6. Provide easily accessible, relevant and current data to appropriate users to direct school and instructional improvement planning.

7. The superintendent may not collect or store personal information about students or staff that does not have an educational purpose or that is not appropriately authorized.

8. The superintendent may not use methods of collecting, reviewing, transmitting, or storing information that fail to protect against improper access.

The Chief Information and Technology Officer (CITO) will review the ETSP Committee's annual report and use it to help assess the district's success in achieving the eight Operational Expectations for technology. The CITO will prepare regular reports to the Superintendent and Board of Education concerning the achievement of the Operational Expectations and the findings and recommendations of the ETSP Committee.

The ETSP Committee also will share their data and conclusions with all key stakeholders, including teachers, school site administrators, central office staff and administrators, parents, students and community members. Information will be shared through the district Intranet system, by posting summaries of ETSP Committee findings on the district website, and through ongoing newsletters and other forms of district communications with parents and the community. The results of the evaluation will be shared at Principals' meetings and will be reviewed with site technology teams so that they may make appropriate modifications to their site plans.

8. EFFECTIVE COLLABORATIVE STRATEGIES WITH ADULT LITERACY PROVIDERS TO MAXIMIZE THE USE OF TECHNOLOGY

8.a. If the district has identified adult literacy providers, description of how the program will be developed in collaboration with them.

San Diego City Schools, the San Diego Community College district, and the San Diego City Libraries are the main adult literacy providers in the region.

San Diego Public Library: READ/San Diego. READ/San Diego is a free literacy, English as a Second Language and family literacy instruction service provided by the San Diego Public Library for adults 18 years of age and older. The program is supported by the City of San Diego and the County of San Diego, with contributions from local businesses, civic and service organizations, individuals and the State of California.

READ/San Diego is staffed by literacy professionals who coordinate the efforts of volunteer reading tutors and cooperate with local adult schools, community colleges and other literacy education provided in making and receiving student referrals. The program's headquarters is located at the Malcolm X Library and Performing Arts Center in southeastern San Diego. An integral part of READ/San Diego is its in-house computer lab, which is equipped with Macintosh and PC computer workstations and comprehensive software systems. The lab offers a wide selection of programs to help learners improve language skills, reading, writing, spelling, math, typing, GED and job preparation skills. Training and support are provided by a lab coordinator and trained volunteer assistants.

READ/San Diego tutors receive comprehensive training, including intensive training in learning disabilities. Tutors generally meet with their students twice a week for a total of 3 hours at one of the City and County's 69 libraries or a mutually convenient public facility provided by community partners. SDUSD provides space at its Ballard Parent Center for the READ/San Diego program.

San Diego City Schools Adult Literacy Programs. Technology also will be integrated as appropriate into the following adult literacy programs run by the district:

- Community-Based English Tutoring Program (CBET). The CBET program provides free adult English language and Family Literacy instruction to parents and community members who pledge to provide personal English language tutoring to California K-12 children with limited English proficiency. The program allows participants to improve English conversation, reading and writing skills, learn how to help their children in school, learn parenting techniques, practice reading to children, tutor K-12 students and meet other parents at their child's school. Free babysitting is provided while parents participate in the program. The CBET program currently is offered at 17 elementary schools within the district. SDUSD operates the CBET program in cooperation with the San Diego Community College district Continuing Education division.

- SDUSD Adult Education High School Diploma Program. This no-fee program provides students the opportunity to complete credits required to earn a high school diploma. The program is open to students who are at least 16 years of age and are no longer attending school. It is currently offered at five high school sites (Crawford, Garfield, Hoover, Madison, and Mira Mesa High Schools).

San Diego Community College District. The San Diego Community College District (SDCCD) Continuing Education division offers free adult non-credit classes in basic education, high school completion, ESL, vocational training, citizenship, consumer science, home economics and child development, classes for students with disabilities, classes for older adults, and health and safety. In addition to its partnership with SDUSD to operate the CBET program, SDCCD Continuing Education provides the following programs:

- The High School Diploma Program/GED. SDCCD Continuing Education offers the opportunity for students to complete a high school diploma while earning college credits. Traditional classroom instruction is offered in day and evening classes in all required high school subjects (including algebra, American literature, economics, computer literacy, mathematics, U.S. Government, and U.S. History). SDCCD Continuing Education also offers General Education Development (GED) preparation classes, pre-tests and practice tests. The SDCCD Continuing Education high school diploma and GED programs are no-fee.

- English as a Second Language (ESL). The ESL program offers English classes for non-native speakers of English. Students must be at least 18 years old and a resident of California. There are seven levels of instruction, ranging from classes for those with no English skills to classes for those with advanced skills. Vocational English as a Second Language classes are offered to help students learn the English, math and basic computer skills needed to succeed in a job training program, learn work-related vocabulary and phrases, learn American English pronunciation, and practice job interviewing techniques. Classes are offered at all SDCCD Continuing Education centers. SDCCD Continuing Education also offers ESL/Citizenship classes and TOEFFL test preparation. Almost 32,000 students participated in the SDCCD ESL program in the 2007-2008 school year.

- Adult Basic Education. The Basic Education program introduces and reviews basic skills at three levels in reading, writing, math, spelling, vocabulary, communication and critical thinking. Emphasis is on identifying and mastering facts, terms and learning strategies, and applying knowledge. The Basic Education program offers courses in reading development (levels 1-6) and arithmetic review (covering basic arithmetic skills, operations with whole numbers, fractions and decimals, and common measures).

