ISTE Standards

Redefining learning in a technology-driven world

A report to support adoption of the ISTE Standards for Students

June 2016

Workforce readiness: The case for the 2016 ISTE Standards for Students

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By a vast majority, schools, districts and states in the U.S. are embracing the need for technology to be embedded in education. These initiatives are supported at the policy level by the government passage and funding of E-Rate and the Every Student Succeeds Act (ESSA). Yet, too few plans focus on the learning goals of this push for technology integration. Instead, many stakeholders focus on tools and apps and then presume transformations in learning in an "if you build it, they will come" kind of thinking. Even worse, others view technology in education as a necessary evil at worst and a mere means to increased productivity at best.

The International Society for Technology in Education (ISTE) has a different vision for technology in education, which is why we developed a third iteration of the ISTE Standards for Students. At their core, the ISTE Standards are about pedagogy, not tools. Which is to say, they emphasize the ways that technology can be used to amplify and even transform learning and teaching. The field of education now realizes the insufficiency of throwing digital tools into classrooms without further support and expecting valid changes in teaching and, more importantly, improved student outcomes. What has not been fully realized, however, is the potential for technology to mend gaps in equity, engage students as unique individuals and prepare them for an uncertain future.

At their core, the ISTE Standards are about pedagogy, not tools.

The 2016 ISTE Standards for Students have been designed to prepare students for work and life in this uncertain future. As cited by the World Economic Forum (2016), "A projected 65% of children entering grade school will work in jobs that do not exist today." Similarly, the Institute for the Future (IFTF) projects vast changes to American labor in the coming decades based on the unstoppable progress of technological change, including everything from big data becoming a factor in most fields to automation increasing job obsoletion to incredible advances in the medical field (IFTF, 2011). IFTF's examination of the near-future of work for young people is particularly telling, with scenarios of differing positive and negative potential futures. One projection sees young people embracing the entrepreneurial opportunities afforded by the collapse of traditional education, a profound need for brain workers and the low cost of working from anywhere with anyone in the world. On the other hand, IFTF proposes a counter future where multiple jobs disappear due to technological innovation, income inequality increases exponentially and the young in particular find themselves in a state of widespread unemployment (IFTF, 2014). At a minimum, our certainty that the only thing we can claim about the future is its uncertainty provides reason enough to prepare students to be diversely skilled, nimble-minded and technologically savvy citizens.

The ISTE Standards for Students embrace these challenges and envision shifts to education that support students as they become agentic, future-focused and adaptable. They include a strong emphasis on student empowerment, a theme called out multiple times in this report. Truly empowering students to have a voice and choice in their learning is scary to many educators today, but ISTE believes doing so is imperative to set students up for future success. And students themselves may not be prepared

to be empowered and so need support and a framework of progression as they build this mental and emotional "muscle." The good news is that digital tools are uniquely suited to facilitating student empowerment in a number of ways, from personalization to supporting student voice to enabling students to choose how they work and demonstrate mastery.

The ISTE Standards for Students embrace these challenges and envision shifts to education that support students as they become agentic, future-focused and adaptable.

The ISTE Standards for Students also expand upon skills long considered necessary for digital age work and life. These skills include communication, creativity, critical thinking and collaboration. Further, the standards recognize that human life is increasingly hybrid between digital and physical, and so push for students to embrace being citizens of the digital space as well as of the globe. Last, the ISTE Standards for Students now focus on key areas likely to be of increasing importance in future careers, most notably design processes and computational thinking, combined with the problem-solving and solution-making mindsets that come with both of these areas.

The International Society for Technology in Education is committed to empowering connected learners in a connected world. We are the premiere nonprofit dedicated to education technology. For questions or comments about this report or the ISTE Standards, please contact the ISTE Standards Department, standards@iste.org.

Methodology

The methodology employed by ISTE to generate the 2016 ISTE Standards for Students is an established practice within the field that includes research, consultation with a broad array of experts and extensive, multi-tiered opportunities for public feedback. It is similar to the process used by the Council for the Accreditation of Educator Preparation (CAEP), the National Board for Professional Teaching Standards (NBPTS), the American Library Association (ALA) and others. At each phase of the process, feedback data were reviewed, organized and carefully considered before proceeding.

Throughout the standards refresh process, ISTE's methodology has been collaborative, purposive and grounded. In addition to a core working team that included both internal staff and outside experts, ISTE convened two groups of advisers to support the process – a Stakeholder's Advisory Council (SAC) and a Technical Working Group (TWG). The SAC (see below) was composed of influencers who represent key education constituencies. They provided high-level insight representing their stakeholders. The TWG (see below) comprised various education representatives from Department of Education staff to higher education faculty and K-12 technology coaches, library and media specialists, teachers and principals. They provided functional insight as well as transformed the public data into standards drafts. Both of these groups helped ISTE confirm the validity and utility of the standards to the field.

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At each phase of the process, ISTE also solicited open feedback from the public gathered through comment forums (hosted both by independent stakeholders and by ISTE representatives) and individual surveys. We welcomed high-level, open perspective on the current and future state of education and technology, as well as released a draft for open feedback, iterating based on that data, and released a second draft for further public comment. In total, over 2,500 individuals shared their perspective on the standards, including hundreds of students. These stakeholders include representatives from all 50 U.S. states and over 50 nations around the world.

