Collaboration for 21st Century K-12 Teaching and Learning

Development Grant Application Narrative
U.S. Department of Education
CFDA Number: 84.411C - Investing in Innovation (i3) Fund
August, 2015

Collaboration for 21st Century K-12 Teaching and Learning (C21CTL)

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Development Grant Application

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Partners:

Knowledge Building in Action - KBIA
A 501(c)(3) nonprofit organization

University of Nevada, Las Vegas - UNLV
College of Education

Clark County School District - CCSD
Las Vegas, Nevada

World Federation of Associations of
Teacher Education - WFATE
A global membership association of educators

State University of New York
At Albany - SUNYA

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21st Century Teaching and Learning Collaboration
Project Narrative

A. Significance of the Project and Needs

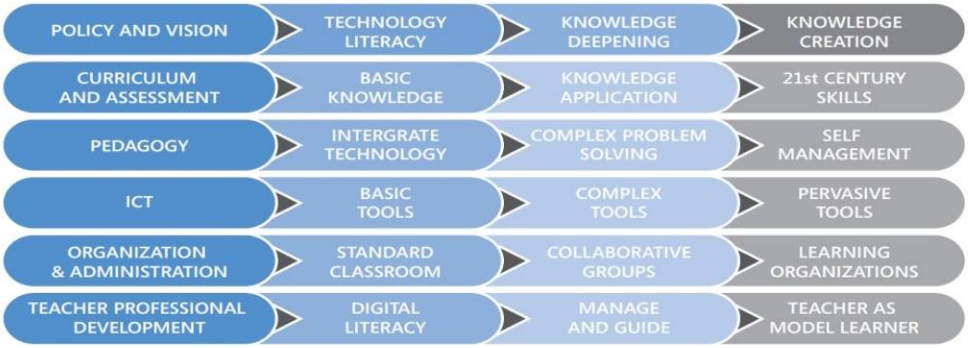
A. 1. A promising new strategy that facilitates the acquisition of 21st Century skills

Societies are transitioning from being industrialized and existing in isolation to being globally-entwined and based in knowledge. Welcome to the *Knowledge Age*, where knowledge and ideas constitute valuable resources and an important source of economic growth. In his book *The Effective Executive*, Peter Drucker predicted that major changes in society would be brought about by information. Drucker argued that *knowledge* has become the central, key resource that knows no geography, and that the largest working group of the labor market will become "*knowledge workers*." The skills needed by modern-day knowledge workers, a group that constitutes the fastest growing sector of today's global work force, are the same as those acquired by students who engage in knowledge building. These prepare them for education, employment, and becoming global citizens in the knowledge society, where information is generated, processed, shared and made available to all members of a society to improve the human condition.

In recent years, several international organizations have designed standards for competencies in teaching and learning that form a foundational framework for improving learning outcomes. The Innovative Learning Environments Project of the Organization for Economic Co-operation and Development (OECD) promotes what schooling, teaching and most especially learning look like in our rapidly-changing world to rethink what is taught, how it is taught, and how learning is assessed. The project explored the nature of learning through the perspectives of cognition, emotion and biology, and provided analyses of the implications for different types of application in learning environments. The research was synthesized to create seven transversal principles to guide the development of learning environments for the 21st Century. Likewise, UNESCO developed an Information and Communication Technologies (ICT) Competency Framework for Teaching (CFT) to emphasize that teachers need to be able to help their students become collaborative, problem-solving, creative learners through using ICT so they can become effective citizens and productive members of the 21st Century workforce in the Knowledge Age.

The UNESCO ICT CFT addresses all aspects of a teacher's work and is arranged in three different approaches to teaching, reflecting successive stages of a teacher's development: ***Technology Literacy*** enables students to use ICTs in order to learn more efficiently. ***Knowledge Deepening*** enables students to acquire in-depth knowledge of their school subjects and apply it to complex-real-world problems. ***Knowledge Creation*** enables students, citizens and the workforce they become to create the new knowledge required for more harmonious, fulfilling and prosperous societies.

Table I. UNESCO ICT CFT - Approach to Educaction Reform



These three approaches are supported by knowledge-building pedagogy, methodologies and assessment tools to create collaborative learning communities in K-12 classrooms, specifically promoting phenomenon learning around topics through a constructivism/cognitivism multi-disciplinary approach to reimagine learning and teaching. These approaches also lead to nurturing effective educators who can have a lasting impact on students. Effective educators embrace and master technology to teach students born and raised in the digital age, and facilitate the acquisition of 21st Century skills for student success through the education process, in the workforce and in life. Effective educators are well-prepared to work in concert around a thoughtful, high-quality curriculum aligned to standards and supported by appropriate materials and assessments - elements that constitute a system that helps students to learn and educators to continue to improve. Effective educators also serve to guide their students toward success throughout the education continuum that will lead toward success in life. In their arsenals and toolkits of teaching are key strategies that facilitate their students acquiring cognitive skills and higher-order thinking that enables understanding, analysis, interpretation, precision and accuracy, problem solving, and reasoning when engaged in learning. The "big ideas" of content areas are also very important building blocks, and the computer-supported collaborative learning model on which our knowledge-building model rests promotes phenomenon learning around ideas while facilitating the acquisition of important 21st Century skills – the 4Cs of future education – ready for post-secondary education and training, and skilled for the 21st Century workforce.

