Inquiry-Based Learning

Environments in both formal education as well as non-formal learning settings enhance the inquiry-based approach to real-world learning with specific methodologies and strategies such as scaffolding, small group dialogue and the creation of media-rich presentations on the interdisciplinary learning process.

Pedagogy and strategies provide learners with opportunities to become problem solvers by studying real-world problems from an interdisciplinary approach. Knowledge-building learning environments support collaboration as learners work toward solving problems by formulating theories, carrying out investigations and research in order to refine their theories over time, refocus on the problem to revise strategies, and share results while monitoring the progress of the learning process.

Knowledge-building pedagogy, methodologies and strategies constitute an arsenal of tools that facilitate learning and the acquisition of skills – by prompting questions about "*how*?". 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 formulate theories that answer the questions around complex situations being studied and utilize scaffolding to arrive at answers and to defend their theories in dialogue with their peers. This process encourages learning from a reality-centered point of view around ideas.

This resulting integrated learning environment supports student inquiry that crosses disciplinary boundaries. Learners take an interdisciplinary approach to learning, drawing upon Math, Science, Social Studies, Language, the Arts and Humanities and other disciplines to both improve and represent their understanding of different aspects of the issues being studied while knowledge-building facilitators and teachers circulate among the small group learning circles to elicit feedback on the lesson and answer questions on the content. This is also where extensive peer learning takes place amongst classmates, and where teachers, instructors and trainers become co-learners. The model for One Plan 4 One Planet supports a sound education setting where teachers are no longer simply transmitters of information. By bringing together its different components - the Community of Practice, Knowledge Building pedagogy, educational technology and assessment tools – under one roof, the model supports interdisciplinary inquiry-based experiential learning around themes, often referred to as Phenomenon Learning.

This resulting integrated learning environment supports student inquiry that crosses disciplinary boundaries. Students take an interdisciplinary approach to learning, drawing upon Math, Science, Social Studies, Language, the Arts and Humanities to both improve and represent their understanding of different aspects of the issues being studied. Knowledge-building facilitators and teachers circulate among the small group learning circles to elicit feedback on the lesson and answer questions on the content. This is also where extensive peer learning takes place amongst classmates, and where teachers become co-learners. The One Plan 4 One Planet Model bundles pedagogy with technology in a complete ecosystem for student-centric learning throughout the education continuum and into the workforce.

When working within collaborative learning environments, members of a small group gathered around a problem, objective or plan are learning with others by capitalizing on different skills and experiences to solve problems. In the process, they become co-learners, gaining knowledge from the experiences of others in their group. They achieve their learning objectives around the production and continual improvement of ideas, which are the currency of the 21st Century Knowledge Age.

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 a group. Collaborative Learning Communities of 21st Century research, business, and government support sharing ideas, information and work on common issues and shared problems to achieve a common goal. Collaboration is also an important Knowledge Economy skill, and one of the 4Cs of future education, joining critical thinking, communication and creativity as those skills students need for success in school, in the workplace, as active citizens and in life. The model's Community of Practice prepares knowledge-building facilitators with resources:

- Tutorials and hands-on training on how to use the Knowledge Forum™, an electronic workspace that supports collaborative learning for an unlimited number of students, accessible through the Internet or hosted on a local server. The tutorials also delve into strategies and tools available to chart the progress of student learning through both formative and summative assessments.
- Videoconferencing setup for partnering learning environments and supporting interactions between knowledge-building facilitators, including between teachers, principals, technicians and staff, and between students themselves.
- Activities designed to introduce participants to the Knowledge Building handbook and inquiry-based experiential learning, including digital badging, one of the fastest-growing phenomenon in education to recognize learning, achievements and skills and especially apropos for learning around topics in a knowledge-building classroom.
- Access to a trove of resources such as literature, case studies, best practice, sample classroom setups, and tutorials

An Introduction to Knowledge Building

Knowledge Building accommodates teachers and instructors at different grade levels within academic learning environments and in different subject matters in training charged with teaching diverse disciplines with diverse groups of students in organizing broad key concepts within a curriculum to create a learning environment conducive to:

- student questioning and theorizing
- student investigation and discourse
- identifying cross-curricular links
- supporting student-driven initiatives

Theme-based learning and exploration, often referred to as “phenomenon learning”, coupled with inquiry-based learning activities based on real issues applicable to everyday life, convert knowledge-building classroom and learning environments into quasi scientific communities. Knowledge Building engages teachers and students alike 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 the group for applications in a global society. Knowledge Building focuses on the exploration of ideas, where facilitators help learners access authoritative resources that enable them to understand, perform analysis and interpretation of the issues being studied. The computer-supported collaborative learning model promotes interdisciplinary learning around ideas while facilitating the acquisition of important 21st Century skills – the 4Cs of future education and the workforce: critical thinking, collaboration, communication and creativity. These prepare primary and secondary students for post-secondary education and training and higher education students for entry into the 21st Century workforce of the Knowledge Economy. It also prepares individuals already in a technical career to acquire the soft skills that will prepare them to apply skills for collaboration and effective communication with their colleagues and co-workers.

In K-12 education, knowledge-building facilitators ask students not what they want to be when they grow up, but rather what problems do they want to solve

Responding to a Clarion Call to Action for Education Transformation

Three decades ago, futurists began to predict that work as we have known it is ending based on probing questions of what is possible and not necessarily what will come to be. Research has shown how new social practices evolve due to increased use of new digital technologies, especially among young people, and recommendations from esteemed international organizations have come forth on the need to redesign learning for the 21st Century. The European Commission reports that higher education curricula are often slow to respond to changing needs in the wider economy, and could be revised to anticipate or help shape the careers of tomorrow. The Commission's Rethinking Education Project (2012) aims to reform education systems across the EU. By meeting growing demand for higher skills levels and prioritizing the use of information and communication technologies. It joins the plethora of organizations advocating for education reform toward skills acquisition as a means to prepare young people for the Future of Work:

OECD "The Future of Education and Skills – 2030"

World Economic Forum *"The Future of Jobs"*

Partnership for 21st Century Skills *"Skills Primer"*

OECD "Schooling Redesigned Toward Innovation"

