

# **Entrepreneurship In Science And Engineering Correlates with Sustained Arts and Crafts Participation**

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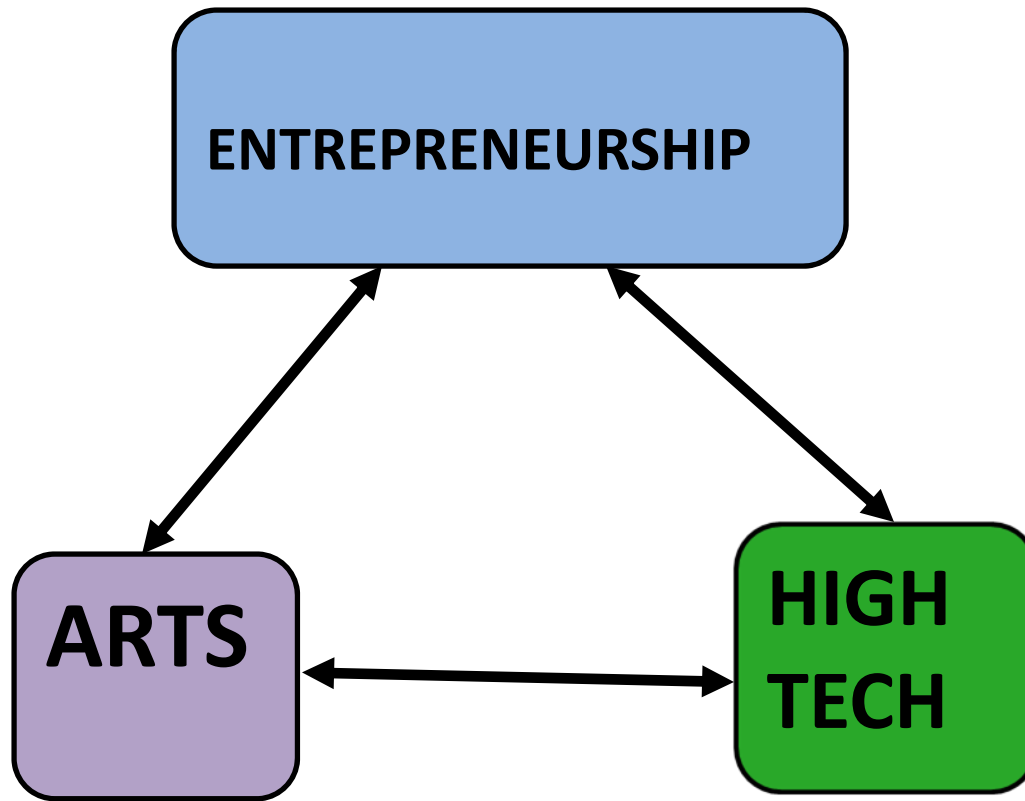
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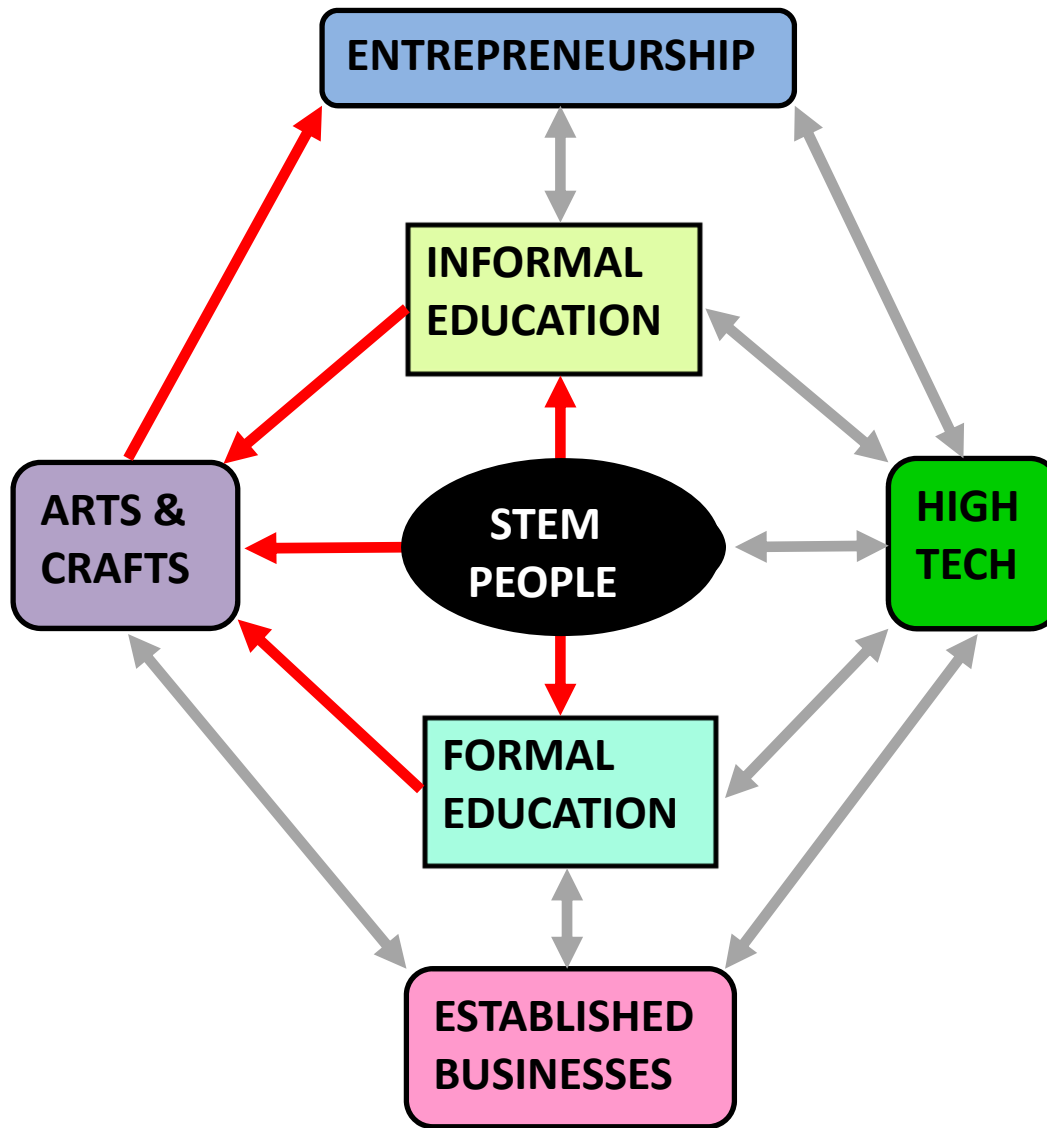
**Michigan State University's Honors College**

