Teaching and Learning *21st Century Skills* in Maine

Prepared by:

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Maine Education Policy Research Institute
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EXECUTIVE SUMMARY

There is a growing consensus among education and business leaders that, in order to compete in today's technology rich and global economy, workers and students need to be able to solve problems that are complex, collaborate and communicate well with others, acquire new skills and information independently, and adapt to rapidly changing conditions. These broad cognitive and affective abilities are often referred to as *21st Century Skills* (NRC, 2011). Reflecting this state and national interest, the Maine Education Policy Research Institute (MEPRI) was asked by the Maine State Legislature's Education and Cultural Affairs Committee to examine how, to what extent, and how effectively Maine schools are teaching *21st Century Skills*.

This charge was addressed through a three-step approach. First, national and Maine policy documents and research reports addressing *21st Century Skills* were reviewed. Second, informal interviews were conducted with key stakeholders throughout Maine in order to explore the role and relevance of *21st Century Skills* to practitioners in the field. Finally, an online survey of Maine middle and high school principals was conducted to assess teaching practices and school policies that might support student learning of *21st Century Skills*.

National and State Perspectives. While the discussion of 21st Century Skills has been occurring for some time, it has more recently benefited from national reports that have provided research-based guidance on relevant skills and constructs. In particular, the National Research Council (NRC) has developed a conceptual framework linking specific *21st Century Skills* to cognitive, intra-personal and interpersonal domains. This roadmap can be particularly valuable to educators and policy makers interested in promoting continued development of programs and interventions aimed at promoting *21st Century Skills*.

Among education and business leaders in Maine, there exists considerable interest in the concept of *21st Century Skills*. These skills are referenced in various practice and policy documents from the Maine Department of Education and other education partners throughout the state. Nevertheless, an identified challenge is the need to develop a common framework or shared understanding regarding the specific skills and competencies relevant to Maine, as well as how these relate to other high profile state initiatives and programs, such as proficiency-based diplomas and Smarter Balanced assessment.

Stakeholder Insights. One possible approach noted by stakeholders would be to build on the Maine DOE Guiding Principles as an initial representation of the concepts related to *21st Century Skills* in Maine. The Guiding Principles have not been directly assessed in the past, and the transition to a proficiency based diploma is the first attempt to do so. This creates an opportunity to develop a common conceptualization for *21st Century Skills*, linked to an assessment system that can potentially be designed specifically to address the measurement of these skills. An initial step in this direction could be a crosswalk exercise matching concepts and definitions across existing initiatives and programs.

Principals survey. In terms of school policy and classroom practice, results from a limited survey of middle and high schools in Maine (n=23 schools) suggest that these schools generally

encourage teachers to address *21st Century Skills*, but do not require it. Among various *21st Century Skills*, survey results suggest that schools address communication and technology skills more directly and formally than other skill areas through methods such as required courses or graduation requirements. Possibly reflecting this, high schools also reported the most success in graduating students proficient in communication and technology *21st Century Skills*—with a considerably higher percentage of their students graduating with these skills, versus other areas. Finally, in terms of assessment, most *21st Century Skill* areas are only being assessed by 30-40% of the participating schools.

Conclusion. As documented in the full report, should the state decide to move forward targeting *21st Century Skills*, a combination of events and policies create a window of opportunity for doing so. The transition to a proficiency based diploma, the rollout of Common Core State Standards and Next Generation Science Standards, the launch of the Smarter Balanced Assessment, interest in *21st Century Skills* by both business and education leaders, and steadily growing conceptual cohesion of these constructs at the national level create a framework in which the development, teaching, and assessment of these skills could advance in a purposeful and meaningful manner.

Contents

INTRODUCTION: WHAT ARE *21ST CENTURY SKILLS*?

In order to compete in today's technology rich and global economy, stakeholders consistently agree that workers and students need to be able to solve problems that are complex, collaborate and communicate well with others, acquire new skills and information independently, and adapt to rapidly changing conditions. These broad cognitive and affective abilities are often referred to as *21st Century Skills* (NRC, 2011).

Many of the terms used to describe *21st Century Skills* are not necessarily unique to this century alone and are precisely the competencies that workers and students have always needed to be both competent and productive. In education, students continue to need to demonstrate mastery in reading, writing, and mathematics as well as the other core content subject areas taught in the traditional classroom. In the workforce, people continue to need to communicate and collaborate well with others and demonstrate positive personal behaviors like punctuality, ethics, and responsibility. The dimensions that have been added to the traditional notion of a "good" worker or a "good" student is the need for that individual to have significant comfort in the use of information and communication technologies and the ability to transfer and apply knowledge across disciplines. In addition, in the 21st century, one needs to be able to adapt, learn, and solve complex problems in an ever-changing and connected world.

> *"Twenty-first century competencies are a blend of cognitive, interpersonal, and intrapersonal characteristics that may support deeper learning and knowledge transfer. Cognitive competencies include critical thinking and innovation; interpersonal attributes include communication, collaboration, and responsibility; and intrapersonal traits include flexibility, initiative, and metacognition"*
> (National Research Council, 2014, p. 35).

Therefore, at the request of the Maine State Legislature's Education and Cultural Affairs Committee, the Maine Education Policy Research Institute (MEPRI) was asked to examine how, to what extent, and how effectively Maine schools are teaching *21st Century Skills*. This report addresses this in three ways. First, we review the definitions and conceptualization of *21st Century Skills* based on national and Maine policy documents and reports. We then summarize the results of informal interviews with key stakeholders throughout Maine that were designed to determine the role and relevance of *21st Century Skills* to practitioners in the field. Finally, we summarize the findings of an online survey of Maine middle and high school principals regarding teaching practices and school policies that might support student learning of *21st Century Skills*.

CONCEPTUALIZATION OF *21ST CENTURY SKILLS*

National Perspective

The National Research Council (NRC) has performed a considerable amount of work providing research based guidance to the field in response to the *21st Century Skills* movement. Specifically, the NRC has synthesized and refined the definitions of the skills and called for more research and funding to validate the constructs underpinning the skills. They have also began identifying what additional work will be needed to assess the teaching and learning of these skills in the context of national educational policy initiatives currently in development (e.g. Common Core State Standards and Next Generation Science Standards).

In the following section, we will focus on establishing an understanding of the skills. We will take a look at the range of definitions that have been put forth by different national stakeholder groups and we will also look at the types of definitions that have been put forth in Maine by state education leaders.

Over the past decade, stakeholders comprised of business leaders, government officials, researchers, and policy makers have developed working lists, definitions, and constructs related to these *21st Century Skills*. Many of the skills that populate various lists are not necessarily "new skills" in terms of what makes a productive worker, a strong member of a project team, or a competent high school or college student. However, the workplace of today has changed significantly compared to our society's agricultural and industrial past. This change can be attributed to the information technology revolution that has occurred in a span of a few decades as well as the globalization of the economy that has simultaneously expanded markets and increased competition for highly skilled employees. The *Committee on Defining Deeper Learning and 21st Century Skills* (NRC) articulates this point well:

> *"The committee views the various sets of terms associated with the 21st Century Skills label as reflecting important dimensions of human competence that have been valuable for many centuries, rather than skills that are suddenly new, unique, and valuable today. The important difference across time may lie in society's desire that all students attain levels of mastery—across multiple areas of skill and knowledge—that were previously unnecessary for individual success in education and the workplace. At the same time, the pervasive spread of digital technologies has increased the pace at which individuals communicate and exchange information, requiring competence in processing multiple forms of information to accomplish tasks that may be distributed across contexts that include home, school, the workplace, and social networks"*
> (National Research Council, 2012, p.3).

The five skills listed in Box 1 (adaptability, complex communication/social skills, nonroutine problem-solving skills, self-management/self-development, and systems thinking) were the product of a workshop held by NRC's Board of Science Education in 2007 and will serve as a starting point for discussing the skills in more detail. Subsequent national reports have also been

published by the NRC related to *21st Century Skills* (NRC, 2011; 2012; & 2014). This ongoing body of work is further refining the definitions of these skills and synthesizing the similarities among existing skill lists put forth by various groups.

Box 1: Preliminary Definitions of *21st Century Skills* (NRC, 2010, p.3)

1. **Adaptability:** The ability and willingness to cope with uncertain, new, and rapidly changing conditions on the job, including responding effectively to emergencies or crisis situations and learning new tasks, technologies, and procedures. Adaptability also includes handling work stress; adapting to different personalities, communication styles, and cultures; and physical adaptability to various indoor or outdoor work environments (Houston, 2007; Pulakos et al.,2000).
2. **Complex communication/social skills:** Skills in processing and interpreting both verbal and nonverbal information from others in order to respond appropriately. A skilled communicator is able to select key pieces of a complex idea to express in words, sounds, and images, in order to build shared understanding (Levy and Murnane, 2004). Skilled communicators negotiate positive outcomes with customers, subordinates, and superiors through social perceptiveness, persuasion, negotiation, instructing, and service orientation (Peterson et al., 1999).
3. **Nonroutine problem solving:** A skilled problem solver uses expert thinking to examine a broad span of information, recognize patterns, and narrow the information to reach a diagnosis of the problem. Moving beyond diagnosis to a solution requires knowledge of how the information is linked conceptually and involves metacognition—the ability to reflect on whether a problem-solving strategy is working and to switch to another strategy if it is not working (Levy and Murnane, 2004). It includes creativity to generate new and innovative solutions, integrating seemingly unrelated information, and entertaining possibilities that others may miss (Houston, 2007).
4. **Self-management/self-development:** The ability to work remotely, in virtual teams; to work autonomously; and to be self-motivating and self-monitoring. One aspect of self-management is the willingness and ability to acquire new information and skills related to work (Houston, 2007).
5. **Systems thinking:** The ability to understand how an entire system works; how an action, change, or malfunction in one part of the system affects the rest of the system; adopting a "big picture" perspective on work (Houston, 2007). It includes judgment and decision making, systems analysis, and systems evaluation as well as abstract reasoning about how the different elements of a work process interact (Peterson et al., 1999).

