California STEM Innovation Network Summit

EXECUTIVE SUMMARY

CALIFORNIA STEM INNOVATION NETWORK SUMMIT

CALIFORNIA STEM LEARNING NETWORK INITIATIVE

April 6-7, 2010

California Technology Institute
Pasadena, California

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INTRODUCTION

The California STEM Innovation (CSI) Network Summit was held at the California Institute of Technology on April 6-7, 2010. The CSI Summit was held in order to obtain input on an emerging plan for a statewide STEM education initiative. The Summit created a forum for leaders from public and private education organizations, business, foundations, and community-based organizations to engage in a dialogue regarding how to enhance and expand access to STEM Education for all students and California communities. Still to be identified are regional participants and ways of resourcing regional efforts.

The Summit was sponsored by the California STEM Learning Network (CSLNet) and the funders of CSLNet's planning process; the S.D. Bechtel Jr. Foundation, the Bill and Melinda Gates Foundation, and California Polytechnic State University, San Luis Obispo. Ethnographic research and analysis was in part conducted through support from the Center For Literacy & Inquiry In Networking Communities (LINC), University of California, Santa Barbara.

The information in this Executive Summary provides an overview of the participant discussions that were conducted during the two-day Summit. The report captures the range and focus of speakers and participants who engaged in dialogue on issues that addressed:

- The broad set of issues identified that can inform the design of the *California STEM Learning Network Long Range Strategic Plan (Strategic Plan)*
- The actions necessary to develop and implement the *Strategic Plan*
- The future steps that participants viewed as necessary to create a collaborative, sustainable STEM Initiative across all segments, organizations and groups in California

The main themes presented in the report that follows reflect a broad range of challenges defined by Summit participants that recognize both new actions required, as well as strategic use of existing resources within the state. In summary, there were six key areas identified by Summit participants:

- Build a network informed by broad and diverse stakeholder engagement through effective communication strategies that supports a collaborative framework for identifying and meeting multiple goals, and that links key individuals from business, government and education who can move the process forward.
- Identify and build upon innovative and creative models for action in ways that will regain California's economic and educational leadership in a global context.
- Define and integrate learning technologies for STEM education in ways that will keep pace with industry changes and the speed of technological innovation in the marketplace.
- Improve both teacher and student recruitment with special focus on important

challenges for engaging underrepresented populations in STEM education across the state.

- Concentrate on meeting student needs to improve the quality of education through strategies that integrate needs of teachers and school districts to support teaching in new ways.
- Educate the public, including elected officials, to build advocacy among parents, families and community leaders on the value of STEM to improve education, and necessary action to change current policy and practice in schools and classrooms.

PARTICIPANTS

Ninety-three people attended the Summit. Participants represented a broad spectrum of institutions and entities that can be grouped into four main categories: K-20 educational institutions, philanthropic organizations, businesses and community-based informal education groups.

As indicated in *Figure 1*, the range of organizations demonstrates that key groups are participating in the CSLNet Initiative. This figure also indicates that foundations and universities were the largest groups participating in the Summit. The largest groups within the education sector were the two public institutions of higher education, where the education of teachers is a major commitment.

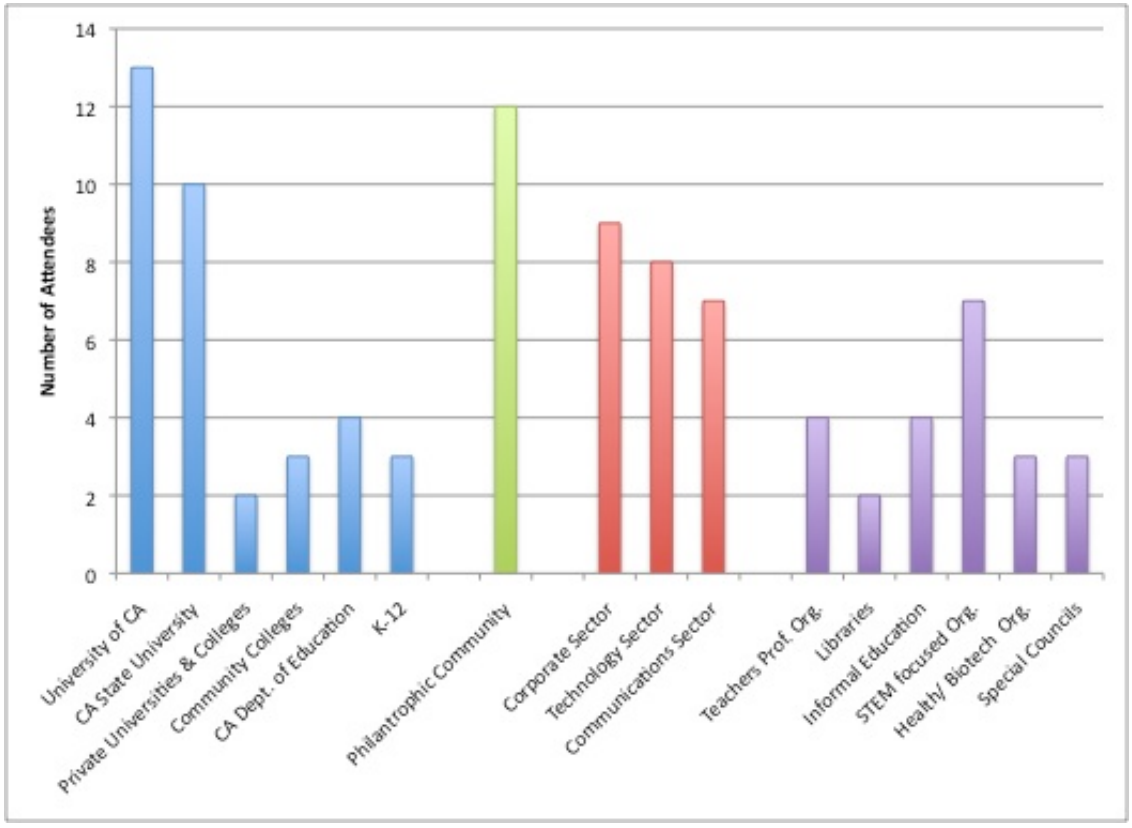

Figure 1: CSLNet Summit Participation by Stakeholder Category presents an analysis of the range of participants within each group at the Summit (*Report on California STEM Summit; California STEM Network Initiative, April, 2010*).

