What it Takes:

Essential Skills of the K-12 CTO

By the CoSN K-12 CTO Council

Wanted: Chief technology officer for a medium-sized school district. Advanced degree and background in education, finance, business and technology required. Must have strong organizational and interpersonal skills and be an expert on strategic planning, budgeting, IT staffing, computer networking, data management, security issues and standards, computer operating systems, hardware maintenance and repair, and all aspects of running an IT business. Must require no more than two hours of sleep per night.

The job of overseeing a school district's technology program has grown exponentially in recent years as computers, the Internet and other technology applications have become essential to the daily operation of schools. What does today's district-level technology leader need to know in order to keep up with the challenge of ever-changing technologies and ever-shrinking budgets? That is the question a group of technology leaders, affiliated with the Consortium for School Networking (CoSN), has set out to address.

This publication is one of several projects planned by CoSN's K-12 CTO Council to help district technology leaders from all parts of the country explore issues and learn from one another. Although actual job titles vary tremendously from one district to another (see "What's in a Name"), we will use Chief Technology Officer or "CTO" generically in this article to refer to the main person or people responsible for technology leadership and decision-making in a school system. We will also refer to the "school district" as the main organization for which a K-12 CTO works, although technology leaders responsible for a network of independent or parochial schools – or even a large, individual school – are likely to identify with the issues explored in these pages.

LEADERSHIP AND VISION

Developing a shared vision and big-picture perspective on a district's goals is crucial to planning for meaningful and effective uses of technology. Whether acting as a member of the executive cabinet or the leader of a technology team that reports to cabinet-level administrators, the CTO plays a key role in district-wide planning and goal-setting. In this context, an effective CTO is one who is equally comfortable serving as a change agent and a consensus builder.

Technology leaders bring to the planning process insight about ways in which the world is changing, the new tools that are available for teaching and learning, and the cutting-edge

WHAT'S IN A NAME?

There is a great deal of variety when it comes to the job titles used by districts to refer to their highest-level technology leaders – referred to generically in this article as "CTOs." In many cases, the differences are simply a matter of semantics or historical chance, although there are some variables that do reflect the different roles technology leaders play from community to community.

Some district technology leaders hold cabinet-level positions, reporting directly to the superintendent of schools. The title attached to such a position might be Chief Information Officer (CIO), Associate Superintendent for Technology or, occasionally, Chief Technology Officer.

More frequently, the top technology leader is a Director or Executive Director of an area such as Educational Technology or Technology Services, reporting to a cabinet-level administrator such as an Associate Superintendent, Chief Operating Officer or Chief Financial Officer.

Sometimes, technology leadership for a district is shared by two people with parallel roles and titles – one in charge of Instructional Technology and another (with a title such as Director of Information Technology) who oversees technology infrastructure and management applications.

In all but the tiniest districts, there are several technology leaders who report to the CTO – or to the two parallel technology directors – each with his or her own specialty. Typically these include:

- Instructional technology;
- Networking and telecommunications;
- Technical support services;
- Data processing and information management.

technologies that have yet to make their way out of the R&D labs. An understanding of the technologically-rich information society for which students must be prepared allows a CTO to serve as a change agent who helps fellow planners think beyond what is happening in schools today to what *could* or *should* be happening. What will students need to know and do in five years? What changes are required in how the schools operate to prepare students for their future?

At the same time, an effective CTO has the ability to work closely with a variety of constituents to develop consensus and buy-in. This means ensuring that communication is good between the "techies" and the "non-techies" and helping to empower stakeholders – both internal and external – to shape and embrace a collective vision for the role of technology within the district.

While maintaining knowledge and expertise about high-tech issues, it is essential for the CTO never to succumb to "technology for technology's sake." Instead, he or she must always keep in mind the key job of education – teaching and learning. In this way, the CTO needs to have a "servant as leader" perspective, viewing information technology as a service business designed to support the district's strategic goals.

Equally important, a CTO must share with other district leaders a passion for equity and a belief that successful, technology-supported learning must take place for all students – not just boys or gifted students or ones whose families can afford computers at home. Among other things, equity means providing school-based resources to help address the lack of availability of interactive technology in the homes of disadvantaged students; ensuring that special needs students benefit from new technology implementations; and finding ways of distributing resources fairly among schools in the district.