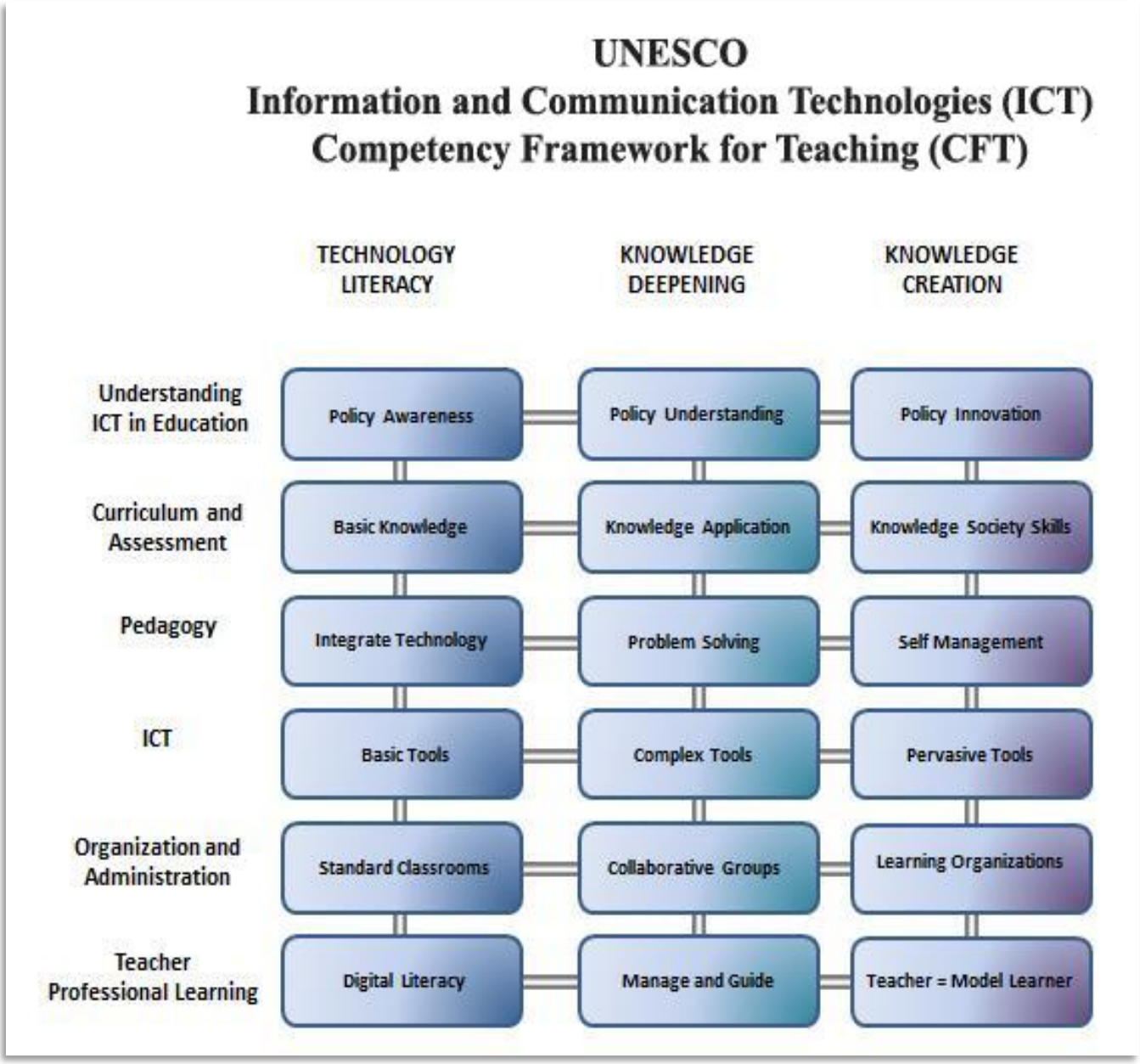
PWC "The Future of Work 2030 – A Wake-up Call"

"Workforce of the Future – Competing Forces in 2030"

According to UNESCO, by 2036, more people worldwide will be graduating through education than since the beginning of history. A combination of technology and its affect on work, demography, and a huge explosion of population are making degrees obsolete. The whole structure of education is in a radical shift. Significant changes in labor demographics and advances in technology are leading to a remarkable transformation in how companies organize work. Technology is moving so fast that it often outstrips the capacity of most enterprises to keep pace. Consequently, companies will need to continuously access new, emerging skills and expertise that will likely be in short supply.

Aligning with ICT Standards for Learning and Teaching in the 21st Century

Our model aligns with international standards that enable students to use information and communication technologies (ICTs) to learn more efficiently, thus responding to calls from international bodies such as UNESCO for Knowledge Deepening and Knowledge Creation. When combined with Technology Literacy, these actions help students become collaborative, problem-solving, creative learners through the use of information and communication technologies. 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.



Source: What is UNESCO's ICT CFT? www.unesco.org

In advocating for education reform, UNESCO's ICT Competency Framework for Teaching acknowledges the need for enabling policy environments, teacher development and training programs and teachers' professional and cultural environments as determinant factors to ICT implementation success:

Modern societies are increasingly based on information and knowledge. So they need to:
-build workforces that have ICT skills to handle information and are reflective, creative and adept at problem-solving in order to generate knowledge;
-enable citizens to be knowledgeable and resourceful so they are able to manage their own lives effectively, and are able to lead full and satisfying lives;
-encourage all citizens to participate fully in society and influence the decisions that affect their lives;
-foster cross-cultural understanding and the peaceful resolution of conflict.
These social and economic goals are the focus of a country's education system. Teachers need to be equipped to achieve these goals, and in partnership with industry leaders and global subject experts, UNESCO has created an international benchmark that sets out the competencies required to teach effectively with information and communication technologies.

SOURCE: UNESCO's ICT Competency Framework for Teachers

UNESCO's framework emphasizes that it is not enough for teachers to have ICT competencies or be able to teach with them. Teachers need to be able to help their learners become collaborative, problem-solving and creative through the use of ICTs so they will be effective citizens and productive members of the workforce. The framework addresses multiple aspects of a teacher's work:

- **Technology Literacy** - enabling learners to use ICT in order to learn more efficiently;
- **Knowledge Deepening** - enabling learners to acquire in-depth knowledge of their school subjects and apply it to complex, real-world problems;
- **Knowledge Creation** - enabling learners, citizens and the workforce they become, to create the new knowledge required for more harmonious, fulfilling and prosperous societies.

Successful Student = Employable Graduate

Acquiring these skills empower students to become problem solvers and opportunity finders, able to remain adaptable when facing obstacles, persist through failure and skilled in communicating and collaborating better. The model supports student growth by helping learners develop a sense of curiosity, initiative and persistence while engaging learners with coursework that leads to acquiring the appropriate mindset for perseverance and determination to succeed. Educators may not even know which skills will be most in demand in 3–5 years, let alone be able to develop or access those skills in a timely manner. For these and other reasons, our model aims to promote the acquisition of so-called 21st Century skills, also known as the 4Cs of Future Education, to complement technical skills.

According to the World Economic Forum, 21st Century workforce skills fall into the categories of Foundation Literacies, Competencies and Character Qualities:

FOUNDATIONAL LITERACIES include the basic skills used to engage everyday tasks and skills, such as reading, writing, using technology and managing money.

COMPETENCES are the skills needed to effectively engage in complex tasks such as critical thinking, creativity, problem solving, collaboration and communication.

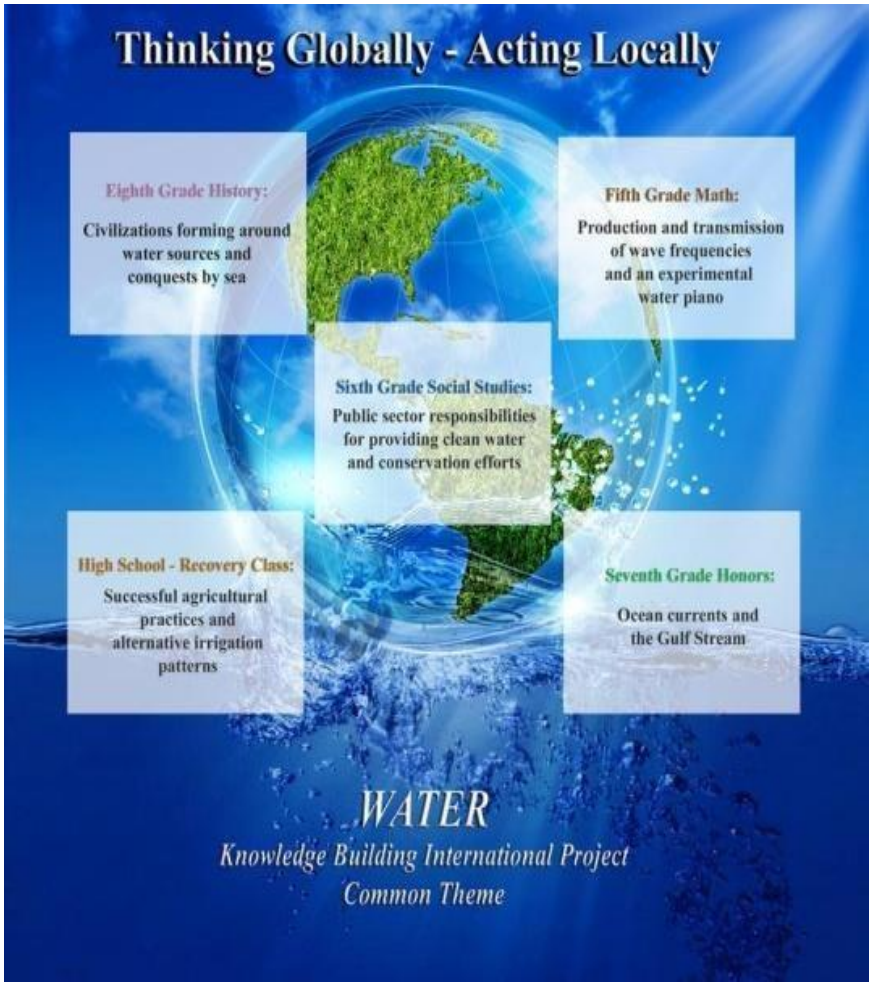
CHARACTER QUALITIES are used when engaging changing environments and include a growth mindset with skillsets such as curiosity, initiative, persistence and adaptability.

