BEYOND
BOUNDARIES

intersectional learning for the innovation economy

TOMAS ELIAESON
AIA, M.Arch, LEED®AP BD+C

LITTLE

I^4

INQUIRY +

IMAGINATION +

INNOVATION +

INTERSECTION

"There is an urgency to improve education to be globally competitive – it is a National Security Issue."

BOB GORDON
Dept. Asst. Secretary of Defense

COLLEGE GRADUATION RATES

4 out of 10
students graduate in 4 years
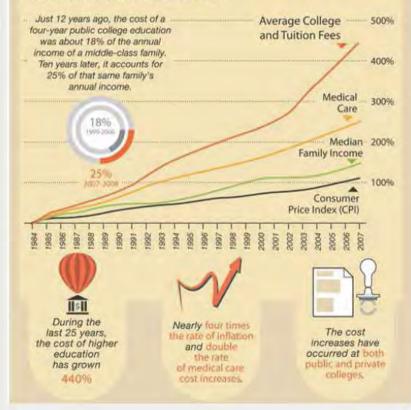
5 out of 10
students graduate in 6 years

THE RISING COST OF HIGHER EDUCATION

The Rise of College and Tuition Fees

The rise of college and tuition fees continues to outpace the median family income and other key individual economic indicators.

Just 12 years ago, the cost of a four-year public college education was about 18% of the annual income of a middle-class family. Ten years later, it accounts for 25% of that same family's annual income.

18% 1999-2000

25% 2007-2008

Average College and Tuition Fees — 500%

— 400%

Medical Care — 300%

Median Family Income — 200%

Consumer Price Index (CPI) — 100%

1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007

During the last 25 years, the cost of higher education has grown 440%

Nearly four times the rate of inflation and double the rate of medical care cost increases.

The cost increases have occurred at both public and private colleges.

The Higher Cost Of HIGHER EDUCATION

An HSBC report compared the average cost of one year in a higher education program at universities in 13 different countries and territories for international students. Here's how they compared:

$26,011 CANADA
Annual Fees: $18,474
Cost of Living: $7,537

$35,705 UNITED STATES
Annual Fees: $25,226
Cost of Living: $10,479

$30,325 UNITED KINGDOM
Annual Fees: $19,291
Cost of Living: $11,034

$6,285 GERMANY
Annual Fees: $635
Cost of Living: $5,650

$7,006 SPAIN
Annual Fees: $1,002
Cost of Living: $6,004

$27,375 UNITED ARAB EMIRATES
Annual Fees: $21,371
Cost of Living: $6,004

$9,441 RUSSIA
Annual Fees: $3,131
Cost of Living: $6,310

$24,248 SINGAPORE
Annual Fees: $14,885
Cost of Living: $9,363

$8,766 CHINA
Annual Fees: $3,983
Cost of Living: $4,783

$19,164 JAPAN
Annual Fees: $6,522
Cost of Living: $12,642

$8,257 TAIWAN
Annual Fees: $3,270
Cost of Living: $4,987

$22,443 HONG KONG
Annual Fees: $13,182
Cost of Living: $9,261

$38,516 AUSTRALIA
Annual Fees: $25,375
Cost of Living: $13,140

Below $10,000 $10,001 - $30,000   More than $30,000

By Lisa Mahapatra

INTERNATIONAL BUSINESS TIMES

Source: HSBC report by Neil Brazil, titled "USA among World's Top Three Most Expensive Destinations for International Students"

RECENT GRADUATES

1 in **3** college-educated workers do not work in occupations related to their college major.

Nearly half (**47 percent**) of college educated workers reported their first job out of college was not related to their major.

32% of college-educated workers report they have **never** found a job related to their college major. Among workers age 35 or older, 31 percent report never findnig a job in their field.
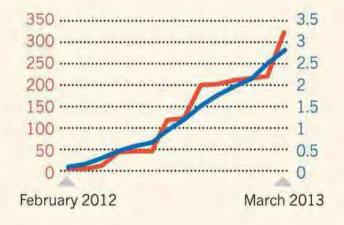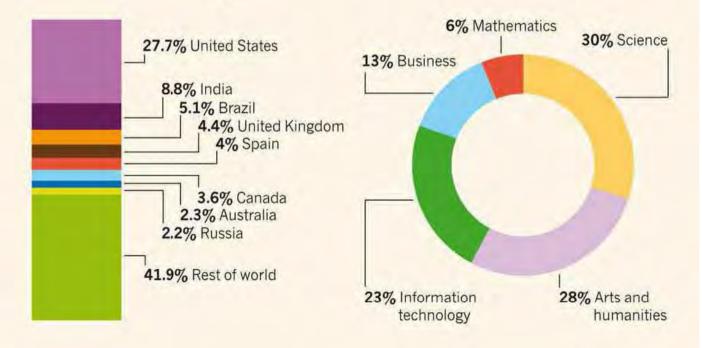
MOOCs rising

Over little more than a year, Coursera in Mountain View, California — the largest of three companies developing and hosting massive open online courses (MOOCs) — has introduced 328 different courses from 62 universities in 17 countries (left). The platform's 2.9 million registered users come from more than 220 countries (centre). And courses span subjects as diverse as pre-calculus, equine nutrition and introductory jazz improvisation (right).