Job Function
Works closely with the executive cabinet and stakeholders to create a vision for how technology will support the district's strategic goals.

Required Knowledge/Skills
- Ability to establish and lead governance committees and facilitate the process of priority-setting and decision-making.
- Interpersonal skills and a willingness to work closely with all constituents.
- Ability to adapt known technologies to new uses and envision natural relationships between emerging technology resources and the education process.
- Big-picture understanding of school organization, of curriculum and of the issues of greatest importance to teaching and learning.
- Understanding of the change process and effective approaches to facilitating change.

PLANNING AND BUDGETING

In addition to helping develop a district-wide vision for technology's role, the CTO has primary responsibility for transforming that vision into a long-range plan. An effective framework for such planning begins with strategic challenges – things that the district must do in order to be successful – and then moves on to more specific goals, objectives and action plans.

Let's take a closer look at one example of moving from vision to reality. In the chart below, the challenge is to close the achievement gap; the goal is to improve student achievement; and the strategic objective is to increase the effective uses of technology to support such achievement goals. Several Information Technology strategies – including creation of a virtual high school and development of data analysis tools – have been identified to meet the objectives.

Strategic Challenge
Close the achievement gap

District Goals and Objectives
Improve student achievement as evidenced by:
- Students demonstrating proficiency in key curriculum areas;
- Students being nationally competitive.

IT Strategic Objective
Increase effective use of instructional technology

IT Strategies and Action Plans
- Develop Virtual HS
- Create instructional software standards
- Develop data analysis tools
- Develop knowledge- sharing databases

This sort of planning requires close collaboration between the instructional team, which must drive the use issues, and the IT team, whose responsibility it is to match curriculum innovation with meaningful technologies. The different constituents, working together, need to identify not only strategies, but also performance timelines, and the resources and headcount that will be required.

Converting strategic plans and staffing requirements into dollars and cents helps the CTO build the case for calculating the real costs of IT. This requires an understanding of Total Cost of Ownership (TCO) and the sorts of ongoing or recurring costs that must be factored into budgeting for technology. It is essential for district planners to go beyond initial expenditures to determine the source of funds for ongoing support, equipment upgrades and future system expansion – and to recognize that technology planning is a dynamic process that needs frequent revisiting and rethinking.

Job Function
Works with the instructional and technical teams to identify the steps needed to meet strategic goals and a budget that takes into account the total cost of implementing technology solutions.

Required Knowledge/Skills
- Ability to think strategically, manage projects, and lead the district from vision to effective delivery of services.
- Ability to set practical and realistic timelines for technology implementation.
- Understanding of the steps and financial tools involved in the budgeting process.
- Strong working knowledge of the concept of Total Cost of Ownership and the ability to translate that into realistic budgets.
- Understanding of the impact and need for technology throughout the enterprise – and the relationship between curriculum, instruction and technology in providing a teaching and learning environment.

TEAM BUILDING AND STAFFING

A staffing strategy to support a district's technology plan cannot be developed as an afterthought; it should be an integral part of strategic planning from the very beginning. One technique for determining whether there is a good match between current personnel and future needs is to build and compare two organization charts.

For starters, create an organization chart with necessary functions (e.g., data management, systems processing, acceptance testing) – including any new functions that have been identified through strategic planning. Comparing this to a current org chart listing today's staffing and roles will help you identify gaps where functions are now being neglected or excessive headcounts where services are no longer needed.

Of course, staffing requires far more than head count and hiring people with the right training. Exemplary technology team members are ones who are:

- Self-starters;
- Creative, independent thinkers;
- Team players;
- Effective communicators and listeners;
- Customer-service oriented;
- Hard workers without a 9 to 5 mindset.

Great teams require great leadership – including the ability to lead by example. The CTO has to be a team player who is willing to share credit for successful projects. All members of the technology team should be given project management roles that they individually are responsible for and the groups closest to the point of technology implementation need to be given true ownership of decisions about the technology that most closely affects them.

Job Function
Creates and supports cross-functional teams for decision-making, technology support, professional development, and other aspects of the district's technology program.

Required Knowledge/Skills
- Strong leadership skills and the ability to empower others to assume leadership roles.
- Skills at facilitating team building activities, modeling examples of trust between department members, and utilizing quality improvement tools for decision-making.
- Strong communication skills and a commitment to keeping all parties informed about technology progress and choices.
- Ability to identify strengths and weaknesses and make effective hiring decisions.

