

maker space:

Promoting Engagement of the California Community Colleges with the Maker Space Movement

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STEM/STEAM
SKILLS FOR
THE
CREATIVE
ECONOMY

INNOVATIONMAKER3
SYMPOSIUM



CCST
CALIFORNIA COUNCIL ON
SCIENCE & TECHNOLOGY

what is making?

Creating.
+
Communal
Interdisciplinary
STEM/STEAM-focused
Diverse
Process
• Open-ended, inquiry-based •
Fun and playful
Empowering

maker space

what can students learn?

Making & makerspaces are complementary

“4 C’s” of 21st Century Skills:

Creative Thinking ❖ Critical Thinking ❖ Collaboration ❖
Communication

Soft Skills:

Problem solving ❖ oral & written communication ❖
teamwork/collaboration ❖ leadership ❖
creativity/innovation ❖ self-direction ❖
professionalism/work ethic

the robots are coming



21st Century
Skills are
increasingly
important

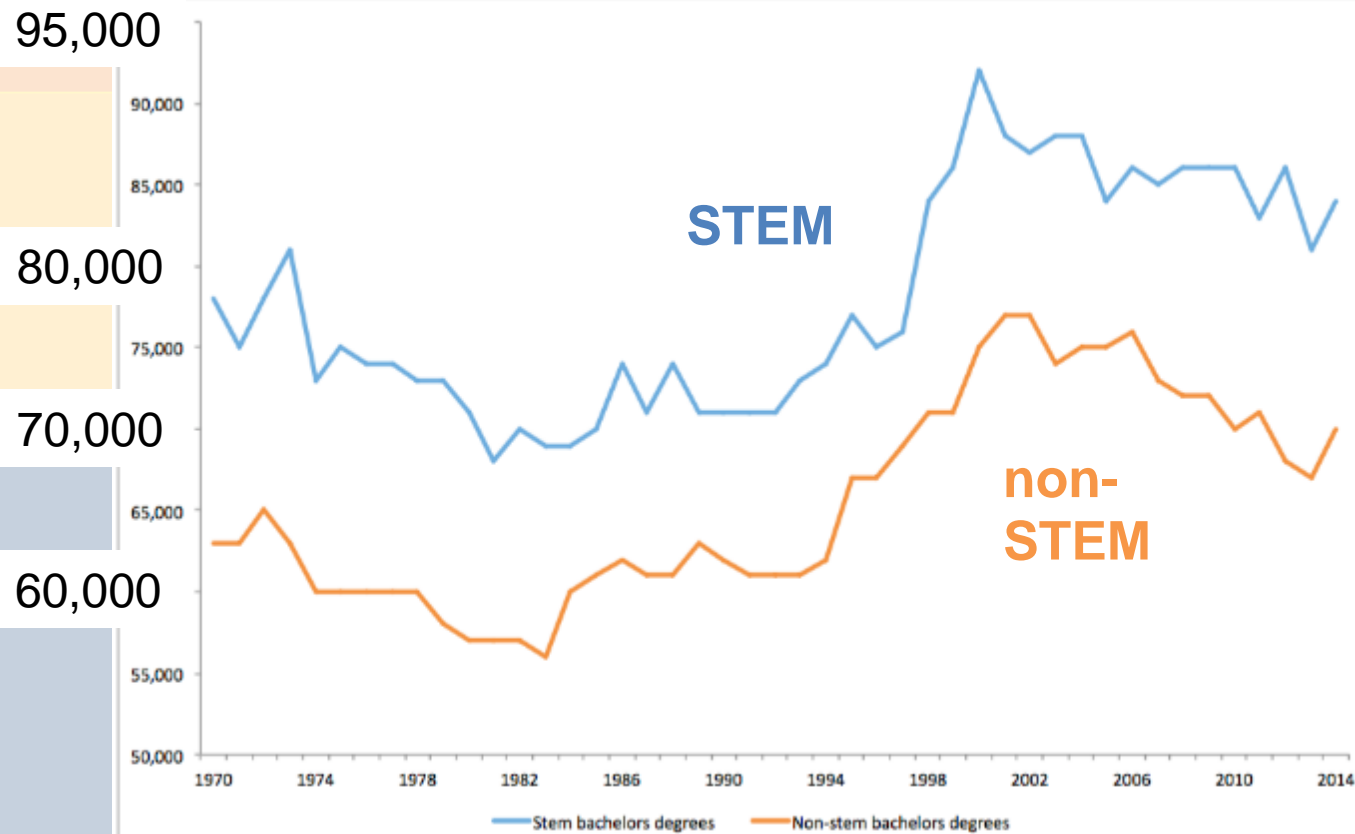
Via *MIT Technology Review*:
Image courtesy of Simbe
Robotics; image courtesy of
Savioke; image courtesy of
Knightscope; image courtesy of
Starship Technologies

making and WBL

Work-based learning programs:

- Improve completion rates
- Develop workplace skills (teamwork, creative problem solving)
- Increase student interest in potential career paths

STEM: life-long impacts



Mean earnings for **STEM** vs. **non-STEM** bachelor's degree holders from 1970 to 2014.