Collaboration in the SDUSD Educational Technology Strategic Plan. SDCCD Continuing Education and San Diego Public Library READ/San Diego programs are partners with SDUSD in the tech plan. Staff members from SDCCD Continuing Education and the San Diego Public Library provided input to and reviewed the draft Educational Technology Strategic Plan; their comments were incorporated into the plan. The SDCCD Continuing Education and San Diego Public Library READ/San Diego programs also collaborate with SDUSD on planning and

implementation of adult literacy programs. SDUSD and SDCCD jointly operate the CBET program, and work closely to articulate their educational programs to provide a seamless transition for students.

SDUSD collaborates with both SDCCD Continuing Education and READ/San Diego on activities offered at the Harold J. Ballard Parent Center. Located in a former elementary school in the Old Town area of San Diego, the Ballard Parent Center is home for the district's San Diego Parent University. Parent University is designed to help parents become more involved in their children's education as academic coaches, to strengthen parenting skills, and improve child-parent relationships. Parents can select academic classes to help support homework, reading, writing, study skills and math. The Ballard Parent Center, in collaboration with SDCCD Continuing Education, provides "Parents and Children Learning Together," a class in which parents and their children (2 to 5 years of age) learn together in a preschool setting. The class includes sessions to help English language learners develop English fluency. The Ballard Parent Center also offers READ/San Diego literacy instruction and one-on-one adult English tutoring. The Parent Center has an extensive parent lending library with parenting books, children's books and videos, and has computers available so parents can access the Internet. Transportation is provided to selected Title 1 schools in the district.

SDCCD Continuing Education and READ/San Diego, through their review of the Educational Technology Strategic Plan, agreed that the activities and actions of the Plan are consistent with Adult Literacy outcomes:

- The activities are designed to support student access to rich academic content, and thereby to improve student achievement of basic education and literacy skills.

- The activities designed to support instructional planning and implementation by providing teachers and administrators with better access to student information.

- The activities provide additional opportunities for teachers to communicate with students outside of the classroom.

SDUSD, SDCCD Continuing Education and READ/San Diego collaborate to share strategies and funding resources to maximize the use of technology by collaboratively operating programs, and sharing facilities and technology access. The access to instructional technology and rich content materials that is developed through the activities of the Educational Technology Strategic Plan will be available to all district programs, including the Adult Education High School Diploma program and the CBET program, operated in collaboration with SDCCD Continuing Education. Programs at the Ballard Parent Center (including the literacy instruction and English tutoring offered with READ/San Diego) will have access to the technology resources provided to the Center through the plan.

9. EFFECTIVE, RESEARCH-BASED METHODS, STRATEGIES AND CRITERIA

9.a. Summarize the relevant research and describe how it supports the plan's curricular and professional development goals.

Student Target Group. The SDUSD Educational Technology Strategic Plan will focus on developing the technology skills of all students but particularly of students in middle school, so that by the 8th grade all students achieve the technology skills identified in the *No Child Left Behind* Act. The integration of technology into the curriculum appears to have the greatest impact in middle school. In a landmark study that analyzed a national database of student test scores, Wenglinsky (1998) found that technology had more of an impact on mathematics score in middle schools that it did in elementary schools (Valdez et. al, 1999). In a statewide evaluation of the Idaho technology initiative, the Idaho Council for Technology in Learning (1999) concluded that there was a positive relationship between the integration of technology and student academic performance in core studies, language, math and reading, and that the gains were greater for 8th graders than for 11th graders.

The Digital Disconnect Between Students and Schools. The U.S. Department of Education obtained students' perspectives for the development of the National Education Technology Plan through an online survey of 210,000 K-12 students (NetDay, 2003). They identified several major themes from the students' comments (U.S. Department of Education, 2004, p. 19):

- Today's students are very technology-savvy, feel strongly about the positive value of technology and rely upon technology as an essential and preferred component of every aspect of their lives.
- Students are not just using technology differently today but are approaching their lives and their daily activities differently because of the technology.
- As students get older, their use of technology becomes more sophisticated, but, comparatively, the younger students are on a fast track to becoming greater technology users and advocates.
- The access point for technology use, particularly for older students, is home-focused, not school-focused.
- Today's students are ultra-communicators.

The U.S. Department of Education noted that even students from low-income groups who do not have access to technology at home see and find it – using computers at schools, libraries or at friends' homes (NCES, 2003).

The National Education Technology Plan (2004) concluded that while there is no disagreement over the need for American students to have the knowledge and skills to compete in an increasingly technology-driven world economy, the educational community is far behind both the business community and tech-savvy students in the use of technology. This "digital disconnect" is a major cause of frustration among today's students, leading to the risk that public schools that do not adapt to their students' technology needs will become increasingly irrelevant. The U.S. Department of Education concludes that "Technology ignites opportunities for learning, engages today's students as active learners and participants in decision-making on their own educational futures and prepares our nation for the demands of a global society in the 21st century" (2004, p.46).

21st Century Skills. What are the demands of a global society in the 21st century? The Partnership for 21st Century Skills is a public-private organization formed in 2002 to answer this question and create a successful model of learning that incorporates 21st century skills into the U.S. system of education. They identified six key elements for fostering 21st century learning:

1. *Emphasize core subjects*, identified by the *No Child Left Behind* Act as English, reading or language arts, mathematics, science, foreign languages, civics, government, economics, arts, history and geography.