In creating a knowledge-building model that bundles methodologies, technology and tools for improved learning outcomes, we looked at several model education systems in countries, consistently at the top of international rankings of learning assessments such as PISA (Program for International Student Assessment) regarding reading, mathematics, and science literacy, and found they had built high-quality education system for their children in primary and secondary education by rethinking teaching and learning.Like Finland, they have drastically changed their education methods to introduce a curriculum based around "teaching by topic", also known as situational learning and experiential learning, where core subjects, such as Geography and History, are replaced by project-based learning, where students are taught cross-subject topics, such as climactic change, sustainability and economic trading zones that incorporate multi-disciplinary content. This "phenomenon learning", which can also be referred to as project-based learning around ideas, plus the effective use of technology for content delivery, learning

assessments and the continued professional development of educators - teachers, principals and support staff – constitute the key to its success.

Situational learning involves development concepts - or schemas, that are mental codification of experiences that organize ways of perceiving cognitively and respond to a complex situation or set of stimuli. As people interact with the world around them, they develop schemas about the way they interpret or understand the world. With situational learning in the context of primary and secondary education schooling, students faced with a new situation or scenario can project their own collection of schemas to frame around what they already know. Simple schemas can be expanded, revised and linked to form more complex schemas of the material being studied. The process of revising, elaborating and integrating these schemas into a complex web of knowledge about real-world and authentic problems will guide the critical-thinking processes sought in student growth. This contrasts with current-day classroom learning activities, which involve a transmission of knowledge that is abstract and often obsolete or out of context, where the teacher acts more like a coach or facilitator of students deepening their understanding of the subject matter being studied rather than simply delivering pre-determined content.

In a knowledge-building classroom, students come together to discover, dissect, apply creativity and collaborate on finding solutions to real-world problems associated with the subject matter they are studying from the curriculum. Knowledge-building classrooms create opportunities for students to acquire 21st Century skills that support problem-solving, related to so-called STEM skills, particularly analytical skills and the scientific method. Here, students become self-directed learners, researching the topic being studied and formulating their theories on what could become innovated solutions to the problems associated with the topic. Learning is not only relevant but engaging, interesting, and fun – primarily because the students are preparing for threats they themselves might come to face or problems impacting their own community. Knowledge Building supports higher-level thinking skills such as metacognition, problem solving, and critical thinking. Knowledge–building classrooms function in the same way as scientific communities, where members of small groups are able to collaborate in formulating theories and utilizing scaffolding to arrive at answers and to defend their theories in dialogue with their peers, which encourages learning from a reality-centered point of view around ideas. Theme-based learning and exploration, coupled with activities based on real issues applicable to everyday life, convert the classroom into living labs, engaging teachers and students alike as co-learners in personalized, meaningful learning through a methodical, systematic approach. The results: a multi-disciplinary perspective to improve student growth and academic achievement through deep learning, supporting mastery of core academic content, and building skills critical to academic and professional success in the 21st Century.

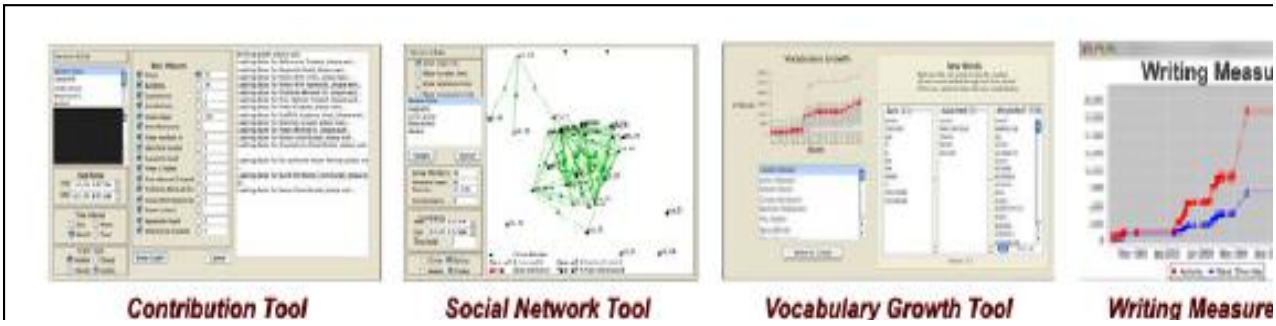
Students in knowledge-building learning environments not only develop competencies and increased literacy skills because they are constantly reading and writing, but also come to see themselves and their work as part of a society-wide effort to advance knowledge frontiers. They are able to create new knowledge from the workings of a collaborative learning community for

applications in a global society. When students work collaboratively on revolving their studies and research around a common theme, they are able to apply the "act locally/think globally" philosophy to turn local issues into global issues. Computer-supported collaborative learning takes place in small group formats around ideas each member of the group contributes to the discussion taking place amongst the students. When dialogue around ideas can be supported in learning environments whose members can share knowledge that will benefit all reciprocally, individual ideas can be transformed into action from the collective knowledge accumulation of the group. These are the Collaborative Learning Communities of 21st Century education, business, and government that support sharing ideas, information and work on common issues and shared problems to achieve a common goal, taking place in the knowledge-building learning environments of K-12 education. Henry Ford once said, "Coming together is a beginning. Keeping together is progress. Working together is success." What better success than to solve problems that constitute a commonality for all?