In 2012, the NRC published a report entitled, "*Education for Life and Work: Developing Transferable Knowledge and Skills in the 21st Century*." In this report terms frequently used to describe *21st Century Skills* were grouped into related clusters and those clusters in turn were grouped into three overarching domains (cognitive, intrapersonal, and interpersonal). In Table 1, a crosswalk that illustrates the domains, clusters, and skills is presented. Also included in the table is a column that lists the skills identified in the US Department of Labor/Employment and Training Administration's Occupational Information Network taxonomy or "O*NET". The far right column includes "main ability" and/or "personality factors" that originate from the field of psychology.

Table 1: Clusters of 21st Century Competencies (NRC, 2012, pgs. 32-34).

Domain	Cluster	Terms Used for 21st Century Skills	O*NET Skills	Main Ability or Personality Factor
COGNITIVE COMPETENCIES	Cognitive Processes and Strategies	Critical thinking, problem solving, analysis, reasoning/argumentation, interpretation, decision making, adaptive learning, executive function	System skills, process skills, complex problem-solving skills	fluid intelligence (Gf)
	Knowledge	Information literacy (research using evidence and recognizing bias in sources); information and communications technology literacy; oral and written communication; active listening	Content Skills	crystallized intelligence (Gc)
	Creativity	Creativity, innovation	Complex problem-solving skills (idea generation)	general retrieval ability (Gr)
INTRAPERSONAL COMPETENCIES	Intellectual Openness	Flexibility, adaptability, artistic and cultural appreciation, personal and social responsibility, (including cultural awareness and competence) appreciation for diversity, continuous learning, intellectual interest and curiosity	[none]	openness
	Work Ethic/ Conscientiousness	Initiative, self-direction, responsibility, perseverance, productivity, grit, Type 1 self-regulation (metacognitive skills, including forethought, performance, and self-reflection), professionalism/ethics, integrity, citizenship, career orientation	[none]	conscientiousness
	Positive Core Self-Evaluation	Type 2 self-regulation (self-monitoring, self-evaluation, self-reinforcement), physical and psychological health	[none]	emotional stability (opposite end of the continuum from neuroticism)
INTERPERSONAL COMPETENCIES	Teamwork and Collaboration	Communication, collaboration, teamwork, cooperation, coordination, interpersonal skills, empathy/perspective taking, trust, service orientation, conflict resolution, negotiation	Social skills	agreeableness
	Leadership	Leadership, responsibility, assertive communication, self-presentation, social influence with others	Social Skills (persuasion)	extroversion

Note: This table is based on reports that built on, synthesized, or analyzed previous work studying *21st Century Skills* (NRC, 2012). This includes the Association for Career and Technical Education; the Assessment and Teaching of *21st Century Skills* Project (ATC21s); the Education Policy Improvement Center; the William and Flora Hewlett Foundation; the Organization for Economic Co-operation and Development (OECD); the Secretary's Commission on Achieving Necessary Skills (SCANS), and O*NET (NRC, 2012).

When reviewing Table 1, it is noteworthy to mention that the NRC made a meaningful distinction between "competencies" and "skills":

> *"In contrast to a view of 21st Century Skills as general skills that can be applied to a range of different tasks in various academic, civic, workplace, or family contexts, the committee views 21st Century Skills as dimensions of expertise that are specific to—and intertwined with—knowledge within a particular domain of content and performance. To reflect our view that skills and knowledge are intertwined, we use the term 'competencies' rather than 'skills'" (NRC, 2012, p. 3).*

Noting the lack of definitive research on the "deeper learning" that is inherent to 21st Century Skills, the NRC has made several recommendations. For the cognitive domain they recommend that designers and developers of instructional material targeting deeper learning should have clearly defined learning goals and models of how learning is expected to develop, as well as assessments to measure student progress. For both the intra- and interpersonal domains, the NRC recommends funding agencies support programs targeting learning and knowledge transfer due to the limited number of empirical studies in this area. Finally, they recommend that designers and developers of curriculum, instruction, and assessment in problem solving and metacognition should use modeling and feedback techniques that highlight the ***processes*** of thinking rather than focusing exclusively on the ***products*** of thinking (NRC,2012).

Maine's Perspective on *21st Century Skills*

The introduction to the Maine State Board of Education's 2010 – 2015 Strategic Plan highlights the role that many envision for *21st Century Skills* in the future of Maine's economy.

> ***CALL TO ACTION:***
> ***Are our schools ready to prepare students for life in the 21st Century?***
> *A central goal of Pre K -12 education in Maine is that all students graduate from high school ready for college, career, citizenship, and life. Many Maine students do not graduate from high school with the education that the 21st Century demands. If our schools are not ready for the challenges and opportunities ahead, then our children cannot be. If our children are not ready, then they – and we – are destined to miss the great potential promises of the future. It will take all educational stakeholders working together to meet the urgent challenge of educating Maine students for the 21st Century. We can build on the strengths we have in Maine and ensure that all Maine students leave the educational system ready to compete with their counterparts across the globe for their place in the rapidly evolving global economy. They must graduate from high school ready for college, career, citizenship and life. The economic future of the whole State depends on their ability to do so. New high school graduates will go on to post-secondary education and find rewarding work locally in the global economy. As a result, the median income in Maine will rise to the midpoint of the New England states, the number of well-paid jobs will increase and poverty in Maine will decrease, and more young people will remain in the State (Maine State Board of Education, 2013, p.1)*

Reflecting this, *21st Century Skills* are referenced in many different places in Maine Department of Education (DOE) documents, including the "Glossary of Terms Related to Proficiency-Based Learning"; Maine DOE's Strategic Plan, "Education Evolving: Maine's Plan for Putting Learners First"; and the Maine Learning Results. For reference, extracts from several of these documents are provided on the following pages so that one can see how *21st Century Skills* are addressed in various forums, and the differences in how skills are conceptualized and defined.

For example, the clusters of skills that have been discussed previously in this report are reflected in the ***Maine Guiding Principles*** (see Figure 1).

Within the ***Maine Learning Results*** (http://www.maine.gov/education/standards.htm), *21st Century Skills* are also referenced multiple times in the following sections: "Summary"; "Career and Education Development"; "Mathematics"; "Science and Technology"; and "World". The "***Career and Education Development***" standards arguably have the most relevance to the aims of this report. In Figure 2 we provide the introduction and outline for the "*Career and Education Development*" standards with indicator labels, with the specific language from Standard B provided in Figure 3.

In addition, Table 2 is provided to enable the reader to compare the concepts included in these documents. We also include the domains of the skills that were used in the principals survey for this report to provide a comparison of the overlap and similarities of all of the terms that are essentially pointing to what are generally understood as *21st Century Skills*.

Figure 1: Maine Department of Education Guiding Principles

Part of the Maine Learning Results: Parameters for Essential Instruction

THE GUIDING PRINCIPLES – The knowledge and skills described in the Maine Department of Education Regulation 132 support Maine students in achieving the goals established in Maine's Guiding Principles. The Guiding Principles state that each Maine student must leave school as:

A. A clear and effective communicator who:
   1. Demonstrates organized and purposeful communication in English and at least one other language;
   2. Uses evidence and logic appropriately in communication;
   3. Adjusts communication based on the audience; and
   4. Uses a variety of modes of expression (spoken, written, and visual and performing including the use of technology to create and share the expressions);

B. A self-directed and lifelong learner who:
   1. Recognizes the need for information and locates and evaluates resources;
   2. Applies knowledge to set goals and make informed decisions;
   3. Applies knowledge in new contexts;
   4. Demonstrates initiative and independence;
   5. Demonstrates flexibility including the ability to learn, unlearn, and relearn;
   6. Demonstrates reliability and concern for quality; and
   7. Uses interpersonal skills to learn and work with individuals from diverse backgrounds;

C. A creative and practical problem solver who: [1995, c. 649, §1 (new).]
   1. Observes and evaluates situations to define problems;
   2. Frames questions, makes predictions, and designs data/information collection and analysis strategies;
   3. Identifies patterns, trends, and relationships that apply to solutions;
   4. Generates a variety of solutions, builds a case for a best response and critically evaluates the effectiveness of the response;
   5. Sees opportunities, finds resources, and seeks results;
   6. Uses information and technology to solve problems; and
   7. Perseveres in challenging situations;

D. A responsible and involved citizen who:
   1. Participates positively in the community and designs creative solutions to meet human needs and wants;
   2. Accepts responsibility for personal decisions and actions;
   3. Demonstrates ethical behavior and the moral courage to sustain it;
   4. Understands and respects diversity;
   5. Displays global awareness and economic and civic literacy; and
   6. Demonstrates awareness of personal and community health and wellness;

E. An integrative and informed thinker who:
   1. Gains and applies knowledge across disciplines and learning contexts and to real life situations with and without technology;
   2. Evaluates and synthesizes information from multiple sources;
   3. Applies ideas across disciplines; and
   4. Applies systems thinking to understand the interaction and influence of related parts on each other and on outcomes.