At the end of the public comment period, ISTE examined the data from Draft 2, sought final feedback from experts on key components of the standards, such as computational thinking, and finalized the ISTE Standards for Students for release at the ISTE Conference & Expo in June 2016 in Denver, Colorado. As is evident, the process of generating the 2016 ISTE Standards for Students had high visibility and was robust, extensive and dynamic.

Research basis for the 2016 ISTE Standards for Students

In addition to feedback from experts and other stakeholders from the field, ISTE did a literature review to scan up-to-date thinking about the field of education technology. Even more importantly, however, was seeking research that showed the efficacy and overall value of various education practices and focus areas and to reflect in the 2016 ISTE Standards for Students rigorous approaches to learning and teaching with technology backed up by research, thought leadership and other data. These sources are primarily research papers and reports derived from academic, nonprofit or governmental studies but they also include a handful of illustrative or argumentative examples from the press or other mainstream sources.

Empowered student learning

Empowering students to take ownership of their learning emerged as a major theme during the refresh. The 2016 student standards exhibit this topic by the student-persona titles, infusion of the concept throughout all of the standards, and placement of "Empowered Learner" as Standard 1. Research indicates that empowering students to have agency in their education and lives leads to many positive outcomes, including that students do better in inequality of access situations, are able to personalize their learning and achieve regardless of ability and build dispositional skills, such as executive functioning, perseverance, self-awareness and tolerance for ambiguity, that many believe are necessary to thrive in current and future society.

Empowering students to take ownership of their learning emerged as a major theme during the refresh.

Consulted sources

Conley, D. T. *A New Era for Educational Assessment.* (2014, October). Retrieved from http://www.jff.org/sites/default/files/publications/materials/A-New-Era-for-Educational-Assessment-092414_0.pdf

Drexler, W. (2010). The networked student model for construction of personal learning environments: Balancing teacher control and student autonomy. *Australasian Journal of Education Technology*, 26(3), 368-385.

Enyedy, N. (2014, November). *Personalized Instruction: New Interest, Old Rhetoric, Limited Results, and the Need for a New Direction for Computer-Mediated Learning.* Retrieved from http://greatlakescenter.org/docs/Policy_Briefs/Enyedy_PersonalizedLearning.pdf

Ferguson, R. F., Rowley, J. F. S., & Friedlander, J. W. (2015, October). *The Influence of Teaching Beyond Standardized Test Scores: Engagement, Mindsets, and Agency.* Retrieved from http://www.agi.harvard.edu/projects/TeachingandAgency.pdf

Freeland, J. (2014, May). *Blending toward competency: Early patterns of blended learning and competency-based education in New Hampshire.* Retrieved from http://www.christenseninstitute.org/wp-content/uploads/2014/05/Blending-toward-competency.pdf

Gerstein, J. (2016, February 13). *Learner empowerment.* Retrieved from https://usergeneratededucation.wordpress.com/2016/02/13/learner-empowerment/

McCombs, B. *Developing responsible and autonomous learners: A key to motivating students, teacher's modules.* Retrieved from https://www.apa.org/education/k12/learners.aspx

Tullis, J. G. & Benjamin, A. S. *On the effectiveness of self-paced learning.* Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3079256/

Computational thinking

Being able to think and solve problems in the way that a computer is designed to solve problems is a vital skill in today's digital age. Computational thinking (CT) is a problem-solving process that includes but also exceeds coding. It is fundamental to solving problems via computer applications but its methods can be used in a variety of situations and approaches. CT combines logic and deep knowledge of the fundamentals of how computers "think." Thus it is an important, contemporary literacy for all students, not just those who are likely to become software engineers. Even if students do not pursue computing in their careers, they will need to be familiar with the vocabulary and processes to effectively communicate with colleagues on technical issues and to be knowledgeable themselves about how computing works and affects their lives.

ISTE has for several years been a thought leader in supporting CT in the classroom and extends this leadership by the overt place CT holds in the 2016 student standards. Some of the fundamentals of CT include breaking problems down into smaller parts in order to analyze their solutions (problem decomposition); recognizing patterns and making connections; automating solutions through a series of ordered steps (aka, using algorithms); using abstractions to represent data, such as models or simulations; organizing and analyzing data logically; and generalizing problem-solving process in order to transfer them to other problems. Other key components of CT are social and emotional skills that are organically required and thus built through the CT approach to problem solving, including persistence, tolerance for ambiguity, confidence in dealing with complexity and open-ended problems and communication and collaboration to solve problems with others.

ISTE has for several years been a thought leader in supporting computational thinking in the classroom and extends this leadership by the overt place CT holds in the 2016 student standards.

Consulted sources

Barr, V. & Stephenson, S. (2011, March). Bringing computational thinking to K-12: What is involved and what is the role of the computer science community? *ACM Inroads*, (2)1, 48-45.