2. *Emphasize learning skills*, including information and communication skills, thinking and problem-solving skills, and interpersonal and self-directional skills.

3. *Use 21st century tools to develop learning skills*, including the information and communications technology (ICT) tools essential to everyday life and workplace productivity.

4. *Teach and learn in a 21st century context*, using real-world examples, applications and experiences both inside and outside the school to learn academic content.

5. *Teach and learn 21st century content*, including global awareness, financial, economic and business literacy, and civic literacy.

6. *Use 21st century assessments that measure 21st century skills*, including a balance of classroom assessments for improved teaching and learning in the classroom and high-quality standardized testing for accountability purposes.

Technology and Learning Gains. 21st-century information and communication tools as well as more traditional computer-assisted instructional applications can positively influence student learning processes and outcomes (Cradler, McNabb, Freeman & Burchett, 2002). Technology has been positively linked to increasing student motivation, learner engagement, communication and collaboration, and problem-solving skills (Sandholtz et. al, 1997; Ringstaff & Kelley, 2002).

When technology is used to perform tasks applying higher order concepts and when teachers are proficient at directing students toward productive uses, technology is associated with learning gains that can be significant (Glennan & Melmed, 1996; Reksten, 2000; Coley, 1997; Schlechty,

1997; Penuel, Golan, Means & Korback, 2000; Kimble, 1999). Students who used computers for simulations and applications to enhance higher-order thinking skills performed better on the National Assessment of Educational Progress (NAEP) than did students whose teachers used technology for drill and practice (Valdez et. al, 1999).

A quantitative synthesis of 42 research studies found a modest, positive effect of teaching and learning with technology on student outcomes. The authors concluded that these results can be generalized across a wide variety of conditions, as well as across student, school and study characteristics (Waxman, Lin & Michko, 2003). Numerous studies document student understanding of mathematics concepts from using computer-based and computer-assisted software (Cradler et. al, 2002). In a landmark study that analyzed a national database of student test scores, Wenglinsky (1998) found that technology can have a positive effect on students' mathematics scores.

Education Technology Strategies and Methods. SDUSD has identified strategies in three key areas to utilize technology to support teaching, learning and student achievement: (1) an integrated information system; (2) integration of technology into the curriculum; and (3) professional development. Each of these strategies is based on relevant research, which is summarized below.

Integrated Information System. Most schools districts have not yet begun to utilize technology to improve access to student data. The technologies used to collect and store student information are aging and frequently incompatible. Rather than being aggregated, information usually is siloed, redundant and difficult to share. This makes it difficult to obtain the data needed to make the best instructional and management decisions to benefit student learning (U.S. Department of Education, 2004). High performing schools view and use technology not as an end in itself but as a means of collecting, analyzing and reporting data to improve curriculum and instruction, and to identify achievement gaps for individual students and groups of students (Rasher, Abromitis & Johnson, 2004, p. 35).

The district has begun the process of developing an integrated information system and content management system that will provide online access to educational resources, tools and information for teachers, students, administrators, staff, parents and community members. The integrated information system and content management system will support these uses by making student record keeping and assessment more efficient. Implementation of the district integrated information system involves the development and implementation of Internet and network access, business applications, and a student information system integrated with student information data warehouse. Users will access the system through a Content Management System, which will provide: (1) teacher access to educational administration applications (attendance, grading, etc.) and educational technology applications and support; (2) student access to educational technology applications and support, including teacher's class websites; (3) parent access to district, school, classroom and student information; (4) community access to district and school information; and (5) staff and administrator access to district business applications.

The Content Management System will provide a Web portal designed to save time and frustration for a teacher by bringing varied technology resources into one place with one password. Common applications such as email, the grading system, student information system, and Google will be accessible in the same environment, and reference tools (such library catalog and subscription databases) also will be available. A teacher who wants to put together a media-rich learning activity or lesson plan can simply log onto the portal and have a multitude of resource available (Prouty, 2004).

The integrated information system also will provide communications technology accessible to students. Technology can provide the means for students with special needs to communicate via email and use the Internet for research, and can also help teachers accommodate students' varying learning styles" (Silverstein, Frechtling, & Miyoaka, 2000).

Integration of Technology into the Curriculum. Technology can be an appropriate vehicle for promoting meaningful, engaged learning. "It allows students to work on authentic, meaningful and challenging problems, similar to tasks performed by professionals in various disciplines; to interact with data in ways that allow student-directed learning; to build knowledge collaboratively; and to interact with professionals in the field. Technologies also can be used to promote the development of higher-order thinking skills and allow opportunities for teachers to act as facilitators or guides and often as a co-learner with the students." (Gahala, 2001).

Research and evaluation shows that technology can enable the development of critical thinking skills when students use technology presentation and communication tools to present, publish, and share results of projects (Cradler et al, 2002). When students use the Internet to research topics, share information, and complete a final project within the context of a semi-structured lesson, they became independent, critical thinkers (Coley, Cradler & Engel, 1997). When students learn to use and apply applications used in the world of work, such as word processors, spreadsheets, computer-aided drawing, website development programs and the Internet, they acquire some of the prerequisite skills for workforce preparedness (Cradler et. al, 2002).