While mainstream schooling focuses primarily on short-term memorization and tasks, knowledge building focuses on ideas, with dynamics of epistemic agency and the advancement of community knowledge within learning environments that support a culture of inquiry and evidence. The dynamic is social, resulting in the creation of public knowledge in contrast to knowledge situated within the individual mind, as is the traditional concern of education. Learners in knowledge-building classrooms take on progressive problem solving, seeking to understand problems and issues at deeper levels rather than relying on memorization techniques. And because they are constantly reading and writing, students engaged in knowledge building gain mastery of the subject being studied. The project's assessment tools embedded in the educational technology unique to Knowledge Building, known as the Knowledge Forum, are designed to prove that students will also do better in standardized testing after having engaged in knowledge building during the school cycle. Additionally, students are motivated and challenged in classrooms where deeper learning is the focus. Due to the multi- and inter-disciplinary nature of constructivism-based knowledge-building pedagogy, students are able to apply what they have learned in one subject area to newly-encountered situations in another. Deeper learning also leads to the acquisition of knowledge and skills students must possess to succeed in 21st century jobs and civic life. At its heart is a set of competencies students must master in order to develop a keen understanding of academic content and apply their knowledge to problems in the classroom - and on the job later in life. Moreover, in the computer-supported collaborative learning environments supported in knowledge-building classrooms, there is lots of peer learning going on, and students can often learn better when they learn from each other while teachers definitely benefit from peer learning.

The challenge, meanwhile, is to equip teachers to guide their students in becoming contributing members of collaborative learning communities in the classroom. Our proposal for "Collaboration for 21st Century K-12 Teaching and Learning (C21CTL)" is based on the implementation of educational technology in the classroom, specifically Knowledge Forum, an electronic workspace accessed through the Internet or housed on a school's server. The

Knowledge Forum allows multiple students to contribute notes, media, and other artifacts to the database on the topic of the class' studies. It also has embedded assessment tools to give a universal view of how the class as a whole is progressing in their studies while also giving the teacher an opportunity to monitor individual student progress as well. Implementing the Knowledge Forum in the C21CTL Project classrooms produces added value in terms of assessing student academic achievement and increasing teaching effectiveness. Most assessment in schools today is done after completing a unit of work and only indicates final outcomes. The Knowledge Forum supports tools for assessment throughout the learning process, so C21CTL Project teachers can to assess students' thinking and progress toward acquiring knowledge as the work proceeds. Rather than waiting until the end completion of a unit of work or study to provide feedback, when it is too late to make adjustments, these assessment tools allow for the collection and analysis of real-time data, enabling teachers to adapt materials to ensure learning objectives are achieved. This constitutes an additional innovation of the project for supporting effective teaching. Java-based applets embedded in the software perform an internal assessment of reading, writing, vocabulary growth and subject mastery, and an important indicator will be the growth of STEM lexicon.

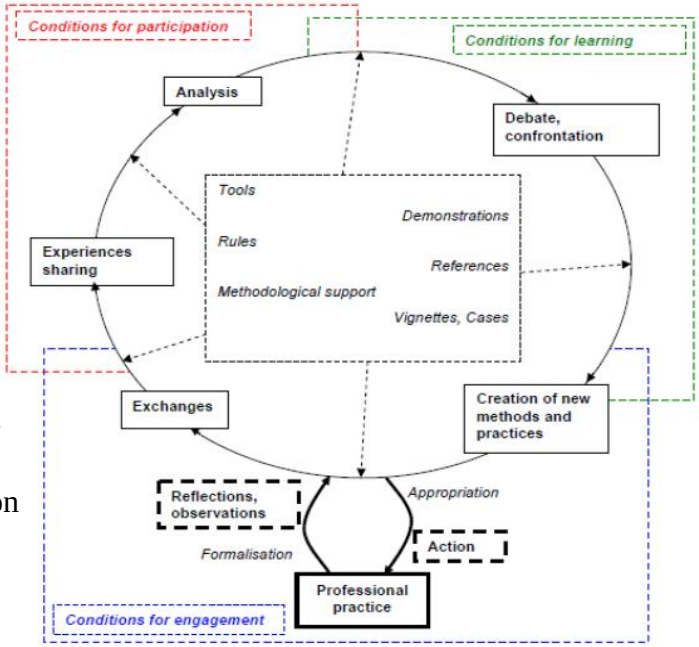


The resulting data give C21CTL Project evaluators and teachers the empirical evidence that literacy gains are being achieved through the constant reading and writing students are doing. Collaboration indicators are being met, and students are making substantive gains in mutual understanding and collaborative knowledge, and are progressing towards all other key achievements and goals. Aggregate student-learning data is collected to make the information valuable to and accessible by educators to support continuous improvement and innovation, for both formative and summative uses. The C21CTL Project will be able to use this statistical data to assess that teaching methods are effective, and evaluate behavioral change and institutional changes in the partnering schools. Having access to specific measureable data through the digital tools of the Knowledge Forum platform will provide the project with targeted, responsive and adaptable teaching and assessment of project achievement both as the project unfolds and after completion.