The demand for 21st Century skills will only increase. Employers seek soft skills such as communication, work ethic, teamwork, dependability and self-motivation in addition to problem-solving skills to follow through.

Source: The World Economic Forum report, "New Vision for Education: Fostering Social and Emotional Learning Through Technology"

In preparing learners for the 21st Century workforce, knowledge-building facilitators ask themselves "*How can learners acquire the skills they need for jobs we don't even know will be created, for technologies that have not yet been invented and solve problems that have not yet been anticipated?"* Through phenomenon-learning strategies, students identify and analyze real-world problems taking an interdisciplinary approach to problem solving. This type of learning is easily facilitated through the use of the Knowledge Forum™, an electronic workspace that supports collaborative learning through knowledge-building edtech. The following illustrates how a multi-disciplinary approach was used in phenomenon learning:

CASE STUDY – K-12 Education PHENOMENON LEARNING AROUND WATER



- An Earth Sciences class studied the Humboldt Current to learn how pollutants from an oil spill in North America reached the shores of the European continent.

- A Social Studies class focused on government's responsibility for providing clean water to its citizens, expanding their learning with activity that could lead Toward understanding the issues that surround water conservation.

- A Mathematics class studied wave frequencies on an experimental water piano.

- A History class studied how civilizations were formed around water sources such as rivers and lakes, how conquests were made by sea, and how water has served as pivotal transportation routes for exploration.

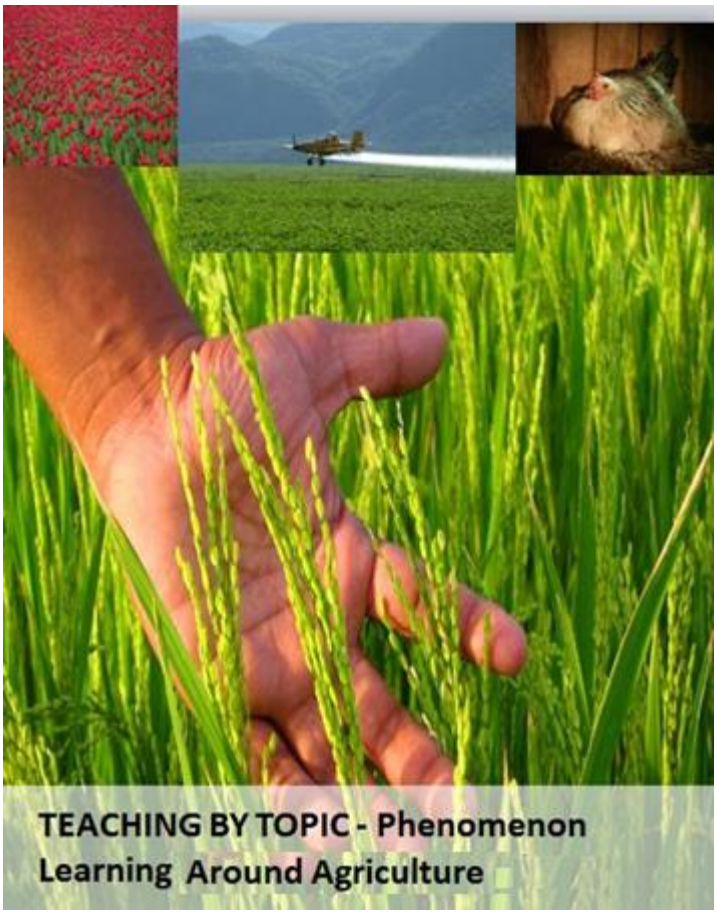
- An Economics class studied how rivers, lakes and oceans provide natural highways for commercial navigation.

- A Biology class studied the physical, chemical and biological analyses of water bodies to learn about the degradation of wetlands that has altered their functions, affecting the ecological balance of surrounding environments

- A Health Sciences class studied the roles water play in achieving healthy nutrition and well-being.

- A Civics class looks into government control for quality, disease abatement, and interstate or inter-province and import/export commerce regulations for water and associated food products.

CASE STUDY – HIGHER EDUCATION PHENOMENON LEARNING AROUND AGICULTURE



- A Chemistry class studies soil composition and the nutrients needed for healthy agricultural crops.

- An Earth Science class studies how challenges around water impact agricultural practices and lead to alternative methods of crop production such as hydroponics.

- A Biology class learns how the agricultural sector produces the many foods needed for healthy bodies, including discussing the pros and cons of GMOs and organics, as well as vermin control needed for healthy crops.

- A Geography class sees how the local topology is suited or not suited for crop production and look to alternative solutions such as vertical gardens.

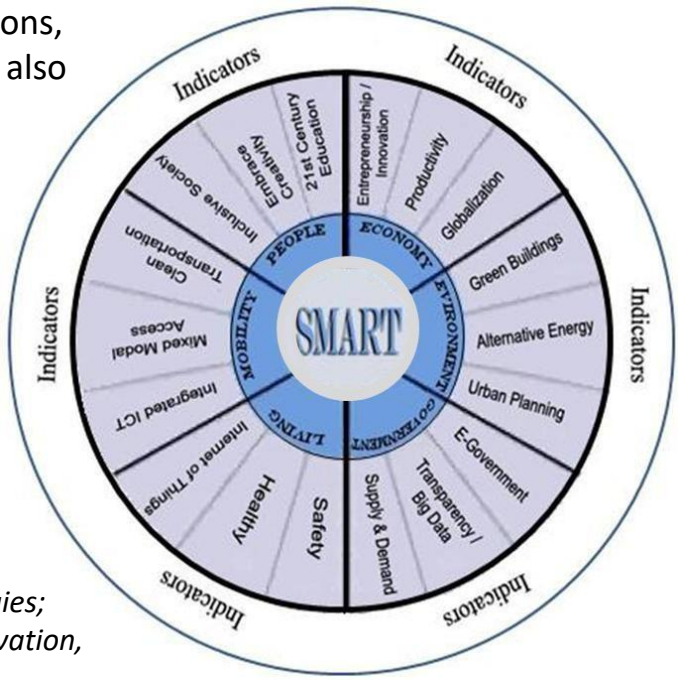
- An Urban Environment class studies how cities are promoting the idea of citizen gardens for mini-crop production and understanding the "farm to table" social movement.

- A History class studies how past agriculture practices have led to those infused with technology.

- An Information Technology class studies systems needed to cultivate, harvest, transport and commercialize agricultural products for domestic consumption and export.

CASE STUDY – INNOVATION CENTER PHENOMENON LEARNING AROUND SMART AND RESILIENT CITIES

Urban centers around the world are demanding 21st-Century solutions to accommodate their growing populations, ones that not only maintain the quality of life but also improve it in a culturally-sensitive manner. Much innovation is taking place to create or improve products and services that can be adopted and adapted to urban centers' needs, producing real value in communities being able to embrace:



- Smart Environments, including green buildings, alternative energy and urban planning;

- Smart Government, including transparency and open data, and E-government services;

- Smart Living, including culturally vibrant, safe and healthy communities and inclusive societies;

- Smart Mobility, including clean/mass transportation and integrated information and communication technologies;

- Smart Economy, including entrepreneurship and innovation, productivity and global interconnections;

- Smart People, embracing creativity, and reimaging teaching and learning for 21st Century education.