Several key strategies will be used to integrate technology, instructional software and online learning supports into all curricular areas so that students develop the 21st century information and communications technology skills that will support their learning and success in the working world. These key strategies include:

- *Standards setting.* Learning goals should drive technology use. The initial task is to develop a clear set of goals, expectations, and criteria for student learning based on national and state educational standards. The school can then determine the types of technology that will support those goals (Gahala, 2001). The district will form a technology skills standards review group that includes representatives of the academic content departments, teachers, and the Educational Technology Department. This group will review, revise and develop educational technology standards for student achievement at grades 5, 8 and 12 (graduation). The content departments will ensure that all curriculum maps and guides incorporate strategies for technology integration.

- *Selection of appropriate content and applications.* Meta-analyses of computer-based instruction studies concluded that computer-assisted instruction and drill and practice software can significantly improve students' scores on standardized achievement tests (Kulik & Kulik, 1987; Kulik, 1994; Sivin-Kachala & Bialo, 2000), and in all major subject areas, preschool through higher education (Coley, 1997). In addition, research has found that mathematics courses that emphasize small-group processes, analyses or real world situations, the use of computational tools, and incorporate adaptive tutoring software into the curriculum can result in improved mathematics skills as measured by standardized assessments. (Koedinger, Anderson, Hadley & Mark, 1997). However, many teachers find it difficult to find and use appropriate software for instruction, and need guidance in locating software and Internet sites to support learning goals (Glenn, 1997). Therefore, the district content departments, site teachers and administrators, and the Educational Technology Department will collaboratively review and recommend software and online tools that can be used to support learning for students who are below grade level in literacy or in math, and for students who need assistance developing English language proficiency.

- *Coaching and mentoring.* Providing classroom-embedded mentoring, tutoring or follow-up activities is among the most effective methods of technology training, and avoids the problem of having to ask teachers for additional time outside the school day (Corcoran, 1995; Gahala, 2001). Teachers are more likely to apply new instructional strategies if they receive feedback and support while trying the new strategies in their classrooms (Gahala, 2001). Teachers who engage in collaborative planning and sharing of instructional strategies with other teachers most frequently demonstrate effective use of computers in the classroom (Becker & Riel, 2000).

  Teachers learn best when engaged in meaningful projects that relate to their own classrooms (Gahala, 2001). They need long-term professional development to adapt and infuse curricula with technology (Wetzel, 2001a, 2001b; Wetzel, Zambo, Buss & Padgett, 2001). Individual tutoring, peer coaching, collaboration, networking and mentoring have been used successfully over extended periods to help teachers at all levels of technology implementation develop technology applications that promote engaged learning (Gahala, 2000l; Ike, 1997; Mckenzie, 1994; Miller, 1998; Norton & Gonzales, 1998; Poole & Moran, 1009; Saye, 1998; Tenbusch, 1998; Yocam, 1996). Mentors who can help teachers adapt technology applications to their classroom needs are important to the success of innovative uses of technology (Zhao, Pugh, Sheldon & Byers, 2002); considerable time for collaborative learning and practice is required for teachers to gain confidence in using technology (Coley, Crader & Engel, 1997). Strudler (1994) stressed the need for a technology coordinator at the school site who can serve as a mentor or "translator" or technology applications and instructional integration for teachers. Therefore, SDUSD will identify key teachers who are academic leaders at the school sites, and will train them to serve as i21 Lead Technology Teachers to help build the technology use and integration capacity of the teachers at their school site.

- *Curriculum development integrated with staff development.* There is significant evidence that the learning and sustaining of new instructional approaches are directly connected to the degree that teachers are engaged in planning and evaluating classroom instruction (Cradler, 2002; Calhorn, 2002). This model of on-going professional development focused on continuous improvement (called Action Research) will be utilized to drive the integration of technology that ultimately will improve student learning. The Educational Technology Department will provide intensive training and support to the teachers at the district's new schools, to prepare them to use the technology resources designed into their school facilities and to integrate them into their teaching. The Educational Technology Department will work closely with the Beginning Teacher Support and Assessment (BTSA) induction program to help prepare new teachers to utilize effective technology in their content area to support student learning and for their own professional development.

*Professional Development. Although virtually every sc*hool in the United States has access to the Internet, computers usually are not a central part of the learning experience (Levin & Arafeh, 2002). The 2004 National Education Technology Plan concluded that the problem does not result from a lack of funds, but results more from a lack of adequate training and lack of understanding of how computers can be used to enrich the learning experience (U.S. Department of Education, 2004).

In their review of over 300 studies of technology use, Sivin-Kachala & Bialo (2000) concluded that teacher training was the most significant factor influencing the effective use of educational technology to improve student achievement. Wenglinksy (1998) found that students whose teachers received professional development on computers showed gains in math scores of up to 13 weeks above grade level. The integration of technology into curriculum and instruction requires professional development that will result in improving student learning (Cradler, McNabb, Freeman, Burchett, 2002).

Successful implementation of the SDUSD Educational Technology Strategic Plan will require a fundamental change in teacher beliefs, attitudes, and instruction. Most teachers have not experienced the kind of teaching with technology and inquiry that they are now being asked to do. Research on how effective change occurs in educational settings has found that change occurs through active engagement with new ideas, understandings, and real-life experiences (Fullan, 1991, 1993). In addition, Elmore (2000, 2002) showed that the practice of improvement must make the connection between teaching practice and student learning more clear and direct. New ideas and learning need to be connected through the context of specific curriculum content and specific instructional problems.