GOALS OF THE SUMMIT: THE OPENING MORNING

The Summit opened with a series of speakers (see *Figure 2: Summit Speakers and Topics*), each representing the different members of the CSLNet Project Team and different constituencies who were invited to frame the issues, to introduce the work of the CSLNet, and to propose questions to be considered in the Breakout Group Sessions. The speakers included:

- Jean-Lou Chameau, President, California Institute of Technology
- Jack O'Connell, State Superintendent of Public Instruction
- Susan Hackwood, Executive Director, California Council on Science and Technology
- Dennis Bartels, Executive Director, Exploratorium
- Stephanie Couch, Project Director, CSI Net
- Jim Hawley, Vice President, California Politics, and General Counsel, TechNet
- Warren Baker, President, California Polytechnic University
- Mohammad Qayoumi, President, California State University, East Bay
- Stacey Aldrich, California State Librarian, California State Library

These individuals have been integral to early development of the *Strategic Plan*. The CSLNet organizing team provided participants with a model for ways in which different communities could contribute to the *Strategic Plan*, and of the scope of the actions that would need to be taken to create a transformative and innovative network. Each speaker provided an overview of the issues that framed the task for their particular Breakout Group Session. Together the speakers created a visual and conceptual framework for developing the CSL Network Initiative.

FIGURE 2: Summit Speakers and Topics

Welcome and Introductions	Jean-Lou Chameau, Jack O'Connell
CSLNet History and Goals	Susan Hackwood
CSLNet Blueprint Design: Conditions, Constraints and Opportunities	Dennis Bartels
Key Elements of the Action Plan -- STEM Leadership Network	Stephanie Couch
STEM Policies and Advocacy	Jim Hawley
Teachers, Leaders and Mentors	Warren Baker
"The STEM," Technology and Technical Support	Dennis Bartels
The STEM Virtual Campus	Mohammad Qayoumi

BREAKOUT GROUPS AND PLENARY DISCUSSION

Six Breakout Sessions were conducted on April 6th to provide Summit participants with the opportunity to consider the CSLNet goals and to identify important issues and actions that will help to shape further refinements of the *Strategic Plan (*see *Figure 3: Breakout Session Leaders and Topics)*. On April 7th, a Plenary Session was conducted as an open forum for all participants to discuss the *Strategic Plan* as well as the necessary steps to implement the *Plan*, including commitments for partnering and collaborative action to support CSLNet goals.

Members of the CSLNet Planning Team were joined by other leaders who facilitated Breakout Sessions. In specific instances, leaders from different educational institutions strategically joined the breakout discussions to expand the scope of the topics. This leadership approach demonstrates the commitment of the CSLNet Team to broaden the range of institutional participation and leadership. Across all Breakout Groups, the corporate, foundation, higher education, and community-based organization worlds were represented. This reiterates the cross-institutional collaboration that was a theme of the morning sessions.

Figure 3: Breakout Session Leaders and Topics

1	2	3	4	5	6
STEM Leadership Network	***STEM Policies and Advocacy***	***Teachers, Leaders, and Mentors***	***"The Stem": Technology and Technical Support***	***The STEM Virtual Campus***	***STEM Out-of-School***
Patricia Sullivan Education Solutions Executive, IBM Corporation	Gerald R. Solomon Executive Director, Samueli Foundation	Jane Close Conoley Dean, UC Santa Barbara Warren Baker President, California Polytechnic State University	Dennis Bartels Executive Director, Exploratorium	Catherine McKenzie Director, Information Systems and Analysis CA Community College Chancellor's Office	Harold Levine Dean, UC Davis Stacey Aldrich California State Librarian

SUMMIT KEY THEMES AND ISSUES

Central to the discussion across groups was the concept of a design approach to developing the different dimensions of the STEM initiative. This approach is one that can engage multiple stakeholders to ensure that the CSLNet *Strategic Plan* meets local, state and global needs, integrates academic content, and involves business as well as communities to create pathways for both the students' academic development as well as preparation for the workforce in areas of specialization central to California's economy. Discussions highlighted the interdependence of education, student futures, career pathways, and the well being of the state. Issues of innovation and creativity also framed the discussion on important steps that California can take to regain and maintain its educational and economic leadership.

Critical aspects of the discussions pointed to barriers that must be addressed, including student and teacher recruitment. Across groups, participants asked not only what students need, but also what teachers and school systems need in order to teach in new ways. These discussions also raised questions about how to best educate and inform the public on a number of directions, including resources available, policy directions, and how the political and educational systems work to support and/or constrain what is available or afforded to students. Finally, participants identified key partners in business, government, and education willing to move the process forward.

Discussions also focused on funding sources, strategic partnerships, and discussions about who was not at the table. Participants noted the need for a multi-level process, and stressed the importance of creating a dynamic, flexible approach to support collaborative actions to achieve goals, and to address unanticipated issues that will arise as the Network engages in implementation of the *Strategic Plan*.

ETHNOGRAPHIC ANALYSIS

An in-depth analysis across all group discussions and speaker presentations was conducted to identify specific key themes and concepts raised by Summit participants. The analysis of the ethnographic transcriptions generated for each Breakout Session, Plenary Session, and speaker presentations produced a set of 12 key themes presented in *Figure 4: 12 Key CSLNet Summit Themes*.

Table A: Summary Overview of STEM Themes and Issues (see *Appendix*), presents concepts and actions organized by the 12 themes. The table also incorporates the key actions and issues of the *Strategic Plan Design Principles*, as well as the *Strategic Plan Intended Outcomes* from the draft of June 7, 2010.

The brief discussion that follows explores aspects of these themes and the specific issues that resonated across speakers and Summit participants. The last section of this report addresses the important connections between the *Strategic Plan* and priority issues identified by Summit participants.