Retrieved from: http://www.maine.gov/doe/proficiency/standards/guiding-principles.html

Table 2: *21st Century Skills* Language used in Maine Education leadership documents and the principals survey

Maine DOE Strategic Plan: "Education Evolving: Maine's Plan for Putting Learners First"	**Maine State Board of Education Guiding Principles (Strategic Plan 2010 – 2015)**	**Maine DOE Guiding Principles *Each Maine student must leave school as:***	**Domains in the MEPRI Principals Survey Administered for this Report**
1) Critical thinking and problem solving 2) Collaboration 3) Agility and adaptability 4) Initiative and entrepreneurialism 5) Effective oral and written communication 6) Accessing and analyzing information 7) Curiosity and imagination	1) All students can become lifelong learners. 2) All students, in meeting their potential, respond best to challenging expectations. 3) All students learn best in a well-constructed, safe environment in which they feel respected. 4) All students need educators who have been provided ongoing support and professional development to improve student achievement. 5) All students can attain maximum performance with a broad constituency of support. 6) All students require a quality education system which is essential for a successful democracy, and a vibrant economy.	1) A clear and effective communicator 2) A self-directed and lifelong learner 3) A creative and practical problem solver 4) A responsible and involved citizen 5) An integrative and informed thinker	1) Critical Thinking 2) Collaboration 3) Communication 4) Creativity & Innovation 5) Self-Direction 6) Making Global Connections 7) Making Local Connections 8) Using Technology as a Tool for Learning

Figure 2: Career and Education Development Standards, Maine Learning Results

CAREER AND EDUCATION DEVELOPMENT

Career and education development helps all students gain the knowledge, skills, and behaviors to interact with others, set goals, and make decisions related to career, college, and citizenship. Success in the twenty-first century differs significantly from the twentieth century model. Lifelong employment with a single employer has virtually vanished. Success today is increasingly dependent on a sophisticated knowledge base, the ability to enhance that base, to collaborate, to self-direct, and to adapt to change. Individuals will need to adapt their goals and decisions over their lifetimes in relation to school and workplace requirements and personal responsibilities. As part of career and education development, students must see education as a continuous lifelong process that will prepare them for and make them adaptable in a complex, information-rich, and fast-changing world.

> Embed Career and Education Development Instruction - The knowledge, skills, and behaviors outlined in Career and Education Development Standards are essential for all students. It is important that the knowledge, skills, and behaviors of career and education development be connected to the context of schools, career, and community. Although stand- alone courses in career and education development may serve to help students focus on career, college, and citizenship goal, all content areas need to embed career and educations standards to enable students to make the connection between content areas schoolwork, and career, college, and citizenship goals. School administrative units should determine the most appropriate content areas and school settings in which to embed these standards.

OUTLINE OF CAREER AND EDUCATION DEVELOPMENT STANDARDS AND PERFORMANCE INDICATOR LABELS

A. Learning about Self-Knowledge and Interpersonal Relationships
   1. Self-Knowledge and Self-Concept
   2. Beliefs and Behaviors that Lead to Success
   3. Interpersonal Skills
   4. Career and Life Roles

B. Learning About and Exploring Education, Career, and Life Roles
   1. Relationships among Learning, Work, the Community, and the Global Economy
   2. Skills for Individual/Personal Success in the 21st Century
   3. Education and Career Information

C. Learning to Make Decisions, Plan and Create Opportunities, and Make Meaningful Contributions
   1. The Planning Process
   2. Decision-Making
   3. Influences on Decision-Making
   4. Societal Needs and Changes that Influence Workplace Success

Retrieved from The Maine Learning Results: http://www.maine.gov/doe/careerandeducation/standards/index.html

Figure 3: Career and Education Development Standard B

B. Learning about and Exploring Education and *Career and Life Roles*: Students identify, demonstrate, analyze, and evaluate:

- An understanding of the relationship between education and work, especially how learning new skills and educational achievement lead to increased work options and success with personal career and life goals; and
- The ability to identify and use education and career information for lifelong learning to achieve success.

Although the performance indicators of Career and Education Development identify specific levels of performance at each grade span for the purpose of assessment, students at all grade spans should have opportunities to identify, demonstrate, analyze and evaluate.

B1 Relationships Among Learning, Work, the Community, and the Global Economy

Performance Indicators & Descriptors			
PK-2	3-5	6-8	9-Diploma
Students identify and demonstrate study habits, attitudes, and behaviors that lead to successful relationships.	Students explain how success in school supports their ability to positively contribute to school, home, and community.	Students explain how educational achievement and lifelong learning lead to increased participation in school, work, community, and the world.	Students evaluate strategies for improving educational achievement, increasing participation as an involved citizen, and increasing work options and earning potential in a 21st century global economy.

Figure 3 (continued): Career and Education Development Standard B

B2 Skills for Individual/Personal Success in the 21st Century

Performance Indicators & Descriptors			
PK-2	3-5	6-8	9-Diploma
Students identify *literacy* and *numeracy* as skills that lead to improvement and success in the classroom.	Students identify and describe skills that lead to student learning and success in the classroom, and the achievement of schoolwork, career, and personal life goals. a. Literacy skills b. *Numeracy* c. *Critical thinking* skills d. *Information and communication technology (ICT) literacy* e. *Interpersonal skills* f. Other academic skills and knowledge	Students analyze their skills in relation to those that lead to learning and success in the classroom, and the achievement of schoolwork, career, and personal life goals. a. Literacy skills b. *Numeracy* c. *Critical thinking* skills d. *Information and communication technology (ICT) literacy* e. *Interpersonal skills* f. Other academic skills and knowledge	Students evaluate strategies to improve skills that lead to lifelong learning and success in the classroom, and the achievement of schoolwork, work and career, and personal life goals. a. Literacy skills *b. Numeracy* c. *Critical thinking* skills d. *Information and communication technology (ICT) literacy* *e. Interpersonal skills* f. Other academic skills and knowledge

B3 Education and Career Information

Performance Indicators & Descriptors			
PK-2	3-5	6-8	9-Diploma
Students identify and locate information resources at home, at school, and in the community that improve study habits, schoolwork, or educational achievement.	Students identify and locate different types of career and educational information resources and use them to explore school and career choices.	Students locate and analyze the use of different types of resources, including *occupational information* and *labor market information*, to explore *post-secondary education, training,* and career choices.	Students use previously acquired knowledge and skills to evaluate and utilize a variety of resources to articulate a plan and make decisions for *post-secondary education, training,* and career choices.

Retrieved from The Maine Learning Results: http://www.maine.gov/doe/careerandeducation/standards/index.html

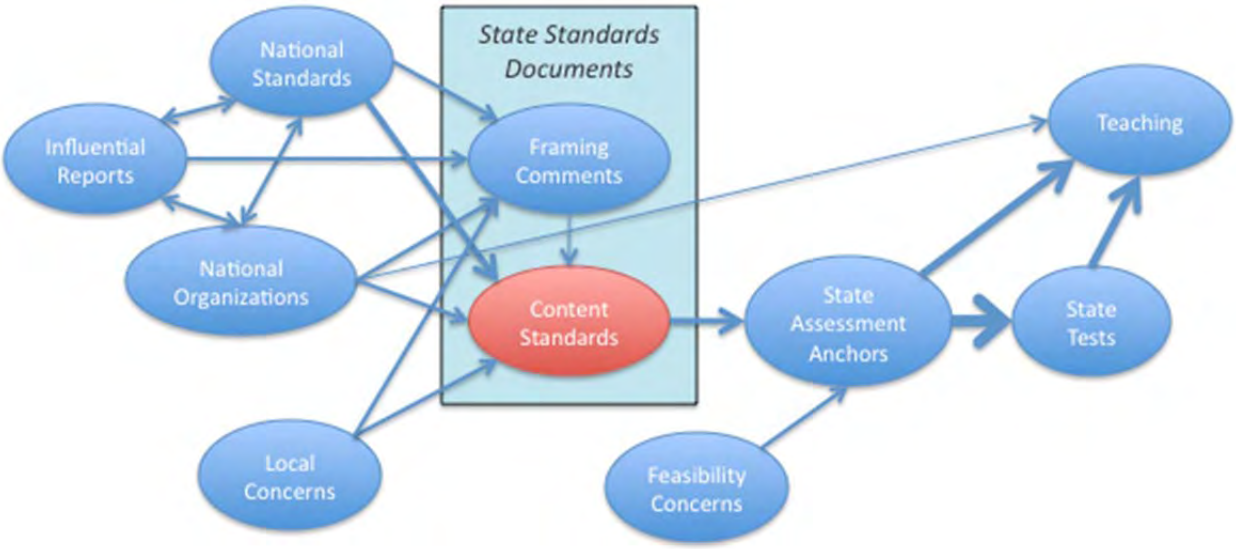
Impact of *21st Century Skills* Discussions on Classroom Instruction

As the previous material suggests, Maine has addressed *21st Century Skills* in various official documents and policy positions. Nevertheless, this alone does not ensure that it translates down to classroom practice. In 2009, the University of Pittsburgh's Dr. Christian Schunn conducted a study of state science education standards of nine states that are part of the Partnership for 21st Century Skills (including Maine) to examine the extent to which elements of *21st Century Skills* are included in those standards. The study used the NRC's 2008 definitions of *21st Century Skills* (adaptability, complex communication skills, non-routine problem solving skills, self-management skills, and systems thinking) and found that there was considerable variability in the inclusion of these skills in the standards from state to state.