Supply and demand

— Number of courses available on the platform

— Number of user accounts on the platform (millions)

February 2012   March 2013

Student origins

27.7% United States
8.8% India
5.1% Brazil
4.4% United Kingdom
4% Spain
3.6% Canada
2.3% Australia
2.2% Russia
41.9% Rest of world

Courses offered

6% Mathematics
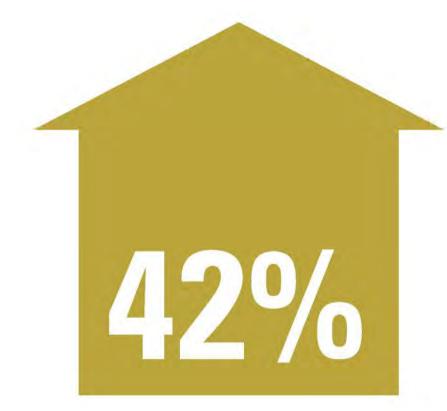30% Science
13% Business
23% Information technology
28% Arts and humanities

"**SAT, ACT no longer required** for admission to over 800 U.S. Colleges and universities."

HUFFINGTON POST

THE GROWTH OF INTERDISCIPLINARY MAJORS

42%

Increase in schools offering university-created interdisciplinary degrees

*College Board's "Annual Survey of Colleges"

At Olin College, nearly half of the students create their own interdisciplinary majors

The number of colleges and universities offering transdisciplinary majors is **on the rise**.

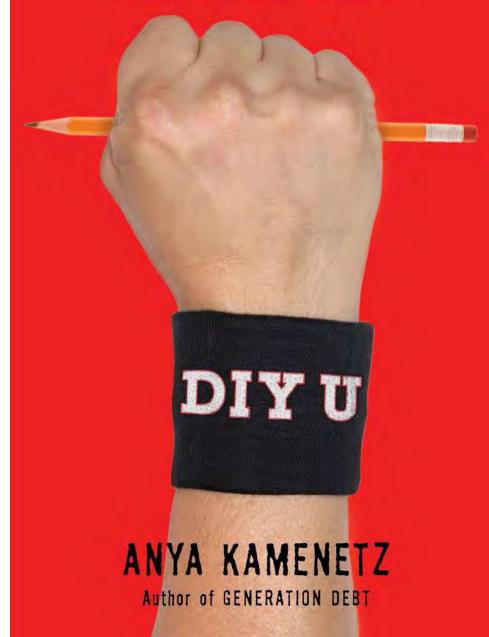Edupunks, Edupreneurs, and the Coming
Transformation of Higher Education

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

DIY U

ANYA KAMENETZ
Author of GENERATION DEBT

1 Self Directed
Higher Learning

2 Turn Knowledge Into
Something Productive

3 Pro-Active Innovation

4 Anticipate Job Shifts

ETHNOMUSICOLOGY

ENVIRONMENTAL RACISM

ECOLOGY OF WELLNESS

BIOETHICS IN CROSS_CULTURAL PERSPECTIVES

ETHOLOGY

PEACE AND CONFLICT RESOLUTION

ANTHROPOLOGY OF MENTAL ILLNESS

SOCIOLOGY OF FASHION

ETHNOBOTANY

WHAT IS THE WORKPLACE LOOKING FOR?

21ˢᵗ CENTURY EMPLOYER NEEDS

Category	Percentage
Science/Tech	82%
Teamwork	76%
Real World Experience	73%
Communication	73%
Critical Thinking	72%
Global Awareness	72%
Research	70%
Innovation	70%
Complex Problem Solving	64%
Statistics	60%
Language/Culture	53%

"What Employers are Looking for in College Graduates" survey by Association of American Colleges & Universities - 2007

"**Self direction** and the ability to **solve complex problems** are two key factors in getting a job today."

DEBRA HUMPHREYS
Vice President for Policy & Public Engagement at The Association of American Colleges and Universities

6 out of 10 Millennials either want to start a
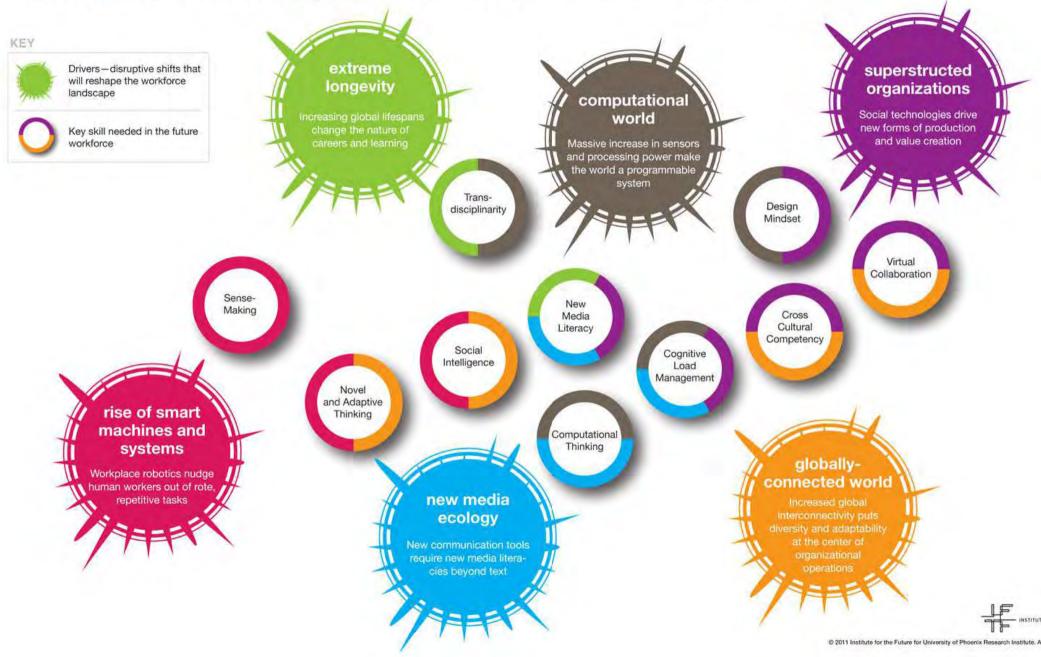business, or already have started one