The Knowledge Forum constitutes the education-technology base on which our strategy was developed. The other component critical to the success of the C21CTL project consists of a Community of Practice to support teacher training and partnering of classrooms: By creating a Community of Practice, C21CTL teachers engage in ongoing professional development and an exchange of information between teachers, faculty, and principals of high schools with a focus on an interdisciplinary approach to studying subject matters of the curricula. Desired measurable outcomes: Participating teachers will be motivated to adopt Knowledge Building methodologies as a way of life, applying lessons learned during training for the project to classes taking place after completion of the project; team teachers will serve as models for change inspiring their colleagues to adopt innovation practices in their own teaching; education administrators will use the C21CTL Project as a stepping-stone to incorporating technology into other aspects of their schools; lessons learned during the project can serve as building blocks for replicating successes and avoiding failures. Measurable indicators: data suggesting ongoing use of the Knowledge Forum platform and technology after project completion; tracking of new teachers/classes from participating schools in professional development training; tracking of new teachers/classes from participating and sister schools joining the Knowledge Building network; continued and expanded participation of C21CTL Project schools in the Knowledge Building International Project network; tracking of access to professional forums for exchange of information and replication.

The teacher training component of the project prepares educators for highly effective teaching and learning with skills, knowledge, experience, digital tools and technology. We adhere to guidelines set forth by UNESCO to integrate Information and Communication Technologies into teaching for technology literacy, knowledge deepening and knowledge creation that will advance student learning and improve outcomes.

We adapted Daele´s Model of Professional Development as a cycle for the project's Community of Practice, where participants can be trained, implement the methodology in their learning environments – whether in the classroom or in community-based programming, use the tools, and reference resources and literature, case studies and best practices, and interact with others. A combination of formal training, information exchanges and technology guidelines creates the Educator Training component of the C21CTL project, providing a valuable resource for our Community of Practice to produce truly effective educators.



Daele´s Model of Professional Development

Several researchers consider professional development as a process supplied not only by prior training but also by interactions with professional peers and by personal reflexivity in and out the workplace. The latest research on learning theories have shown that a process of continuous training fosters innovation in teaching. A process that mixes formal training and trading information through discussions with colleagues and reflection on teaching practices is most conducive to the creation of new teaching methods and practices and increasing effectiveness. When teachers are able to exchange ideas and experiences, they help each other to develop their skills and expertise, and these exchanges help to solve contextual problems in teaching.

Teacher professional development is a main concern amongst educators. While there are examples of ongoing structured training opportunities for teachers to come together to explore common practices, interests and purposes either at a local level (i.e. inside their school or institution) or at a global level (i.e. on the Web), there should be more that are both available and accessible to a whole range of educators. At the local level, while teachers may exchange in a face-to-face relationship, this fails to capture the insights for others. At the global level, web technologies like fora, blogs and wikis allow the accumulation of exchanges for a wide audience but in an unstructured and poorly contextualized way. Thus, knowledge created through existent discussions is hardly reusable.

The C21CTL project supports a sound education setting where teachers are no longer simply transmitters of information. Educators are trained as leaders, motivators and facilitators of learning. In a computer-supported collaborative learning environment, teachers and faculty improve student achievement by enabling students ~~to~~ become better information seekers, analysts, problem-solvers and communicators through the use of technology. At the same time, our Educator Training model promotes gaining proficiency in the use of technology in the classroom and become highly effective, through the built-in support mechanisms and digital tools, particularly those that measure teacher effectiveness as well as student performance and academic success. Administrators can learn from each other and bring the best practices to their schools. They learn how to assess the structures, processes, and systems needed to create the culture for knowledge-building learning on their campuses, and how to establish compelling, challenging, and achievable goals toward creating coherence in the roles and responsibilities of students, staff, administration, and parents.

This model allows for valuable contributions toward shared and accessible pools of knowledge from the field. First, through videoconferencing functions, teachers observe other experienced CSCL teachers in different teaching contexts. They can then experiment their practice in their own context, building on what they learned from more experienced peers. When encountering difficulties, they can access the online portal chat and forum functions to look for help from colleagues and experienced teachers. The forum content is a searchable database of the compiled anonymous journal entries, recording problem and solutions, the usefulness of a method, and difficulties using a method or solution in practice. The forum allows teachers to pinpoint unusual situations precise contexts, specific methodologies, and difficulties. This dual

approach - knowledge sharing and practice resolutions - is a unique approach that responds to the needs of novice teachers and experienced teachers alike who begin to implement the knowledge building methodologies in their classrooms. By connecting teachers within similar disciplines and areas of study, we favor knowledge co-construction and innovation that allows teachers to construct and improve their own practice by analyzing different existing practices. It also helps to bridge the gap between teachers´ practices and education policies and standards by providing an inventory of real and effective teaching practices and case studies. By connecting teacher from different disciplines, interdisciplinary collaboration takes place to enhance the curricula.