Figure 4: 12 Key CSLNet Summit Themes	
1	Contributions of STEM for learning
2	Process of Design
3	STEM Resources
4	Policy Resources
5	Actions Needed: Programs
6	Actions of/for Teachers
7	Actions Needed: Directions to Support STEM Teacher Development
8	Actions Needed: Student Career Pathways
9	Actions Needed: Directions to Support a STEM Initiative
10	Action Needed: Proposed as Non-negotiables
11	Barriers and Challenges to Overcome in Order to Change Current Conditions
12	Research Needed

SUMMARY DISCUSSION OF STEM THEMES AND ISSUES

1) Contributions of STEM for Learning. Speakers took the lead in identifying the major benefits of STEM education and of the importance of developing "virtual learning" resources. Breakout Group 5 was the single group to address these issues and was the one directed to consider important goals for developing virtual learning resources. Ideas included the opportunity to support collaboration with technology (1.10.1), as well as to support faculty in designing course work (1.10.3). Two key benefits for students include the potential for creating the electronic or "e-portfolio" that would allow a student to track achievements and proficiencies (1.13), and to develop a flexible credit system that could track students that move across institutions (1.15). One challenge noted was the need to develop ways to entice students to engage in learning offered online (1.14). The Plenary discussion also identified the need to define what STEM literacy means, including defining important terminology that can translate across disciplines, and across stakeholders, to support a common framework for developing programs and learning resources (1.4).

2) Process of Design. The central theme of discussion across four of the six Breakout Groups (Groups 1-4) focused on the structure of communication and the potential to address important challenges that are presented by a broad and diverse stakeholder engagement in STEM education. Communicating to stakeholders about the importance of STEM education (2.3), and developing a comprehensive communication plan (2.10) was mirrored by ideas for gathering input, ensuring that the CSLNet process stays tuned in to stakeholders (2.16). Four speakers noted the importance of creating a unified voice for STEM education (2.18), which was echoed in the Plenary Session with a call to establish a STEM "movement" that embraces the passion and commitment to educational reform. This idea also linked with the concept that spokespersons and others with skills in marketing and outreach could also be tapped to help speak for the cause of educational reform (2.17.1). Breakout Group 2 raised the question of diversity and who participates in the planning and implementation design in terms of under-representative groups. The issue of diversity is a strong theme that was raised and considered by Summit participants as it relates to access to STEM resources for under-represented students.

3) STEM Resources. Six of the eight speakers stated that existing STEM resources should be utilized in various ways to build and expand needed learning resources and programs. Five of the Breakout Groups (2-6) as well as the Plenary Session, responded by suggesting that one function of the CSLNet is to provide a clearinghouse or other mechanisms to identify and vet STEM resources (3.4, 3.4.1, 3.4.2, 3.6), as well as to provide a process to make existing technologies accessible for users (3.5). The Plenary Session also offered the opportunity for others to talk about their programs and plans, including efforts to identify model programs and school sites, noting the importance of linking these in terms of people with knowledge and experience in program implementation (3.1.1).

4) Policy Resources. In the realm of policy, speakers identified two key goals that were further explored by Group 2 as well as the Plenary Group: first, to build strong advocates among our elected officials (4.1), and second, to consider the political clout to be gained through strong advocacy achieved through CSLNet actions (4.2, 4.2.1, 4.6.1, 4.6.2, 4.6.3). Communication issues also surfaced in Groups 2, 3, and 4 in considering the value of engaging across state and local policy (4.3) and in informing the public on policy processes, including how schools work (4.4.1) and how much influence school boards have over local policy, especially where the classroom is concerned (4.4.2).

5) Actions Needed: Programs. All six groups cited the need to identify model programs, agreeing with all eight speakers who also suggested that this is a high priority that the Network can address. Four of the eight speakers touched on issues related to the need for quality, scalable program development, with three noting the need for project-based learning. Groups 5 and 6 focused on benefits of linking Network goals with out-of-school and after-school programs and expectations that general STEM literacy could be attained through existing programs (5.7.1), and could also increase student interest in STEM fields (5.7.3) and potentially increase student interest in pursuing STEM fields in college (5.7.2). Two challenges noted by Group 5 concerned the idea that use of learning technologies should be carefully defined (5.8), and the need to design technology use in education in ways that keeps pace with industry changes and the speed of technological innovation in the marketplace (5.9).

6) Actions of/for Teachers. Four of the Breakout Groups (2-5) raised concerns about supporting a range of needs anticipated for the transition to STEM instruction. The central idea that teachers in the classroom need to be supported in order to achieve STEM education goals (6.3.1, 6.3.2, 6.5, 6.6, 6.7) also resonated with the Plenary Session comment from a teacher noting that nothing will change unless assessments are redesigned in ways that allow teachers the freedom to change the way they teach (see comment 11.1). Group 3 observed that one central challenge for schools, teachers and students concerns the tension across different cultural backgrounds and ways of interacting that must be addressed in order to achieve effective student learning. Group 5 also targeted issues that address the need to coordinate funding and development of coursework in ways that eliminate duplication of effort (6.8, 6.8.1, 6.8.2), and that also assure that STEM materials are being integrated into the classroom, going beyond simply bringing technology into the classroom (6.9.1).

7) Actions Needed: Directions to Support STEM Teacher Development. *Summit* speakers identified goals that concern quality teacher recruitment (7.2), retaining quality teachers (7.3), the importance of STEM professional development and providing mentoring opportunities for teachers by those in the science community (7.4). Group 3 also noted the importance of supporting teacher needs in order to attract high quality teachers. The Plenary Session discussion on the question of certification for STEM teachers resulted in the idea that California should be the first to develop standards for STEM teacher certification, adding this to the list of actions that could raise California's standing in education.