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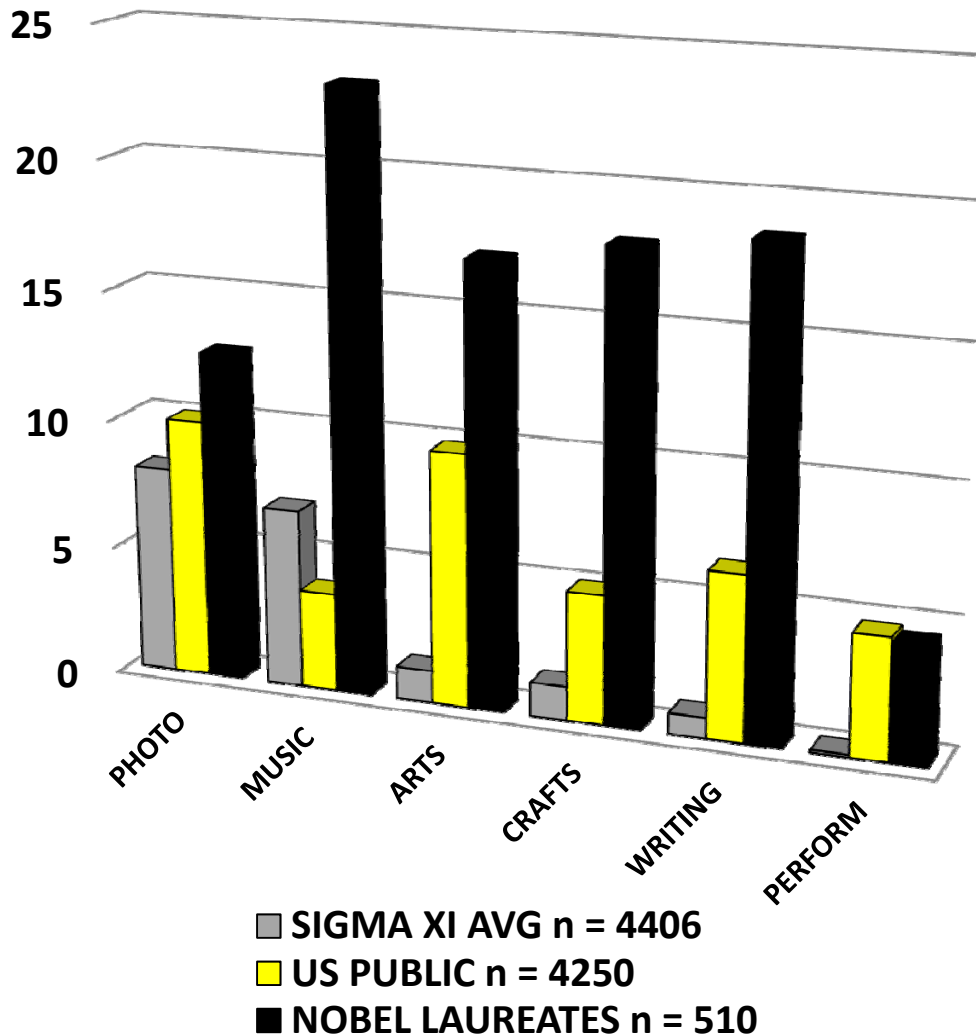