Dr. Schunn's analysis did not focus on the status of teaching and learning in science, but rather on the state science education standards. He provides the following guidance on Figure 4 related to various outside factors influencing classroom instruction:

1. Teaching is most directly influenced by state tests (which teachers do not directly know the precise contents of in advance) and the assessment anchors (that closely predict state test content and are presented to teachers directly).
2. State standards have two elements: a) framing comments that discuss the overall goals of the state standards, the overarching themes, and b) actual content standards that describe what skills and knowledge the students are expected to learn at particular grade levels.
3. Many state standards are heavily influenced by the national standards, but there can be variability in content standards reflecting variation in the mixture of local concerns.
4. State standards can differ significantly from state tests due to feasibility concerns: a) what standards are in fact attainable, and b) what standards are testable with available resources for test development and test grading.
5. Assessment anchors and tests can vary significantly over time, but state standards are more stable (Schunn, 2009, pgs. 1 -2).

Figure 4. How national and local factors influence classroom instruction (Schunn, 2009).



Workforce Development in Maine

Figure 5 illustrates the job sectors that are projected to have the most growth in Maine through 2020. Table 3 shows that educational or professional training beyond a high school diploma will be needed for many job sectors that are projected to grow in Maine over the next decade. Sectors of the economy that showed gains in jobs between 1990 and 2009 had a larger share of workers with bachelor's degrees or higher on their payrolls than employers that lost jobs during that period of time. Industries such as education, health, business, and professional services have a higher than average share of workers with at least a Bachelor's degree, whereas manufacturing and construction have a lower percentage of employees that have a bachelor's degree or greater. However, even for higher level jobs, there has been a significant shift towards workers needing *21st Century Skills* such as: understanding and monitoring complex systems, collaboration, using computer technology, communicating well, and increasing responsibilities within jobs (SWIB, 2012).

Figure 5: Projected Change in Maine Employment 2010-2020 (SWIB, 2012)

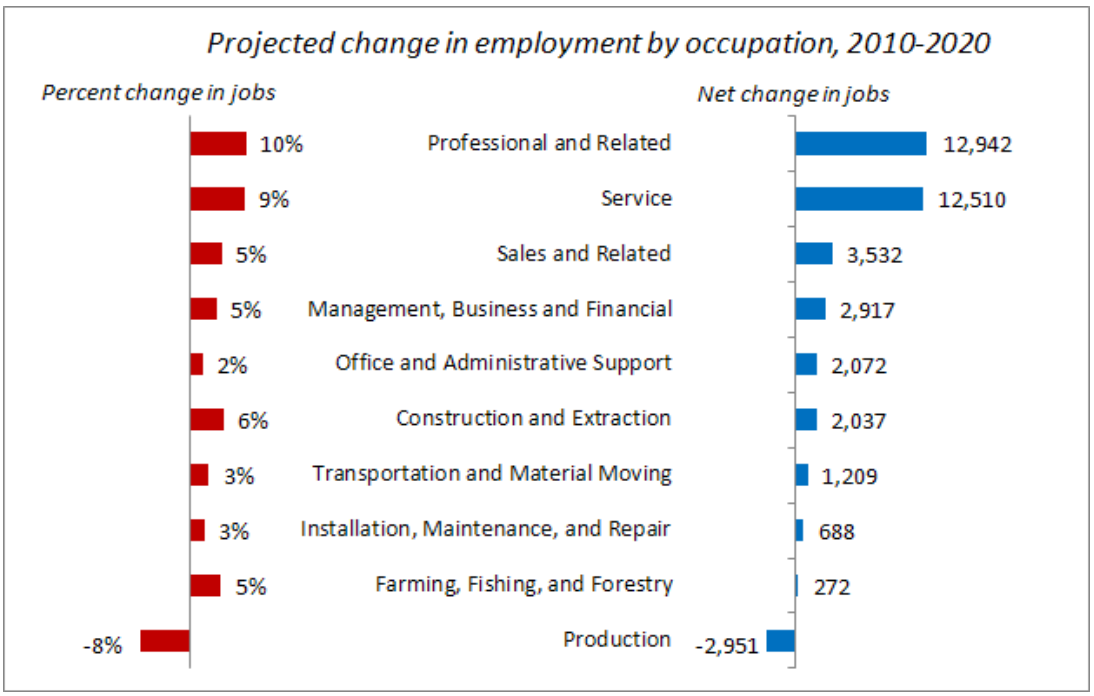


Table 3: Projected Employment in Maine 2010 - 2020 (Maine DOL, 2012)

Occupational Employment by Educational Requirement in Maine in 2010 and Projected 2020										
Educational Requirement	**Average Employment**		**Percent of Total Employment**		**Change in Employment**		**Average Annual Openings**			**2011 Average Wage**
	2010	**2020**	**2010**	**2020**	**Net**	**Percent**	**Growth**	**Replace-ment**	**Total**	
Total	***641,551***	***676,779***	***100.0%***	***100.0%***	***35,228***	***5.5%***	***4,361***	***15,146***	***19,507***	***$19.32***
Doctoral or professional degree	16,577	18,742	2.6%	2.8%	2,165	13.1%	216	318	534	$58.43
Master's degree	11,712	12,846	1.8%	1.9%	1,134	9.7%	111	260	371	$27.62
Bachelor's degree	81,771	86,570	12.7%	12.8%	4,799	5.9%	511	1,857	2,368	$28.17
Associate's degree	43,583	47,498	6.8%	7.0%	3,915	9.0%	495	799	1,294	$31.61
Postsecondary non-degree award	35,724	38,777	5.6%	5.7%	3,053	8.5%	347	672	1,019	$16.46
Some college, no degree	2,607	2,785	0.4%	0.4%	178	6.8%	17	71	88	$21.76
High school diploma or equivalent	282,635	291,936	44.1%	43.1%	9,301	3.3%	1,475	6,271	7,746	$17.69
Less than high school	166,942	177,625	26.0%	26.2%	10,683	6.4%	1,170	4,903	6,073	$11.31

Particularly relevant to the issue of educational preparation and *21st Century Skills*, the Maine Department of Labor used Table 4 in their strategic planning document to illustrate the concept of the potential "skills gap" between jobs projected to grow in the state and the skills needed of workers to fill those jobs. The department used O*Net skill importance ratings to compare occupations that are projected to grow with occupations projected to decline between 2010-2020. The O*Net skill importance rating is a 100 point scale indicating how important the particular skill is for a certain job, with higher ratings reflecting more vital skills. The *High Wage, High Growth, In Demand Occupations* column presents mean skill importance ratings for eleven occupations that share the following attributes: 1) Projected employment growth greater than the 5.5% projected for all Maine occupations, 2010-2020; 2) Median wage above the $15.63 per hour / $32,510 per year median wage of all Maine occupations in 2011; 3) Each occupation is expected to have at least 20 openings per year between 2010 and 2020; and 4) Usual educational requirement for entry is education beyond a high school diploma. The Declining Occupations columns present mean skill importance ratings for *Office/ Administrative Support* and *Production* work. These were selected for comparison due to the fact that net job losses are projected to occur between 2010 and 2020 for these types of jobs (SWIB, 20120).

Table 4: Skills Comparison for Growing vs. Declining Occupations (SWIB, 2013)

Skill	Average skills importance rating		
	High Wage, High Growth, In Demand Occupations	Declining Occupations	
		Production	Office and Admin. Support
Active Listening	*64*	*47*	*63*
Critical Thinking	*63*	*50*	*51*
Speaking	*63*	*47*	*64*
Reading Comprehension	*60*	*46*	*52*
Judgment and Decision Making	*57*	*43*	*47*
Monitoring	*57*	*51*	*49*
Social Perceptiveness	*55*	*45*	*54*
Complex Problem Solving	*53*	*42*	*44*
Coordination	*53*	*45*	*51*
Time Management	*53*	*46*	*51*
Writing	*51*	*35*	*44*
Active Learning	*50*	*34*	*41*

INTERVIEWS WITH MAINE STAKEHOLDERS: STATE INTITIATIVES RELATED TO *21ST CENTURY SKILLS*

Beyond a review of models and policies for addressing *21st Century Skills*, a second goal of this study was to determine the role and relevance of *21st Century Skills* to practitioners in the field. Therefore, the report's author contacted several key stakeholders and conducted informal interviews through telephone conversations in the early spring of 2014. As needed, additional information was gathered through subsequent email exchanges.

Feedback was sought initially from school district staff on the type of information MEPRI should include on the principals survey. These conversations also provided an opportunity to obtain insight on how *21st Century Skills* are being taught and measured in the field. Discussions with Maine Department of Education staff were also initiated in order to learn more of how *21st Century Skills* are defined and measured by the Department. As summarized below, the majority of these conversations focused on (1) Proficiency Based Education and (2) current and future state assessment programs. In addition, the report draws on (3) previous MEPRI work that examined the Maine Learning Technology Initiative in the context of *21st Century Skills*.

Proficiency Based Diploma

Through the passage of PL 669 (LD 1422), "An Act to Prepare Maine People for the Future Economy", starting in 2018 Maine Schools will be required to issue diplomas that are based on students' demonstrated proficiency in meeting standards. The standards and assessment systems through which to measure the demonstrated proficiency are currently in development. Subsequently, Section 9 of LD 1492 gave specific guidance on bringing stakeholders together to test the assessment of the Guiding Principles and the role of the Maine Department of Education in assisting schools with the transition to the new system (Silvernail, 2013).