8) Actions Needed: Student Career Pathways. Speakers addressed the idea that multiple pathways for students will be essential to meet the growing need for those entering STEM fields, including the idea that that not all students will need to go to college to prepare for STEM careers, with Group 5

in agreement (8.2, 8.4). Group 4 and the Plenary Group also noted the need to excite students about STEM subjects by providing different types of learning experiences (8.6). Plenary discussion also considered ideas about career and college pathways developed through collaborative partnerships (8.10), with Group 5 noting the need to develop early student engagement in career pathways (8.7). A proposal was put forward during the Plenary discussion outlining ways for students to earn STEM recognition that also identified the use of e-portfolios to track cumulative accomplishments (8.12.1), and other forms of recognition including the opportunity for students to earn STEM badges (8.12.2), and to receive a STEM seal on their high school diploma at graduation (8.12.3). The importance of bringing parents into the STEM literate world was also included with the caveat that incentives for parents and families needs further exploration (8.12.4).

9) Actions Needed: Directions to Support a STEM Initiative. Five of the six Breakout Sessions considered a number of ideas and actions that can help to implement a STEM Initiative (Groups 1-5). The process of implementation will require that the Network focus on connecting people (9.2), including the business community (9.4), and in education, administrators and leaders in STEM fields were also noted as a high priority (9.11, 9.15), with the Plenary Group suggesting that school administrators should be STEM certified (9.12). Assessment issues were also raised by four of the six Breakout Groups (1,2,4,5), noting that assessments should be augmented with real world experiences at an early age in order to engage students in effective STEM learning (9.10). The Plenary Group suggested that Network goals should strive to achieve "world class" standing in order for California to meet its goals for global STEM recognition, noting that the U.S. is no longer among the leading nations in education.

10) Action Needed: Proposed Non-negotiables. Increasing the use of technology in education was identified by one speaker as a major factor in the transition to STEM education, with Group 2 in agreement, and Groups 2-4 recognizing a major challenge in achieving this goal will be ways to overcome the digital divide (10.1.1), and the need to increase access to technology for families in addition to students (10.1.2). Approaching the creation of STEM materials and programs should also be focused on meeting student needs (10.2), especially the needs of low-performing students (10.3). This last issue is one that touches on the need to provide access for under-represented students and communities, and will be discussed further in the last section on the *Strategic Plan Design Principles and Outcomes*. Group 5, whose topic was the virtual classroom, also posed the need to explore and evaluate hybrid models for STEM implementation (10.5).

11) Barriers and Challenges to Overcome in Order to Change Current Conditions. Developing early engagement for students is a high priority identified by one speaker as an important challenge, with Group 5 in agreement. Group 3 recognized understanding the dynamic global context of preparing students for STEM careers in considering critical dimensions of STEM teacher training programs (11.4). Group 3 also noted that some undergraduates view the teaching field as an undesirable career track to enter, and suggested that this must change in order to increase the number of students training to become teachers (11.3). The Plenary Group also focused on issues of defining workforce needs as a separate goal that will potentially lead to bringing new partners to the table such as local government (11.5), noting that municipal and county agencies will also grow in their need for STEM trained staff (11.5.2). Recognizing that a huge challenge will be to develop processes that are flexible (11.6) and that keep pace with the dynamic nature of STEM business and industry

(11.5.1) was also noted by Group 5 and also during Plenary Session discussion. Among the greatest challenges will be in overcoming barriers to recruiting from among diverse student populations, especially among those that are considered "high-need" under-represented students. Plenary discussion on these issues also highlighted the specific case of the Hispanic community, where college degrees are valued, but the lack of connections to STEM career professionals and role models in math and science will need special attention.

12) Research Needed. The final category, *Research Needed*, focuses on the importance of continuing research, not just evaluation or assessment, but exploring ways to make visible how and what students are learning (12.2), what technology is available in schools (12.6), how hybrid models are developed and used (12.8), and what students lack that would be needed to insure access and successful engagement (12.7). These dimensions of research are central to the systems approach proposed in the discussions across groups. They also reflect the conceptualization of a systems approach that contrasts with a focus on individuals alone. This will create what some argued is a *grounded approach* to design, implementation and assessment (12.5). Group 5 identified research into processes for scalability of programs. One issue identified by the Plenary Group suggested that STEM literacy for families, and especially for parents, should also be explored and incorporated into the framework for the transition to STEM education (12.9).

SUMMIT THEMES AND THE CSLNET LONG RANGE STRATEGIC PLAN: NEXT STEPS

The Summit themes and issues presented in *Table A*, can also be considered in terms of the *Long Range Strategic Plan* (June 7, 2010), to consider the ways in which the *5 Design Principles for the STEM Initiative* (p.8) and the proposed six outcomes (p.4) are reflected in the concepts and potential actions identified by Summit participants. These two components of the *Strategic Plan* are presented in summary form in *Table B: Summary of CSLNet 5 Design Principles,* and in *Table C: Summary Overview of the CSLNet Summit Themes that Address the Strategic Plan Intended Outcomes*.

Gaining a snapshot view of thematic areas of discussion across the two-day Summit that directly link with the *Strategic Plan* provides the opportunity to consider current understanding and perceptions about key goals identified in the *Strategic Plan*. Utilizing the feedback gained from the Summit discussions can also inform regional efforts to guide initial planning and design of locally based, collaborative processes that will take shape in future work as part of the *Strategic Plan* implementation process.

Table C shows a comparison of Summit themes and *Strategic Plan Intended Outcomes*. The table presents a spread across the six *Intended Outcomes* ranging from two to five of the 12 Summit themes. *Outcome 1* and *Outcome 3* were addressed in five of the 12 Summit themes, indicating the highest level of interest expressed during the Summit in addressing STEM education and learning opportunities for all K-14 students including focus on creating multiple career pathways for students, and overcoming a range of challenges that include STEM teacher training, and developing programs that keep pace with technological advancements. *Outcomes 2, 4 and 5* with three each, ranked next highest, demonstrating that Summit discussions addressed initial exploration of the "learner-centric" approach to creating STEM education in ways that focus on student needs, that can increase interest in STEM, and assure that teachers are prepared to guide students in attaining STEM proficiencies. *Outcome 6* with two issues addressed, ranked lowest of the six outcomes. This suggests that Summit participants may consider the need to advocate for STEM as a later component of the effort and last on the list of ideas that are considered essential for implementing STEM education.

