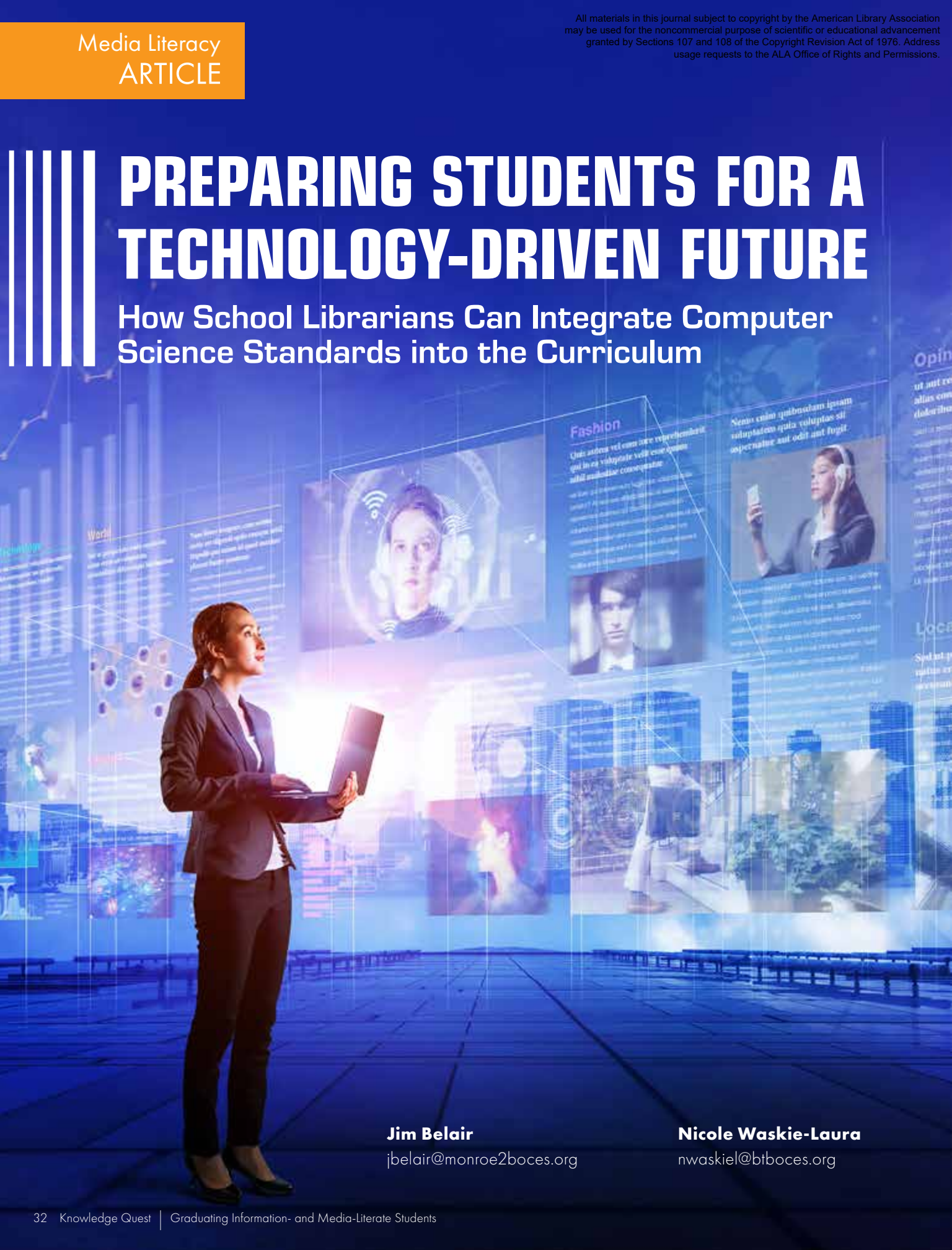
PREPARING STUDENTS FOR A TECHNOLOGY-DRIVEN FUTURE

How School Librarians Can Integrate Computer Science Standards into the Curriculum



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Gone are the days of Marian the Librarian, the physical card catalogue, and reading on the job. Yet, for many school leaders, community members, and even colleagues, these unshakeable perceptions of the school librarian remains. So what do we do? How do we change this view of librarianship to better match the reality of our work?

One potential path is to increase our explicit connections with broad, recognizable initiatives, like digital fluency and computer science. The New York State Computer Science and Digital Fluency (CS/DF) Standards, in alignment with the *AASL Standards Framework for Learners*, can serve as a useful tool to shift mindsets and promote the perception of librarians as cutting-edge instructional leaders.