The integration of technology into curriculum and instruction requires professional development that will result in the highest probability of improving student learning (Cradler, McNabb, Freeman, Burchett, 2002). There is significant evidence that the learning and sustaining of new instructional approaches are directly connected to the degree that teachers are engaged in planning and evaluating classroom instruction. This model of on-going professional development focused on continuous improvement is often called action *research* (Cradler, 2002; Calhoun, 2002). Teachers need opportunities to experiment and conduct action research using technology within the context of specific content (U.S. Department of Education, 2001). Teachers engaged

in collaborative planning and sharing of instructional strategies more effectively use technology in the classroom (Becker and Riel (2002). When teachers receive a project-based approach to staff development, they in turn apply project-based teaching principles to their own teaching (Cradler & Crader, 2002).

When teachers are learning to integrate technology into their classrooms, the most important staff development features include opportunities to explore, reflect, collaborate with peers, work on authentic learning tasks, and engage in active, hands-on learning (Kelley & Ringstaff, 2002; Schacter, 1999). When teachers develop and implement personalized plans for the integration of technology into the curriculum, there were greater increases in student learning and sustained infusion of technology into instruction (Cradler, 2002a).

The SDUSD Educational Technology Strategic Plan focuses staff development on the instructional strategies that teachers use in the classroom. The i21Lead Technology Teachers will provide support and guidance to teachers as they apply what they learn to their teaching.

Education Technology Models and Strategies. The Educational Technology planning group reviewed a wide range of education technology models, identified which components of each model would or would not be feasible in San Diego City Schools (a very large school district with very limited resources), and used the components that the group deemed most feasible to develop the strategies included in this Plan. Education technology models and strategies that were reviewed include:

- *The Total Information Management System* (TIM) implemented by the Poway Unified School District in San Diego County and highlighted in the National Education Technology Plan (2004). This system includes a data warehouse that pulls relevant data from the student information system, human resources, special education, student assessment, and delivers up-to-date, on-command information to the teacher. It provides profiles of the students within a class, including current and historical data and contact information for the student and parents. The system also provides ready email links to other teachers. Teachers can use the data provided by the system to drive instructional practice. The SDUSD Educational Technology Strategic Plan includes a significant focus and investment in developing a student information system (with data warehouse) that will provide this kind of information for teachers. The SDUSD plan includes professional development to help teachers learn how to access the system and use the data obtained to impact instruction and student achievement.

- *The Curriculum Technology Integration Plan* (Cradler & Cradler, 2000), which includes a process for continually incorporating research findings into instructional strategies and curriculum planning. CTIP is an action-research process that supports continuous assessment at the classroom, school or district level followed by modifications of the instructional setting as needed. Features of the CTIP model include: defining standards-based objectives for learners; defining specific tasks students will be doing and the interactions between students, technology and teachers; describing the materials and equipment needed, and where and how long the activities will be; identifying assessments to evaluate student work; and identifying a process for informing students, other teachers,

parents and administrators of the extent to which the learning standards are reached or exceeded. The SDUSD Educational Technology Strategic Plan has adopted components of the CTIP model, including its focus on technology standards to create learning objectives for students.

- *The Apple Classroom of Tomorrow* model (Dwyer, Ringstaff & Sandholtz, 1991), which identifies five general phases of technology implementation:
  (1) Entry phase, in which technology is first introduced;
  (2) Adoption phase, in which technology is integrated into the traditional classroom (traditional lecture and textbook teaching methods still predominate) and with little change in student achievement;
  (3) Adaptation phase, in which traditional teaching methods are consistently supported with computer activities (particularly the use of office productivity software), resulting in increased efficiency in the classroom;
  (4) Appropriation phase, which hinges on each teacher's personal mastery (appropriation) of the technology. This phase results in more innovative instructional strategies, marked by team teaching and interdisciplinary project-based instruction.
  (5) Invention phase, in which teachers are willing to experiment and change, and view learning as an active, creative and social interactive process.

  The SDUSD Education Technology planning team agreed that most district teachers are in the adoption and adaptation phases of this model. The district's Educational Technology Strategic Plan is designed to help teachers develop the personal mastery of and comfort with technology needed to help them advance to the appropriation and invention phases, resulting in improvements in student achievement.

SDUSD also reviewed a number of models described in the National Education Technology Plan (2004) that, although effective in other school districts, were not considered by the planning team to be feasible for adoption at this time. The size of the district would make some models difficult to adopt (for example, a model that abolishes grade levels and instead focuses on individual learning plans for each student, as adopted by the Chugach School District). The availability of financial resources restricts the SDUSD's ability to implement components of other model programs, including those that supply every student with their own computer (Henrico County, Virginia) and those that provide students with home access to computers and the Internet (eSPARC, a regional technology program of the Pennsylvania Department of Education).

The SDUSD planning team reviewed with great interest those models that utilize distance learning for student instruction and professional development (the Florida Virtual School, the West Virginia Virtual School, and Louisiana's Online Professional Development program). The SDUSD Educational Technology Strategic Plan incorporates online teacher and staff training in its professional development program. The development of the district technology infrastructure described in the district Educational Technology Strategic Plan will provide the foundation needed for the district to implement more distance learning strategies in the future.

The Implementation Process. SDUSD recognizes that implementation of the Educational Technology Strategic Plan requires substantial organizational change. The successful implementation of the plan will require that individual teachers, staff and administrators change their accustomed work practices and procedures. To understand and predict the likely progression of this change, the Educational Technology Workgroup reviewed research on the Technology Adoption Lifecycle, a model of the adoption of new technology in organizations.