The C21CTL Project´s Educator Training component is ongoing and collaborative. When we find good candidates who want to become educators within the CSCL environments, we nurture them and aim to reward them with personal and professional opportunities to capacitate them to contribute toward transforming their schools into 21st Century learning organizations. What is unique and innovative about the Educator Training component of our Community of Practice is that we organize venues, train educators in the theory, methodology, practice and the use of the tools, and provide opportunities to collaborate with seasoned teachers and administrators in peer-to-peer mentoring. In this way, they are able to learn from each other, share material and discuss important issues such as assessments, classroom management, and ways to address socio-economic barriers to accessing education and improving outcomes.

The training is geared toward educators – teachers, faculty, principals, administrators, superintendents, specialized staff, etc. – to learn about knowledge-building and distance learning principles, CSCL theory and methodology, and incorporating these into practice. Trainees receive an overview of the field as well as information about researchers, teachers and students working together to develop new tools, under- standing learning possibilities for students, and benefits to knowledge building educators. Initial training sessions — referred to as the KB Summer Institute — engage teachers in reflective discourse about content, learning, and teaching, enables teachers to examine each other's instructional strategies, and engage in discussions about how to improve student learning. Trainees create scenarios of real learning activities they might employ in the learning environments and gain proficiency in using the platform and assessment tools. Once they return to their classrooms and other learning environments, trainees are enrolled in a global network, where experienced KBIA CSCL educators will help them maintain and develop the concepts and methodologies learned at the Summer Institute. Then, throughout the school year, trainees will be invited to participate in regularly-scheduled videoconferencing to exchange information, explore methods, and share experiences among experienced CSCL educators and their partnered classrooms.

An online portal provides access to centralized resources, and content experts are available for consultations through the chat and forum functions of the portal. Trainees will also have access to the peer-to-peer university (P2PU) course "Introduction to the field of Computer Supported Collaborative Learning", to our NING social network platform, and to our customized educational online portal:

Taken together, edtech joins the Community of Practice to form the Alternative Learning and Teaching Ecosystem – ALTE, a model that supports the acquisition of 21st Century skills in K-12 education. The teacher training would be coordinated through the University of Nevada, Las Vegas College of Education and put into practice in the elementary, middle-school and high-school classrooms of the Clark County School District as partnering LEA in the project. Learning assessments would be conducted by research faculty at the State University of New York at Albany.

Through C21CTL, we aim to train UNLV undergraduate and graduate students from the College of Education teaching at CCSD schools as effective educators, well-prepared to work in concert around elements of a system that helps students to learn and educators to continue to improve through on-going professional development with participation in the Knowledge Building Community of Practice (KBCOP).

Utilizing technology effectively enables us to live, learn, and work successfully in an increasingly complex, information-rich and knowledge-based society. Students can become creative and effective users of productivity tools, communicators, collaborators, as well as informed, responsible, and contributing citizens. Through the ongoing and effective use of technology in the schooling process, students have the opportunity to acquire important technology capabilities, with the key individual in helping students develop those capabilities being the classroom teacher. He or she is responsible for establishing the classroom environment and preparing learning opportunities that facilitate students' use of technology to learn and communicate. Consequently, it is critical that all classroom teachers be prepared to provide their students with these opportunities. Knowledge building supports a method of teaching and learning through a multidisciplinary approach of experiential learning and guided discovery.

Students are able to achieve high academic standards by utilizing knowledge-building principles to study core subject areas and electives while preparing for future learning and educational success. Through knowledge-building learning environments, students learn how to execute, monitor, and regulate the knowledge construction process, become proficient information technology users, information seekers, analyzers, evaluators, problem-solvers and decision-makers. Students move away from memorization technique of rote learning to look at issues within a culture of inquiry and evidence through research, developing theories, sharing information, refining ideas through scaffolding, and arriving at solutions that they formulate together around ideas and discourse, similar to the learning process utilized in scientific research communities. They search for information about the subject matter chosen in a given class from authoritative resources in print, such as books, scientific journals, magazines and newspapers, from virtual resources and the Internet, and from interactions through videoconferencing. They are able to internalize information and apply the knowledge they have gained to a given authentic problem that might have a direct impact on their own lives and their communities and studied in alignment with standards such as common core. Through knowledge-building methodology, specifically scaffolding, students learn to evaluate information, think critically, and acquire problem-solving skills by considering creative and innovative approaches to real-

world problems. And when they are partnered with classrooms in other communities and in different parts of the world, local problems become global issues, and students become the global citizens who come up with solutions they formulate around their own ideas bolstered by the research they have done.

Our proposal for The C21CTL treats "ICT literacy" as a core skill to assess cognitive skills that students employ in conjunction with their use of the education technology selected for the project, specifically the Knowledge Forum™, an electronic workspace accessible through a broadband connection or hosted on a local server. Students also create multi-media presentations on their subject for sharing with their partnered classrooms.