The New York State CS/DF Standards, while recently adopted, have been in the making for several years. In 2018 the New York State Education Department convened an authoring workgroup and review panel to begin drafting new standards focused on computer science and digital fluency for PreK–12. The standards were intended to prepare students for life in a technology-rich world, with equity, access, interdisciplinary connections, coherence, and relevance/engagement serving as the guiding principles for development.

The standards were drafted and reviewed by teachers, school librarians, administrators, professors, content experts, early-learning experts, consultants, and parents and were released for widespread stakeholder review. Following a robust revision process, the standards were approved in December 2020; full implementation is anticipated for September 2024 (New York State Ed. Dept. 2020).

The standards are organized into five conceptual areas, with subconcepts in each area:

- **Impacts of computing** focuses on the reciprocal impacts between computing and individuals, communities, and culture at a local, national, and global scale. Subconcepts within this area include societal impacts, the ethics of computing, accessibility considerations, and computer science career paths.
- **Computational thinking** focuses on underlying programming concepts, including algorithms, variables, abstraction, decomposition, data analysis, modeling, and simulation.
- **Networks and system design** delves into cloud computing, data, connectivity, and the function of hardware and software.
- **Cybersecurity** explores risks, safeguards, and actions related to keeping our data and resources secure.
- **Digital literacy** empowers learners to fluently access, use, create, and share digital information.

Each of the conceptual areas are further broken down into grade-level bands: Kindergarten to first grade, second to third grade, fourth to sixth grade, seventh to eighth grade, and ninth to twelfth grade. At the elementary level, the standards are designed to be embedded across the curriculum. At the secondary level, students have the opportunity to deeply explore digital technologies, computer programming, and the role they play in society. The standards are intended to develop digitally savvy students who can adapt to the constantly evolving technologies they will encounter in their school, work, and life.

The New York State CS/DF Standards are one model of many that can serve as a launching point for infusing computer science principles into school library instruction and programs. This past June a group of New York School Library Systems Directors collaboratively reviewed the CS/DF standards and brainstormed ways that school libraries can lead and support implementation—not just in the realm of digital literacy, but across all five conceptual areas. As a result of the brainstorming and debriefing process, six potential alignment areas between the CS/DF standards and an effective school library emerged: makerspaces, digital citizenship, inquiry, curation, literacy collaborations, and career readiness. Within these categories, there are clear connections to the AASL Shared Foundations. As you examine the CS/DF standards or similar standards in your state, we encourage you to use the examples below as inspiration for further connections with your school library.

Makerspaces

School libraries across the world have embraced makerspaces because they offer opportunities for hands-on learning, inquiry, problem-solving, and exploration. The makerspace movement aligns with the Explore Shared Foundation from the AASL Standards as school librarians encourage students to "discover and innovate in a growth mindset developed through experience and reflection" (AASL 2018). As school librarians, we have the opportunity to provide our students with access to maker resources, instruction on the use of various tools, and space to investigate, iterate, and create.

The makerspaces we create in our school libraries can vary widely. For example, we may gather materials for students to engage

GRADE BAND	CS/DF STANDARD	LIBRARY APPLICATION
Elementary	*K–1 Computational Thinking: Abstraction and Decomposition* Identify a problem or task and discuss ways to break it into multiple smaller steps.	In the library makerspace, students could code a path for a basic robot (such as Cubetto, BeeBot, Robot Mouse, Caterpillars) to go from point A to point B. Students would code distance and direction (left, right, front, back). If you do not have access to robotics kits, try contacting your local educational service agency/board of cooperative education services or public library, ask the PTA for a grant, or have the students "code" one another across a masking-taped floor.
Secondary	*7–8 Computational Thinking: Algorithm and Programming* Design or remix a program that uses a variable to maintain the current value of a key piece of information.	In the library makerspace, students could create binary bracelets where they encode their name or a secret message in a bracelet.

Table 1. Connecting school library makerspaces with CS/DF concepts.

GRADE BAND	CS/DF STANDARD	LIBRARY APPLICATION
Elementary	*K–1 Cybersecurity: Safeguards* Identify simple ways to help keep accounts secure.	The school librarian can teach students the importance of logging in and out of a computer. Additionally, this can be applied to online databases and library catalogues.
Secondary	*7–8 Cybersecurity: Risks* Determine the types of personal information and digital resources that an individual may have access to that need to be protected.	The school librarian can review different types of personal information that someone may want to steal or use without permission. The conversation could include what is appropriate to share, ways to keep this information safe, and how to respond if personal information is used or accessed without permission.