(Source: University Ventures Letters, Volume VI, #5. March 4, 2016.)

making strong ecosystems



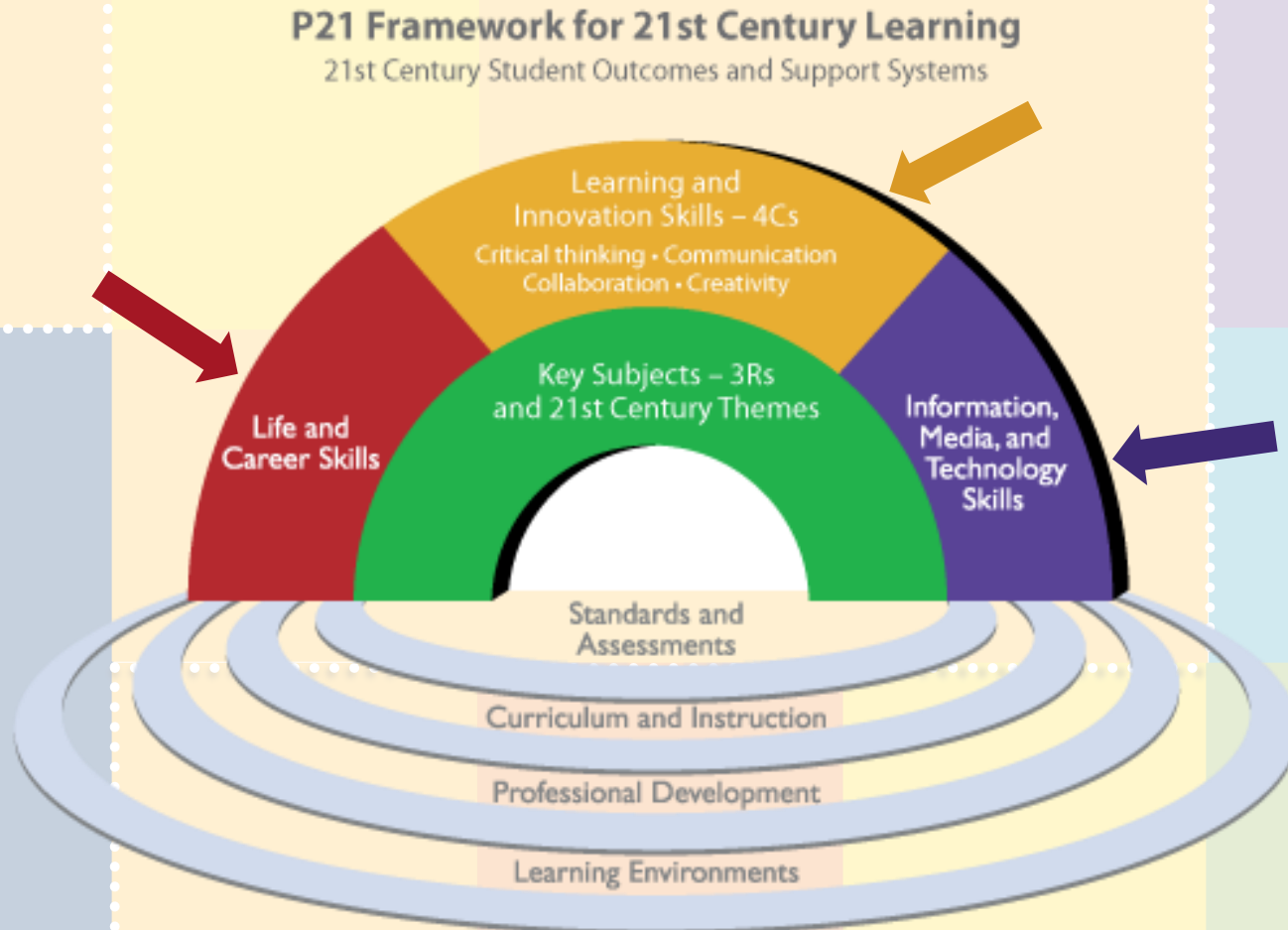
Ranked least prevalent pillar worldwide
(41%, 31% excl. US)

2013 World Economic Forum survey of 1,000 entrepreneurs: 8 pillars of entrepreneurial ecosystem

Cultural support
Tolerance of risk
Mentoring, training
and failure,
celebration of
learning
Culture of Respect
Innovation,
positive image
Risk
Tolerance of support
Etsy; Ebay
entrepreneurshi
Kickstarter;
Indiegogo
p) =
MAKER
MINDSET


making assessments

Academic: P21 Framework



making assessments

Entrepreneurial: Entrepreneurial Ecosystem Vibrancy— Connectivity (Strangler and Bell-Masterson, 2015)

Indicator	Measure	Possible Sources
 CONNECTIVITY	Program connectivity	Under development
	Spinoff rate	Possibly: CrunchBase; LinkedIn
	Dealmaker networks	Private databases, including Capital IQ

Connections matter, and a dense network of connections, among a small number of programs, is arguably more important than a sparse network among a larger number.¹⁶

making considerations

- Statewide network of MakerSpaces
- Lead institution
- Geographically dispersed
- Connect CCs to regional economies
- Offer links to jobs, WBL

making considerations

- Strong support from CTE, STEM/STEAM
- Staff commitment
- Mutually beneficial interactions between MSs and traditional course offerings
- Integrate with traditional instruction framework
- Complement existing course offerings

how might the network look?