# Simplified Richard Florida Model



**Hypothesis:**  
**Are STEM  
people  
attracted to  
arts-rich  
communities  
because STEM  
people are  
themselves  
artists?**

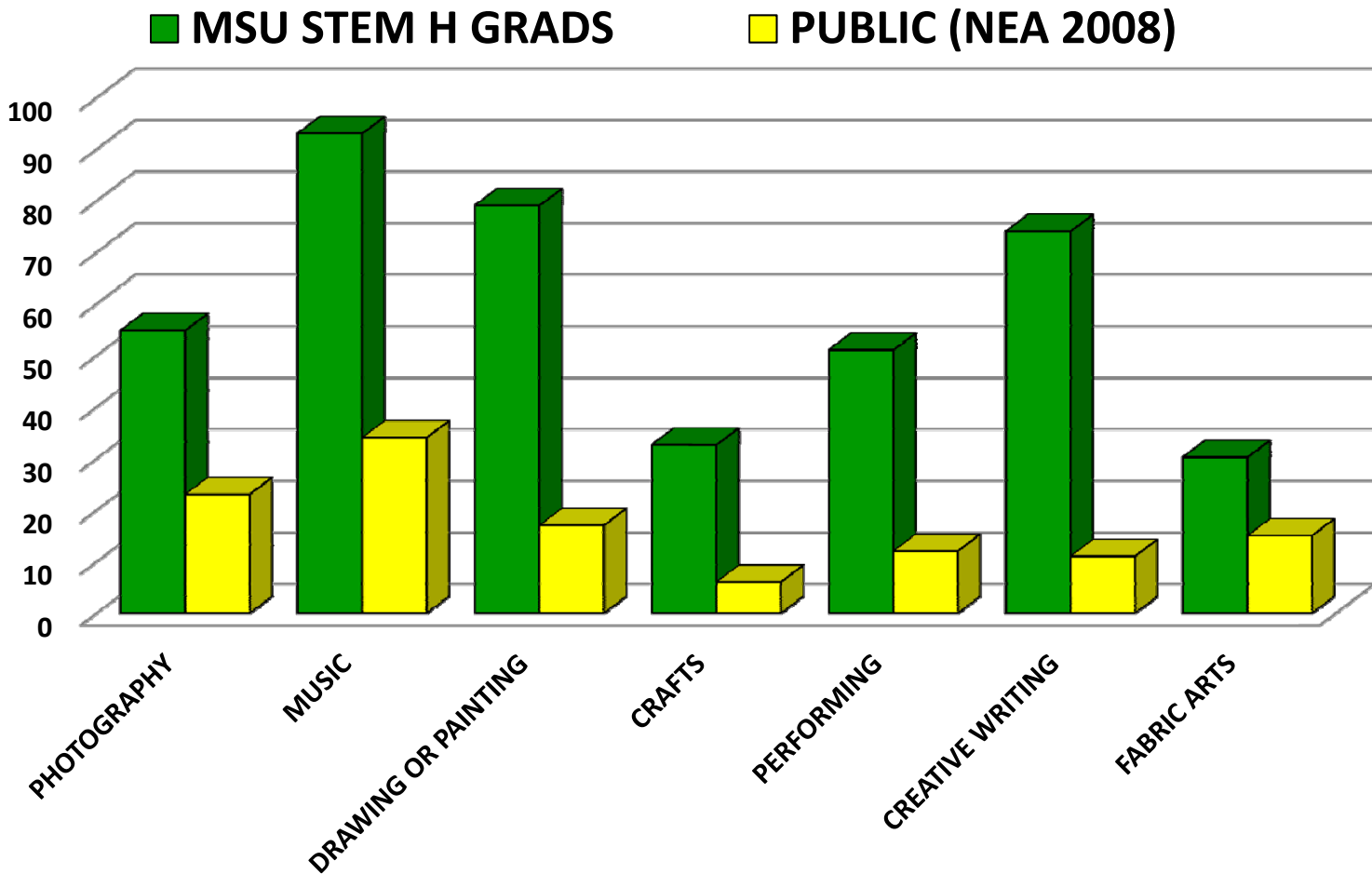
# Adult Avocations Correlate with Scientific Success