By aligning the curriculum of the project-based learning in ALTE environments to standards such as common core, we value what content is learned; by supporting computer-supported collaborative learning environments, we also value how students engage in inquiry, enabling them to function as do professionals – scientists, business people, and community leaders – responding to real-world problems in learning communities similar to those in research and business. The model has been proven effective from over 30 years of research led by the Building Cultural Capacity for Innovation (https://web.archive.org/web/20150215021806/ http://ikit.org/bcci/) - a multi-nation design research project with a practical application in classroom learning in over 17 countries around the world. Students engaged in ALTE-equipped classrooms are able to learn based on a broad set of competencies: seeking out information and researching answers to problems, learning to analyze oftentimes complex materials, and being able to distinguish between useful and irrelevant material. Learning becomes relevant as students study common themes related to the real-world challenges their own communities face.

A. 2. Significance of the proposed project: Technology has increased the demand for workers who have good STEM basics and can communicate effectively. Future jobs will exist that are not even envisioned today. Tomorrow´s employees also need to think critically, solve problems, innovate, and collaborate in teamwork. The growth in information technology and changes in work organization have contributed to the rising demand for higher-order cognitive skills in workers. Given the increased autonomy and responsibilities in many work environments, "soft skills" such as motivation, problem-solving, making contributions to the broader working environment, ability to accept and learn from criticism, etc., have become very important skills sought in workers for the 21st Century labor market. Let´s not forget about globalization, which produces real gains for a country's economy and has a real impact on wages and income of workers as a whole – and the corresponding need for employers to acquire a workforce that is multicultural and multilingual. Students – the nation´s future professionals – need to be skilled at learning quickly and on their own, in order to handle the challenges of academic study and demands of the labor market later in life. Attitudes and behavior, including the ability to engage in study skills, time management, awareness of one's performance, persistence, and the ability to utilize study groups, are also required for college readiness and

skills needed to succeed throughout the educational spectrum. The ALTE model facilities these goals.

Students educated with the ALTE model use acquired skills to become independent learners, able to handle the challenges of academic study. Acquiring 21st Century skills will contribute toward students becoming "college ready", able to succeed at a wide range of post-secondary institutions such as universities, community colleges and vocational training. Research shows that if students are prepared to succeed in college entry level courses, they will most likely be able to cope with the full range of college courses they can encounter throughout their academic studies. But in order to prepare students for college readiness, we cannot wait until children are approaching college age to prepare them for college success. We must start arming them at an early age with the skills and knowledge they will need for post-secondary education. K-12 teachers play a critical role in preparing their students with the skills they will need to be "college ready". The ALTE model constitutes tools K-12 educators need to facilitate the learning of knowledge and acquisition of skills that will prepare secondary education students for entry to higher education and the workforce, or being "career-ready", and to attain their college completion goals without having to go through remediation in post-secondary education. The ALTE approach works to address the underlying issues related to effective education reform by:

- Giving students what they need to do well in school at an early age, as early as 2nd grade to help with the 3rd - 4th grade slump. This will lessen, if not completely close, the gaps among students in primary school that manifest themselves over the K-12 continuum.
- Contextualization through phenomenon learning presents information in an engaging way**,** which makes learning not only relevant to the student but fun and engaging as well. The Network for Teaching Entrepreneurship reports that 1 in 3 U.S. high school students drop out - 7,000 students every day or one student every nine seconds – mostly African American, Latino and Native American students. In the NTE survey, an overwhelming percent of dropouts report they would have stayed in school if it were relevant to their lives.
- Small group learning can help teachers identify and understand students' weaknesses and shortcomings and serve as a technique to help student overcome them and progress in the learning process. It also helps with classroom management, self-directed learning and peer learning.
- A project such as C21CTL attracts and retains high-quality teachers who have been well-trained both in education pedagogy and the use of technology within school cultures that support visionary and shared instructional leadership, and are conducive to professional development. Knowledge-building teachers meet and exceed standards outlined in UNESCO's ICT Competency Framework for Teaching. Additionally, UNLV's COE attracts a teaching force that is reflective of the demographics of CCSD's student population in terms of races and cultures.
- Knowledge building is based on collaborative learning that thrives on complexity and idea diversity, where all members of a learning community contribute theories regarding the solution to real-world problems. The objectives of the ALTE model is to bring knowledge building into students' efforts to solve societal problems and serve the public good, creating an effective way

of acquiring important 21st Century skills while mastering content that is well grounded in science and the humanities. Simultaneously, educators are acquiring and mastering their own teaching skills, especially those aligned with the UNESCO ICT CFT. This framework outlines the competencies that teachers need to integrate ICTs into their professional practice, emphasizing the role that ICTs can play in supporting major education focus areas across growth phases of knowledge acquisition and leveraging ICTs in unique ways. It also provides a lens through which to integrate ICT into teacher training. ALTE mimics previously-mentioned high-quality education systems by transforming learning to ensure that what we are teaching and testing are important, reasonable and challenging to every student.