Communication is also crucial to building and supporting technology teams. A monthly "tech update" sent to all individuals responsible for supporting technology initiatives is a good way to convey breaking news and technology information to those people who need to provide leadership at the local level.

SYSTEMS MANAGEMENT

Typically, the majority of a CTO's time is spent overseeing the day-to-day operation of the district's IT systems. All of the project management and personal leadership skills described earlier come into play in the effective running of this large-scale enterprise, as does the need to be a perpetual learner.

With the organization looking to the CTO for leadership on purchasing decisions, software standards, system reliability, infrastructure, network security, upgrades, maintenance and support for the entire enterprise, it is necessary to keep up with a wide array of frequently-changing technologies. CTOs need to read constantly, subscribe to e-mail lists and discussion groups, and be vigilant about watching the horizon for technology breakthroughs and trends. This means being astute observers of environments beyond K-12 education – including colleges, universities, and business, where the first implementations of powerful new technologies often occur.

Job Function
Directs, coordinates, and ensures the implementation of all tasks related to: the development of technical specifications and infrastructure decisions; the selection, purchasing, installation and maintenance of IT; and the integration of technology into every facet of operations.

Required Knowledge/Skills
- Knowledge and expertise about infrastructure and performance standards for all aspects of the IT system.
- Strong technical background accompanied by a personal commitment to ongoing research and learning.
- Ability and willingness to hire skilled experts to support and oversee different aspects of the IT program.
- Ability to make purchasing and implementation decisions based on needs of the total school system – and on an understanding of the full life cycle of technology purchases.

Equally important, the CTO must recognize that it is impossible to be an expert on every aspect of technology. Building a great team, knowing when to delegate responsibility, and understanding how to oversee the work of team members without decreasing their sense of ownership are all just as important as developing personal expertise.

Making sure that the various technology systems employed by a district are standardized and compatible with one another is one of the most challenging parts of a CTO's job. Also important is vigilance about security issues and an understanding of the tools and techniques

needed to prevent the spread of viruses, intrusion by hackers or other breaches of network security.

A commitment to the true business of education can lead to a challenging balancing act. As tempting as it might be to "just say no" to technologies that could place additional stresses on the overall system, the CTO's job is to figure out ways to support and integrate the best uses of technology for teaching and learning while minimizing potential risks. Although this will sometimes entail asking constituents to give up a favorite tool in order to transition to one that is more stable or easily integrated, the overall goal must be to make life easier for the instructional community, not for the technology support staff.

In the end, it falls to the CTO to ensure the smooth operation of the entire IT system, with opportunities for growth and minimal downtime. If we truly believe in the importance of technology for education, if we continue to encourage teachers and administrators to integrate it into all aspects of a district's operations, then we must be committed to making sure that the technology is there and working when it is needed.

INFORMATION MANAGEMENT

The fact that a growing number of districts use the title "chief information officer" to refer to their highest-level technology leader is a reflection of the crucial role information plays in today's schools. The accountability movement and the powerful data-gathering abilities of digital-age tools have combined to produce an information culture in which data management is key to strategic planning.

On the instructional end, the CTO needs to be knowledgeable about data-driven decision making and be able to locate, customize or create applications that make it easy for district educators to:

- Assess student progress, frequently and painlessly;
- Generate comprehensive baseline data for each student, class, and grade level, for both performance and content standards;
- Analyze data so that it is easy to identify each student's academic strengths and weaknesses;
- Monitor gains in student proficiency on a continuous basis;
- Plan new interventions for individual students, groups of students, classes, and/or grade levels using relevant, up-to-date information;
- Provide for ongoing review and evaluation of all school improvement efforts and intervention strategies:
- Show per-pupil expenditures linked with measures of progress.

Job Function
Oversees the establishment and maintenance of systems and tools for gathering, mining, integrating and reporting data in usable and meaningful ways.

Required Knowledge/Skills

- Understanding of data-driven decision making and the role information needs to play in shaping and supporting a district's educational programs.
- Understanding of techniques and tools for data gathering, warehousing, and analysis – including a knowledge of available applications and the options for customizing them or building new tools in-house.
- Knowledge of data-related industry standards (eg., SIF and SCORM) and of governmental mandates (e.g. NCLB or IDEA) with information reporting requirements.
- Ability to assess and respond to the needs and concerns of a variety of knowledge workers.