Bers, M. U., Flannery, L., & Kazakoff, E. R. (2014, March). Computational thinking and tinkering: Exploration of an early childhood robotics curriculum. *Computers and Education*, 72, 145-157. doi:10.1016/j.compedu.2013.10.020

Grover, S. & Pea, R. (2013, January/February). Computational thinking in K-12: A review of the state of the field. *Educational Researcher*, 42(1), 38-43. doi: 10.3102/0013189X12463051

Lye, S. Z., & Koh, J. H. L. (2014, December). Review on teaching and learning of computational thinking through programming: What is next for K-12? *Computers in Human Behavior*, 41, 51-61. doi:10.1016/j.chb.2014.09.012

Twining, P., Raffaghelli, J., Albion, P., & Knezek, D. (2013, August 5). Moving education into the digital age: the contribution of teachers' professional development. *Journal of Computer Assisted Learning*, 29(5), 426-437. doi:10.1111/jcal.12031

Wing, J. M. (2008, July 31). Computational thinking and thinking about computing. *Philosophical Transactions of the Royal Society*, 366, 3717-3725. doi:10.1098/rsta.2008.0118

Social and emotional skills

Social and emotional skills, often called dispositions, mindsets or even "soft skills," have become a major topic of discussion in both education and work in the U.S. These items include a broad, often interrelated set of attributes, including grit/perseverance, growth mindsets, entrepreneurialism and executive functioning. Many of these items include sub-categories, such as "calculated risk" in entrepreneurialism or "self control" in executive functioning. Largely, the research into social and emotional skills is meant to switch the focus from the "self-esteem" movement that dominated in the 1990s and early 2000s to a more personalized and empowered approach. That said, some feel that these topics are mere fluff. Most notably, "grit" has risen to such prominence–including attendant backlash–that it almost veers into jargon. However, much of the research on the importance of these skills for students' educational and life success is compelling, including a study that showed that students who receive instruction in these areas scored 11% higher than students who did not (World Economic Forum, 2016, 6).

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Emphasizing these dispositional skills in education, including in the ISTE Standards, has also received critical feedback on the grounds that social and emotional skills are challenging to assess and so, while they may be valuable, they have no place in learning standards. ISTE concedes that these skills may be difficult to assess using standardized testing approaches but also contends that standardized models are not the only means of assessing students and that there are valid and useful

ways of building and assessing social and emotional skills. You can find these skills embedded throughout the 2016 student standards but most notably in Empowered Learner (Standard 1); Digital Citizen (Standard 2); Innovative Designer (Standard 3); Computational Thinker (Standard 4); and Global Collaborator (Standard 7).

Consulted sources

Center on the Developing Child - Harvard University. (n.d.) *Executive function & self-regulation.* Retrieved from http://developingchild.harvard.edu/science/key-concepts/executive-function/

Dweck, C. (2007). *Mindset: The New Psychology of Success.* New York: Ballantine.

Dweck, C. (2015, September 22). Carol Dweck revisits 'growth mindset'. *Education Week.* Retrieved from http://www.edweek.org/ew/articles/2015/09/23/carol-dweck-revisits-the-growth-mindset.html

Hochanadel, A., & Finamore, D. (2015). Fixed and growth mindset in education and how grit helps students persist in the face of adversity. *Journal of International Education Research*, 11(1), 47-50. doi:http://dx.doi.org/10.19030/jier.v11i1.9099

Meltzer, L. (Ed.). (2010). *Executive function in education: From theory to practice.* New York: Guilford Press.

World Economic Forum. (2016, March). *New vision for education: Fostering social and emotional learning through technology.* Retrieved from http://www3.weforum.org/docs/WEF_New_Vision_for_Education.pdf

Futurism

Futurism in the contemporary context is a field of science and philosophy focused on predicting the future, often the near-future. This field influenced the ISTE Standards for Students refresh in two key ways. First, experts on work in the U.S. argue that working life in the future will look significantly different than it does now, and that many of today's students will be working in jobs that have not yet been invented. To put stakeholders in this future frame of mind when thinking about the next iteration of the ISTE Standards for Students, ISTE drew from the work of the Institute for the Future to challenge current understandings of the world of work and how education plays into it as well as to inspire new ideas. Second, ISTE also consulted the 2014 and 2015 NMC Horizon Reports, which report on trends and transitions in K-12 education and project their likely impact. These reports helped ISTE prioritize concepts, hone focus and inspire out-of-the-box thinking about the near-future of education in drafting the 2016 student standards. Because the ISTE Standards must serve the field of education for the next five to 10 years and, more importantly, must prepare today's students today for learning and working even further ahead in time, our consideration of this work on the near-future improves the likelihood of the standards remaining relevant and having legitimate impact on students' lives.

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Consulted sources

Institute for the Future. (2011). *The future of California's workforce.* Retrieved from http://www.iftf.org/uploads/media/IFTF_SR-1469_CCSF_CA-Workforce_rdr.pdf

Institute for the Future. (2014, December). *The future of youth employment: Four scenarios exploring the future of youth employment.* Retrieved from http://www.iftf.org/fileadmin/user_upload/downloads/ourwork/IFTF_FutureYouthEmployment_December2014.pdf

New Media Consortium & the Consortium for School Networking. (2014). *NMC horizon report: 2014 K-12 edition.* Retrieved from http://cdn.nmc.org/media/2014-nmc-horizon-report-k12-EN.pdf

New Media Consortium & the Consortium for School Networking. (2015). *NMC horizon report: 2015 K-12 edition.* Retrieved from http://cdn.nmc.org/media/2015-nmc-horizon-report-k12-EN.pdf

Digital citizenship

Digital citizenship is a topic that is increasingly urgent and that also continues to shift in meaning and purpose. By now it is well established that young people (and not so young people) use the internet and other technology tools ubiquitously. Furthermore, stakeholders largely agree on the high importance of students learning how to be safe, legal and ethical online. The 2016 ISTE Standards for Students reflect this shared understanding while also extending the current borders of what "digital citizenship" means. Most notably, the emphasis on student agency within the Digital Citizen standard highlights the citizen component of the

name, a word that connotes not only responsibilities but also individual rights and communal investment. Emphasizing this aspect gestures to the increasingly hybrid – both physical and digital – nature of human life. It also suggests the importance of understanding how technology infringes on human rights, from a recognition of how automated personalization limits exposure to diverse ideas and people to the ongoing dialogue about privacy rights in relation to governments, corporations and others.