Start-up companies are generally a good fit for
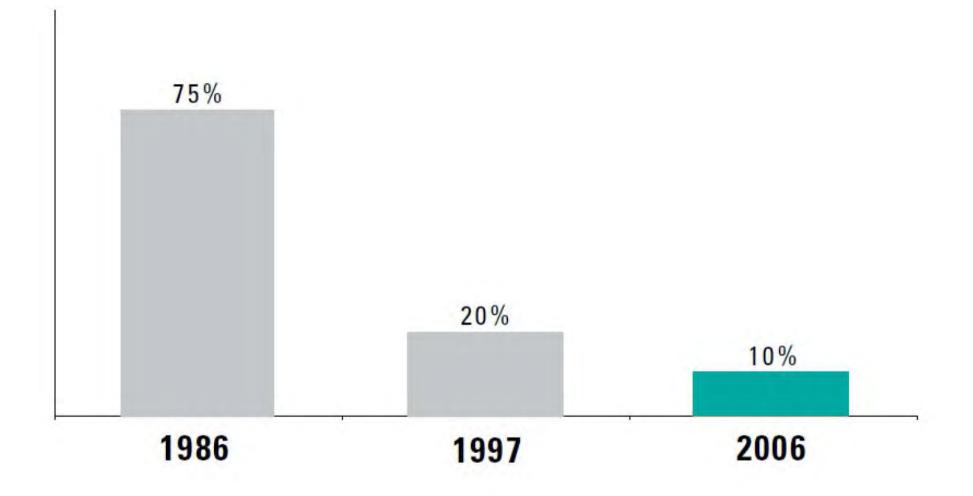students with interdisciplinary backgrounds

Future Work Skills 2020

While all six drivers are important in shaping the landscape in which each skill emerges, the color-coding and placement here indicate which drivers have particular relevance to the development of each of the skills.

extreme longevity

Increasing global lifespans change the nature of careers and learning

computational world

Massive increase in sensors and processing power make the world a programmable system

superstructed organizations

Social technologies drive new forms of production and value creation

rise of smart machines and systems

Workplace robotics nudge human workers out of rote, repetitive tasks

new media ecology

New communication tools require new media literacies beyond text

globally-connected world

Increased global interconnectivity puts diversity and adaptability at the center of organizational operations

Trans-disciplinarity

Design Mindset

Virtual Collaboration

Sense-Making

New Media Literacy

Cross Cultural Competency

Social Intelligence

Cognitive Load Management

Novel and Adaptive Thinking

Computational Thinking

IFTF INSTITUT

© 2011 Institute for the Future for University of Phoenix Research Institute. A

Institute for the Future

% **Knowledge** stored in your brain needed to do your job

75%
20%
10%

1986
1997
2006

Robert Kelley, Carnegie-Mellon University, longitudinal study with knowledge workers

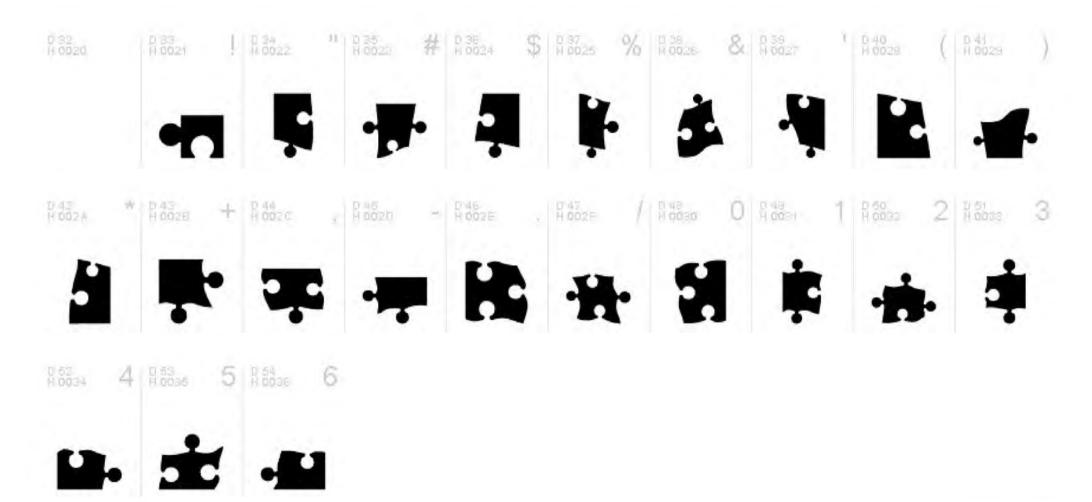**BEYOND THE 'BUZZ'**

"The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn."