The Maine Department of Education defines proficiency based education as:

> *"…[A]ny system of academic instruction, assessment, grading and reporting that is based on students demonstrating mastery of the knowledge and skills they are expected to learn before they progress to the next lesson, get promoted to the next grade level or receive a diploma. In Maine, academic expectations and 'proficiency' definitions for public-school courses, learning experiences, content areas and grade levels are outlined in the Maine Learning Results which includes the Guiding Principles, expectations for cross-disciplinary skills and life-long learning, and eight sets of content-area standards, including the Common Core State Standards in English language arts and mathematics.*
>
> *The general goal of proficiency-based education is to ensure that students acquire the knowledge and skills that are deemed to be essential to success in school, higher education, careers and adult life. If students struggle to meet minimum expected standards, they receive additional instruction, practice time and academic support to help them achieve proficiency, but they do not progress in their education until expected standards are met."*
>
> Retrieved from: http://www.maine.gov/doe/proficiency/about/proficiency-based.html

Several school districts were brought together in September 2013 and were trained and assisted by Maine DOE staff on how to develop protocols. That group was recently engaged in developing and vetting their standards at a March 2014 benchmarking meeting in Waterville. Educators are now beginning the process of developing performance-based assessment strategies for students using the Quality Performance Assessment (QPA) model. A repository for assessments is being built and Maine DOE has created a dedicated portion of their website for information and resources related to this initiative titled, "Getting to Proficiency" (http://www.maine.gov/doe/proficiency/index.html).

Through the conversations with stakeholders, it was widely viewed that the Maine DOE Guiding Principles represent concepts related to *21st Century Skills* that have been discussed in this report. According to Department staff the Guiding Principles have never been explicitly measured in the past and the proficiency based diploma is the first attempt to do this measurement. It was also expressed that with proficiency based standards there is a strong need to be very clear about learning expectations, feedback, and progress towards goals. With that in mind, there is the potential to begin measuring competencies more directly related to *21st Century Skills*.

Assessing *21st Century Skills*

Maine DOE uses a number of assessment programs to measure students' academic progress. Together, these are known as the Maine Comprehensive Assessment System (MeCAS, http://www.maine.gov/doe/assessment/). DOE staff report that none directly measure *21st Century Skills*, although proxy measures could be derived through secondary analysis of existing data. One example given was the Depth of Knowledge (DOK) items in Science where each level has specific skills and competencies that a student would need to demonstrate proficiency. In the box below is information from the Department's "DOK Definitions for Science" website for Level 3 (Strategic Thinking) that aligns well with some of the *21st Century Skills* terms mentioned previously like "critical thinking" and "non-routine problem solving".

Level 3 (Strategic Thinking) requires reasoning, planning, using evidence and a higher level of thinking than the previous two levels. The cognitive demands at Level 3 are complex and abstract. The complexity does not result only from the fact that there could be multiple answers, a possibility for both Levels 1 and 2, but also because the multi-step task requires more demanding reasoning. In most instances, requiring students to explain their thinking is at Level 3; requiring a very simple explanation or a word or two should be at Level 2. An activity that has more than one possible answer and requires students to justify the response they give would most likely be a Level 3. Experimental designs in Level 3 typically involve more than one dependent variable. Other Level 3 activities include drawing conclusions from observations; citing evidence and developing a logical argument for concepts; explaining phenomena in terms of concepts; and using concepts to solve non-routine problems. Some examples that represent, but do not constitute all of Level 3 performance, are:
*Identify research questions and design investigations for a scientific problem.
*Solve non-routine problems.
*Develop a scientific model for a complex situation.
*Form conclusions from experimental data.

Retrieved from: http://www.maine.gov/doe/mea/resources/depth-of-knowledge.html

In addition, no crosswalk exists between *21st Century Skills* and current assessments used by the Department. Attempts at creating such a crosswalk have been made in the past, with a barrier potentially being the challenge of developing common agreement on specific and/or measurable definitions of *21st Century Skills*. Stakeholder interviews suggested that the *Maine Guiding Principles* would be a good starting point for such an endeavor.

Future state assessments of student knowledge and achievement will use the Smarter Balanced Assessment, which is aligned with the Common Core State Standards (CCSS) and scheduled to be implemented in 2014-2015. Maine is part of a consortium of 27 states working together to develop computer based assessments of student learning and higher-order skills. The Smarter Balanced Assessment will replace the New England Common Assessment Program (NECAP) and the SAT for math, reading, and writing (http://www.maine.gov/doe/assessment/).

The Smarter Balanced Assessment Consortium (SBAC) is developing the CCSS content standards in English language arts/literacy and mathematics. Achievement standards are linked to the CCSS operational definition of college content-readiness and must: 1) align with college and work expectations; 2) include rigorous content and application of knowledge through high-order skills; 3) build upon strengths and lessons of current state standards; 4) be informed by top-performing countries, so that all students are prepared to succeed in our global economy and society; and 5) be evidence and/or research-based (SBAC, no date).

Maine Learning Technology Initiative (MLTI)

In 2011, MEPRI conducted an evaluation study of the Maine Learning Technology Initiative (MLTI), also known as the middle school laptop program (Silvernail, 2011). The 1:1 infrastructure and capacity that has been built around the state for middle school students through MLTI is a significant asset for student learning related to *21st Century Skills*. The report was a comprehensive look at MLTI in its first decade of existence and examined how laptops were being used by the 7th and 8th grade classes, the perceived benefits of the program as reported by teachers and students, as well as the cost of implementation. For the purposes of this report, we are highlighting selected findings from the MLTI evaluation report that are most closely related to *21st Century Skills*.

Two studies on *21st Century Skills* were conducted in the MLTI evaluation report. The first was a pilot study where materials were created by the researchers and a technology integrationist that would help educators teach students how to evaluate electronic/digital resources. The intervention aimed to give students skills related to determining if the website they reviewed was useful; determining the purpose of the website reviewed; and assessing the reliability of the information on the site. Students received pre- and post-test measures assessing knowledge gain on how to evaluate the material. Table 5 shows that students that received the instruction (intervention) did better on the post-tests than did the control group (Silvernail, 2011).

Table 5: Pre-Post Test Differences – Experimental vs. Control Groups (Silvernail, 2011)

7th - 9th Grades		Average	Standard Deviation	Effect Size
Pretest	**Experimental**	**14.55**	**4.49**	**0.19**
	Control	**15.52**	**5.11**	
7th - 9th Grades		Average	Standard Deviation	Effect Size
Posttest	**Experimental**	**16.47**	**5.50**	**0.41**
	Control	**14.19**	**5.58**	

The second study was an extension of the pilot designed to help students learn how to systematically evaluate internet resources. Teachers worked with the research team to create benchmarks and curriculum materials, and the intervention was carried out over a five month period. Two different methods of delivery were used. The first was in the form of a class lesson in which students analyzed the same website and engaged in discussions regarding its strengths and weaknesses. The second method involved the teacher assigning students individual research projects whereby they used internet resources in relation to the benchmarks established for the study. The results in Table 6 below indicate that there was statistically significant improvement in student performance following the intervention. These studies demonstrated the impact that students' laptops can have on enhancing the *21st Century Skills* of locating and evaluating online information (Silvernail, 2011).

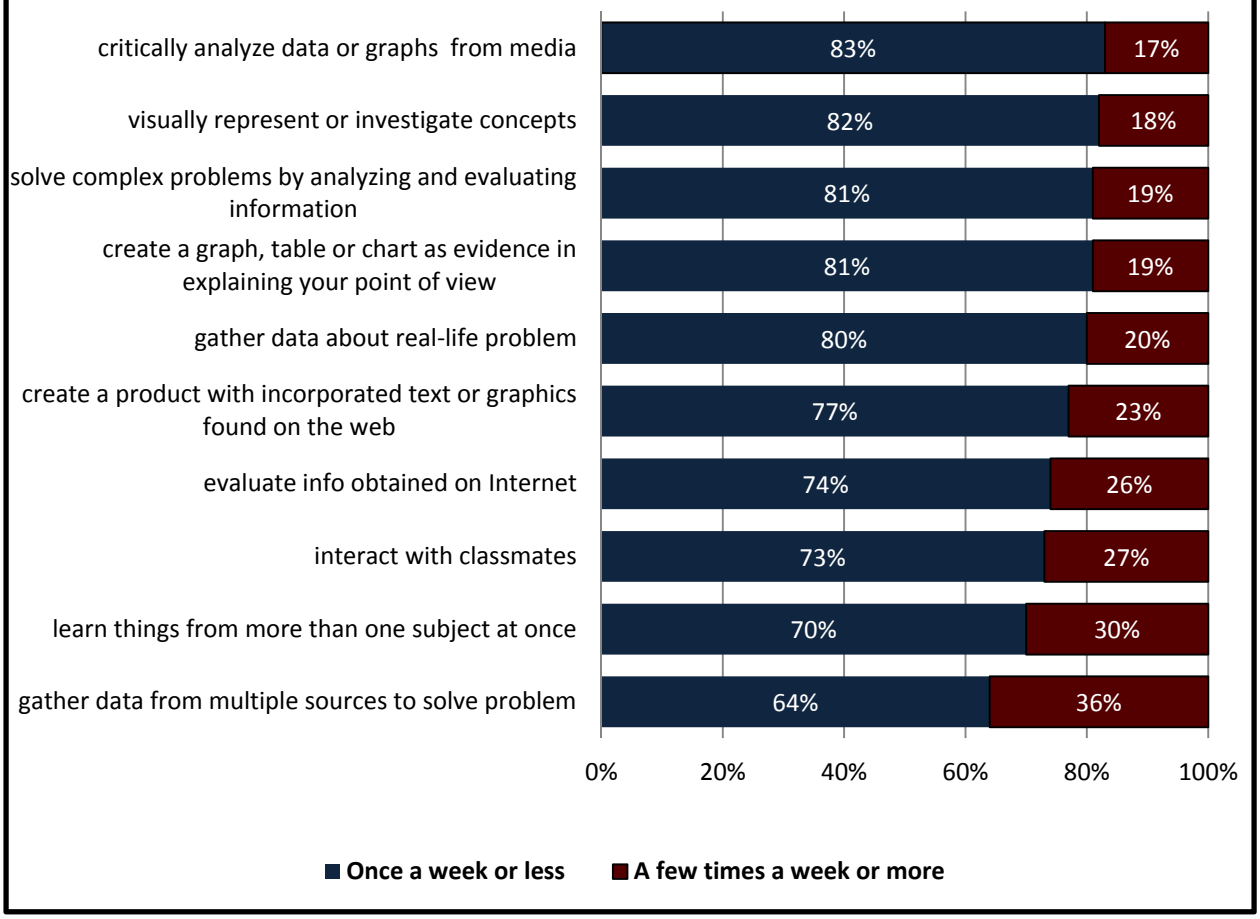
Table 6: Pre and Post Assessment 7th & 8th Grade Student Results (Silvernail, 2011)