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Consulted sources

Common Sense Media. (2015). *The Common Sense census: Media use by teens and tweens.* Retrieved from https://www.commonsensemedia.org/sites/default/files/uploads/research/census_researchreport.pdf

Gehl, R. W. (2013, March 4). What's on your mind?: Social media monopolies and noopower. *First Monday*, 18(3-4). Retrieved from http://firstmonday.org/article/view/4618/3421

Lenhart, A. (2015, April 9). Mobile access shifts social media use and other online activities. *Pew Research Center: Internet, Science & Tech.* Retrieved from http://www.pewinternet.org/2015/04/09/mobile-access-shifts-social-media-use-and-other-online-activities/

Ribble, Mike. (2015). *Digital citizenship in schools: Nine elements all students should know, 3rd edition.* Eugene, OR & Arlington, VA: International Society for Technology in Education.

Wong, A. (2015, April 21). Digital natives yet strangers to the web. *The Atlantic.* Retrieved from http://www.theatlantic.com/education/archive/2015/04/digital-natives-yet-strangers-to-the-web/390990/

Zeide, E. (2014, October 9). The proverbial 'permanent record'. [Abstract.] *Social Science Research Network.* Retrieved from http://papers.ssrn.com/sol3/Papers.cfm?abstract_id=2507326

Curation

Curation means "to take charge of or organize, to pull together, sift through, select for presentation, to heal and to preserve" and has generally referred to work with physical artifacts in libraries or museums (Mihaildis & Cohen, 2013, n.p.). In the digital age, however, curation can no longer remain a specialized skill set due to the vast amounts of information available to any individual with internet access, and it is intimately interconnected with the acquisition, construction and demonstration of knowledge. Furthermore, curation does not need to remain rarified due to the various digital tools that empower individuals to curate their own collections. Finding and sorting content, recognizing patterns and distinctions within sources and organizing content into focused groupings are all skills that require higher-order thinking skills and can be deployed to display and share knowledge or creativity. Indeed, preliminary results from a study published in 2012 showed that for students with a thirst to learn, digital curation provided a particularly useful and compelling means to acquire, construct and demonstrate deep knowledge (Gadot & Levin, 2012). The 2016 ISTE Standards for Students recognize the increasing importance of this vital and dynamic skill by embedding and highlighting it within Standard 5, Knowledge Constructor. It is also reflected implicitly in the theme of empowered learning that runs throughout the standards as well as gestured to in Digital Citizen (Standard 2), Creative Communicator (Standard 6), and Global Collaborator (Standard 7).

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Consulted sources

Beagrie, N. (2006, Autumn). Digital curation for science, digital libraries, and individuals. *International Journal of Digital Curation*, 1(1), 3-16.

Gadot, R. & Levin, I. (2012, July). *Digital curation as learning activity.* Proceedings from EDULEARN12 conference. Barcelona, Spain.

Mihailidis, P., & Cohen, J. N. (2013). Exploring curation as a core competency in digital and media literacy education. *Journal of Interactive Media in Education*, 2(1), doi:10.5334/2013-02. Retrieved from http://jime.open.ac.uk/articles/10.5334/2013-02/

Blended learning

Blended learning refers to situations where students receive instruction in both face-to-face and online environments. Embedded within the concept is an assumption that blended learning environments also give students some control over the pace, flow or focus of their schoolwork, which aligns blended learning to the student empowerment at the heart of the 2016 ISTE Standards for Students. Blended learning includes classrooms that have been fully "flipped," as well as the many that take a more hybrid and varied approach. Blended learning also helps prepare students for fully online learning situations. The 2016 ISTE Standards for Students are not designed exclusively for blended learning environments but, rather, presuppose an educational system where learning is often blended and where blended learning environments will become more and more abundant.

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Consulted sources

Center for Technology in Learning and the US Department of Education. (2010, September). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies.* Retrieved from https://www2.ed.gov/rschstat/eval/tech/evidence-based-practices/finalreport.pdf

Chan, R. (2014). *Supporting student success through time and learning: A step by step guide to successfully implement blended learning and expanded learning time at your school.* Retrieved from http://www.timeandlearning.org/publications/supporting-student-success-through-time-technology

Ferdig, R. & Kennedy, K., eds. (2014). *Handbook of Research on K-12 Online and Blended Learning.* Retrieved from http://press.etc.cmu.edu/files/Handbook-Blended-Learning_Ferdig-Kennedy-etal_web.pdf

Freeland, J. (2014, May). *Blending toward competency: Early patterns of blended learning and competency-based education in New Hampshire.* Retrieved from http://www.christenseninstitute.org/wp-content/uploads/2014/05/Blending-toward-competency.pdf