In the same vein that phenomenon learning leads toward problem-solving, Knowledge Building also enhances skills required in the Future of Work. Because of their belief in technology and its advances, business leaders express concern about an increasing number of jobs that will no longer be necessary as the makeup of the workforce changes. But the extent to which technology actually can displace people may be much smaller than business leaders were led to believe. A recent OECD (Organisation for Economic Co-operation and Development) report found that just 14% percent of jobs in member countries are highly automatable, although another 32% percent of jobs could substantially change in response to technology. Furthermore, even if workforces shrink, people will not become irrelevant to organizations.

A 2013 study at Oxford (UK) found that certain tasks remain resistant to automation, especially those related to creativity and ideation, social and emotional intelligence, and perception and manipulation. People who can innovate, deploy, leverage, and create – with or without technology - are unlikely to find themselves out of a job.

In the World Economic Forum "The Future of Jobs" report of 2016, it was predicted that complex problem-solving will be the number one skill needed in the Fourth Industrial Revolution. The report cited these top ten skills for recruitment across industries and geographies:

At the time of the report…..	Needed in 2020
1. Complex Problem Solving	1. Complex Problem Solving
2. Coordinating with Others	2. Critical Thinking
3. People Management	3. Creativity
4. Critical Thinking	4. People Management
5. Negotiation	5. Coordinating with Others
6. Quality Control	6. Emotional Intelligence
7. Service Orientation	7. Judgment and Decision Making
8. Judgment and Decision Making	8. Service Orientation
9. Active Listening	9. Negotiation
10. Creativity	10. Cognitive Flexibility

The model bundles theory-based pedagogy and methodologies, technology and learning assessment as new approaches to the study of traditional subjects, as well as laying the groundwork for an introduction of new subjects and examining real-world problems. Knowledge Building aims to help learners acquire 21st Century skills required in the Knowledge Economy that will sustain them on their journey through the education continuum, entry into the workforce or on a path toward successful entrepreneurship. These skills enhance a person's employability with capabilities for analytical problem-solving, innovation and creativity, self-direction and taking the Initiative. Learning to learn is achieved by accessing authoritative resources, critical thinking, and acquiring skills in being able to communicate, work in teams and collaborate. Knowledge Building also promotes problem-solving that binds together the STEM movement and the processes and methods that are apparent is all business applications and valued for well-functioning societies.

These skills also contribute toward producing more informed and engaged citizens. Citizenship is the responsibility of everyone interested in a flourishing society; those able to understand and solve problems for others become invaluable to support the conditions needed for all citizens to have the opportunity to prosper and thrive. They also can help individuals flourish and reach fulfillment as human beings, to have a sense of meaning and purpose, be self-directed and achieve a better life.

> *"While the world is changing faster than ever, our organizations, our schools, and too often our minds are locked in the habits of the past. The result is a massive waste of human talent."*
>
> ~ Ken Robinson, Ph.D., Education Reform Specialist

The 4Cs in the Future of Work

In a survey conducted by The Chronicle of Higher Education and American Public Media's Marketplace (USA) regarding hiring recent college graduates, 50,000 employers cited job candidates were lacking in written and oral communication skills, adaptability for managing multiple priorities, and making decisions. The survey, "*The Role of Higher Education in Career Development: Employer Perceptions*", showed an overwhelming expression by employers of the need to hire employees with problem-solving skills and the ability to learn and apply new knowledge to real-life situations for decision making. Higher education, however, is still stressing knowledge transfer measured by grades and standardized scores, thereby turning out college graduates who are not employable when measured against current workforce requirements; this contributes to creating a skills gaps between what is taught and what is demanded by 21st Century employers. Among demanded skills reside the 4Cs of Future Education:

Critical Thinking – in order to thrive in the 21st Century and the Knowledge Economy, individuals must learn to ask questions, challenge assumptions, invent new ways of solving problems, connect new knowledge to information already known, and apply their knowledge and reasoning skills in new situations – that is, they must develop critical thinking skills. A study conducted by the Association of American Colleges and Universities (USA), "*It Takes More than a Major: Employer Priorities for College Learning and Student Success*", stated that 93% percent of employers indicated the desire to hire employees with the ability to think critically, communicate clearly, and solve complex problems. Today's education and vocational training institutions, however, are lacking in acknowledging the notion that learners possess different learning styles and preferences. In his book, *The Theory of Multiple Intelligences*, author Howard Gardner stresses the importance of acknowledging multiple intelligences that allow individuals to function and/or excel at different aspects of life and learning.

Theories of Multiple Intelligences

Intelligence	Learning Style and Preferences	Description	Ideal for Job Candidates
Verbal Linguistic Intelligence	Words and Language	- Written and spoken words - Interpretation and explanation of ideas and information via language - Understand relationship between communication and meaning	Lawyers, journalists, teachers/professors and trainers, linguists and translators, writers, editors, historians, speakers, television and radio presenters, voice-over artists, ministers and religious preachers
Logical-Mathematical Intelligence	Logic and Numbers Processes Measurements	- Problem Analysis - Detect patterns - Excel in mathematical calculations - Grasp scientific reasoning and deduction - Understand causal relationship between cause and effect toward a tangible outcome or result	Engineers, architects, researchers, statisticians and scientists, brokers, market analysts and traders, accountants, bankers, insurance brokers, arbitrators, computer programmers and IT specialists
Bodily Kinesthetic Intelligence	Body Movement Control	- Physical agility and balance - Manual dexterity - Eye-body coordination	Physicians, surgeons, nurses and physical therapists, athletes, biologists, dancers, geologists, biologists, anthropologists, archaeologists and geologists, instrumentalists
Spatial-Visual Intelligence	Spatial-Visual Images and Space	Aware of surroundings and good at recalling images. Interpretation and creation of visual images, pictorial imagination and expression. Understand relationships between images and meanings and between space and effect.	Artists, architects, cartographers, city planners, engineers, graphic designers, inventors, landscape architects, sculptors, photographers, organizers, event planners

Source: *Theory of Multiple Intelligences*, Howard Gardner

Theories of Multiple Intelligences (continued)

Intelligence	Learning Style and Preferences	Description	Ideal for Job Candidates
Musical Intelligence	Music, sound, rhythm	- Awareness, appreciation and use of sound; - Recognition of tonal and rhythmic patterns; - Understand relationship between sound and feeling.	Composers, musical performers, singers, choir members and entertainers, music producers, musical instrument repair specialists, environment and noise analysts and acoustic engineers, DJs, choirmasters, orchestra conductors, play and movie scores, voice coaches.
Interpersonal Intelligence	Ability to relate to other people's feelings	- Relate to others well; - Astute interpretation of behavior and communications; - Understand the relationship between people and their situations, including other people; - Interpret moods from facial expressions.	Caregivers, therapists, counselors, psychologists and psychiatrists, mediators, healthcare professionals, educators, coaches and mentors, human resources professionals, politicians, advertising and media professionals, home health aides
Intrapersonal Intelligence	Self-Awareness	- Understand one's own needs for and reaction to change, ability to deal with change in the workplace; - Understand one's relationship to others and the world; - Personal cognizance with the capability of understanding oneself.	People who are self-aware and involved in the process of changing personal thoughts, beliefs, and behavior in relation to their situation as well as other people, their purpose and aims.

Source: *Theory of Multiple Intelligences*, Howard Gardner

Collaboration – The explosion of new mobile devices and cloud-based applications, availability of ubiquitous and inexpensive Internet access, and the changing nature of work are rapidly transforming the workplace into environments for effective collaboration. While work environments over the past 20 years have seen much of the structured or process-oriented work automated and outsourced, the remaining work is unstructured, complex and highly collaborative.

Today's companies and businesses are created by teams that take the greatest responsibility for running an enterprise effectively, be it a business, entrepreneurial endeavor, government entity or nonprofit; if team members cannot collaborate, there is very little chance the enterprise will succeed. Encouraging feedback can make collaboration more successful. Collaborating with others involves strong communication skills and being able to work with a range of different personalities, strengths an weaknesses.

Communication – The lifeblood of any relationship – personal, professional and including those needed in business - is communication. Excellent communications is vital to the success of any project or program to improve customer relations, to work in teams, for public sector operations or to address stakeholder concerns. Experts predict the next big wave of transformative innovation will be in communication.