Table C also shows that Summit theme 9, *Directions to Support a STEM Initiative (see Table A),* linked with four of the six *Outcomes* (*1, 2, 3,* and *4)*, indicating that Summit participants did consider important actions for overall STEM implementation. Summit theme 5, *Actions Needed: Programs,* ranked next with three of the six outcomes addressed, which aligns with the fact that all program speakers and all the

TABLE B: Summary of the CSLNet 5 Design Principles*	
DP1	**Year-Round Access to STEM Education for All K-14 Students**
1A	Offer STEM K-14 learning opportunities year-round through in-school and out-of school programs
1B	Offer STEM K-14 learning opportunities to all students, with emphasis on access for underrepresented and high-need students
DP2	**Interdisciplinary STEM Teaching and Learning**
2A	STEM literacy can enhance the use of technology to explore real world problems and solutions
2B	STEM literacy can enhance student mastery of 21st century skills (critical thinking, problem solving, communication, creativity, innovation, collaboration, media literacy)
2C	STEM literacy can encourage students to utilize 21st century skills in a global context
DP3	**Statewide System of STEM Stakeholders and Partners**
3A	Link local, regional, statewide and out-of-state STEM networks to collaborate on developing a coordinated system of STEM learning opportunities
3B	Create an integrated STEM network system of regional and statewide “leads” or “hubs” to support collaborative action across stakeholders
3C	Serve as a knowledge network for innovative and evidence-based teaching, learning and leadership in science, technology, engineering and mathematics
3D	Deliver professional development and technical assistance using effective strategies and practices for STEM education
3E	Bring together elementary, middle school and high school teachers, informal educators, and higher education faculty, STEM oriented businesses and other partners to align and enrich educational opportunities, strengthen college and career pathways, and support for the ongoing development of digital literacies
3F	Develop higher education and business/industry partnerships for mentoring, internships, apprenticeships, and the fostering of college and career aspirations and a culture of success
DP4	**Innovation to Support and Engage in Partnered Action**
4A	Develop strategies to assure that schools and programs keep pace with dynamic changes in industry, technology, and the needs of society
4B	Develop student-centric course work and instruction that integrates innovative STEM learning experiences
4C	Utilize technology to support diverse opportunities for students to attain early college credit
4D	Prepare students for STEM mastery that can be assessed by both standardized and performance-based measures
DP5	**Total Quality Management Approach to Support STEM Program Scalability, Sustainability and Continuous Improvement**
5A	Develop STEM schools, programs and learning resources through collaborative public/private partnerships consisting of stakeholders in education, business and others with an expertise in STEM fields
5B	Design STEM resources to be useful, catalytic, sustainable, scalable and of high quality from the perspective of local users, as well as those across the network
5C	Utilize ethnographic research to evaluate resources, programs and processes to inform a continuous program improvement cycle and eliminate duplication
5D	Provide access for participating educators to related professional development through engagement in a STEM professional learning community

*See *California STEM Learning Network Long Range Strategic Plan,* June 7, 2010

TABLE C: Summary Overview of CSLNet Summit Themes that Address the Strategic Plan Intended Outcomes

	CSLNet STRATEGIC PLAN INTENDED OUTCOMES*	SUMMMIT KEY THEMES											
		Contributions of STEM for Learning	Process of Design	STEM Resources	Policy Resources	Actions Needed: Programs	Actions of/for Teachers	Directions to Support STEM Teacher Development	Student Career Pathways	Directions to Support a STEM Initiative	Proposed as Non-negotiables	Barriers and Challenges to Overcome in Order to Change Current	Research Needed
		1	2	3	4	5	6	7	8	9	10	11	12
1	Provide high quality STEM learning opportunities for all K-14 students both in and out of school					X				X	X	X	X
2	Build students' enthusiasm for STEM, and their knowledge and capacity to apply STEM to address real world challenges facing our daily lives					X			X	X			
3	Increase the number of students from diverse backgrounds that complete either a STEM certificate program or two year degree programs with the intent to transfer to four year colleges and universities to major in STEM fields					X			X	X	X	X	
4	Enhance students' ability to communicate and collaborate, leveraging technology and tools commonly used in STEM disciplines and study			X						X			X
5	Prepare educators through ongoing professional development opportunities to advance students' STEM learning in different contexts						X	X				X	
6	Generate and implement new knowledge about effective STEM education programs and practices		X		X								

*See *California STEM Learning Network Long Range Strategic Plan*, June 7, 2010

Breakout Groups pointed out the need to identify program examples (Table A: 5.10.4), and also proposed the idea that an important task to address includes identifying mechanisms to seek out and vet potential model programs (Table A: 3.4).

Of the five *Design Principles*, three encompassed ideas that were of high interest to Summit participants and included Design Principles 1, 3 and 5. *Table D: Summary of CSLNet Summit Themes that Address the Strategic Plan 5 Design Principles*, shows that *Design Principle (DP) 3* (*STEM Statewide System of Stakeholders and Partners*) was of highest interest with at least 11 of the 12 Summit issues addressing aspects of *DP3*. This is consistent with the fundamental approach to engaging a broad set of diverse stakeholders in collaboration and partnership building that is essential to the success of the CSLNet *Strategic Plan*, and which is a core component of the design for building the CSLNet initiative multi-level stakeholder process (2.7, 2.8.3, 9.1, 4.1, 10.4). The idea that the network should be more than institutional partnerships and should focus on connecting people and providing a forum for communication is also an important concept expressed by Summit participants (2.8.4, 2.10, 2.16, 2.17, 3.1.1, 4.3.1, 9.2)

DP1 (*Year-Round Access to STEM Education for All K-14 Students*), with 8 issues addressed, followed next in order of interest and links directly with expressed concern for overcoming barriers to recruiting students and teachers from under-represented groups (11.1, 11.1.3), and in stakeholder outreach to challenged communities (10.3). Another dimension of this to consider as the CSLNet process advances to regional action is to plan for outreach and engagement with diverse stakeholders among STEM professionals and community members who can participate directly in regional efforts to inform the CSLNet implementation plan from the perspective of under-represented groups and challenged communities (2.11). Summit participants also explored several aspects of out-of-school and after-school programs as a means to advance student interest in STEM fields (3.3, 3.4, 3.6, 4.4.3, 5.6, 5.7. 5.10). One thread of this discussion explored the current and future contributions of informal learning programs that are available through year-round institutions. While the year round opportunities were part of the informal program discussion, the proposition of shifting schools to a year-round system was not discussed formally.