Murphy, R., Snow, E., Mislevy, J., Gallagher, L., Krumm, A., and Wei, X. (2014, May). *Blended learning report.* Retrieved from http://5a03f68e230384a218e0-938ec019df699e606c950a5614b999bd.r33.cf2.rackcdn.com/MSDF-Blended-Learning-Report-May-2014.pdf

Powell, A., Rabbitt, B., & Kennedy, K. (2014, October). *iNACOL blended learning competency framework.* Retrieved from http://www.inacol.org/resource/inacol-blended-learning-teacher-competency-framework/

Design processes and the maker movement

The "maker movement" has become a particularly buzzy trend in education and factors into a larger conversation rethinking education. The rethinking highlighted in the maker movement includes giving children the ability to "tinker" to figure out how things work in a hands-on and exploratory way and "make" their own prototypes and processes, which has grown easier and more dynamic with the sharp drop in prices for programmable fabrication machines or 3D printers. But the overarching re-visioning of education manifested in the maker movement includes other principles such as learning based on projects or solving problems, situations where students develop social and emotional skills and the opportunity for students to become deep critical thinkers, creative communicators and dynamic collaborators.

The broader principle of "design-make-play" is illustrative of this larger shift, as students use design processes—engineering, human-centered or other—to tackle problems in a meaningful, organized and inventive way, while also acquiring deep knowledge of how things work through making and developing curiosity, exploration and a passion for learning through play (Honey & Kanter, 2013). This diversity of skills is reflected throughout the ISTE Standards for Students, including in Computational Thinker (Standard 5). But they are manifested most directly in Standard 4, Innovative Designer, which dually puts students into situations that mirror the world of work more than does traditional education while simultaneously empowering them to be expressive, creative individuals engaged in solving real problems and creating viable products or solutions.

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Consulted sources

Blikstein, P. (2013). Digital fabrication and "making" in education: The democratization of education. In J. Walter-Hermann & C. Buching (Eds.), *FabLabs: Of machines, makers, and inventions.* Bielefeld: Transcript-Verlag.

Gray, L. (2013, November 18). Making education more like real life through design thinking. *Huffington Post.* Retrieved from http://www.huffingtonpost.com/leeanne-gray-psyd/making-education-more-lik_b_3949352.html

Halverson, E. R. & Sheridan, K. (2014, December). The maker movement in education. *Harvard Educational Review*, 84(4), 495-504. doi:http://hepgjournals.org/doi/10.17763/haer.84.4.34j1g68140382063

Honey, M., & Kanter, D. E. (Eds.) (2013). *Design, make, play: Growing the next generation of STEM innovators.* New York, NY: Routledge.

Martin, L. (2015). The promise of the maker movement for education. *Journal of pre-college engineering education research*, 5(1), article 4. doi:http://dx.doi.org/10.7771/2157-9288.1099

Sheridan, K., Halverson, E. R., Litts, B., Brahms, L., Jacobs-Priebe, L., & Owens, T. (2014, December). Learning in the making: A comparative case study of three makerspaces. *Harvard Educational Review*, 84(4), 505-531. doi:http://dx.doi.org/10.17763/haer.84.4.brr34733723j648u

Global citizens

Asserting the value of global citizenship is an argument that feels both perennial and dated. It is certainly not new and yet affirming it continues to seem necessary. From ISTE's perspective, the topic's importance arises from a couple of factors. First, technology enables meaningful connections in ways never seen before. Students can easily connect to virtually anyone–from an expert on a subject of interest to a counterpart in a school across the world–with a few computer clicks. They also have immediate access to knowledge from around the globe and the ability to work synchronously or asynchronously with collaborators in any geographic location. Technology can truly connect us in meaningful, dynamic ways. Second, many current problems are global problems and they will require global solutions. Whether the subject is climate change or inequality, students need to learn how to empathize with others outside their immediate sphere of experience, find information that brings understanding of an issue and collaborate with others who are dedicated to finding meaningful solutions to legitimate problems. The United Nations' Global Education Initiative asserts that education "must give people the understanding, skills and values they need to cooperate in resolving the interconnected challenges of the 21st Century" (UN, n.d., n.p.). ISTE believes that technology provides a forceful means to enable students to connect with others and empower them to collaboratively and individually tackle authentic problems. By doing so, we contend that they will be prepared for a future whose problems are weighty and able to truly change the world for the better.

Technology can truly connect us in meaningful, dynamic ways.

Consulted sources

P21: Partnership for 21st Century Learning. (2014). *Framework for State Action on Global Education.* Retrieved from http://www.p21.org/storage/documents/Global_Education/P21_State_Framework_on_Global_Education_New_Logo.pdf

United Nations. (n.d.). Foster global citizenship. *Global Education First Initiative.* Retrieved from http://www.unesco.org/new/en/gefi/priorities/global-citizenship/

Connections between the ISTE Standards for Students and other education initiatives

The ISTE Standards for Students provide a framework for learning in-depth, digital age skills and attributes with learning that is amplified, even transformed, through technology. They emphasize pedagogy, but pedagogy re-visioned to meet the promise of technology to significantly change and improve education. As such, they do not supersede other education initiatives, they work alongside them. The ISTE Standards for Students support and deepen the learning derived from content-area standards including the Common Core State Standards (CCSS), Next Generation Science Standards (NGSS) and others. They also shore up the education technology initiatives touted by the U.S. Department of Education and lay out a path to follow for educators building their lessons based on SAMR, TPACK or other implementation frameworks. The ISTE Standards for Students are thus not "one more set of standards" but, rather, a dynamic, useful guide supporting and deepening many other initiatives.

