performance Standards are available at https://edu.wyoming.gov/educators/standards/arts.

(x) 2019 Wyoming Computer Science Content and Performance Standards as approved by the Wyoming State Board of Education on March 21, 2019;

(A) 2019 Wyoming Computer Science Content and Performance Standards approved on March 21, 2019 shall be fully implemented on or before the first day of the 2022-2023 school year.

(B) The Wyoming Computer Science Content and Performance Standards are available at link to CS webpage.

(b) The above-referenced content and performance standards are available at the Wyoming Department of Education website at https://edu.wyoming.gov (or at cost of production) from the Wyoming Department of Education, 122 E. 25th Street, Suite E200, Cheyenne, WY 82002.

(c) The above-referenced content and performance standards are the most current editions.

(d) The above performance standards that are incorporated by reference do not include any amendments to or editions of the standards since the effective date of this rule.