DP5 (Total Quality Management Approach to Support STEM Program Scalability, Sustainability and Continuous Improvement), with 7 of the 12 issues addressed, reflects Summit participant interest in addressing scalability of successful models (5.1, 5.2, 2.8.2, 12.3), and in considering long-term planning for program development that will grow through systematic evaluation and program improvement (2.15, 6.8). Additional interest in identifying STEM expertise and in linking in with strong leaders from local to regional scales to help guide collaborative program and learning resource development was also identified by Summit participants as an important dimension of the CSLNet Initiative effort (2.4, 7.4, 9.15, 11.2, 12.2).

DP4 (*Innovation to Support and Engage in Partnered Action*), and *DP2* (*Interdisciplinary STEM Teaching and Learning*), ranked lowest as issues of interest, with 4 and 2 issues addressed, respectively. Both these *Design Principles* address broad goals that may not be perceived as immediate or essential "short-term" actions to initiate *Strategic Plan* implementation, and while essential to the overall set of goals for STEM education, attention to these concepts can be developed as the CSLNet process gains ground.

TABLE D: Summary Overview of CSLNet Summit Themes That Address Proposed Design Principles

CSLNet Design Principles*		SUMMIT KEY THEMES											
		Contributions of STEM for learning	Process of Design	STEM Resources	Policy Resources	Actions Needed: Programs	Actions of/for Teachers	Directions to Support STEM Teacher Development	Student Career Pathways	Directions to Support a STEM Initiative	Proposed as Non-negotiables	Barriers and Challenges to Overcome in Order to Change Current Conditions	Research Needed
		1	2	3	4	5	6	7	8	9	10	11	12
Design Principle 1: Year-round Access to STEM Education for All K-14 Students	1A			X	X	X				X		X	
	1B		X								X	X	X
Design Principle 2: Interdisciplinary STEM Teaching and Learning	2A	X											
	2B			X									
	2C	X											
Design Principle 3: STEM Statewide System of Stakeholders and Partners	3A		X		X	X				X			
	3B		X							X			
	3C		X				X			X	X		X
	3D							X				X	
	3E			X		X			X				
	3F					X		X	X	X			
	3G					X			X	X			
Design Principle 4: Innovation to Support and Engage in Partnered Action	4A					X				X			
	4B								X		X		
	4C												
	4D									X			
Design Principle 5: Total Quality Management Approach to Support STEM Program Scalability, Sustainability and Continuous Improvement	5A					X				X			
	5B					X	X						X
	5C		X										
	5D						X	X		X		X	X

*See *California STEM Learning Network Long Range Strategic Plan,* June 7, 2010

CONCLUSION

This report provides a brief summary overview of key themes and issues that emerged from the CSLNet Initiative two-day summit of April 2010. The ethnographic approach to documenting the process, capturing knowledge and information contributed by Summit participants, and providing a summary review is intended to support the ongoing *Strategic Plan* implementation process. Providing systematic evaluation of the concepts and issues that are identified and addressed as the CSLNet Initiative process advances will assure that knowledge gained through collaborative efforts to launch STEM education in California also becomes a resource to be utilized by all who are engaged in this growing endeavor.

Appendix

Table A

Table A: Summary Overview of STEM Themes and Issues, California STEM Learning Network Initiative

TABLE A: SUMMARY OVERVIEW OF STEM THEMES AND ISSUES
CALIFORNIA STEM LEARNING NETWORK INIATIVE

	THEMES AND ISSUES	Strategic Plan		Morning Session								Mid-Day Session			Breakout Sessions							PLENARY SESSION DAY 2
		Design Principles	Intended Outcomes	Opening Remarks	CSI NET History and Goals	"The STEM": Technology and Tech Support	STEM Leadership Network	STEM Policies and Advocacy	Teachers, Leaders and Mentors	STEM Virtual Campus	STEM Out-of-School	National STEM Strategy	The "E" in STEM	California Perspective	STEM Leadership Network	STEM Policies and Advocacy	Teachers, Leaders and Mentors	"The STEM": Technology and Tech	The STEM Virtual Campus	STEM Out-of-School	
															1	2	3	4	5	6		
1.0	**CONTRIBUTIONS OF STEM FOR LEARNING**																					
1.1	STEM enhances learning	X									X	X	X	X								
1.2	Literacy enhances learning										X											
1.3	STEM Literacy is both support for and an outcome of STEM learning				X	X																
1.4	Need to define what STEM literacy means																					X
1.5	STEM literacy can enhance the use of technology to explore real world problems and solutions	X																				
1.6	STEM literacy can enhance student mastery of 21st century skills (critical thinking, problem solving, communication, creativity, innovation, collaboration, media literacy)	X																				
1.7	STEM literacy can encourage students to utilize 21st century skills in a global context	X																				X
1.8	A STEM literate society is innovative, creative and able to disseminate knowledge to future generations																					X
1.9	**Contributions of a virtual campus**																		X			
1.10	Virtual campus provides:																		X			
1.10.1	Asynchronous collaboration									X									X			
1.10.2	Archiving knowledge									X												
1.10.3	Providing environment for faculty to design courses for students	X								X												
1.11	Governor's e-textbook provides resources					X								X								
1.12	Open-source materials materials provide resources									X												
1.13	E-portfolio provides a resource for documenting student learning								X					X					X			X
1.14	How to draw students to research rich virtual campuses and classrooms																		X			
1.15	Create a credit system across segments that moves with student from one institution to another									X									X			
2.0	**PROCESS OF DESIGN**																					
2.1	Potential to revise plan in middle	X				X																
2.2	Systems (not individuals) at center of issues					X			X	X		X	X									
2.3	Informed electorate			X		X									X	X	X	X				