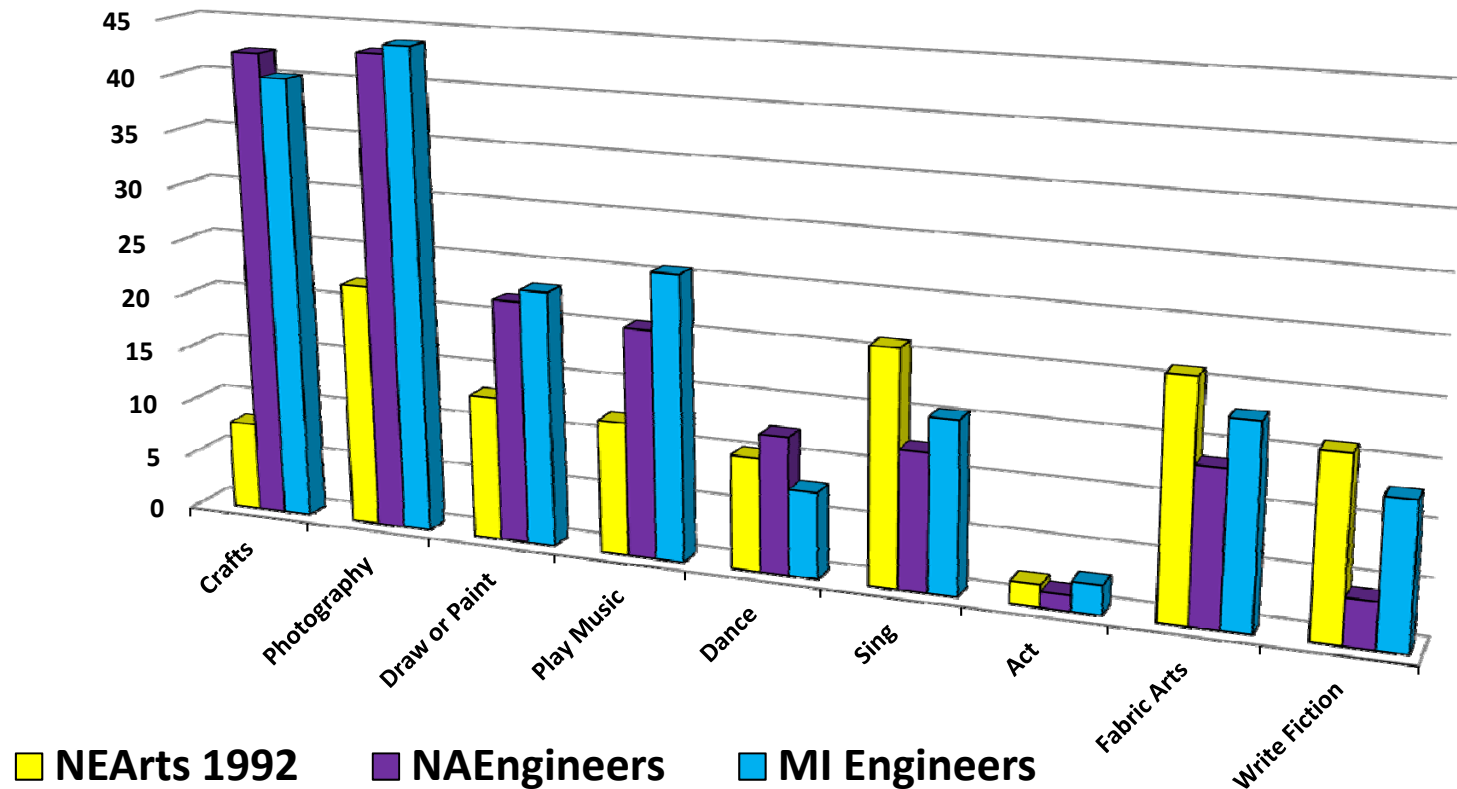
Compared with typical scientist, Nobel laureates are:

- 2X photographers
- 4X musicians
- 17X artists
- 15X craftsmen
- 25X writers
- 22X performers
- (R-B, et al., 2008)

# Lifetime Participation In Arts And Crafts Of MSU Honors College STEM Grads (1990-95) vs Public

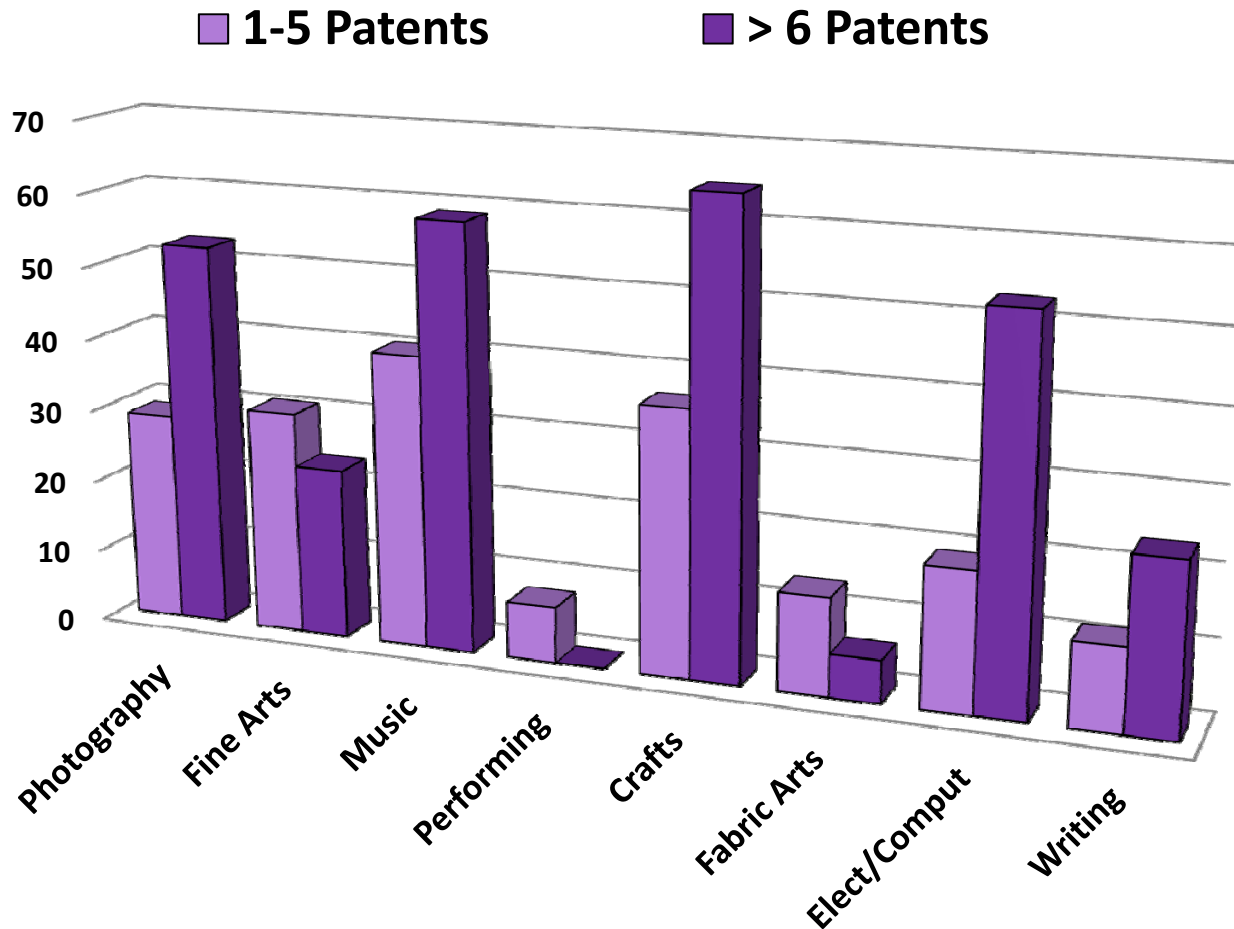


# Engineers Participate More in Arts and Crafts as Adults than