Common Core, Next Generation Science and other content-area standards

More and more education leaders recognize the need to prepare students for the digital age and they reflect this reality in the learning standards they adopt for their schools, districts and states. New learning standards, such as the CCSS, the NGSS and other state and content-area standards, now embed technical skills, such as keyboarding or calculator use, into their frameworks. Furthermore, some go as far as integrating activities that require technology, such as the listening or blogging requirements of the ELA CCSS or the more holistic approach to engineering, sciences and human culture in the NGSS.

Like these other standards, the ISTE Standards are learning standards. However, rather than outlining specific activities and milestones based on grades and subjects, the ISTE Standards provide a support framework across the grades and for all subject areas that serve as a groundwork for what's possible in learning using technology. The ISTE Standards thus support other state and content-area standards by emphasizing the pedagogical approaches that lead to the achievement of the skills and knowledge bases found in other standards. Specifically, the 2016 ISTE Standards for Students have a focus on students using design processes (Standard 4) and learning computational thinking skills and mindsets (Standard 5); both of these areas support the depth emphasized in new math standards, the rigor and cross-subject focus of new ELA standards and project-based vision of the NGSS and others. Further, standards such as Creative Communicator (Standard 3) and Global Collaborator (Standard 7) encourage sharing, collaboration, communication and social engagement in ways that support the new visions for rigor and broad critical thinking embedded in all of the new state and content-area standards. Last, ISTE notes that the emphasis on student empowerment throughout the 2016 ISTE Standards for Students will enable students to meet these new requirements as they move from being passive vessels to active learning agents.

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National Education Technology Plan

The National Education Technology Plan (NETP), released at the end of 2015, lays out the vision of the U.S. Department of Education for the purpose and use of technology in American education. Several of the NETP's focai align well with the 2016 ISTE Standards for Students, and there are key areas where the standards support and expand upon the NETP vision.

The NETP highlights the potential of technology to amplify learning, a prospect that has largely not yet been achieved. ISTE wholeheartedly agrees and the aspirational vision of the ISTE Standards for Students supports a new vision for what technology can and should do to transform teaching and learning. Furthermore, the NETP emphasizes the possibility for technology to

bridge divides between equity and accessibility for learners in underserved communities or with differing abilities. ISTE concurs and asserts that the transformative, tech-amplified learning reflected in the ISTE Standards for Students supports the NETP's vision of a world where all learners are able to thrive and achieve. Most notably, ISTE sees this vision supported in the emphasis on student voice and choice embedded through the 2016 standards and emphasized in Empowered Learner (Standard 1).

The NETP highlights the potential of technology to amplify learning, a prospect that has largely not yet been achieved.

ISTE also applauds the NETP's call for cultivation and assessment of "noncognitive competencies," those social and emotional skills that are now recognized as crucial for successful functioning in the contemporary world (discusses earlier in this report under "Social and emotional skills"). Supports for building such competencies are embedded throughout the 2016 standards and called out directly in Standard 1, which is dedicated to student empowerment and agency, as well as Standards 4, Innovative Designer, and 5, Computational Thinker.

Future Ready

Future Ready serves as a key component of the Department of Education's ConnectED initiative under President Barack Obama. Future Ready focuses specifically on superintendents' committing to setting and implementing a vision for districtwide connectivity. The ISTE Standards for Students, as well as the other ISTE Standards, take these systems-levels visions to the actual classroom. For example, Standard 2, Digital Citizen, takes a future-focused approach to what students need to be safe, legal, ethical and engaged citizens in the digital space. The standards can also serve as a guide for what professional learning to choose to best amplify pedagogy. Last, in tandem with the ISTE Essential Conditions, the ISTE Standards support a holistic vision for technology adoption and a re-visioning of digital age learning that goes beyond devices and connectivity to get to the unfulfilled potential of technology to transform learning.

Open Educational Resources

Open Educational Resources (OER) are less an initiative than a movement that spans education from kindergarten through college and beyond. That said, the movement has the backing of the Office of Education Technology under President Barack Obama, which has been hard at work engaging companies to offer OER and encouraging districts to put forth OER curriculum and tool initiatives. OER are resources available for educational use and reuse without cost or restriction to educators. They include everything from curriculum to content in the public domain to digital platforms, applications and other tools. The ISTE Standards for Students support students in responsibly and ethically finding, sourcing and curating resources through the standards Digital Citizen (Standard 2) and Knowledge Constructor (Standard 3), including an awareness of Creative Commons and other open designations. Further, the 2016 standards put a strong focus on student empowerment, a concept embedded throughout the standards and most visibly in Standard 1, Empowered Learner. This focus reflects a shifting perspective brought about by the wide access to knowledge and other people afforded us by technology, a shift that also led to the OER movement. The expansion and wide use of the internet means that knowledge and access are less and less hierarchical, leading directly to a desire for open access resources and tools and a need for self-motivated, engaged citizens. The ISTE Standards' emphasis on empowering student agency reflects and extends this cultural shift.

The ISTE Standards for Students support students in responsibly and ethically finding, sourcing and curating resources.