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															1	2	3	4	5	6		
2.4	Innovations are conceived and designed by informed individuals	X	X		X							X	X	X								
2.5	Can't be abstract thought but must be grounded thought																X					
2.6	Develop STEM schools, programs and learning resources through collaborative partnerships consisting of stakeholders in education, business, and others with an expertise in STEM fields	X																				
2.7	CA STEM Project's organization includes: leadership core, STEM council, and technology collaborative	X			X										X							
2.8	Role of CSL Network can serve multiple functions:																					X
2.8.1	Certify STEM learning programs; defining parameters on what is promoted for widespread use in STEM education																					X
2.8.2	Identify Best Practices and models of implementation, scaling and expermentation																					X
2.8.3	Raise the bar on network interaction to encourage dynamic and fluid connections (i.e., not old social engineering model); provide incentives for network participation to increase the value of engaging for stakeholders																					X
2.8.4	Provide a forum for communication across stakeholders																					X
2.9	Create an integrated STEM network system of regional and statewide "leads" or "hubs" to support collaborative action across stakeholders	X																				X
2.10	Develop a comprehensive communication plan	X	X												X		X					
2.11	Reach under-representative groups to participate in the design process		X	X				X					X			X						
2.12	California's new 3 R's: Rigor, Relevance, Relationship			X									X									
2.13	Questioning what California is attempting to achieve by 2025																X					
2.14	Set goals that also define action (e.g., all California students will be STEM literate by 2011; or double the number of STEM degrees by a future date)																					X
2.15	Coherent long-term	X								X		X	X									
2.16	Listen to state and local voices	X													X							
2.17	Establish STEM as a "movement" that builds on diverse social skills and collaborative action oriented to a vision to pursue change, transformation and reform																					X
2.17.1	Identify leaders who can be spokespersons																					X
2.18	Speak in unison				X		X	X	X													X

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															1	2	3	4	5	6	
2.2	Link local, regional, statewide and out-of-state STEM networks to collaborate on developing a coordinated system of STEM learning opportunities	x																			x
3.0	**STEM RESOURCES**																				
3.1	STEM resources exist			x	x	x			x	x	x										x
3.1.1	Chancellor's office is progressing with identifying models, people and school sites that offer validation and scaling up potential																				x
3.2	Technology backbone	x	x			x	x	x				x	x								
3.3	Potential for connections but currently lack connections					x				x						x			x	x	
3.4	Needs a clearinghouse																x		x	x	
3.4.1	Regional hub to gather resources																			x	x
3.4.2	Need model for vetting resources																			x	x
3.5	Making technologies that are already out there accessible (e.g. through clearinghouses)		x															x			
3.6	Create an inventory of organizations (out-of-school)			x																x	
3.7	Successful examples provided			x																	
3.7.1	Cal Tech/CalSci/Preschool				x						x										
3.7.2	Expansion of California partnership academies																				
3.7.3	Formal learning systems—e.g., science museums & others											x	x								
3.7.4	Finnish Model that values teaching as a profession.											x	x						x		
4.0	**POLICY RESOURCES**																				
4.1	Need to build federal and state policy maker support who have the power to make change and have the funding to enact change		x					x	x				x			x					x
4.2	Political clout from collaboration							x	x							x					
4.2.1	Build an "advocacy" network to take on specific issues (e.g., finding funding to address the digital divide, and other needs to support public access to technology)																				x
4.3	Participation across structural layers															x					
4.3.1	Listen to state and local voices	x														x					
4.4	Educating the public about:																x				
4.4.1	How schools work																x				
4.4.2	How much influence state and local school boards have over what occurs in classrooms																x				

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															1	2	3	4	5	6	
4.4.3	After-school, out-of-school programs																			X	
4.5	Locating where the opportunities are connected with federal policy, i.e. with the reauthorization of ESEA and America Competes Acts		X	X																	
4.6	Who should be at the decision maker table:			X												X					
4.6.1	(Diversity) people who understand the system			X												X					
4.6.2	People who have power to make change			X												X					
4.6.3	End users like Cisco, AT&T & GenTech			X												X					
5.0	**ACTIONS NEEDED: PROGRAMS**																				
5.1	Connecting good work	X				X				X			X								
5.2	Scaling up good stuff	X				X				X											
5.3	Current programs not scalable												X								
5.4	Project-based							X	X	X											
5.5	Accelerate online development											X	X								
5.6	Influential out-of-school internet use is compared to in-school																		X	X	
5.7	Consider outcomes for out-of-school or after-school programs:																			X	
5.7.1	General STEM literacy	X	X																	X	
5.7.2	College preparation	X	X																	X	
5.7.3	Increase student interest in STEM fields	X	X																	X	
5.8	Defining goals of technology	X																	X		
5.9	Consider speed of changing technologies	X																	X		
5.10	Defining program types:																				
5.10.1	After school																			X	
5.10.2	Out-of-school																			X	
5.10.3	Non-school																			X	
5.10.4	Need to identify program examples			X	X	X	X	X	X	X	X				X	X	X	X	X	X	
6.0	**ACTIONS OF/FOR TEACHERS**																				
6.1	Explore kinds of learning experiences that we want teacher educators to have	X	X													X		X			
6.2	Teachers are asked to teach in ways drastically different than how they learned [in undergraduate and K-12]																X				
6.3	Teacher educators needs support	X	X																		
6.3.1	Community members should support teachers																X				