	Pre Assessment			Post Assessment		
	N	average	Standard Deviation	n	average	Standard Deviation
Students	**297**	**15.01**	**4.58**	**347**	**17.80**	**5.59**

In addition, in 2010, MEPRI researchers assessed student perceptions regarding their use of the laptops in ways related to various *21st Century Skills*. As illustrated in Table 7, responses indicated that students may be underutilizing their laptops in these areas. The evaluators provided the following analysis and interpretation of these data:

"…less than one in five report frequent use in gathering information about a real-life problem, creating a graph, table or chart, or using their laptops to analyze or evaluate information. Thus, it appears the laptops are not being used with a high degree of frequency in developing these 21st Century Skills. What is unclear from the survey results is if this infrequent use, relatively speaking, is because teachers are not teaching these 21st Century Skills. What is unclear from the survey results is if this infrequent use, relatively speaking, is because teachers are not teaching these skill, regardless of instructional mode, or because teachers lack skills to effectively develop activities that use the laptops to teach these skills" (Silvernail, 2011, p.11).

Table 7: Percent of students indicating how often they use their laptop to do the following...(Silvernail, 2011)



PRINCIPALS SURVEYS: WHAT ARE MAINE SCHOOLS DOING TO TEACH *21ST CENTURY SKILLS*?

Finally, a third goal of this report was to collect a baseline understanding of the teaching and learning of *21st Century Skills* in Maine schools through a survey of Maine middle and high school principals. The instrument used was an adaptation of one created by Hixson, Ravitz, & Whisman (2012) for a study on *21st Century Skills* teaching and learning in West Virginia.

The broad domains assessed in the survey are presented in Table 8. This was based on the conceptual framework in the *International Innovative Teaching and Learning* study (Shear, et. al., 2010), as well as work from the Partnership for 21st Century Skills (p21.org) and the Hewlett Foundation (2010). Finally, given the West Virginia study was targeted towards classroom teachers, the original instrument was modified for school principals in order to assess school-wide practices and initiatives. A copy of the survey can be found in Appendix B.

Table 8: MEPRI Principals Survey Framework (based on Hixson, et. al., 2012).

1. CRITICAL THINKING SKILLS refer to students being able to analyze complex problems, investigate questions for which there are no clear-cut answers, evaluate different points of view or sources of information, and draw appropriate conclusions based on evidence and reasoning.
2. COLLABORATION SKILLS refer to students being able to work together to solve problems or answer questions, to work effectively and respectfully in teams to accomplish a common goal and to assume shared responsibility for completing a task.
3. COMMUNICATION SKILLS refer to students being able to organize their thoughts, data and findings and share these effectively through a variety of media, as well as orally and in writing.
4. CREATIVITY AND INNOVATION SKILLS refer to students being able to generate and refine solutions to complex problems or tasks based on synthesis, analysis and then combining or presenting what they have learned in new and original ways.
5. SELF-DIRECTION SKILLS refer to students being able to take responsibility for their learning by identifying topics to pursue and processes for their own learning, and being able to review their own work and respond to feedback.
6. GLOBAL CONNECTIONS refers to students being able to understand global, geo-political issues including awareness of geography, culture, language, history, and literature from other countries.
7. LOCAL CONNECTIONS refers to students being able to apply what they have learned to local contexts and community issues.
8. USING TECHNOLOGY AS A TOOL FOR LEARNING refers to students being able to manage their learning and produce products using appropriate information and communication technologies.

Survey Results

This online survey was conducted during Spring of 2014. Requests to complete the survey were emailed to all middle and high school principals in Maine using contact information available through Maine DOE. Principals were provided with a description of the instrument and a link to the online survey. The email noted that principals could forward the link to other personnel familiar with *21st Century Skill* efforts at their school, or complete the survey themselves if they wished. A follow-up email was also distributed two weeks later, reminding principals of the request. At the end of the process, surveys were completed for twenty-three schools.

Participating principals reported that teachers were generally encouraged to address 21st Century Skill areas, but not required to do so (see Table 9). The exceptions to this pattern were communication skills, which were required by nearly two-thirds of responding schools (65.2%), and technology skills, which were required by slightly more than half (56.5%). In contrast, relatively few schools required that students be able to apply what they have learned to local community issues.

Table 9: To what extent does your school seek to formally address the following *21st Century Skills*?

Skill Area	Up to teachers	Encouraged but not required	Required
Critical Thinking Skills	9.1%	50.0%	40.9%
Collaboration Skills	21.7%	47.8%	30.4%
Communication Skills	4.3%	30.4%	65.2%
Creativity and Innovation Skills	17.4%	56.5%	26.1%
Self-Direction Skills	13.0%	52.2%	34.8%
Global Connection Skills	28.6%	42.9%	28.6%
Local Connection Skills	13.6%	72.7%	13.6%
Use of Technology as a Learning Tool	8.7%	34.8%	56.5%

Results of the survey also suggest that schools address communication and technology skills more directly and formally than other *21st Century Skills* (see Table 10). These areas were tied for being covered in the most schools (78.3%) through strategies such as required courses or graduation requirements. Communication skills were also addressed through extracurricular activities in nearly 80% of schools, and were the most widely assessed of all *21st Century Skills*, with over half of schools (56.5%) regularly doing so through local or in-house assessments. Similarly, technology skills were assessed by nearly half of all schools (47.8%), and available through extracurricular activities in nearly 70% of schools.

While schools tended to address communication and technology skills through required courses or graduation requirements, other *21st Century Skills* were less likely to be addressed this

formally. For example, less than half of schools reported addressing collaboration skills, creativity skills, or local connection skills in this way. In terms of assessment, most *21st Century Skill* areas are only being assessed by 30-40% of participating schools, with self-direction (26.1%) and local connection (17.4%) skills assessed by the fewest number of schools.

Appendix A briefly lists examples offered by some respondents regarding their promotion and assessment of *21st Century Skills*.

Table 10: Does your school do the following…?

Skill Area	School-wide practices that promote the skill (required courses, graduation requirements)	Offer extra-curricular opportunities for interested students	Regularly assess the skill through local or in-house assessment
Critical Thinking Skills	52.2%	82.6%	39.1%
Collaboration Skills	47.8%	78.3%	30.4%
Communication Skills	78.3%	78.3%	56.5%
Creativity and Innovation Skills	47.8%	82.6%	36.4%
Self-Direction Skills	60.9%	69.6%	26.1%
Global Connection Skills	56.5%	52.2%	39.1%
Local Connection Skills	47.8%	73.9%	17.4%
Use of Technology as a Learning Tool	78.3%	69.6%	47.8%

The survey also assessed principal opinions regarding the percentage of students who graduate from their school with the necessary *21st Century Skills*. Table 11 presents this information separately for middle and high schools. As expected, high school principals generally report higher percentages of completing students with these skills than middle school principals. For example, only 18.2% of middle schools reported that 80% or more of their students had developed necessary communication skills by the time they completed middle school. However, by the time students completed high school, 63.6% of schools reported that 80% or more of their students had developed communication skills.

Two skill areas stood out as having relatively higher rates of acquisition by the time of high school graduation: Communication and technology (also with 63.6% of schools reporting 80% or more of students developing these skills). In part, this may reflect the degree to which these two areas are addressed in schools, as reflected in Table 11. No other *21st Century Skill* approached this level of student acquisition by high school graduation. In contrast, global connection skills were rated as the least acquired skill, with only 27.3% of high schools indicating that at least 60% of their students developed global connection skills by graduation.

Table 11: Based on your opinion, what percentage of your students has developed these skills by the time they graduate?

Skill Area	<20%	20% up to 40%	40% up to 60%	60% up to 80%	More than 80%
Critical Thinking Skills					
Middle School (N=11)	9.1%	9.1%	36.4%	36.4%	9.1%
High School (N=11)		18.2%	27.3%	45.5%	9.1%
Collaboration Skills					
Middle School (N=11)		9.1%	36.4%	45.5%	9.1%
High School (N=11)		9.1%	18.2%	63.6%	9.1%
Communication Skills					
Middle School (N=11)			27.3%	54.5%	18.2%
High School (N=11)		9.1%	9.1%	18.2%	63.6%
Creativity and Innovation Skills					
Middle School (N=11)	18.2%	18.2%	27.3%	27.3%	9.1%
High School (N=11)	9.1%		36.4%	45.5%	9.1%
Self-Direction Skills					
Middle School (N=11)	9.1%	18.2%	45.5%	18.2%	9.1%
High School (N=11)	9.1%		18.2%	45.5%	27.3%
Global Connection Skills					
Middle School (N=11)		27.3%	18.2%	36.4%	18.2%
High School (N=11)	9.1%	27.3%	36.4%	27.3%	
Local Connection Skills					
Middle School (N=11)	9.1%	18.2%	18.2%	54.5%	
High School (N=11)	9.1%	9.1%	27.3%	36.4%	18.2%
Use of Technology as a Learning Tool					
Middle School (N=11)				45.5%	54.5%
High School (N=11)			18.2%	18.2%	63.6%

Finally, respondents were asked to indicate how teachers and staff in their schools enhanced their own *21st Century Skills.* As reflected in Table 12, schools reported using a variety of solutions. The most frequent training opportunities noted were district sponsored professional development, Maine DOE/MLTI trainings, and self/independent study. These were followed closely by support from other colleagues or teachers.