- ALVIN TOFFLER

"What matters today, however, is not how much our students know, but **what they can do with what they know**."
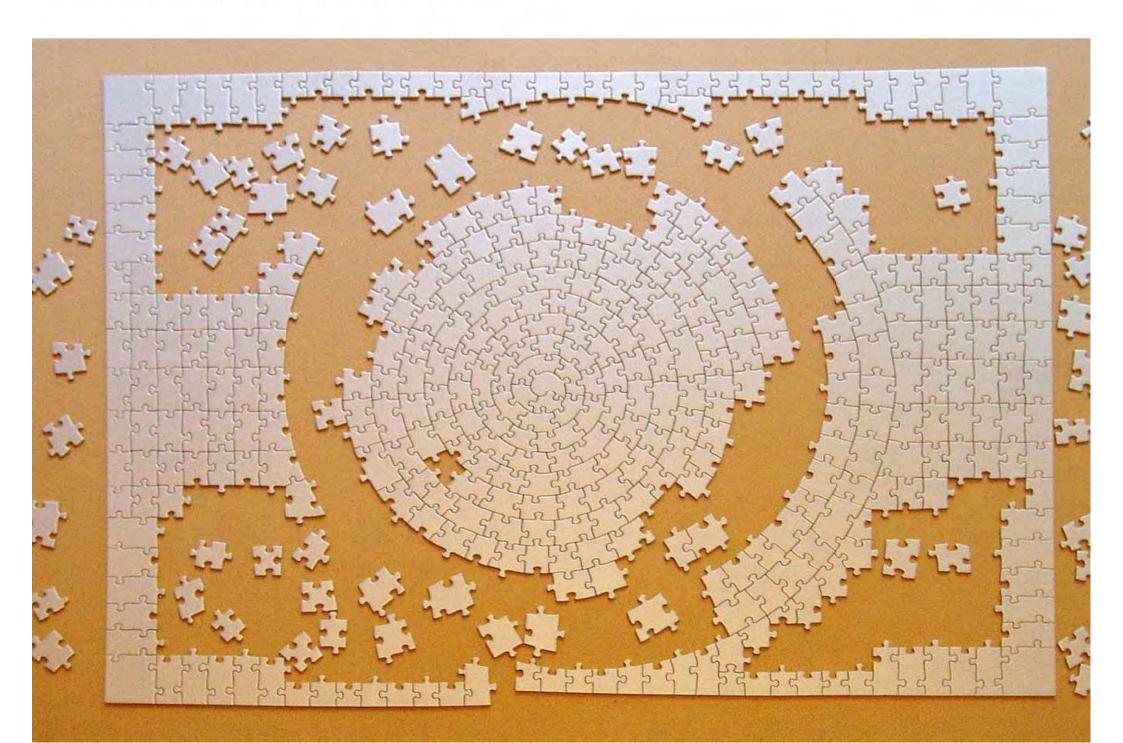
TONY WAGNER
Expert In Residence at Harvard University's new Innovation Lab

KNOWLEDGE TODAY: PUZZLE PIECES

Celebrate **non-traditional** thinkers
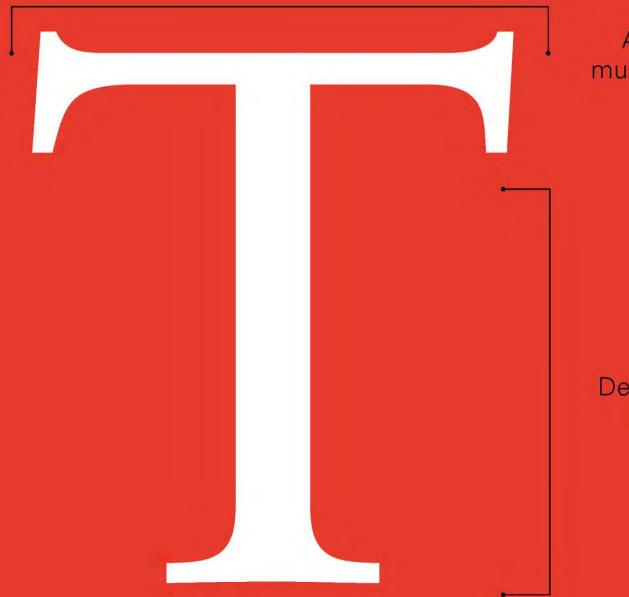
Individualized;
INTERDISCIPLINARY

THE GROWTH OF INTERDISCIPLINARY MAJORS

1. Ecosystems
2. Nanotechnology
3. Mechatronics
4. Bio-systems
5. Neuro-Experience
6. Bio-Chemical
7. Bio-Medical
8. Geo-Genetics

9. Geo-Matics
10. Carbon Negative Design
11. Integrated Engineering
12. Integrated Science
13. Bio-Infomatics
14. Manufacturing Systems
15. Computational Biology

IN SEARCH OF T-SHAPED PEOPLE

Horizontal
Ability to understand
multiple fields (disciplines)

Vertical
Depth of understanding in
the field (discipline)

TRANSDISCIPLINARITY

=

DISRUPTIVE INNOVATION

TRANSDISCIPLINARY COMPANIES = disruptive innovators.