Data management has long been part of the administrative side of the equation – with extensive databases used for student records, scheduling, managing budgets and keeping track of human resource issues. As data mining becomes an increasingly integral part of the instructional planning process, the CTO must lead the way in creating compatible systems that integrate and allow links to be made between the instructional and the administrative data. In such an integrated system, access needs to be real-time, with data elements and structures shared by all applications.

Serving as an effective information officer involves not only technical challenges, but also human ones. In many districts, every department has developed its own systems, applications and

business practices tailored to departmental needs. The CTO must be able to take a wide-angle view of all of the data needs of the organization as a whole – and then apply his or her interpersonal skills to helping all stakeholders understand how they will benefit by migrating to a new, integrated data management system.

BUSINESS LEADERSHIP

Typically, the CTO advises the superintendent or CFO on technology expenditures. He or she oversees the selection of technology items; reviews requisitions for their purchase; and exercises authority to approve, amend or reject purchases based upon compatibility with district goals and needs.

Job Function
Serves as a strong business leader who guides purchasing decisions, assists in determining the "return on investment" for all technology implementations, and fosters good relationships with vendors, potential funders, and other key groups.

Required Knowledge/Skills
- Comfort managing a budget, making purchasing decisions, and handling the financial aspects of running an IT business.
- Knowledge about market rates for technology equipment and services and the issues that determine ROI.
- Ability to direct, manage, and negotiate with vendors and business partners.
- Strong communication skills, the ability to build partnerships and articulate a vision for the district's technology program.

In making such purchasing decisions, the CTO must ensure that the district is getting its money's worth. With declining budgets, it is particularly necessary for today's CTO to be a great fiscal manager, establishing metrics to be used as efficiency guides and to help determine return on investment (ROI).

Along these same lines, it is important for the CTO to cast a critical eye on potential technology expenditures to determine if they are really needed. This means playing "devil's advocate" and pushing others on the technology planning team to justify the value of new and expensive purchases – in other words, to answer the question "Couldn't we do it just as well, and less expensively, without this technology?"

When convinced that a particular technology use really is key to a district's strategic goals, the CTO is often called upon to don another business hat – that of public relations officer for technology endeavors. In this role, the CTO is responsible for articulating, to both internal and external stakeholders, a systemic vision for where the district is headed. Communicating regularly with community leaders and participating in local business organizations keeps visibility for school technology programs high and helps build support that will stand the district in good stead when it comes to bond referendums and other initiatives requiring community support.

In addition, building effective partnerships with businesses, universities or associations that can offer financial and intellectual support is a key role for the CTO. Similarly, it is important to develop close working relationships with technology vendors – including information exchanges, pilot projects and other win-win arrangements.

EDUCATION AND TRAINING

Professional development is a crucial, often underfunded, aspect of a district's technology program. The CTO has the responsibility to oversee district-wide, technology-related staff development efforts – from ensuring a sufficient budget through the implementation and assessment process.

Successful coordination in this area involves an awareness of the latest thinking about effective professional

Job Function
Budgets, plans for and coordinates on-going, purposeful professional development for all staff using new technologies.

Required Knowledge/Skills
- Current understanding of both technical and educational best practices and the appropriate uses of technology to support high-caliber, rigorous student work.
- Understanding of the key elements contributing to successful professional development.
- Awareness of technology-related professional growth needs of all staff members – including administrators and support staff – and the ability to respond to these needs, including providing "just in time" opportunities to remain current on technical content.
- Ability to plan professional development activities that help teachers meet a wide range of instructional goals for the district with help from interactive technologies.

development. (For more about professional development, see *Highly Qualified* in this year's CoSN Compendium.)

While the top priority of technology-related professional development should be to help teachers maximize their effectiveness, staff development efforts can not stop there. Technology competencies should be identified for all employee groups and the opportunities to improve these necessary skills should be widely available. Participants should be involved in the needs assessment process, as should department leaders whose role is to evaluate employees on their use of technology.

Professional development efforts can be greatly enhanced by ongoing internal communication. Newsletters and other bulletins, for instance, can help build awareness among employees of available resources and stimulate interest in utilizing technology to support all aspects of a district's programs.