First developed in 1957 at Iowa State College, the original purpose of the Technology Adoption Lifecycle was to track farmer's purchases of hybrid seed corn. Everett Rogers broadened the use of the model in his 1962 book *Diffusion of Innovations* (fifth edition, Free Press, 2003), in which he argued that people can be classified into five categories, according to when they first begin to use a new idea. People in an organization also fit into these five categories in regards to their adoption of technology (Abers, 2004; Moore, 1991). The five categories include:

1. Innovators. Making up 2.5% of the population, innovators are daring, rash and risky. They are technology-savvy visionaries who are eager to try new ideas, undaunted by complexity and risk, and willing to make organizational changes. They are able to cope with a high level of uncertainty. The innovator plays a gatekeeping role in the flow of new ideas into a system.

2. Early Adopters. Making up 13.5% of the population, the early adopter is the opinion leader who often serves as a role model for others. They are future-focused, competitive, and willing to make organizational changes. Early adopters are more integrated into society than the innovators. The early adopter decreases uncertainty about a new idea by adopting it, and then conveying his or her evaluation of the innovation to others in the organization through interpersonal networks.

3. Early Majority. The early majority makes up 34% of the population, and will adopt new ideas just before the average member of a system. People in the early majority are pragmatists who believe that technology helps improve productivity. They generally require complete systems of hardware, software, associated support, and educational resources.

4. Late Majority. Making up another 34% of the population, members of the late majority adopt new ideas just after the average member of a system. They usually are conformists who feel that they must adopt a new technology because everyone else is doing so, and because they do not want to be left behind. Adoption may be both an economic necessity for the late majority, and the result of increasing network pressures from peers.

5. Traditionalists. The final 16% of the population generally have low tolerance for risk, and are the last in a social system to adopt an innovation. They often are suspicious of innovations and change agents, and their innovation-decision process is relatively lengthy.

Although the Technology Adoption Lifecycle tends to follow the typical bell curve that describes populations, Moore (1991) argued that, with emerging technologies, the rate of diffusion is not

continuous. Instead, he described a "chasm" between the early adopters and the early majority. This chasm results in part from a difference in goals: while the early adopter wants to be among the first to implement technology change in their organization, the early majority is more interested in productivity improvements.

SDUSD has relied on this research on the diffusion of innovations to establish its objectives for technology implementation within the school district. In instances in which a teacher or staff member is responsible for choosing to implement technology (such as integrating technology into the curriculum), we estimate that 80% of the population (all but the traditionalists) will implement the technology within the five-year timeframe of the plan. Although the traditionalists make up 16% of the population in the theory of the diffusion of innovation, we expect that percentage to be higher in education. As U.S. Secretary of Education Rod Paige noted in 2004, "Education is the only business still debating the usefulness of technology. Schools remain unchanged for the most part, despite numerous reforms and increased investments in computers and networks." (U.S. Department of Education, 2004, p. 22).

In addition, the Technology Adoption Lifecycle research points out the need to recognize the potential chasm between the early adopters in the organization and the early majority. The Educational Technology Workgroup paid particular attention to those proposed innovations that, to date, less than 20% of the organization has adopted. This level of adoption suggests that SDUSD may be facing the diffusion chasm in these innovations, and must take appropriate steps to overcome the obstacles to the adoption of these technical innovations.

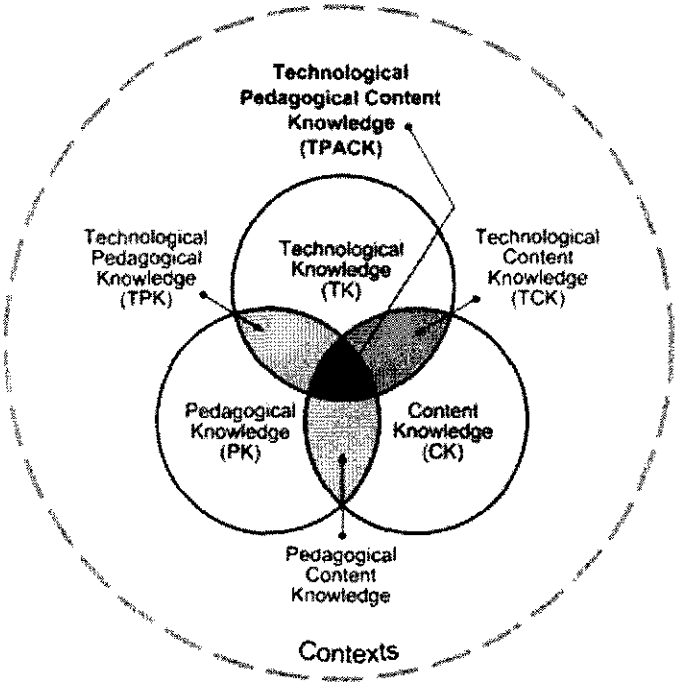
9.b. Description of the district's plans to use technology to extend or supplement the district's curriculum with rigorous academic courses and curricula, including distance learning technologies.

To succeed in school and their careers, students must develop both a deep knowledge of the core academic content areas identified by No Child Left Behind (English language arts, science, mathematics, geography, history, economics, world languages, government and civics, and arts) and the 21st century skills they will need to apply their knowledge, work with others and manage their lives (Kay, 2009). The SDUSD i21 Project is designed to create an engaging, interconnected 21st century learning environment that, coupled with ongoing teacher professional development:

- *creates opportunity for new learning practices that will support the teaching and learning of 21st century skill outcomes;*
- *allows all students to become expert learners in relevant, real world 21st century contexts (e.g., through project-based or other applied work);*
- *provides 21st century architectural and interior designs for group, team and individual learning, and;*
- *provides universal design in quality learning tools and technology resources.*
  (adapted from Partnership for 21st Century Skills)

None of these above points happen in isolation and without a guiding teacher who has received professional development designed to intersect three key areas of knowledge: content, pedagogy and technology.