Implementation frameworks

Educators often use implementation frameworks when planning lessons, assignments, assessments and so forth. Implementation frameworks include models, such as the SAMR model developed by Ruben Puentedura, based on the concept that technology can be used to Substitute, Augment, Modify or Redefine learning activities. Another example is TPACK, a model built by Punya Mishra and Matthew J. Koehler, extending the work of Lee Shulman to include technology. TPACK emphasizes the interplay between technological, pedagogical and content knowledge in the effective integration of technology. Other examples include models such as the Partnership for 21st Century Skills (P21) framework and the UNESCO ICT Competency framework. The ISTE Standards for Students provide an approach for implementing these models that works collaboratively to deepen and extend learning with technology. For example, with SAMR, the ISTE Standards provide a launchpad for technology-infused pedagogy based on skill level and readiness of each individual teacher. On the other hand, both TPACK and the ISTE Standards reinforce the message that content, pedagogy and technology need to work together to achieve meaningful and effective results in learning. ISTE maintains that, like with content-area standards, various implementation frameworks are deepened and supported by the ISTE Standards for Students.

The ISTE Standards for Students provide an approach for implementing these models that works collaboratively to deepen and extend learning with technology.

Crosswalks between 2007 and 2016 student standards

If your school already uses the 2007 standards, you are well on your way to addressing the 2016 ISTE Standards for Students. The following crosswalks are intended to support adoption and implementation of the 2016 standards. The charts are intended to help identify where there are changes, advancements, new concepts or skills that have been eliminated. They are not intended to fully explain or describe the similarities and differences in the two set of standards and in most cases, the correlations are partial or conceptual.

The 2016 ISTE Standards for Students are an evolution from the 2007 standards and emphasize student agency and a learner-driven approach. This evolution may suggest changes to your current approach, as well as curriculum and lesson planning to ensure that the student performance indicators are being fully addressed. ISTE encourages you to study them to help inform updates to other standard crosswalks based on the 2007 standards.

2016 ISTE Standards for Students adoption crosswalk

Use this crosswalk as a preliminary resource for supporting an adoption process to help identify gaps in your current policies.

	2007 ISTE STANDARDS FOR STUDENTS																							
	Creativity and Innovation				Communication and Collaboration				Research and Information Fluency				Critical Thinking, Problem Solving and Decision Making				Digital Citizenship				Technology Operations and Concepts			
2016 ISTE STANDARDS FOR STUDENTS	1.a.	1.b.	1.c.	1.d.	2.a.	2.b.	2.c.	2.d.	3.a.	3.b.	3.c.	3.d.	4.a.	4.b.	4.c.	4.d.	5.a.	5.b.	5.c.	5.d.	6.a.	6.b.	6.c.	6.d.
1. Empowered Learner **Students leverage technology to take an active role in choosing, achieving and demonstrating competency in their learning goals, informed by the learning sciences. Students:**																								
a. articulate and set personal learning goals, develop strategies leveraging technology to achieve them, and reflect on the learning process itself to improve learning outcomes.																		✓	✓					
b. build networks and customize their learning environments in ways that support the learning process.					✓																			
c. use technology to seek feedback that informs and improves their practice and to demonstrate their learning in a variety of ways.																		✓						
d. understand the fundamental concepts of technology operations, demonstrate the ability to choose, use and troubleshoot current technologies, and are able to transfer their knowledge to explore emerging technologies.																					✓	✓	✓	✓
2. Digital Citizen **Students recognize the rights, responsibilities and opportunities of living, learning and working in an interconnected digital world, and they act and model in ways that are safe, legal and ethical. Students:**																								
a. cultivate and manage their digital identity and reputation and are aware of the permanence of their actions in the digital world.																								
b. engage in positive, safe, legal and ethical behavior when using technology, including social interactions online or when using networked devices.																				✓				
c. demonstrate an understanding of and respect for the rights and obligations of using and sharing intellectual property.																	✓							
d. manage their personal data to maintain digital privacy and security and are aware of data-collection technology used to track their navigation online.																								
3. Knowledge Constructor **Students critically curate a variety of resources using digital tools to construct knowledge, produce creative artifacts and make meaningful learning experiences for themselves and others. Students:**																								
a. plan and employ effective research strategies to locate information and other resources for their intellectual or creative pursuits.									✓	✓														
b. evaluate the accuracy, perspective, credibility and relevance of information, media, data or other resources.										✓	✓													
c. curate information from digital resources using a variety of tools and methods to create collections of artifacts that demonstrate meaningful connections or conclusions.											✓													
d. build knowledge by actively exploring real-world issues and problems, developing ideas and theories, and pursuing answers and solutions.																✓								

2016 ISTE Standards for Students adoption crosswalk *(continued)*

Use this crosswalk as a preliminary resource for supporting an adoption process to help identify gaps in your current policies.