Creativity – It has been noted that as a global society, we need to radically rethink our view of intelligence that can be applied to the jobs of the future. More often than not, creativity comes from the interaction of different disciplinary ways of seeing things. Ken Robinson, a popular theorist in rethinking education, proposes that intelligence is dynamic developed through interactions of the brain, and cites creativity as a needed skill for the Future of Work:

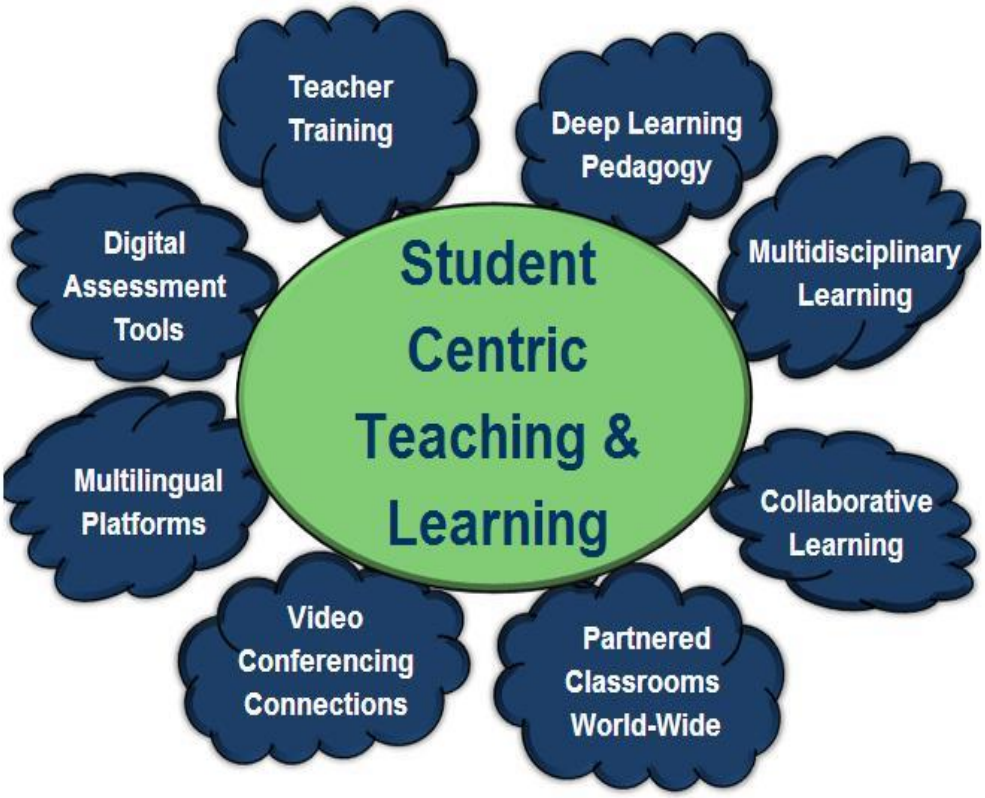
Creativity = Original ideas that have value

Knowledge-Building Phenomenon Learning offers opportunities to examine real-world problems through processes involved in scientific reasoning and discovery. Its primary focus is to capacitate learners with Knowledge Economy skills, where their future success will be predicated on being able to collaborate and use information to solve complex problems, in being able to adapt and innovate in response to new demands and changing circumstances, improve their communication and work together with their peers in small group innovative learning environments. Knowledge-Building learners are able to marshal and expand the power of technology to create new knowledge and expand human capacity and productivity, and acquire a mastery of the subject matters being studied through deep learning.

Improved outcomes of this type of effective teaching and learning is made apparent when the model's assessment tools provide a visualization and empirical evidence of student growth and subject mastery in real time throughout a learning cycle, for example in an academic environment in K-12 or higher education, but especially in primary and secondary education systems. Assessments are performed on collaboration indicators to assure learning benchmarks are being met, and students are making substantive gains in mutual understanding and collaborative knowledge, while progressing towards all other key achievements and goals outlined for the curriculum. The assessment tools embedded in the Knowledge Forum™ platform support both formative assessments for course correction and summative assessments for verified learning outcomes.

Knowledge Building Pedagogy

Knowledge Building transforms standard classrooms into 21st Century learning environments by bundling technology, pedagogy, teacher training and assessment tools that verify student growth and teaching efficiencies.



- Computer-Supported Collaborative Learning around topics that leads to subject mastery for STEM, college readiness and acquiring the 21st Century skills that employers seek in their employees, including critical thinking, collaboration, communication and creativity - the 4Cs of Future Education.

- Adherence to technology standards set-froth by UNESCO, OECD and World Federation of Associations for Teacher Education to rethink teaching and learning in 21st Century Education.

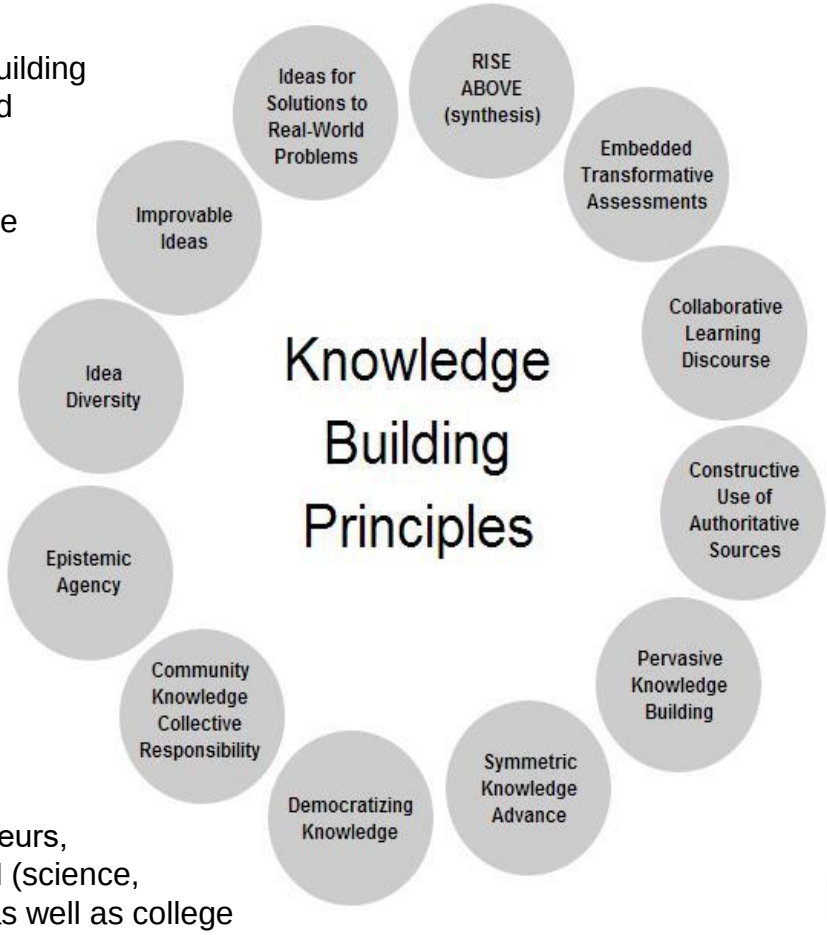
- Formative and summative assessment tools that verify improved learning outcomes.

- Supporting platforms for partnering classrooms world-wide for Collaborative Learning through the Knowledge Forum™ electronic workspace

- Affordable and scalable for unlimited number of users, with multiple entry points via the Internet In closed communities for controlled access in adherence with data protection and privacy regulations.