Apple

Bell Labs

VOLVO

IBM

3M
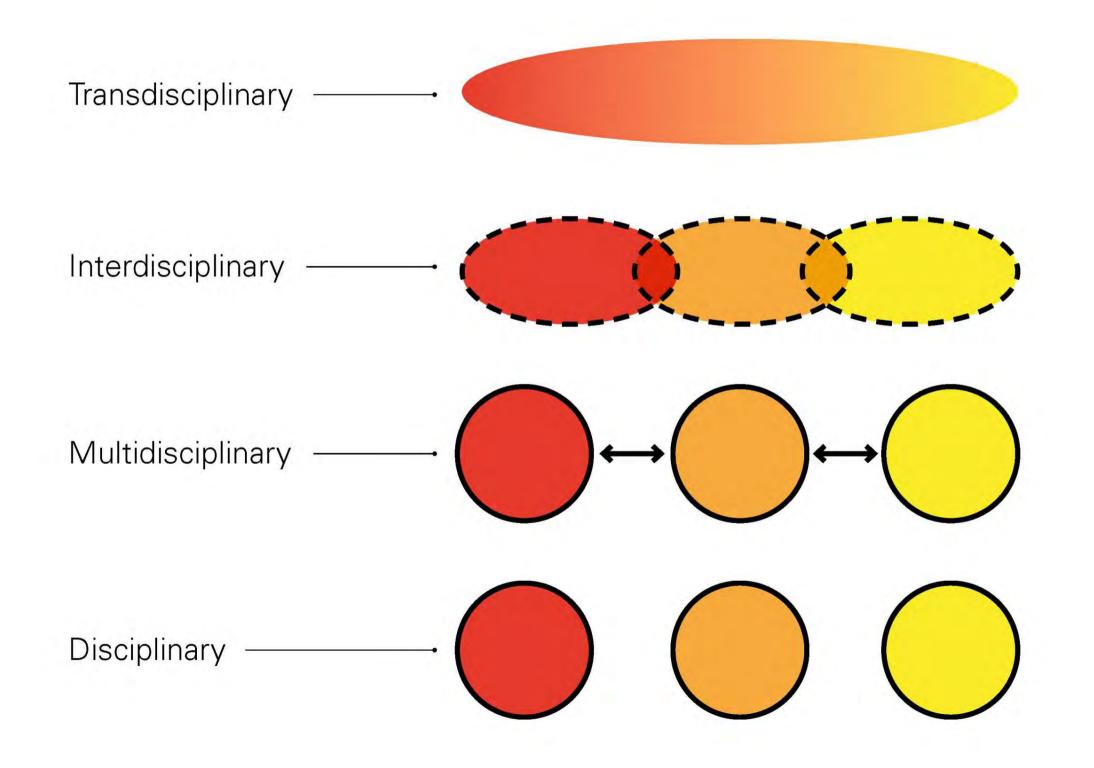
WHAT IS TRANSDISCIPLINARITY?

1. **An Attitude**
2. **Unity Of Knowledge**
3. **Bridging Gaps And Conecting Dots**
4. **Relentless Inquiry**
5. **Quest For Meaning**
6. **Harmony Between All Things**

"The Transdisciplinary Evolution of Learning" Basarab Nicolescu

"Transdisciplinarity refers to the highest level of integrated study, that which proposes the unity of intellectual frameworks beyond the disciplinary perspectives and points toward our potential **to think in terms of frameworks, concepts, techniques, and vocabulary that we have not yet imagined**."

JULIE A. BUCKLER
From her essay, "Towards a New Model of General Education at Harvard"

Transdisciplinary

Interdisciplinary

Multidisciplinary

Disciplinary

WHY
TRANSDISCIPLINARITY

LIVING IN A

V U C A

VOLATILITY

rate of change

UNCERTAINTY

unclear about
present situations
and future
outcomes

COMPLEXITY

multiplicity of key
decision factors

AMBIGUITY

lack of clarity
about the
meaning of an
event

WORLD

"Learn how to see. Realize that everything connects to everything else."

Leonardo da Vinci

"A more interdisciplinary approach to learning will **better prepare people for the kind of problems they'll be confronting.**"

JUDY GILBERT
Google's former director of talent

TEN SKILLS FOR THE FUTURE WORKFORCE

1 SENSE-MAKING

DEFINITION: *ability to determine the deeper meaning or significance of what is being expressed*

2 SOCIAL INTELLIGENCE

DEFINITION: *ability to connect to others in a deep and direct way, to sense and stimulate reactions and desired interactions*

3 NOVEL & ADAPTIVE THINKING

DEFINITION: *proficiency at thinking and coming up with solutions and responses beyond that which is rote or rule-based*

4 CROSS-CULTURAL COMPETENCY

DEFINITION: *ability to operate in different cultural settings*

5 COMPUTATIONAL THINKING

DEFINITION: *ability to translate vast amounts of data into abstract concepts and to understand data-based reasoning*

6 NEW-MEDIA LITERACY

DEFINITION: *ability to critically assess and develop content that uses new media forms, and to leverage these media for persuasive communication*

7 TRANSDISCIPLINARITY

DEFINITION: *literacy in and ability to understand concepts across multiple disciplines*

8 DESIGN MINDSET

DEFINITION: *ability to represent and develop tasks and work processes for desired outcomes*

9 COGNITIVE LOAD MANAGEMENT

DEFINITION: *ability to discriminate and filter information for importance, and to understand how to maximize cognitive functioning using a variety of tools and techniques*

10 VIRTUAL COLLABORATION

DEFINITION: *ability to work productively, drive engagement, and demonstrate presence as a member of a virtual team.*