Technological Pedagogical Content Knowledge (TPACK) is a model for *i21* Interactive Classroom professional development and is based on the work of Punya Mishra and Matthew J. Koehler from Michigan State University (Koehler & Mishra, 2008). TPACK attempts to capture some of the essential qualities of knowledge required by teachers for technology integration in their teaching, while addressing the complex, multifaceted and situated nature of teacher knowledge. At the heart of the TPACK framework, is the complex interplay of three primary forms of knowledge: Content (CK), Pedagogy (PK), and Technology (TK).



The TPACK approach goes beyond seeing these three knowledge bases in isolation. On the other hand, it emphasizes the new kinds of knowledge that lie at the intersections between them. Considering pedagogy and content together we get Pedagogical Content Knowledge (PCK), knowledge of pedagogy that is applicable to the teaching of specific content. Similarly, considering technology and content taken together, we get Technological Content Knowledge (TCK), the knowledge of the relationship between technology and content. At the intersection of technology and pedagogy, is Technological Pedagogical Knowledge (TPK), which emphasizes the existence, components and capabilities of various technologies as they are used in the settings of teaching and learning.

The intersection of all three elements is Technological Pedagogical Content Knowledge (TPACK). True technology integration involves understanding and negotiating the relationships between these three components of knowledge. A teacher capable of negotiating these relationships represents a form of expertise different from and greater than the knowledge of a disciplinary expert (say a mathematician or a historian), a technology expert (a computer scientist) and a pedagogical expert (an experienced educator). Effective technology integration for pedagogy around specific subject matter requires developing sensitivity to the dynamic, transactional relationship between all three components.

As we develop 21st century learning environments coupled with highly qualified teachers, we must also provide our students multiple ways to learn knowledge and skills.

Universal Design for Learning (UDL) principles assist educators to customize their teaching for individual differences in each of the following three brain networks (CAST, 2009):

1. **Multiple means of representation** to give learners various ways of acquiring information and knowledge.
2. **Multiple means of expression** to provide learners alternatives for demonstrating what they know.
3. **Multiple means of engagement** to tap into learners' interests, challenge them appropriately, and motivate them to learn.

The essential tools of the ***i21*** classroom include the pairing of Interactive White Board (IWB) technology with student computers (Netbooks) to increase the ability to teach and to optimize student access and engagement. These tools allow the teacher to configure the learning environment according to the context of the student-centric work at hand to meet state standards and learn 21st Century skills as thinkers, creators, designers and builders (Marzano, 2009).

SDUSD's successful Enhancing Science Education Through Technology ($E^{S}ETT$) Initiative is a research-based program for students. Initially pilot tested at two district middle schools in the 2004-05 academic year, the $E^{S}ETT$ Initiative was then expanded with the support of EETT competitive grants to another twenty-six district middle schools that serve low-income and diverse students. Over a two-year period, teachers participating in the $E^{S}ETT$ program demonstrated much greater increases in computer knowledge and skills than did all middle school teachers (a 22.4 percentage point gain vs. a 9.7 point gain). While all middle school teachers reported a 48.7% increase in using technology in the classroom (Standard 9) over the two years, $E^{S}ETT$ teachers reported an 82.3% increase. $E^{S}ETT$ teachers also reported a 73.5% increase in using technology to support student learning (Standard 16), compared to a 42.5% increase for all middle school teachers. In addition, $E^{S}ETT$ students overall demonstrated a much faster rate of growth in their gains in proficiency in science than did students across the district. Across the district, 69.5% more students scored proficient or advanced in science in 2008 than in 2006. At $E^{S}ETT$ schools (which started at a lower level of proficiency than average), the average growth rate was 167.6%.

When the Educational Technology Strategic Plan has been fully implemented, the district will be positioned to offer new technology supports for the delivery of rigorous academic courses and curricula. The ETSP includes the Integrated 21st Century (i21) Interactive Classroom Initiative as a primary strategy, which when completed, will provide learning environments in 7000+ district classrooms that will extend student learning beyond the four walls of the classroom. Through a district upgraded 10 GB backbone and expanded broadband capacity (100-500 MB) at school sites, curriculum, tools and resources will be available 24/7 anyplace anywhere. The expanded bandwidth capacity will provide access to other networks and systems providing rich content resources for teaching and learning on student computers (Netbooks). The Local Area Network infrastructure will provide access to the Digital California Project K-12 Statewide Network, will allow students and teachers to access content on the Internet and World Wide Web, and will allow distance learning to occur both internally within district classrooms and externally from remote locations.

On September 29, 2008, the SDUSD Board of Education approved the establishment of a virtual high school as an online diploma program in 2008-09 as part of a three year road map to provide students access to standard-based online learning courses and resources that support them in attaining their educational goals.