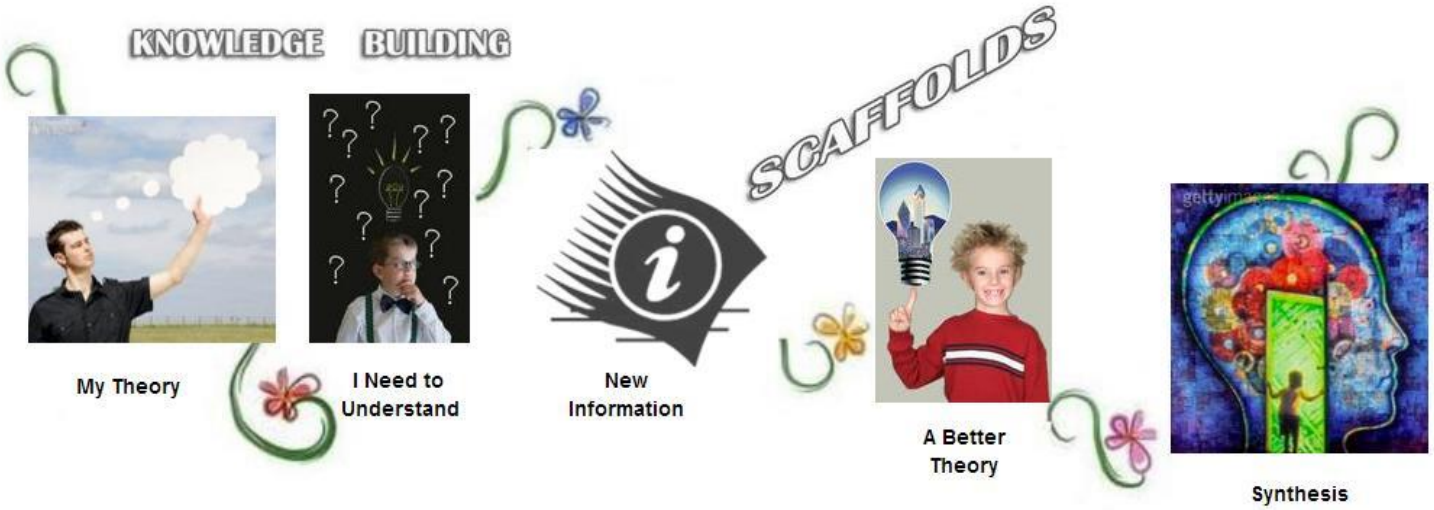
Knowledge Building attempts to transform learning and teaching in modern classrooms through the effective use of technology to support highly-researched pedagogical strategies for teaching and learning.

Learners progress through the 12 knowledge-building principles by contributing individual ideas toward the creation of communal knowledge. Coupled with tools for the assessment of academic achievement and teaching efficiency, Knowledge Building moves forward effective educational practices in K-12 learning environments inside and outside the traditional classroom.



Knowledge Building forms the basis of project-based learning to help members of diverse learning environments understand key steps in the scientific method – creating and defending a hypothesis, observation and an analysis of evidence – that leads toward increasing knowledge and making sense of the world around them. They are thus equipped with skills to solve tough problems, gather and evaluate evidence, and make sense of information. These are the skills demanded of today's employees and entrepreneurs, as well as skills used in higher education STEM (science, technology, engineering and math) disciplines as well as college readiness in K-12 education.

Scaffolding is a bedrock strategy of Knowledge Building. Scaffolds support a learner progressing toward mastery of concepts based on the theory of zone of proximal development (ZPD), representing the distance between what students can do by themselves and the next level of learning they can achieve with competent assistance. In Knowledge Building, that assistance is provided by the teacher, who becomes a facilitator of learning rather than a dispenser of pre-determined content as has been the factory-era model for education that is standard in today's classrooms and other learning environments.



Knowledge Forum Educational Technology

Knowledge Forum™ is an electronic workspace that shifts the focus of learning from an emphasis on individual learning to the building of group knowledge.

Knowledge Forum™ goes beyond best practice in knowledgeware, putting a learning community in charge of its own knowledge building, and provides multiple supports to help it succeed. Ordinary edtech and knowledgeware allow knowledge to be shared and discussed but does nothing to support essential cognitive and social processes.

Whether in a classroom or in an office, successful knowledge building requires collective cognitive responsibility. Knowledge Forum is designed to foster collective cognitive responsibility and at the same time avoid work overload. It forms the core of Knowledge Building Hubs of Innovation, where researchers and practitioners work together to create high-profile models of an inclusive knowledge society, one in which participants work together to produce knowledge rather than focus exclusively on individual achievement. It supports Knowledge Building Design and Development Networks, where partners in a global design lab and testbed work to realize the potential of knowledge-building communities. Here, they work with multi-level, networked teams assuming collective responsibility for knowledge advancement at all levels. In this way, work succeeds when all succeed.

Students engaged in Knowledge Building through utilization of the Knowledge Forum™ become global citizens who are socialized into a global knowledge-creating culture. They are intellectually engaged in their own educational development, thrive on complexity and idea diversity, and are well grounded in science and the humanities. They also come to appreciate their role in progressive societies able to develop multiple ways of contributing to innovation.

The Knowledge Forum™ supports the learning environments ripe for creating knowledge-building communities in education and in business. It is a software-based platform for collaborative learning, based on the philosophy that shared knowledge leads to innovation and growth in any setting. It is a tool to improve ideas, moving from initial ideas to new ideas, and from promising ideas to creation and innovation. The platform has multiple access points to support an unlimited number of users working on common problems. These range from organizations needing to be more innovative to students taking a multi-disciplinary approach to learning, scientists searching for a breakthrough in research to the public sector improving services through technology.

The power of Knowledge Forum is in its Java-based tools that allow users to revise, critique, build on, reference, organize, and rise above their own ideas and those of others in a defined knowledge-building community. These communities constitute learning environments in the classroom or in the office, research lab or public sector, where ideas are at the center of a group's discussions. KF supports the discourse that takes place when ideas are build upon by everyone in a collaborative learning environment.

The software was developed by an international team of cognitive scientists, engineers, researchers and educators and can be accessed through the Internet or hosted on a dedicated server.

Knowledge Forum™ as educational technology consists of four components:

The electronic workspace supports collaborative learning where numerous individuals can utilize tools for posting comments and designing multimedia presentations on the platform.

Knowledge Forum shifts the focus on learning from an emphasis on individual learning to the building of group knowledge.

Formative assessment tools provide both universal overviews as well as individual progress made in gaining subject mastery, acquiring specific skills or making contributions to the discourse taking place in the collaborative learning environment.

Educators utilizing Knowledge Forum with their students belong to a Community of Practice to share information, network, and gain access to a library of resources that enhances the learning and teaching experiences in a knowledge-building classroom.

Knowledge-Building learners are supported by facilitators who are proficient in ICTs. They are able to acquire skills and knowledge based on a broad set of competencies that enable them to seek out information and research answers to problems. Because of this, learners can analyze oftentimes complex materials, and distinguish between useful and irrelevant material. Learning becomes relevant, as learners study common themes related to the real-world challenges their own communities face. With Knowledge Building, we bust the myth that our attention spans have decreased. On the contrary, Knowledge Building is engaging and requires the participation of all members of a learning community to be successful at creating knowledge. Members of a knowledge-building learning environment keep a tab on what's going on in their small group so as to not be left behind!