Table 12: Type of Opportunity for Enhancing Skills

Type of Opportunity for Enhancing Skills	% of Schools
District-sponsored professional development	78.3%
Maine DOE / MLTI	78.3%
School or district technology integrationist	47.8%
Conferences	56.5%
University course work	60.9%
On their own	78.3%
From other teachers/colleagues	73.9%
Regionally-sponsored professional development	47.8%

CONCLUSION

In order to compete in today's technology rich and global economy, stakeholders consistently agree that workers and students need to be able to solve problems that are complex, collaborate and communicate well with others, acquire new skills and information independently, and adapt to rapidly changing conditions. These broad cognitive and affective abilities are often referred to as *21st Century Skills* (NRC, 2011).

An ongoing issue with *21st Century Skills* has the competing lists of skills and frameworks considered "21st Century". The National Research Council (NRC) has helped in this regard by providing research-based guidance regarding skills and constructs. In particular, NRC has developed a conceptual framework linking specific *21st Century Skills* to cognitive, intra-personal and interpersonal domains. This roadmap can be particularly valuable to educators and policy makers interested in promoting continued development of programs and interventions aimed at promoting *21st Century Skills*.

In Maine, there exists considerable interest in the concept of *21st Century Skills*. These skills are referenced in various practice and policy documents from the Maine Department of Education and other key education partners throughout the state. Nevertheless, a challenge stakeholders recognize is the need to develop a common framework or shared understanding regarding the specific skills and competencies relevant to Maine, as well as how these relate to other high profile state initiatives and programs, such as proficiency-based diplomas and Smarter Balanced assessment.

One possible approach noted by stakeholders would be to build on the Maine DOE Guiding Principles as an initial representation of the concepts related to *21st Century Skills* in Maine. Furthermore, based on reports from Department staff, the Guiding Principles have not been directly assessed in the past, and the transition to a proficiency based diploma is the first attempt to do so. This creates an opportunity to develop a common conceptualization for *21st Century*

Skills, linked to an assessment system that can potentially be designed specifically to address the measurement of these skills. An initial step in this direction could be a crosswalk exercise matching concepts and definitions across existing initiatives and programs.

In terms of school policy and classroom practice, results from a limited survey of middle and high schools in Maine suggest that these schools generally encourage teachers to address *21st Century Skills*, but do not require it. Among various *21st Century Skills*, survey results suggest that schools address communication and technology skills more directly and formally than other skill areas through methods such as required courses or graduation requirements. Possibly reflecting this, high schools also reported the most success in graduating students proficient in communication and technology *21st Century Skills*—with a considerably higher percentage of their students graduating with these skills, versus other areas. Finally, in terms of assessment, most *21st Century Skill* areas are only being assessed by 30-40% of the participating schools.

In conclusion, should the state decide to move forward targeting *21st Century Skills*, a combination of events and policies create a window of opportunity for doing so. The transition to a proficiency based diploma, the rollout of Common Core State Standards and Next Generation Science Standards, the launch of the Smarter Balanced Assessment, interest in *21st Century Skills* by both business and education leaders, and steadily growing conceptual cohesion of these constructs at the national level create a framework in which the development, teaching, and assessment of these skills could advance in a purposeful and meaningful manner.

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APPENDIX A: QUALITATIVE SURVEY RESPONSES

Domain	School-wide practices that promote the skill (required courses, graduation requirements)	Offer extracurricular opportunities for interested students	Regularly assess the skill through local or in-house assessment
Critical Thinking Skills	*Study Skills Course, Collaborative Activities in ALL Science, Math and English Classes *We have a school-wide rubric for problem solving for which students need evidence *PBL activities are sent out weekly with a strong recommendation to try them out *Complex reasoning skill training and required measurement topic in our standards as part of the MCCL	*Robotics *Starting with the Class of 2018	*Department common assessments *Starting with the Class of 2018 *Heading in the direction; Currently working on common assessments
Collaboration Skills	*Literature circles, math problem solving, labs in science *Starting with the Class of 2018	*Civil Rights Team *Starting with the Class of 2018	*Starting with the Class of 2018 *Heading in the direction; Currently working on common assessments
Communication Skills	*Two major assessments which require students to deliver a 10 - 20 minute Presentation *iPad Protocols *Writing has a standard of performance across all content areas in the high school	*Drama, speech and debate *Speech competition *Starting with the Class of 2018	*Starting with the Class of 2018 *Heading in the direction; Currently working on common assessments

Self-Direction Skills	*Evening study hours, tutoring, academic team meetings for struggling students, teacher office hours *Proficiency-based math classes *We have a school-wide rubric which measures habits of work and portfolios which measure evidence of progress *We have a rubric for this as part of our habits of work and eligibility is based upon this	*Student Council *Starting with the Class of 2018	*Starting with the Class of 2018 *Heading in the direction; Currently working on common assessments
Creativity and Innovation Skills	*Drama classes, theater productions, art classes for every grade *Applied art technology class *Starting with the Class of 2018	*Odyssey of the mind, champion chess team *Yearbook, book clubs, theater *Starting with the Class of 2018	*Starting with the Class of 2018 *Heading in the direction; Currently working on common assessments
Global Connection Skills	*Social Studies classes		*Heading in the direction; Currently working on common assessments
Local Connection Skills	*Community service is required for graduation *Starting with the Class of 2018	*Community service club *We offer specific courses that are centered on connecting with the community *Starting Class 2018	*Heading in the direction; Currently working on common assessments
Use of Technology as Learning Tool	*Utilization of GoogleApps to help logistic practices and collaborative work *MLTI		*Heading in the direction; Currently working on common assessments

APPENDIX B: PRINCIPALS SURVEY INSTRUMENT

Instructions: The Maine Education Policy Research Institute at the University of Maine's Center for Research and Evaluation has been asked by the Legislature's Education and Cultural Affairs Committee to conduct a study on the teaching and learning of *21st Century Skills* in Maine schools. These can be broadly defined as the skills needed for students to be college and workforce ready in today's world and are reflected in the Maine DOE Guiding Principles.

This survey asks about your school's teaching practices that might support students' learning of the following skills.

1. Critical Thinking
2. Collaboration
3. Communication
4. Creativity & Innovation
5. Self-Direction
6. Making Global Connections
7. Making Local Connections
8. Using Technology as a Tool for Learning

You will be asked a few questions about ways your school may be addressing these skills in and out of the classroom. Because there can be considerable grade-to-grade variation in how schools approach these topics, please answer these questions ONLY in relation to 7th grade or 11th grade, depending on your school. If your school includes both 7th and 11th grade, please answer in relation to 11th grade. If your school does not include 7th or 11th grade, please discontinue the survey.

Responses will be used to help inform the Maine State Legislature on what is happening in the field related to the teaching and learning of *21st Century Skills*. Participation in the survey is voluntary and will take approximately 10 minutes to complete. All responses will be anonymous. Neither your identity nor your school will be revealed in the report. You can skip any question that you would prefer not to answer. We appreciate your responses and the time that you have taken to complete this survey. Copies of the final reports will be available following their presentation to the legislature. A copy of the final report will be available following our presentation of the findings to the legislature. If you have any questions, please contact Craig Mason at cre@maine.edu or 581-2493.

Please select your district and school name from the drop down boxes below:

What is your position in your school?

- ❍ Superintendent
- ❍ Principal
- ❍ Guidance Counselor
- ❍ Curriculum Coordinator
- ❍ Teacher
- ❍ Other

For which grade are you completing this survey?

- ❍ 7th Grade
- ❍ 11th Grade

1. CRITICAL THINKING SKILLS refer to students being able to analyze complex problems, investigate questions for which there are no clear-cut answers, evaluate different points of view or sources of information, and draw appropriate conclusions based on evidence and reasoning.

To what extent does your school formally seek to address CRITICAL THINKING SKILLS?

- ❍ We do not directly address CRITICAL THINKING SKILLS in school planning--it's up to individual teachers.
- ❍ Teachers are encouraged to address CRITICAL THINKING SKILLS, but it is not required.
- ❍ Teachers are required to address CRITICAL THINKING SKILLS.

Does your school do the following....

	Yes	No	Is there an example that you would like to share with the legislature and other schools as part of our report?
Have school-wide practices that promote CRITICAL THINKING SKILLS for all students, such as required course work, graduation expectations, etc.?	❍	❍	
Offers opportunities for students who are interested to develop CRITICAL THINKING SKILLS, through extracurricular activities, clubs, electives, etc.?	❍	❍	
Regularly assess students' CRITICAL THINKING SKILLS as part of a local or in-house assessment?	❍	❍	

In your opinion, what percentage of students in your school have developed CRITICAL THINKING SKILLS by the time they graduate?

- ❍ Less than 20%
- ❍ 20% up to 40%
- ❍ 40% up to 60%
- ❍ 60% up to 80%
- ❍ 80% or more

2. COLLABORATION SKILLS refer to students being able to work together to solve problems or answer questions, to work effectively and respectfully in teams to accomplish a common goal and to assume shared responsibility for completing a task.

To what extent does your school formally seek to address COLLABORATION SKILLS?