Institute for the Future

TRANSDISCIPLINARITY IS ABOUT

1. **Connecting the dots**
2. **Viewing challenges from multiple perspectives**
3. **Recognizing the complexity and multidimensionality of reality**
4. **Addresses tasks situated between boundaries of disciplines**
5. **Real world problems with stakeholders**
6. **Team based**
7. **Convergent vs divergent**
8. **Social relevancy**
9. **Creating deep educational experiences.**
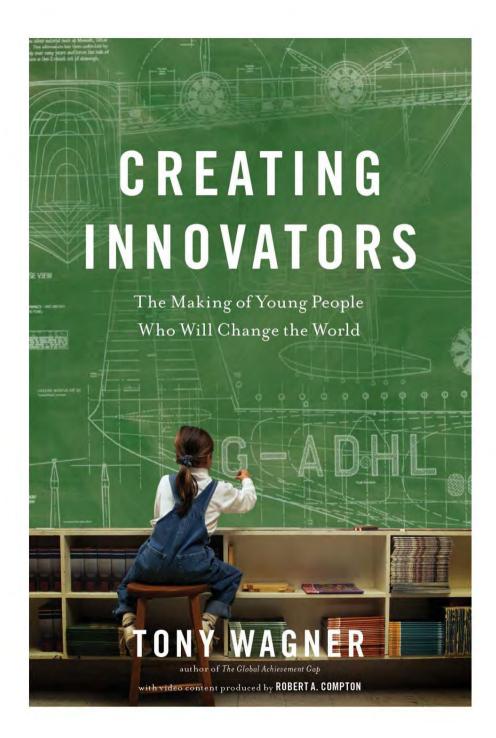
"Transdisciplinarity has tremendous potential for increasing discovery and innovation, but it also uncovers **serious communication difficulties and examples of failure** that are especially acute **when team members are separated by distance**, which is typical."
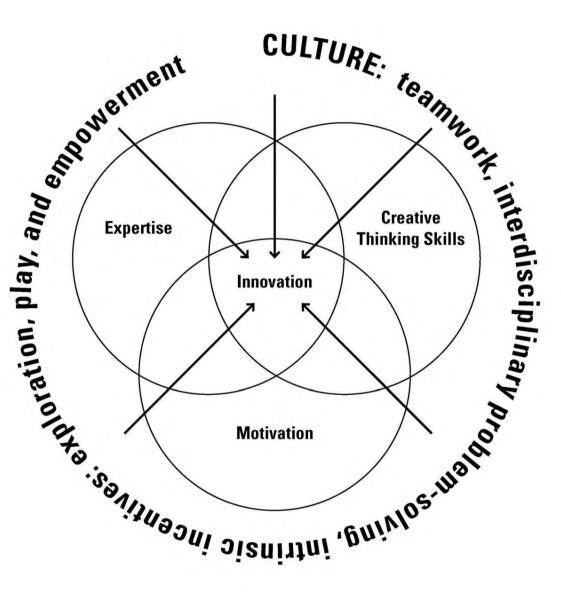
SHARON J. DERRY
Transdisciplinary Graduate Education University of Wisconsin-Madison, Gerhard Fischer University of Colorado-Boulder

"Innovation is not a skill set, **it is a frame of mind.**"

Tomas Chamorro-Premuzic
"The 5 characteristics of Successful Innovators"

CREATING INNOVATORS

The Making of Young People
Who Will Change the World

TONY WAGNER

author of *The Global Achievement Gap*

with video content produced by ROBERT A. COMPTON

CULTURE: teamwork, interdisciplinary problem-solving, intrinsic incentives: exploration, play, and empowerment

Expertise

Creative Thinking Skills

Innovation

Motivation

INNOVATION PROCESS: DESIGN THINKING

DESIGN THINKING @ THE NUEVA SCHOOL

By asking What do we need next? and using the stages on this chart, design thinkers craft a unique process for each particular project. As students become more mindful of the process they have used on previous projects, they build confidence in their ability to successfully navigate open-ended challenges.

Monitor Team Dynamics (SEL)

Building upon Nueva's long history in teaching Social Emotional Learning (SEL), we have made team check-ins an explicit aspect of our Design Thinking process. Students have the opportunity to verbalize their concerns and brainstorm solutions collectively.

Motivate & Inspire

Monitoring the motivation of a team and learning how to inspire a team are important qualities of an effective design thinker. If the various stages of the Design Thinking process are visited without an inherent enthusiasm or heightened motivation, the results are likely to be less than innovative. We help build the leadership skills and initiative of our students through our emphasis on this step.

Project Management

Using classic techniques of project planning and time management, students practice how to monitor their progress and meet deadlines.

Incorporate Feedback

Students evaluate all of the feedback they have obtained about their prototypes. Combining this information with additional research and brainstorming, they decide how best to proceed. Should we change our prototype? Have we answered the key questions? Do we need more information? Do we need more ideas? Should we scrap this and start over?

Seek Feedback

Soliciting feedback from users is a key aspect of the Design Thinking process. There are many factors that go into a person's response to an item or an experience. Designers bring an open mind and a beginner's mindset of "not knowing" in order to gather both positive and negative feedback to improve their solutions. Experimentation as well as failures are valued for their information and because they contribute to future successes.

Observe

Through observation, much can be learned. Often people will say one thing, but when a keen observer looks, they will find that actually the behavior is different.

Ask & Listen

Active listening and curiosity are practiced and enhanced as a critical skill of Design Thinking. Through direct lessons and extensive practice, students become proficient interviewers who recognize the power of beginning questions with the word, "Why".

Research

Identifying experts, locating extreme users, and performing on-line research are all key aspects of the Design Thinking process. Students use this stage to understand and learn new information as well as to answer questions or locate resources throughout the process.

Develop Empathy & "Look Beneath the Surface"

After collecting information, students then strive to infer the underlying thoughts and feelings of a user. By immersing themselves in the experiences of users and developing "deep empathy," they are able to develop a deeper understanding that can lead to key insights.

Synthesize & Define

Many design challenges are complex and multi-faceted. Grappling with them can be daunting and cause some people to give up hope of solving them. By focusing on particular user types and their needs, along with the insights gathered during the "Deep Dive," students define an area that is large enough to allow for innovation, yet bounded enough to allow for success. Solving even a small part of a large issue is worthy of effort. We foster an attitude of optimism that is supported by the tools of the Design Thinking process.

Brainstorm

Brainstorming is a set of skills as well as a mindset. By adhering to a few Brainstorming Rules, teams and individuals learn to "turn off their judging brains" in order to increase the fluency of their ideas. At Nueva, we encourage students to use "Sketch Brainstorming" to allow them to rapidly capture their ideas.