Table 2. Opportunities for school librarians to support digital literacy via the CS/DF standards.

in artistic endeavors, provide robotics and coding kits, upcycle materials, or provide space and resources for students to fabricate and solve problems. School library makerspace programs present many opportunities for connections with the CS/DF concepts. At left are a few examples to jump-start your thinking (see table 1).

Digital Citizenship

The New York Computer Science Standards define digital citizenship as "the norms of appropriate, responsible behavior with regard to the use of technology" (New York State Ed. Dept. 2020). Digital citizenship lives within the broader concept of digital literacy, defined by the CS/DF standards as "the knowledge of and the ability to use digital technologies to create, research, communicate, collaborate, and share information and work" (2020, 10). The concepts of digital literacy and digital citizenship are inseparable from computer science, as students need both the technical and dispositional skills to engage in responsible and productive technology use.

The Engage Shared Foundation calls on school librarians to teach our students to responsibly and ethically gather, use, and share information. As we teach our students how to access, evaluate, and leverage digital tools, we know the importance of simultaneously teaching the considerations of use for different purposes and audiences. Likewise, in our connected world, our students are creating a digital footprint with each interaction they have with technology. From comments and posts, to personally identifiable information that is shared when creating online accounts (e.g., online gaming accounts, social media accounts), to the data generated by their academic

GRADE BAND	CS/DF STANDARD	LIBRARY APPLICATION
Elementary	*4–6 Computational Thinking: Algorithms and Programming* Describe the steps taken and choices made to design and develop a solution using an iterative design process.	The Iterative Design Process is similar to various inquiry cycles we are familiar with: define a problem, develop a solution, test the solution, and repeat until you solve the issue. This can easily be achieved by using a research process, such as the Stripling Model of Inquiry. Students can explore an issue or topic of their choice, then create and deliver a presentation that describes the steps taken to iteratively conduct their research.
Secondary	*9–12 Impact of Computing: Ethics* Debate issues of ethics related to real-world computing technologies.	The school librarian, in collaboration with a colleague in social studies or ELA, can structure an opportunity for students to research and debate if the internet should be free or paid.

Table 3. Inquiry alignment with CS/DF computational thinking concept.

activities (e.g., grades, library circulation history), it is imperative for students to understand how to protect their data, the role of data privacy, and how to interface with others online in constructive, ethical, and respectful ways.

While there is a dedicated digital literacy concept area in the CS/DF standards, opportunities for school librarians to support these skills can be found across the standards. We invite you to look beyond the obvious connections to discover more opportunities (see table 2).

Inquiry

With inquiry as a lens, school librarians can leverage strong connections between the CS/DF standards and the guiding documents of our profession. The Inquire Shared Foundation is the heart of effective school library instruction, as it invites us to "build new knowledge by inquiring, thinking critically, identifying problems, and developing strategies for solving problems" (AASL 2018). As school librarians, our pedagogical focus centers on building students' critical thinking skills. We achieve this by providing resources and guiding students through the research process, both for personal inquiry and in collaboration with teachers across disciplines.

As we seek to move our students beyond low-level research projects toward deep, meaningful inquiry, the issues related to the ethics and impacts of computing provide a wealth of debatable topics. Alignment with the inquiry process is particularly evident in the CS/DF computational thinking concept area (see table 3).

Curation

The Curate Shared Foundation is defined as "making meaning for oneself and others by collecting, organizing, and sharing resources of personal relevance" (AASL 2018). Today information is ubiquitous and freely available to everyone all the time. As access has expanded, the role of the school librarian has similarly evolved. We assist our students and colleagues through the process of narrowing the breadth of information at their disposal to meet their needs. School librarians can achieve this goal by curating and sharing high-quality, relevant, and meaningful resources that represent a range of perspectives. In conjunction with curation, we are tasked with promoting knowledge about and comfort with using these materials, by creating resource guides in a range of modalities and providing coaching and instruction on how to access, gather, assess, and synthesize information. Additionally, we help our students and colleagues build their capacity to curate their own quality resources to meet their information needs.

Within the CS/DF standards, curation can be found wherever the standards point toward characteristics of digital information/data and public/private information uses (see table 4).