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															1	2	3	4	5	6	
6.3.2	Paraprofessionals (e.g., aids, teaching assistants, parent volunteers) should support teachers																X				
6.4	The majority-minority disconnect between students, teachers and schools																X				
6.5	(Re) introducing Finnish Model and concern that society doesn't value teaching as a profession.																X				
6.6	Center on teacher needs																	X			
6.7	Need ways of tracking progress of teachers																X				
6.8	Eliminate duplication of efforts	X																			
6.8.1	How to fund																		X		
6.8.2	What to fund as far as content creation																		X		
6.9	Educational institutions become "integrators" of materials																		X		
6.9.1	Simply taping classrooms and digitizing materials is not enough																		X		
7.0	**ACTIONS NEEDED: DIRECTIONS TO SUPPORT STEM TEACHER DEVELOPMENT**																				
7.1	California should be the first to develop STEM teacher certification																				X
7.2	Recruiting high quality teachers			X					X												
7.3	Retaining high quality teachers								X												
7.4	Engaging teachers with scientific community/mentoring	X	X					X	X												
7.5	There needs to be support for the profession in order to make it attractive																X				
7.6	Renewing STEM teachers (professional development)	X	X		X				X	X			X			X					
8.0	**ACTIONS NEEDED: STUDENT CAREER PATHWAY**																				
8.1	Build Relationships with Industry	X	X	X																	
8.2	Re-visioning STEM as career	X	X					X				X									
8.3	Multiple pathways	X	X									X							X		
8.4	Not everyone goes to college			X				X	X										X		
8.5	Creating a plan of the academic components to build the next generation of the technical workforce											X									
8.6	Move the focus from curriculum to learning experiences that get students excited	X	X															X			X
8.6.1	Every student and teacher should develop a "personal learning network" to explore interests outside of school to foster excitement																				X

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															1	2	3	4	5	6		
8.7	Longer career paths	X	X																X			
8.8	Utilize technology to support diverse opportunities for students to attain early college credit	X																				
8.9	Offer STEM K-14 learning opportunities year-round through in-school and out-of school programs	X	X																			
8.10	Form collaborative partnerships among STEM educators, business and others to foster development of college/STEM career pathways	X																				X
8.11	STEM skills must include fluency in other languages and ability to collaborate across diverse cultures																					X
8.12	Students can earn STEM recognition																					X
8.12.1	E-Portfolio tracks real-time accomplishments and proficiencies																					X
8.12.2	Badge for STEM students																					X
8.12.3	STEM seal on the high school diploma																					X
8.12.4	Parents can also share in STEM accomplishments																					X
9.0	**ACTIONS NEEDED: DIRECTIONS TO SUPPORT A STEM INITIATIVE**																					
9.1	Need ideas for how to get process rolling					X																X
9.2	Need for human connectivity (not just network connectivity)	X																X				
9.3	Integrate STEM							X	X			X	X									
9.4	Industry-Education Integration	X																	X			
9.5	Develop higher education and business/industry partnerships for mentoring, internships, apprenticeships, and the fostering of college and career aspirations and a culture of success	X																				X
9.6	Extend STEM goals globally	X																X				
9.7	Need for virtual campus									X		X	X									
9.8	Need for measurement, assessment, and deliverables	X													X							
9.8.1	Need for measurement, assessment, and deliverables by philanthropic organizations															X						
9.8.2	Use of logic models and backwards mapping to accomplish goals															X						
9.9	Prepare students for STEM mastery that can be assessed by both standardized and performance-based measures	X																				
9.10	Starting real world experiences early as an engagement strategy rather than just an assessment at end of school	X	X															X	X			

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9.11	Leaders in the field and administration need to be part of the process.	X															X		X		X
9.12	Develop STEM competency credential for Administrators																				X
9.13	Develop strategies to assure that schools and programs keep pace with dynamic changes in industry, technology, and the needs of society	X																	X		X
9.14	Set goals that reflect "world class" achievement; the U.S. ranks low in education and California must exceed U.S. standing to regain leadership																				X
9.15	Connection to science community	X	X														X	X			
9.16	Connection to summer programs	X	X														X				
10.0	**ACTIONS NEEDED: PROPOSED AS NON-NEGOTIABLES**																				
10.1	Use technology all of the time					X										X					
10.1.1	Bridge the digital divide															X	X	X			
10.1.2	Reach all families															X	X	X			
10.1.3	Faculty at public institutions are lagging behind private online schools:																	X			
10.1.3.1	Variations in online models																	X			
10.1.3.2	Defining the population to be served	X	X															X			
10.2	Learner “centric”	X				X				X		X	X				X	X			X
10.3	Focus on lowest performing communities	X	X			X		X	X												X
10.4	Community centered to take advantage of local knowledge and expertise					X			X	X										X	
10.5	Exploring and evaluating hybrid models	X	X																X		
11.0	**BARRIERS AND CHALLENGES TO OVERCOME TO CHANGE CURRENT CONDITIONS**																				
11.1	Overcome barriers to recruiting diverse groups	X	X																		X
11.1.1	Find way to engage girls												X								
11.1.2	Develop early engagement for students	X	X										X						X		
11.1.3	Focus on underrepresented "high-need" students	X																			X
11.1.3.1	Hispanic students value college degree, but lack connections to math/science																				X
11.2	Ways of having teachers learn to design systems	X	X									X	X								
11.3	Undergraduates don’t go into teaching because it is “stagnate” and “isolating”																X				
11.4	Defining the "17 Grand Challenges" and how jobs will be driven by them (Book on engineering)															X					

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															1	2	3	4	5	6		
11.5	Must address both workforce development needs and also needs of the educational system																					X
11.5.1	Workforce needs are constantly "changing" and dynamic	X																				X
11.5.2	Include Government workforce in assessing needs and bringing in partners to support the STEM Initiative																					X
11.6	Any design has to be flexible																		X			
11.7	Serve as a knowledge network for innovation and evidence-based teaching, learning and leadership in science, technology, engineering and mathematics	X																				
11.8	Align and enrich STEM education to strengthen college and career pathways and support ongoing development of digital literacies	X																				
11.9	Develop STEM assessments that will allow teachers freedom to expand the classroom environment to support STEM learning																					X
12.0	**RESEARCH NEEDED**																					
12.1	How students learn												X									
12.2	Explore relationships among pedagogy, content and processes of learning	X															X					
12.3	Program processes to build scalable projects	X											X						X			
12.4	Examine local situated nature of programs and learning												X									
12.5	Must be grounded thought																X		X			
12.6	Evaluate state of STEM technology in schools		X															X				
12.7	Examine what students lack																		X			
12.8	Explore and evaluate hybrid models	X	X																X			
12.9	Explore STEM literacy issues for families and parents																					X