Analyze & Choose

Students benefit from exposure to different methods of analyzing and making decisions. Beginning with simple pros and cons and moving to weighted ratings of various criteria, students will build a repertoire of techniques to use in the future.

Create Prototypes

The Design Thinking process embodies a "bias towards action." By making representations of ideas, problems can be identified and resolved early in the design cycle. Tangible objects or simulated experiences allow students to obtain more informed feedback from users before committing the time and resources to a final version.

The Prototype and Feedback stages are linked together in an iterative cycle that is done many times to converge on a better solution.

Central diagram

- Collaborate
- Research/ "Deep Dive"
- Focus
- What Next
- Prototyping Cycle
- Generate Ideas
- Make Informed Decisions

TRANSDISCIPLINARY STRATEGIES

1. **Student-centered**
2. **Problem-based**
3. **Collaborative**
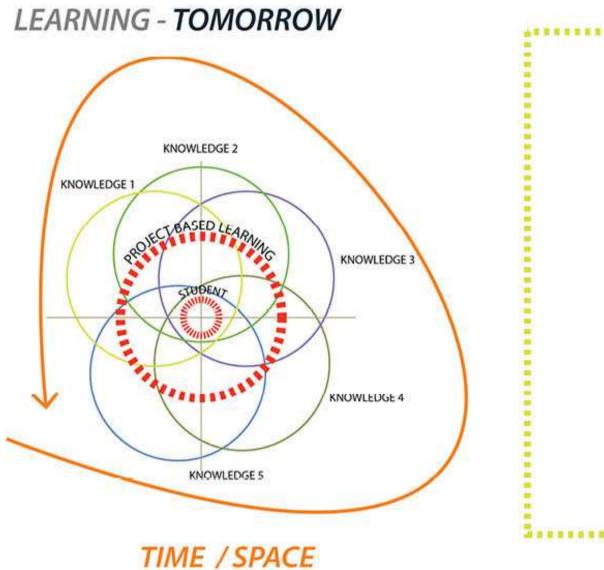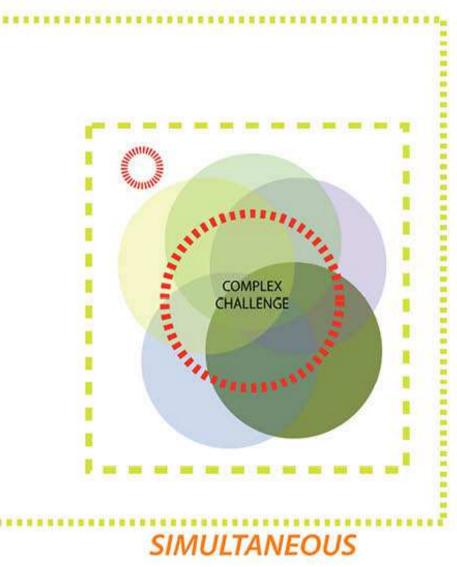4. **Knowledge-application**
5. **Communication-based**

methodologies of
TEACHING

vs.