Literacy Collaborations

The Collaborate Shared Foundation involves partnering with others to "broaden perspectives and work toward common goals" (AASL 2018). As school librarians we interact with the entire school community through our work with students across grade levels, our involvement in building- and district-wide initiatives, and our

GRADE BAND	CS/DF STANDARD	LIBRARY APPLICATION
Elementary	*2–3 Impacts of Computing: Ethics* Identify public and private digital spaces.	The school librarian can help students create a curated list of books that they want to read for themselves and a list of titles they would recommend to a friend and save each to an appropriate private or public location. Additionally, the school librarian could teach students that they are able to leave a book review or rating for a book in the library catalog (public), but they cannot change the title or description of the book (private).
Secondary	*9–12 Computational Thinking: Data Analysis and Visualization* Refine and visualize complex data sets to tell different stories with the same data set.	The librarian can provide resources and instruction for students to watch different streaming video clips (data sets) on the same topic from multiple perspectives.

Table 4. Curation within the CS/DF standards.

GRADE BAND	CS/DF STANDARD	LIBRARY APPLICATION
Elementary	*K–1 Computational Thinking: Modeling and Simulation* Identify and describe one or more patterns (found in nature or designed), and examine the patterns to find similarities and make predictions.	During story time in the library, students can predict what will happen next in the story based on their previous observations. They can also find or predict sequences or patterns in stories.
Secondary	*9–12 Networks & System Designs: Hardware and Software* Develop and communicate multistep troubleshooting strategies others can use to identify and fix problems with computing devices and their components.	Students could create how-to videos and pamphlets for accessing the e-book platform, online databases, or streaming videos. These guides could be created for use by fellow high school students or for elementary students in lower grade levels. The school librarian could work with students to help them design guides and instructional videos for other library skill-related items such as effective internet searching, citations, or note-taking.

Table 5. Opportunities to collaboratively develop student literacies across formats.

collaboration with teachers across content areas. We are champions for interdisciplinary learning and connecting various subject areas together. School librarians can serve as the bridge between disciplines, as our instruction focuses on skills that transfer across subjects and modalities.

Literacy comes in many forms, including print, visual, media, and information/digital literacy, to name a few. Jointly these literacies are essential in helping our students prepare for the future and present a golden opportunity for school librarians to collaborate with colleagues. As we consider literacy through the lens of the CS/DF standards, it is important to note that not all aspects of the standards need to be addressed using technology or electronics. In the examples in table 5, we identify opportunities to collaboratively develop student literacies across a myriad of formats.

Career Readiness

A primary goal of education is to prepare our students for what comes next as they enter adulthood. One of the AASL Common Beliefs states, "Learners should be prepared for college, career, and life" (2018). Whatever path our students take, they will undoubtedly encounter new technologies and applications. To be ready for the future, our students need to not only understand how to use the technologies of today but also be ready to apply underlying theories and foundational skills to the developments of tomorrow. In addition to an awareness of how technology works, students need critical thinking skills so they can locate, assess, and use information—from using GPS to find their way home from an unfamiliar location,

GRADE BAND	CS/DF STANDARD	LIBRARY APPLICATION
Elementary	*K–1 Network & Systems Designs: Hardware & Software* Identify ways people provide input and get output from computing devices.	The school librarian can help students investigate the ways individuals input information into a computing device, like a barcode, that results in output, like a student account or book record, to understand networks and system design.
Secondary	*7–8 Critical Thinking: Algorithms and Programming* Design, compare, and refine algorithms for a specific task or within a program.	The school librarian can instruct students in the use of Boolean algorithms to create powerful search strategies and to compare/contrast search results.

Table 6. Career exploration and readiness skills within CS/DF standards.

to navigating online banking, to researching academic topics, new consumer goods, or the latest news.

Within the CS/DF standards, career exploration and readiness skills can be found explicitly in the impacts of the computing/career paths subarea and in less overt ways through connections to the foundational skill sets that students will need post-graduation (see table 6).

Conclusion

The examples above are a small sampling of the possibilities the CS/DF standards, or similar standards in your state, offer for school librarians to integrate computer science and digital fluency into programs and instruction. While books and fostering a love of reading will always be paramount in our profession, a school librarian should also provide leadership and support across the curriculum through literacy, inquiry, and technology. As the role of the school librarian continues to evolve, we need to embrace the changing landscape of education to remain relevant and essential. The *AASL Standards Framework for Learners* provides clear benchmarks for school library instruction; the CS/DF standards deepen the connections between library instruction and real-world skills for our students. By layering computer science standards into our teaching, we strengthen our message to stakeholders about the importance of our instructional role, we support the needs of students in our building, and we reinforce our position as instructional leaders in our schools.

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