ETHICS AND POLICIES

An effective CTO understands the social, legal and ethical issues related to technology and models responsible decision-making with regard to these areas. For starters, the CTO oversees the creation, revision and enforcement of the district's Acceptable Use Policy (AUP). This involves consensus-building around key issues related to appropriate uses of the Internet and e-mail, as well as communication with all parties about what is expected of them.

While many districts believe that education and enforcement of the AUP are the most important ways of keeping students away from inappropriate digital content, technology-based filters and controls are increasingly a part of the school technology scene. Legal mandates for filtering, as well as increasingly aggressive tactics by groups promoting inappropriate content, all contribute to the need for technology-based protection. Being thorough about selecting and monitoring such tools – to ensure that their benefits outweigh the negative impact they can have on research and communication – is an important part of a CTO's job.

It is also essential to be knowledgeable and vigilant about a variety of other issues related to technology use. The CTO must participate in the development of policies that clearly enforce privacy, confidentiality, and copyright law and assign ownership of intellectual property developed with district resources. All of these issues need to be explored as they relate to multimedia projects, district web sites, e-mail correspondence, peer-to-peer sharing and other uses of emerging technologies. Finally, the CTO needs to be involved in setting policy and standards involving such things as environmentally safe and healthy practices in the use of technology.

To ensure the success of such endeavors, the CTO must work closely with a variety of departments. Although the technology division may be authorized to create and publicize standards, enforcement is likely to be the responsibility of campus and department leaders. It is, therefore, essential to collaborate effectively at every step – from planning through follow-up.

Job Function

Oversees the creation, implementation and enforcement of policies and educational programs related to the social, legal and ethical issues involved in technology use throughout the district.

Required Knowledge/Skills

- Knowledge about laws and legal issues related to copyright, privacy, filtering and other aspects of school technology use.
- Awareness of other relevant issues including safety, technology-related health concerns and guidelines for fair and ethical implementation of technology.
- Experience with AUP development and enforcement.
- Commitment to modeling responsible technology use and working closely with all constituents.

COMMUNICATION SYSTEMS

Communicating with all members of the educational community is key to any school or district leader's role. The CTO has the chance –

and the responsibility – to hone the tools with which these sorts of information exchanges happen. In fact, technology-enhanced communication with stakeholders, including students, staff and community members, provides one of the most tangible methods of demonstrating the value of technology resources.

Job Function
Directs and coordinates the use of e-mail, district web sites, voicemail systems and other forms of communication technology to facilitate decision-making, dialog and effective communication with the community and other key stakeholders.

Required Knowledge/Skills
- Working knowledge of various communication tools – including purchasing options and the technical issues related to implementation.
- Understanding of web design and support issues and the staffing needed to keep district and school sites updated and operational.
- Knowledge about converging technologies and new options for enhancing communication through technology.
- Strong communication skills and the ability to provide leadership to stakeholders in the utilization of communication resources.

Leveraging the expanding number of community members who have access to the Internet, the CTO should ensure that school web sites provide student with curriculum resources, such as online databases. At the same time, web and e-mail communications should offer information to parents regarding school events and student grades, performance and attendance. The CTO needs to work closely with curriculum leaders and principals to ensure that teachers have the necessary training to provide and regularly update this information and that security measures are taken to protect sensitive data from unauthorized access.

As the analog and digital worlds converge, a traditional communication device – the telephone – comes increasingly under the purview of the K-12 CTO and others charged with harnessing the power of technology to support schooling. Automated out-calling systems play an important role in notifying parents of important events or student absences; voice mail boxes for staff members further communications with families who do not have email access; and voice-based homework helplines can be used from home by students who need assistance. With technology analysts expecting voice and data networks to become increasingly integrated into seamless communications systems, and broadband technology to make it possible for a growing number of stakeholders to access video-based presentations, leaders will find themselves with ever-more-powerful ways of supporting the exchange of information.

Ultimately, the CTO is responsible for ensuring that technology-supported communications methods are reliable and available at all times, through the purchase of appropriate hardware, applications, and support. The CTO must also provide guidelines for the use of each of these communication resources and should work collaboratively with other departments to ensure effective implementation of these same resources into daily operations.

In summary, the K-12 CTO must be a skilled administrator, a knowledgeable educator, an effective communicator, and a technologically-savvy individual who can work with all district staff at all levels within the organization. Still interested? Apply at your closest K-12 school district!

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