ISBN: 978-92-3-01053-9

The training component of the model hosted at the Community of Practice 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. Training includes:

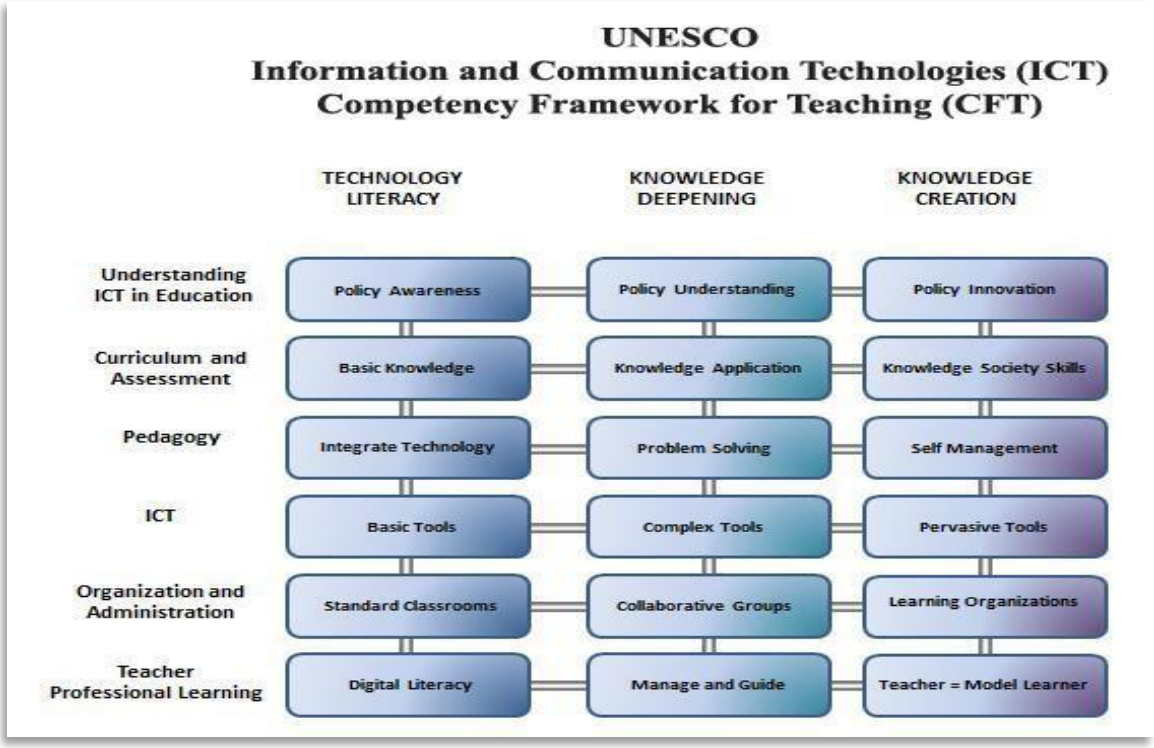
- A review of Knowledge Building as a pedagogical strategy for inquiry-based learning practical implications, including:
  - the role of the teacher or instructor
  - student engagement
  - curriculum expectations
  - responsive and flexible planning
  - student assessment, evaluation, and reporting.

- Training on the workings of the model, that serves as a seamless, cohesive learning environment to support integrated learning. Its foundational basis on inquiry-based learning entails an overall mindset, one that pervades school and classroom life to foster a culture of collaborative learning and idea improvement. Teachers continually encourage students to contribute their ideas and engage in critical problem-solving processes in a variety of contexts, whether curricular or social.

The Innovative Learning Environments Project of the Organization for Economic Cooperation and Development promotes what schooling, teaching and most especially learning look like in our rapidly-changing world. It promotes efforts to rethink what is taught, how it is taught, and how learning is assessed. The project explores the nature of learning through the perspectives of cognition, emotion and biology, and provides analyses of the implications for different types of application in learning environments. Research was synthesized to create seven transversal principles to guide the development of learning environments for the 21st Century, which are addressed by the model:

OECD

1. Learners at the Centre
2. The Social Nature of Learning
3. Emotions are Integral to Learning
4. Recognising Indiviual Differences
5. Stretching all Students
6. Assessment for Learning
7. Building Horizontal Connections



One of the most commonly-cited reasons for using ICTs in diverse learning environments has been to better prepare the current generation of learners for a workplace where ICTs, particularly computers, mobile devices, the Internet and related technologies, have become more and more ubiquitous. Since the introduction of ICT in education, schools now face new social, cultural, and pedagogical phenomena that challenge teachers in terms of their technical ability, knowledge and expertise.

ICTs create new possibilities to encourage teachers to harness new opportunities that ICTs offer to make teaching and learning more meaningful and rewarding. The ability to utilize ICTs in the classroom has become the new literacy for the 21st Century that changes teaching and learning by being a source of knowledge, a medium for transmitting content, and an interactive resource furthering dialogue and creative exploration. In the United States, the National Center for Education Statistics reports, however, a wide gulf between the promises of ICTs and the reality of their use in learning environments. Despite considerable investment, ICT implementation advances at a slower rate than expected in the educational systems of many countries.

Although educational innovation is considered as a top priority all over the world, and the potential of ICT to foster it increasingly given recognition (European Commission, 2015; Eurydice, 2011; OECD, 2010), ICT adoption often is regarded as a highly-demanding challenge that usually meets resistance by school authorities. Although it is largely believed that decades of large investments in ICTs and the increasing digitalization of teaching and learning processes can benefit the education system at different levels, data to support the perceived benefits are limited and evidence of effective impact is scarce. ICTs are seemingly mostly used with traditional teaching practices, where the focus is on computer skills rather than integrated learning intentions, and often teachers' practices relate more to issues of management and organization than to learning and assessment. K-12 teachers, for example, still lack the confidence or support from their principals and districts to exploit ICT for new teaching approaches; they are relegated to mundanely using ICT mostly for presentation, information delivery, and as management tools.

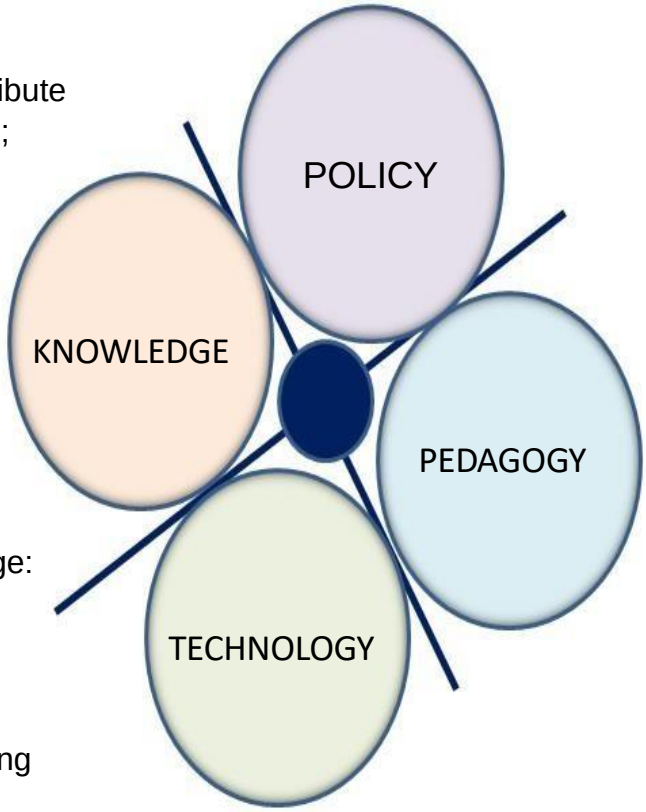
Educational Innovation is any dynamic change intended to add value to the educational processes and resulting in measurable outcomes, be that in terms of stakeholder satisfaction or educational performance.

SOURCE: OECD Centre for Educational Research and Innovation

The OECD warns that educational innovation cannot be simply something new but it must be a change that creates a positive value. To better understand the process of innovation that contributes
to an incremental improvement of the education system, the OECD proposed a systematic approach to technology-based school innovations, leading to the identification of four axes for the analysis of technology-based innovations in education:

POLICY links innovation to policy-making and policy choices that need to be made to facilitate innovation, its impact and its knowledge base. Curriculum, professional development for teachers and school leaders, and assessment are key elements. Most educational systems, however, generally fail to adapt quickly to any form of educational innovation and experimentation, although . In formal education settings such as K-12 schooling, the emphasis on ICT adoption usually meets resistance from the administration and oftentimes from teachers themselves.