2016 ISTE STANDARDS FOR STUDENTS	2007 ISTE STANDARDS FOR STUDENTS: Creativity and Innovation				Communication and Collaboration				Research and Information Fluency				Critical Thinking, Problem Solving and Decision Making				Digital Citizenship				Technology Operations and Concepts			
	1.a.	1.b.	1.c.	1.d.	2.a.	2.b.	2.c.	2.d.	3.a.	3.b.	3.c.	3.d.	4.a.	4.b.	4.c.	4.d.	5.a.	5.b.	5.c.	5.d.	6.a.	6.b.	6.c.	6.d.
4. Innovative Designer **Students use a variety of technologies within a design process to solve problems by creating new, useful or imaginative solutions. Students:**																								
a. know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.	✓												✓			✓								
b. select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.														✓										
c. develop, test and refine prototypes as part of a cyclical design process.																✓								
d. exhibit a tolerance for ambiguity, perseverance and the capacity to work with open-ended problems.																								
5. Computational Thinker **Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions. Students:**																								
a. formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.													✓											
b. collect data or identify relevant data sets, use digital tools to analyze them, and represent data in various ways to facilitate problem-solving and decision-making.				✓								✓			✓									
c. break problems into component parts, extract key information, and develop descriptive models to understand complex systems or facilitate problem-solving.																✓								
d. understand how automation works and use algorithmic thinking to develop a sequence of steps to create and test automated solutions.																								
6. Creative Communicator **Students communicate clearly and express themselves creatively for a variety of purposes using the platforms, tools, styles, formats and digital media appropriate to their goals. Students:**																								
a. choose the appropriate platforms and tools for meeting the desired objectives of their creation or communication.											✓													
b. create original works or responsibly repurpose or remix digital resources into new creations.	✓	✓																						
c. communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models or simulations.			✓			✓																		
d. publish or present content that customizes the message and medium for a variety of audiences.					✓	✓																		
7. Global Collaborator **Students use digital tools to broaden their perspectives and enrich their learning by collaborating with others and working effectively in teams locally and globally. Students:**																								
a. use digital tools to connect with learners from a variety of backgrounds and cultures, engaging with them in ways that broaden mutual understanding and learning.					✓		✓																	
b. use collaborative technologies to work with others, including peers, experts, or community members, to examine issues and problems from multiple viewpoints.					✓																			
c. contribute constructively to project teams, assuming various roles and responsibilities to work effectively toward a common goal.								✓						✓										
d. explore local and global issues and use collaborative technologies to work with others to investigate solutions.					✓		✓									✓								

2016 ISTE Standards for Students implementation crosswalk

Use this crosswalk to guide preliminary efforts to align lesson plans and curriculum with the standards.*

	2016 ISTE STANDARDS FOR STUDENTS																											
	Empowered Learner				Digital Citizen				Knowledge Constructor				Innovative Designer				Computational Thinker				Creative Communicator				Global Collaborator			
2007 ISTE STANDARDS FOR STUDENTS	1.a.	1.b.	1.c.	1.d.	2.a.	2.b.	2.c.	2.d.	3.a.	3.b.	3.c.	3.d.	4.a.	4.b.	4.c.	4.d.	5.a.	5.b.	5.c.	5.d.	6.a.	6.b.	6.c.	6.d.	7.a.	7.b.	7.c.	7.d.
1. Creativity and Innovation **Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.**																												
a. Apply existing knowledge to generate new ideas, products, or processes													✓									✓						
b. Create original works as a means of personal or group expression																						✓						
c. Use models and simulations to explore complex systems and issues.																							✓					
d. Identify trends and forecast possibilities.																		✓										
2. Communication and Collaboration **Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.**																												
a. Interact, collaborate and publish with peers, experts or others employing a variety of digital environments and media.																								✓	✓	✓		
b. Communicate information and ideas effectively to multiple audiences using a variety of media and formats.																							✓	✓				
c. Develop cultural understanding and global awareness by engaging with learners of other cultures.																									✓			✓
d. Contribute to project teams to produce original works or solve problems.																											✓	
3. Research and Information Fluency **Students apply digital tools to gather, evaluate and use information.**																												
a. Plan strategies to guide inquiry.									✓																			
b. Locate, organize, analyze, evaluate, synthesize and ethically use information from a variety of sources and media.									✓	✓																		
c. Evaluate and select information sources and digital tools based on the appropriateness to specific tasks.										✓	✓										✓							
d. Process data and report results.																		✓										
4. Critical Thinking, Problem Solving and Decision Making **Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.**																												
a. Identify and define authentic problems and significant questions for investigation.													✓				✓											
b. Plan and manage activities to develop a solution or complete a project.														✓													✓	
c. Collect and analyze data to identify solutions and/or make informed decisions.																		✓										
d. Use multiple processes and diverse perspectives to explore alternative solutions.												✓	✓			✓			✓									
5. Digital Citizenship **Students understand human, cultural and societal issues related to technology and practice legal and ethical behavior.**																												
a. Advocate and practice safe, legal and responsible use of information and technology.						✓	✓																					
b. Demonstrate a positive attitude toward using technology that supports collaboration, learning and productivity.	✓		✓																									
c. Demonstrate personal responsibility for lifelong learning.	✓																											
d. Exhibit leadership for digital citizenship.																												
6. Technology Operations and Concepts **Students demonstrate a sound understanding of technology concepts, systems and operations.**																												
a. Understand and use technology systems.				✓																								
b. Select and use applications effectively and productively.				✓																								
c. Troubleshoot systems and applications.				✓																								
d. Transfer current knowledge to learning of new technologies.				✓																								

ISTE recommends this as a starting point for study of the standards and towards documenting greater alignment in your curriculum that maintains fidelity to the 2016 ISTE Standards for Students.

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