- ❍ We do not directly address COLLABORATION SKILLS in school planning--it's up to individual teachers.
- ❍ Teachers are encouraged to address COLLABORATION SKILLS, but it is not required.
- ❍ Teachers are required to address COLLABORATION SKILLS.

Does your school do the following....

	Yes	No	Is there an example that you would like to share with the legislature and other schools as part of our report?
Have school-wide practices that promote COLLABORATION SKILLS for all students, such as required course work, graduation expectations, etc.?	❍	❍	
Offers opportunities for students who are interested to develop COLLABORATION SKILLS, through extracurricular activities, clubs, electives, etc.?	❍	❍	
Regularly assess students' COLLABORATION SKILLS as part of a local or in-house assessment?	❍	❍	

Based on your opinion, what percentage of your students have developed COLLABORATION SKILLS by the time they graduate from your school?

- ❍ Less than 20%
- ❍ 20% up to 40%
- ❍ 40% up to 60%
- ❍ 60% up to 80%
- ❍ 80% or more

3. COMMUNICATION SKILLS refer to students being able to organize their thoughts, data and findings and share these effectively through a variety of media, as well as orally and in writing.

To what extent does your school formally seek to address COMMUNICATION SKILLS?

- ❍ We do not directly address COMMUNICATION SKILLS in school planning--it's up to individual teachers.
- ❍ Teachers are encouraged to address COMMUNICATION SKILLS, but it is not required.
- ❍ Teachers are required to address COMMUNICATION SKILLS.

Does your school do the following....

	Yes	No	Is there an example that you would like to share with the legislature and other schools as part of our report?
Have school-wide practices that promote COMMUNICATION SKILLS for all students, such as required course work, graduation expectations, etc.?	❍	❍	
Offers opportunities for students who are interested to develop COMMUNICATION SKILLS, through extracurricular activities, clubs, electives, etc.?	❍	❍	
Regularly assess students' COMMUNICATION SKILLS as part of a local or in-house assessment?	❍	❍	

Based on your opinion, what percentage of your students have developed COMMUNICATION SKILLS by the time they graduate from your school?

- ❍ Less than 20%
- ❍ 20% up to 40%
- ❍ 40% up to 60%
- ❍ 60% up to 80%
- ❍ 80% or more

4. CREATIVITY AND INNOVATION SKILLS refer to students being able to generate and refine solutions to complex problems or tasks based on synthesis, analysis and then combining or presenting what they have learned in new and original ways.

To what extent does your school formally seek to address CREATIVITY AND INNOVATION SKILLS?

- ❍ We do not directly address CREATIVITY AND INNOVATION SKILLS in school planning--it's up to individual teachers.
- ❍ Teachers are encouraged to address CREATIVITY AND INNOVATION SKILLS, but it is not required.
- ❍ Teachers are required to address CREATIVITY AND INNOVATION SKILLS.

Does your school do the following....

	Yes	No	Is there an example that you would like to share with the legislature and other schools as part of our report?
Have school-wide practices that promote CREATIVITY AND INNOVATION SKILLS for all students, such as required course work, graduation expectations, etc.?	❍	❍	
Offers opportunities for students who are interested to develop CREATIVITY AND INNOVATION SKILLS, through extracurricular activities, clubs, electives, etc.?	❍	❍	
Regularly assess students' CREATIVITY AND INNOVATION SKILLS as part of a local or in-house assessment?	❍	❍	

Based on your opinion, what percentage of your students have developed CREATIVITY AND INNOVATION SKILLS by the time they graduate from your school?

- ❍ Less than 20%
- ❍ 20% up to 40%
- ❍ 40% up to 60%
- ❍ 60% up to 80%
- ❍ 80% or more

5. SELF-DIRECTION SKILLS refer to students being able to take responsibility for their learning by identifying topics to pursue and processes for their own learning, and being able to review their own work and respond to feedback.

To what extent does your school formally seek to address SELF-DIRECTION SKILLS?

- ❍ We do not directly address SELF-DIRECTION SKILLS in school planning--it's up to individual teachers.
- ❍ Teachers are encouraged to address SELF-DIRECTION SKILLS, but it is not required.
- ❍ Teachers are required to address SELF-DIRECTION SKILLS.

Does your school do the following....

	Yes	No	Is there an example that you would like to share with the legislature and other schools as part of our report?
Have school-wide practices that promote SELF-DIRECTION SKILLS for all students, such as required course work, graduation expectations, etc.?	❍	❍	
Offers opportunities for students who are interested to develop SELF-DIRECTION SKILLS, through extracurricular activities, clubs, electives, etc.?	❍	❍	
Regularly assess students' SELF-DIRECTION SKILLS as part of a local or in-house assessment?	❍	❍	

Based on your opinion, what percentage of your students have developed SELF-DIRECTION SKILLS by the time they graduate from your school?

- ❍ Less than 20%
- ❍ 20% up to 40%
- ❍ 40% up to 60%
- ❍ 60% up to 80%
- ❍ 80% or more

6. GLOBAL CONNECTIONS refers to students being able to understand global, geo-political issues including awareness of geography, culture, language, history, and literature from other countries.

To what extent does your school formally seek to address GLOBAL CONNECTIONS?

- ❍ We do not directly address GLOBAL CONNECTIONS in school planning--it's up to individual teachers.
- ❍ Teachers are encouraged to address GLOBAL CONNECTIONS, but it is not required.
- ❍ Teachers are required to address GLOBAL CONNECTIONS.

Does your school do the following....

	Yes	No	Is there an example that you would like to share with the legislature and other schools as part of our report?
Have school-wide practices that promote GLOBAL CONNECTIONS SKILLS for all students, such as required course work, graduation expectations, etc.?	❍	❍	
Offers opportunities for students who are interested to develop GLOBAL CONNECTIONS SKILLS, through extracurricular activities, clubs, electives, etc.?	❍	❍	
Regularly assess students' GLOBAL CONNECTIONS SKILLS as part of a local or in-house assessment?	❍	❍	

Based on your opinion, what percentage of your students have developed GLOBAL CONNECTIONS by the time they graduate from your school?

- ❍ Less than 20%
- ❍ 20% up to 40%
- ❍ 40% up to 60%
- ❍ 60% up to 80%
- ❍ 80% or more

7 LOCAL CONNECTIONS refers to students being able to apply what they have learned to local contexts and community issues.

To what extent does your school formally seek to address LOCAL CONNECTIONS?

- ❍ We do not directly address LOCAL CONNECTIONS in school planning--it's up to individual teachers.
- ❍ Teachers are encouraged to address LOCAL CONNECTIONS, but it is not required.
- ❍ Teachers are required to address LOCAL CONNECTIONS.

Does your school do the following....

	Yes	No	Is there an example that you would like to share with the legislature and other schools as part of our report?
Have school-wide practices that promote LOCAL CONNECTIONS SKILLS for all students, such as required course work, graduation expectations, etc.?	❍	❍	
Offers opportunities for students who are interested to develop LOCAL CONNECTIONS SKILLS, through extracurricular activities, clubs, electives, etc.?	❍	❍	
Regularly assess students' LOCAL CONNECTIONS SKILLS as part of a local or in-house assessment?	❍	❍	

Based on your opinion, what percentage of your students have developed LOCAL CONNECTIONS SKILLS by the time they graduate from your school?

- ❍ Less than 20%
- ❍ 20% up to 40%
- ❍ 40% up to 60%
- ❍ 60% up to 80%
- ❍ 80% or more

8. USING TECHNOLOGY AS A TOOL FOR LEARNING refers to students being able to manage their learning and produce products using appropriate information and communication technologies.

To what extent does your school formally seek to address the USE OF TECHNOLOGY AS A TOOL FOR LEARNING?

- ❍ We do not directly address the USE OF TECHNOLOGY AS A TOOL FOR LEARNING in school planning--it's up to individual teachers.
- ❍ Teachers are encouraged to address the USE OF TECHNOLOGY AS A TOOL FOR LEARNING, but it is not required.
- ❍ Teachers are required to address the USE OF TECHNOLOGY AS A TOOL FOR LEARNING.

Does your school do the following....

	Yes	No	Is there an example that you would like to share with the legislature and other schools as part of our report?
Our school has school-wide activities or initiatives with the goal of promoting the USE OF TECHNOLOGY AS A TOOL FOR LEARNING for all students, through required course work, graduation expectations, etc.?	❍	❍	
Offers opportunities for students who are interested to develop skills around the USE OF TECHNOLOGY AS A TOOL FOR LEARNING, through extracurricular activities, clubs, electives, etc.?	❍	❍	
Regularly assess students' USE OF TECHNOLOOGY AS A TOOL FOR LEARNING as part of a local or in-house assessment?	❍	❍	

Based on your opinion, what percentage of your students have developed skills around the USE OF TECHNOLOGY AS A TOOL FOR LEARNING by the time they graduate from your school?

- ❍ Less than 20%
- ❍ 20% up to 40%
- ❍ 40% up to 60%
- ❍ 60% up to 80%
- ❍ 80% or more

Finally, what types of opportunities do teachers in your school have to enhance their own *21st Century Skills*? (Select all that apply)

- ❑ District sponsored professional development
- ❑ Maine Department of Education or MLTI workshops
- ❑ From technology integrationist staff in their school or district
- ❑ Conferences
- ❑ University coursework
- ❑ On their own / independent study
- ❑ From other teachers or colleagues with whom they work
- ❑ Training provided by a grant (Please name the grant below) _____
- ❑ Other (Please briefly describe below) _____
- ❑ Regionally sponsored professional development
- ❑ School sponsored professional development