PEDAGOGY is largely about how technology can contribute to improving teaching strategies and learning outcomes;



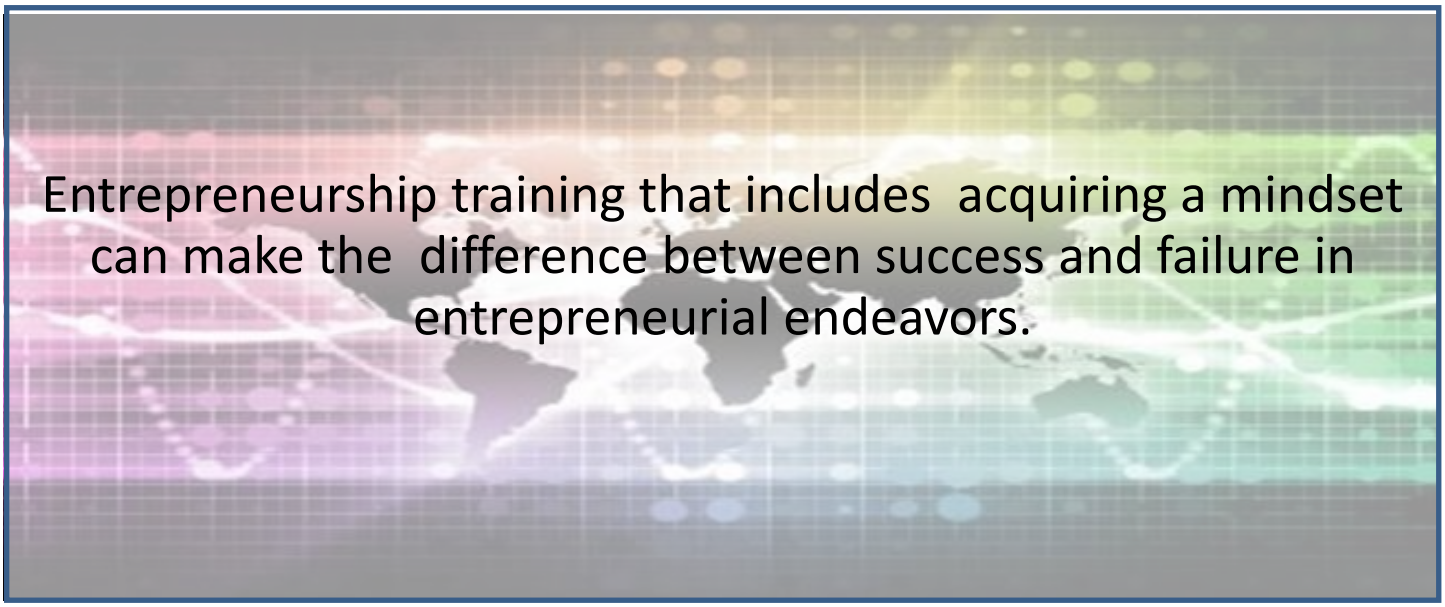
TECHNOLOGY reflects the strong importance placed on infrastructure (access to laptops, broadband internet connection, learning management systems, etc.) as an enabler for access and equity with regard to technology in education;

KNOWLEDGE is linked to the role knowledge plays in innovation processes, focusing on three knowledge challenge:
i)to establish a sufficient knowledge base;
ii)to secure effective dissemination of knowledge; and
iii)to use the knowledge base.

This approach stresses the importance of efforts in monitoring and evaluation, underlying the benefits derived from empirical assessment:

- informing decisions about the scaling-up or the diffusion of innovations;
- instilling a culture of output-oriented innovation (i.e. aimed at measurable improvements that can help when coping with innovation fatigue or resistance);
- getting value for monetary investments;
- obtaining feedback on the results of particular policy measures intended to foster innovation.

The world has changed in ways that now require everyone to think like an entrepreneur.



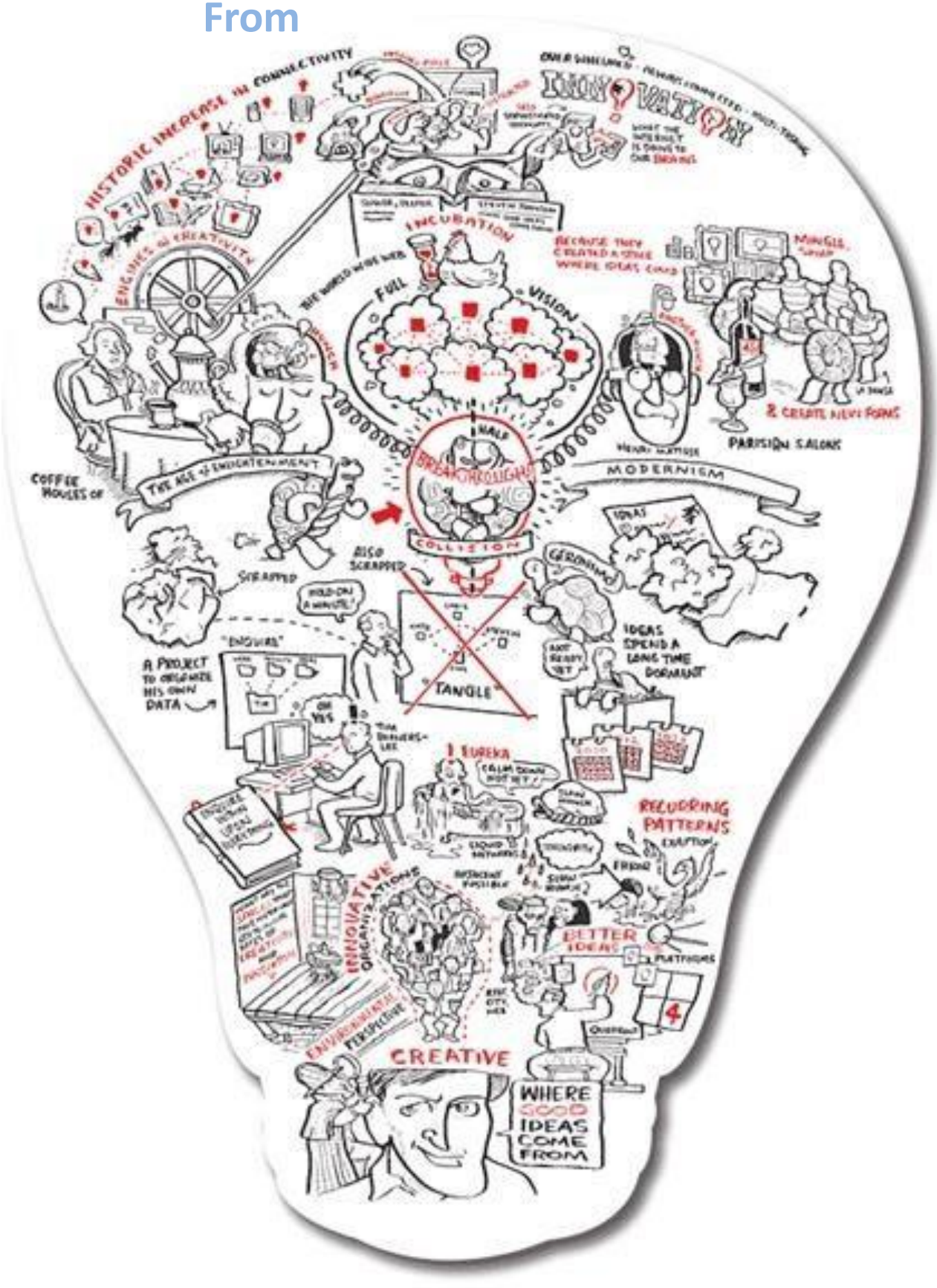
Dr. Tony Wagner, Expert In Residence at Harvard's Innovation Lab, has been quoted as saying, ***"The world doesn't care what you know – what the world cares about is what you can do with what you know."*** The World Economic Forum has proposed that entrepreneurship education not simply be added on the perimeter of mainstream education; it needs to be at the core of the way education operates.

> *"Entrepreneurship is essential for developing the human capital necessary for the society of the future."*
>
> ~ World Economic Forum

Shaping Entrepreneurial Traits

As with most human behavior, entrepreneurial traits are shaped by personal attributes and environment. Entrepreneurs differ mostly from the general population and from wage earners due to their heightened sense of individual responsibility and effort. Entrepreneurs actively strive to achieve goals and develop tenacity and creativity, as well as enhance an ability to detect opportunities and become agents for change - that is, they do new and different things. These are said to be the personal characteristics of entrepreneurs that make them different from non-entrepreneurs.

Where Good Ideas Come From



https://www.youtube.com/watch?v=NugRZGDbPFU