typologies of
LEARNING

classROOM

LEARNING - **TODAY**

STUDENT   COLLEGE PATH

KNOWLEDGE 1   KNOWLEDGE 2   KNOWLEDGE 3   KNOWLEDGE 4   KNOWLEDGE 5

TIME / SPACE

COMPLEX
CHALLENGE

SEQUENTIAL

LEARNING - *TOMORROW*

KNOWLEDGE 2

KNOWLEDGE 1

PROJECT BASED LEARNING

KNOWLEDGE 3

STUDENT

KNOWLEDGE 4

KNOWLEDGE 5

TIME / SPACE

COMPLEX CHALLENGE

SIMULTANEOUS

5 PATTERNS FOR DESIGNING TRANSDISCIPLINARY SPACES

TRANSPARENCY

SKETCH-SCAPES

INCLUSIVITY

RELEVANCE

FLEXIBILITY / ADAPTABILITY

STUDENTS @ CLASSROOMS

IMPART   CREATE   DISCOVER

EXCHANGE   THINK
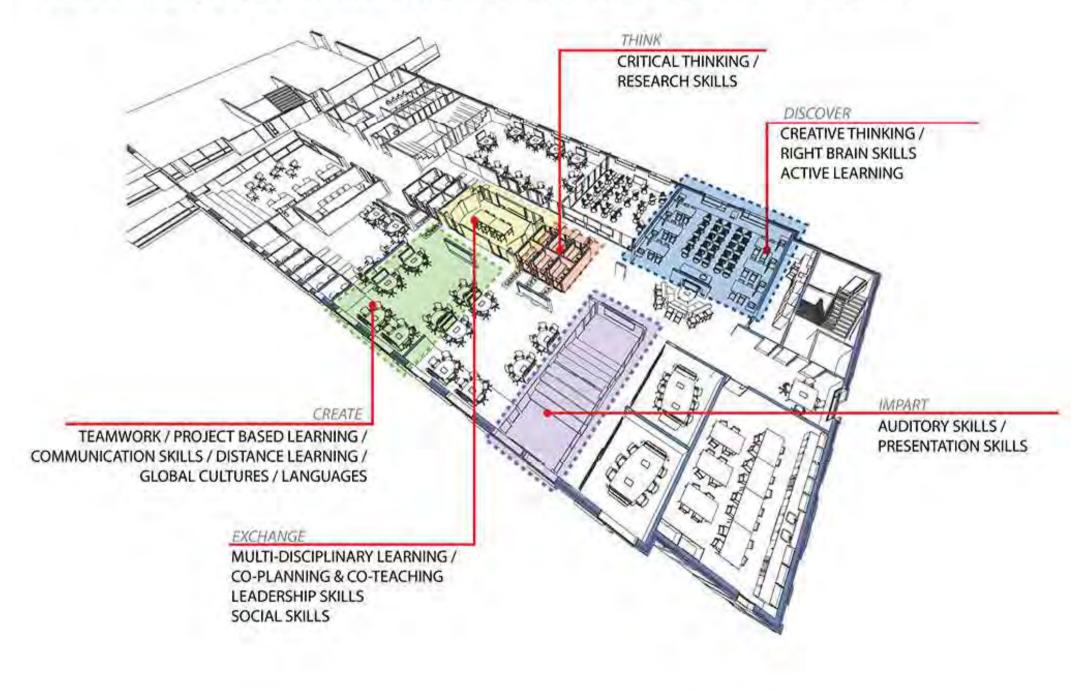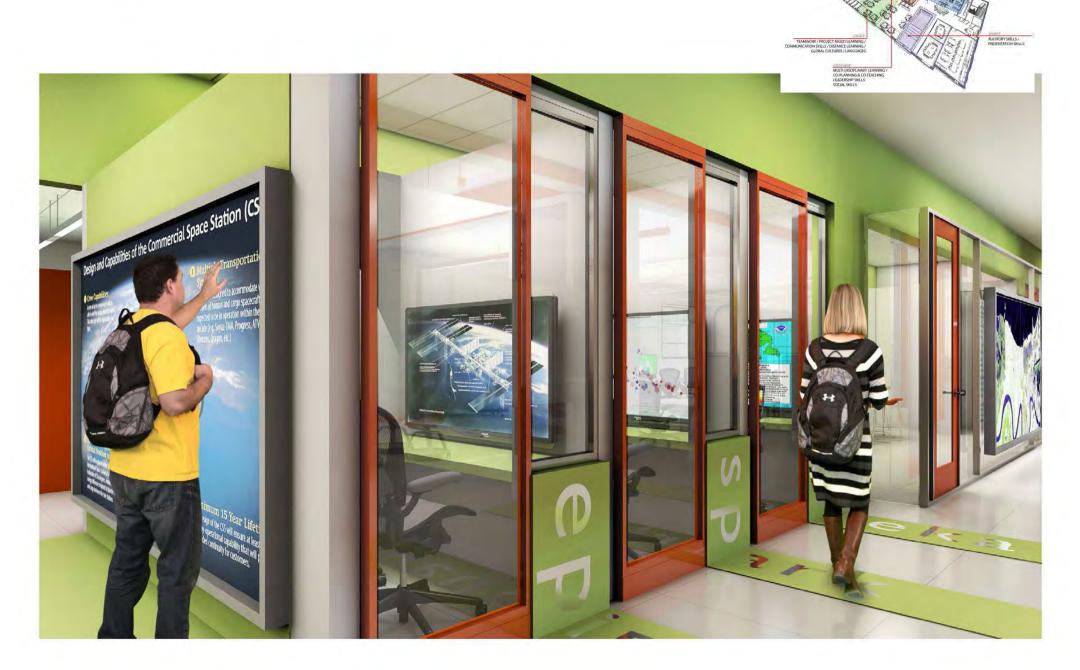
THE IMMERSIVE LEARNINGSCAPE - A TRANSDISCIPLINARY ATELIER

THINK
CRITICAL THINKING /
RESEARCH SKILLS

DISCOVER
CREATIVE THINKING /
RIGHT BRAIN SKILLS
ACTIVE LEARNING

CREATE
TEAMWORK / PROJECT BASED LEARNING /
COMMUNICATION SKILLS / DISTANCE LEARNING /
GLOBAL CULTURES / LANGUAGES

IMPART
AUDITORY SKILLS /
PRESENTATION SKILLS

EXCHANGE
MULTI-DISCIPLINARY LEARNING /
CO-PLANNING & CO-TEACHING
LEADERSHIP SKILLS
SOCIAL SKILLS

THINK-SCAPE

THINK-SCAPE

CREATE-SCAPE

CREATE-SCAPE

CREATE-SCAPE

DISCOVER-SCAPE

DISCOVER-SCAPE

DISCOVER-SCAPE

Design and Capabilities of the Commercial Space Station (CSS)

1 Crew Capabilities:
A crew of up to seven people will be able to visit the station at the outset. The crew size will be increased over

3 Multiple Transportation Systems:
The CSS is designed to accommodate various models of human and cargo spacecrafts expected to be in operation within the next decade (e.g. Soyuz-TMA, Progress, ATV, ARV, Shenzou, Dragon, etc.)

Place Orb... ISS:
The C... Intern... Inclination of 5... energy differen... and cargo betwe...

4 Uniform Interface Systems:
The CSS will be built using internationally certified units and interfaces for docking, communications, life support, scientific and experimental lockers, and computer and data monitoring interfaces.

5 Minimum 15 Year Lifetime:
The design of the CSS will ensure at least 15 year of fully-operational capability that will provide extended continuity for customers.

IMPART-SCAPE

IMPART-SCAPE

IMPART-SCAPE

EXCHANGE-SCAPE

EXCHANGE-SCAPE

STEVEN JOHNSON

WHERE DO GOOD IDEAS COME FROM

Chance favors the connected mind.

THANK YOU

teliaeson@littleonline.com

TOMAS ELIAESON
AIA, M.Arch, LEED®AP BD+C

LITTLE