A.3. Potential replicability of the proposed project or strategies, including the potential for implementation in a variety of settings. (34 CFR 75.210)

The ALTE Model incorporates several components, including viable education technology, for a range of learning environments inside and outside the traditional classroom. It can be applied to alternative learning paths such as vocational training and high school completion, prisons, and adult learning for GED, as well as after-school programming and summer learning projects. Because the knowledge-building technology, the Knowledge Forum, is available in several languages, the model can complement teaching English Language Learners (ELLs). It is easily replicable, scalable and affordable, with the bulk of the expenses directed toward training teachers in its use and the application of the assessment tools embedded in the platform.

The ALTE model is also intended to be a validated solution to persistent educational challenges such as college readiness, drop-outs, achievement and gender gaps, addressing students with special needs. It supports the expansion of effective solutions to serve large numbers of students, both in urban and rural settings, and has a 20-year track record of effectiveness, which has been documented through research and the practical application of knowledge-building pedagogy in K-12 education systems throughout the world. Several of these projects were designed as a partnership between the compulsory education system, higher education and the Ministry of Education in specific regions of several countries, including Finland, Norway, Italy, Portugal, Singapore, China, Canada and Spain. They aim to support students in in-depth and collaborative knowledge building through an examination of real-life problems in order to formulate theories while posing and answering questions that are increasingly complex and elaborate. A rigorous external evaluation of one such project, that has been ongoing since 2006, assessed the value of knowledge building to various stakeholders, including students and teachers, in Catalonia, Spain, and was conducted by the Ministry's Superior Council for Education Evaluation with the aim of evaluating the principal theoretical and methodological criteria needed to further develop and institutionalize the project.

With college- and career-readiness issues becoming key priorities for the PK–20 education community and the nation at large, today's teachers will need to be qualified to help their students be successful in learning – in a wide range of subject matters. This will form a springboard for them to continue to learn post-secondarily and acquire skills that will ultimately

prepare them for the workforce, and as productive citizens in society. The technology-based pedagogy of the ALTE model does not obviate the need for teachers to serve as leaders, motivators and facilitators, and the role of the teacher in our project is of utmost importance. While traditional learning defines the role of the teacher as being primarily a dispenser of information, solely responsible for ensuring that learning occurs, knowledge-building pedagogy trains the teacher more as a facilitator of learning through membership in the knowledge-building Community of Practice. In the computer-supported collaborative learning environments supported by the ALTE model, they become mentors and coaches of their students, who typically work in small groups, thus enabling them to manage the learning process more efficiently. In ALTE classrooms, a mainstream education class of 30 students using memorization techniques to learn for mandated testing is transformed into a knowledge-building class of 5-6 groups working collaboratively around ideas of subject matter aligned with the standards and gaining knowledge through constructivism techniques, communication and critical thinking skills, and self-directed learning. Their work supports deeper explorations and discovery of knowledge through project-based learning, with a higher level conceptualization that gives them greater explanatory power. In ALTE-equipped learning environments, students take over high levels of social and cognitive responsibility. Additionally, student ideas that have an "out-in-the-world" application or are based in real world scenarios and not tied solely to personal knowledge or beliefs form the basis for creating knowledge that is accessible to an entire community, in our case a community of students learning in small groups. In knowledge building, it is referred to as "community knowledge" with the "community" referring to students learning in small groups.

We are proposing a true paradigm shift with a model that reimagines learning, where the format of the traditional, more passive approach to learning is replaced by a more collaborative method of learning. Instead of sitting and listening to the teacher deliver pre-determined content that needs to be memorized to pass another test, students can gain subject mastery through knowledge building. They do not sit in rows of individual desks but rather work in small groups where they are encouraged to delve into the subject matter, come up with creative and innovative ideas to share with their classmates, work together to discuss and solve problems in a collaborative learning environment, led by the teacher who becomes a facilitator of learning. Every member in the small group learning environment is encouraged to contribute his or her idea, access authoritative resources and share the knowledge they have gain through their research. In this process, students acquire important 21st Century skills such as critical thinking, communication and creativity, the "4Cs" of future education while supporting the development and ongoing training of effective educators. Students in the small-group learning environments supported by the ALTE model are members of a "knowledge community", functioning collaboratively similar to a scientific community of investigation and research, which is missing today from K-12 education on a wide-spread scale.