- TAP – responsible for growth and success
- Steering committee – draw from outside
 - CEOs from MSs outside network
 - Execs from businesses & foundations
 - Reps of key Maker orgs (Maker Media, Fab Lab)
- Regularly meet/share knowledge
 - Webinars (every other month, rotating topics)
 - Annual in-person meeting @/near Maker Faire

how might the network look?

- Sharing of staff resources
 - Pool buying power for equip/software
 - Pool staff time for grant applications/requests for donations
- Shared methodology for identifying how each MS will meet network's goals

start measuring success

Questionnaire-style:

- # of measurable products
- # workshops, badges, etc
- % completing a certificate program
- % transferring to 4-yr
- % obtaining related job
- Is MS receiving contributions from local bus & gov't?
- Do regional employers recognize and value badges, etc. earned at MS?

Behavioral Metrics:

Learning Dimensions Rubric framework (Exploratorium, 2015)

Facilitation Field Guide		
<small>the tinkering studio</small>		<small>exploratorium</small>
Facilitation Goals	Practices	Techniques
Spark initial interest	<ul style="list-style-type: none">• Welcome people and invite them to the space• Introduce the activity and set the mood for the interaction	<ul style="list-style-type: none">• Smile and introduce yourself• Orient learners to the available tools and materials• Offer a place to start working• Meet them at eye level when explaining or modeling• Show examples that demonstrate a variety of thinking• Suggest a prompt that generates possibilities
Sustain participation by following the learner's ideas	<ul style="list-style-type: none">• Value tentative ideas, "mistakes," and wrong directions• Support their process in moments of failure and frustration	<ul style="list-style-type: none">• Observe learners for a bit before jumping in• Ask questions about their process• Listen to their ideas• Restate statements or questions• Offer new materials or tools• If you don't know the answer, work together• Give learners suggestions instead of directions• Show enthusiasm about their ideas
Deepen understanding through making connections	<ul style="list-style-type: none">• Guide people to go a little bit further than they could on their own• Surface connections between projects and links to outside learning experiences	<ul style="list-style-type: none">• Encourage people to look around the space for inspiration• Point out shared goals around the room• Offer technical terms only when relevant• Let participants explain their thoughts and define the next steps• Encourage risk-taking and experimentation• Offer challenges that allow learners to go further down their own path• Discuss how the experience might relate to outside interests• Celebrate moments of wonder, surprise, and joy

<http://tinkering.exploratorium.edu/learning-and-facilitation-frameworks>

funding + sustainability

- Revenue sources to consider:
 - Membership dues
 - School district funds
 - Foundations
 - Federal agencies
 - Local government
 - Business sponsors
 - For-credit courses
 - Classification as campus resource

start making

Startup checklist:

- ☐ Goals
- ☐ Activities
- ☐ Tools/Equipment
- ☐ Space/Infrastructure
- ☐ Staff
- ☐ Community and Campus Support
- ☐ Website and Database
- ☐ Funding Strategy

thank you!

Report Authors:

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Promoting Engagement of Community Stakeholders

Exhibit 1-2 : Components of Entrepreneurial Ecosystem Pillars

Accessible markets

- Domestic market:
 - Large companies as customers
 - Small/medium-sized companies as customers
 - Governments as customers
- Foreign market:
 - Large companies as customers
 - Small/medium-sized companies as customers
 - Governments as customers

Funding & finance

- Friends and family
- Angel investors
- Private equity
- Venture capital
- Access to debt

Government & regulatory framework

- Ease of starting a business
- Tax incentives
- Business-friendly legislation/policies
- Access to basic infrastructure
- Access to telecommunications/broadband
- Access to transport

Major universities as catalysts

- Promoting a culture of respect for entrepreneurship
- Playing a key role in idea-formation for new companies
- Playing a key role in providing graduates for new companies

Human capital/workforce

- Management talent
- Technical talent
- Entrepreneurial company experience
- Outsourcing availability
- Access to immigrant workforce

Support systems/mentors

- Mentors/advisers
- Professional services
- Incubators/accelerators
- Network of entrepreneurial peers

Education & training

- Available workforce with pre-university education
- Available workforce with university education
- Entrepreneur-specific training

Cultural support

- Tolerance of risk and failure
- Preference for self-employment
- Success stories/role models
- Research culture
- Positive image of entrepreneurship
- Celebration of innovation