K-12 online learning and virtual schools are expanding rapidly. The market for K-12 online learning is estimated to be growing by 30% annually. There are 26 statewide or state-led virtual schools in the United States, and 42 states have significant supplemental online learning programs, significant full-time programs in which students take most or all of their courses online, or both. More than half (57%) of public secondary schools in the United States provide student access to online learning, and 72% of school districts with online learning plan to expand online offerings in the coming year (NCES, 2005). As of January 2007 there were 173 virtual charter schools serving 92,235 students in 18 states (NACOL, 2008). Total enrollment in K-12 online learning programs in 2007 is estimated to top one million students (NACOL, 2008). Data suggest that in about six years 10 percent of all courses will be computer-based, and by 2019 about 50 percent of courses will be delivered online (Christensen, Horn & Johnson, 2008).

The virtual school program represents another district strategy to reduce student dropout rates as well as benefit students and the district in the following ways:

- It expands educational opportunities for students by allowing them to continue their studies outside the traditional classroom. This can benefit at-risk students, dropouts, migrant students, young adults or pregnant, students from foster programs, and students who are homebound due to illness or injury.

- It enables students to take advanced placement, honors, or other advanced courses that are not available in their school due to lack of resources or qualified teachers.

- It offers more flexible alternative programs to meet the needs of more students and their families.

- It offers the potential to recapture ADA by attracting students who otherwise might attend a charter or non-district school.

- It addresses the needs of "millennial" students who have grown up with technology and use high-tech tools in their daily lives. Their use of technology often outpaces the more traditional modes of education offered in most classrooms, and threatens to make them ever more disconnected from their own education.

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E-RATE SUPPLEMENT

Financial Resources

The San Diego Unified School District will be able to secure the financial resources needed to achieve the educational technology goals outlined in this Educational Technology Strategic Plan, including professional development and training, software, and other related items that might not be eligible for E-Rate discounts.

SDUSD will utilize funding from a variety of sources to achieve its educational technology goals, including:

- General Fund, unrestricted state and local funding, used to cover the majority of the district's ongoing operations.

- Categorical funds, state and federal funds that are restricted in their use to specific purposes and programs, including educational technology funded under the No Child Left Behind Act

- Proposition S bond funds, passed by the voters in the City of San Diego in 2008, which provides funding for technology upgrades for the district's elementary schools and high schools

- Grant funds and donations of equipment and services from companies and organizations. SDUSD maintains a grants office that keep close watch on potential funding opportunities and that works with district staff to guide their development of competitive grant proposals. Educational Technology Department staff members have submitted a competitive ARRA EETT program proposal to help fund the implementation of this plan, particularly the professional development that is not funded through E-Rate.

In addition to the E-Rate program, SDUSD participates in a number of programs to reduce its costs for telecommunications and computers. These programs include:

- *CALNET Contract.* SDUSD participates in statewide contracts competitively bid and negotiated by the California Department of Governmental Services, which results in savings on telecommunications charges.

- *The California Teleconnect Fund,* operated by the California Public Utilities Commission, and which provides 50% discounts of most ongoing costs for telecommunications services provided by common carriers.

- *Western States Contracting Alliance*, cooperative multi-state contracting developed on behalf of public entities by the state purchasing directors from 15 western states, and which provides competitive prices on computers and peripheral products.

- The *California Multiple Awards Schedule* (CMAS), which provides contract terms and negotiated discounts on equipment and services through the California Department of Governmental Services.

- The *K12 Educational Technology Voucher Program* funds are available as a result of a settlement agreement in an antitrust case against Microsoft Corporation. Per the settlement agreement, a fund was established to offer vouchers to public schools that can be used to purchase computer hardware, software, or professional development.

Services and Products for Which E-Rate Funds are Being Requested

Telecommunications Services

The telecommunications network including phone and data circuits is the basis of the communication system, which is essential to achieving the goals that are mentioned above. The Schools and Library Division of the Federal Communications Commission has ruled that all telecommunication "...activities that are integral, immediate, and proximate to the education of students or the provision of library services to patrons" are eligible for E-rate discount. The funding for these services is paid from the General Fund, therefore the match will be paid from General Funds. The district discount is approximately 70%. These Telecommunications services include:

- Basic phone (POTS) and services listed below which support or supplement these services
    - alarm and elevator lines throughout the district
    - centrex lines
    - conferencing services
    - custom calling services
    - direct inward dialing
    - directory assistance services
    - FAX machine lines
    - homework hotline services
    - wire maintenance
    - local measured service
    - lease charges for trunk or transport lines

- Long Distance Service
    - PIC Change Charge

- Cell Service

- Paging Service

- ATM circuits
- DSL services
- Frame relay services
- Distance learning circuits
- Permanent virtual circuit (PVC's)
- WAN Services

Internet Access

Internet access charges are required and are paid out of the General Fund. The district discount is approximately 70% for these services. Internet Access Services required to achieve the goals of the Educational Technology Strategic Plan include:

- digital subscriber lines
- domain name registration
- email services
- email account fees
- firewall services
- GSP services
- web hosting
- wireless internet access

Internal Connections

Internal Connections are required to build the infrastructure for movement of data throughout the district. These services have a shared discount of 70% with individual school discounts higher or lower depending upon the Free/Reduced lunch counts at each school. The match for these services is approximately 10% to 30%, and is covered from a variety of funding sources including grant funds (EETT, private foundation grants etc). Proposition S bond funds also provide the match for many of these infrastructure projects.

Internal Connections required to achieve the goals of the Educational Technology Strategic Plan include:

- wireless access points
- antenna
- attendant consoles for PBX/Centrex
- active hardware cabinets
- internal wiring including conduit and raceway
- caching components
- CSU/DSU