Assessment tools embedded in the ALTE model can be leveraged to support a teacher's development as an effective educator. Under the status quo of K-12 education in the U.S.,

teachers are expected to be content conveyors, following pre-defined curriculum in preparation for accountability tests. Utilizing the ALTE model, teachers become effective, creative agents at the complex intersection of navigating academic content and student cognition, thereby helping improve student achievement. The activities supported by the ALTE model dovetails with the goals of professional development for K-12 teachers: to ensure opportunities that improve the craft of teaching with tools to do so, while providing data that school systems can use in determining whether students learn more as a result. C21CTL activities also contribute to professional development and training research bases. We adapted Daele´s Model of Professional Development as a cycle for our Community of Practice, where educators - teachers, principals, tech support and other faculty members - can be trained, use the tools, methodologies and resources, make references to literature, case studies and best practices, and interact with each other on an ongoing basis. The KBCOP supports interaction between partnered teachers, who meet periodically through videoconferencing to examine student work on the Knowledge Forum from the collaborative classroom project around a common issue or theme chosen for the C21CTL, brainstorm ways to instruct students who haven't yet mastered standards, and evaluate results. This ensures that teachers both have enough time for accessible and inexpensive professional development and work to improve their own practice. It also sustains an interactive professional development program that guides educators as they learn to use minute-to-minute and day-by-day strategies to integrate assessment into student learning. Additionally, it lends itself to self-directed learning techniques so that the teaching does not reflect the learning styles of the good to exceptional students while the marginal-to-failing students are left behind.

B. Quality of the Project Design and Management Plan

The C21CTL project consists of: (1) **Educator training** following UNESCO guidelines for UNLV students teaching in the CCSD to integrate technology into teaching while advancing student learning and creating a Community of Practice; (2) **Technology-enhanced pedagogy and methodology** delivered via the Internet where multi-disciplinary coursework is aligned with common core standards and curricula; (3) **Assessment of student learning** utilizing embedded tools for formative and summative assessments during the school cycle and creating Quasi-Experimental Designs; (4) **Partnered classrooms** facilitating project-based learning and interactions between students and teachers around the world.

Knowledge-building pedagogy actively engages students in brainstorming ideas, identifying problems, researching for solutions and evidence, debating and engaging in discussion and discourse with their classmates and with their peers. These activities have a clear goal of co-creating new perspectives and advancing knowledge beyond the limit of an individual. Numerous research findings show that this approach, specifically the knowledge-building approach, induces motivation to learning (especially when the subject matter is relevant to the student's life), improves learners' higher order thinking (e.g. critical thinking, problem-solving), and fosters personal development (e.g. communication skills, inter-personal skills and lifelong-learning attitudes). The components of the ALTE Model (small, collaborative group work,

teachers as facilitators, identifying and solving problems by brainstorming ideas and researching solutions) are well researched as best practices, with numerous studies showing how effective these practices are. What is new and novel about this approach is the technology-supported assessment of the learning that takes place in the classroom. In addition to fostering a deeper understanding of problems studied, implementing the ALTE model in the classroom produces added value in terms of assessing student achievement. Teachers can tell immediately if all of their students are participating and the extent to which they are referencing, reading, and building on each others' notes contributed to the Knowledge Forum platform. They can see almost instantaneous effects on levels and kinds of participation and increases in vocabulary (both quantity and difficulty level), and the amount of writing done. This constitutes an assessment of learning as well as assessment for learning – data that can be used as feedback to modify learning activity in real time.

The analytic toolkits can assess social network patterns when we are interested in collaboration dynamics, and vocabulary growth when we are looking at concept attainment. In fact, the focus of our evaluation for this grant revolves around literacy improvement among CSCL students involving the assessment of vocabulary growth and usage. The tools can provide formative assessments that are valuable for gauging students' achievements in writing, which also holds value for students gaining proficiency in both their mother tongue as well as in the common language of the project in which they collaborate with peers in other countries. For the Knowledge Building International Project, English is the common language. It is also important to note that knowledge builders monitor and build their work, engaging in self-assessment rather than being totally dependent on external evaluations such as standardized testing.

To capture student progress, teachers can use both summative assessment measures such as standardized tests and also novel formative tools such as those for social network analysis. This tool captures the degree to which students take collective cognitive responsibility by being aware of other contributions, building on "*rise-aboves*" or referencing others´ ideas, and participating in top-level planning, decision making, and coordination. With respect to providing evidence on knowledge creation, we utilize the Ways of Contributing framework to show evidence of theory improvement. This framework is used to measure development in causal reasoning and the ability to produce increasingly coherent explanations to puzzling phenomena or problems of understanding. The "Ideas Tool" provides teachers with the ability to zero-in on inquiry threads that feature knowledge advancement by integrating various functions such as color coding and highlighting, tagging and visualization. This tool also enables students to collaboratively evaluate the community´s ideas. Teachers and students alike are able to use these tools to gain feedback that transform on-going practice. The ATK (Analytic Toolkit) allows teachers to monitor progress made in the Knowledge Forum by the individual student and by the classroom as a whole. It also produces important data for evaluation purposes, making it possible to analyze the number and quality of contributions as well as the diversity of vocabulary and keywords. Teaching efficacy can also be assessed with a universal overview of the progress made by the individual student, the small groups or the entire classroom in mastering the subject matter

around which knowledge is being built. The improved analysis visualization tool, the Knowledge Space Visualization Tool (KSV) analyzes curriculum standards in 3-D, can be applied iteratively over the course of the study, providing easily readable "hard evidence" of student engagement with core concepts and terms. There are also Latent Semantic analysis tools we will employ to gage breadth of coverage of key concepts in student notes. Students can be identified by name or by an assigned number for greater anonymity. This leverages the power of technology for continuous improvement in student learning.