General Public

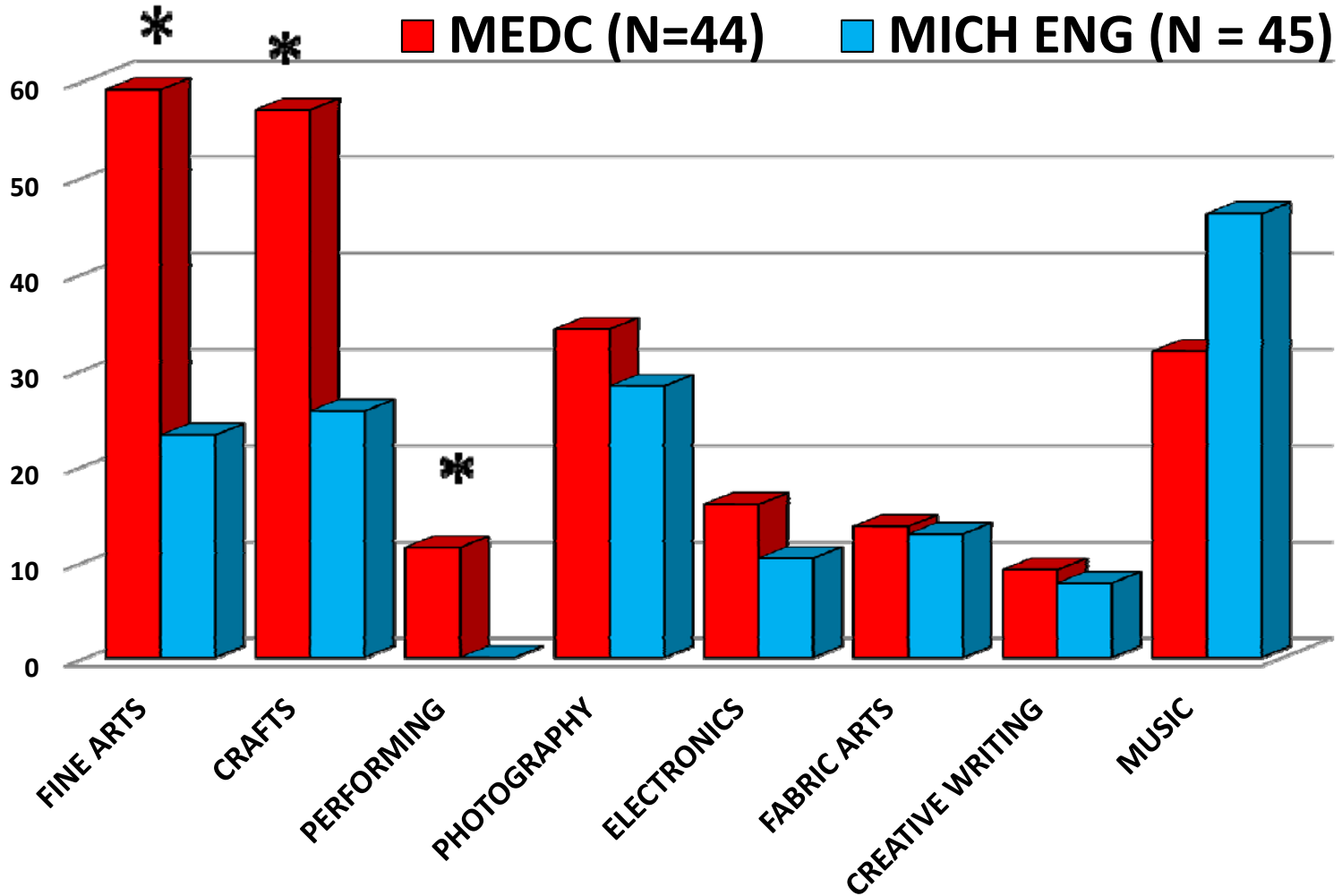


- 1992 NEA Survey of Arts Participation In America, 1982-1992. Research Division Report #27. ED 378 105. Compiled by John P. Robinson <http://www.eric.ed.gov/PDFS/ED378105.pdf>

# Impact of Sustained Arts & Crafts Participation on Patent Output Among NAE Members



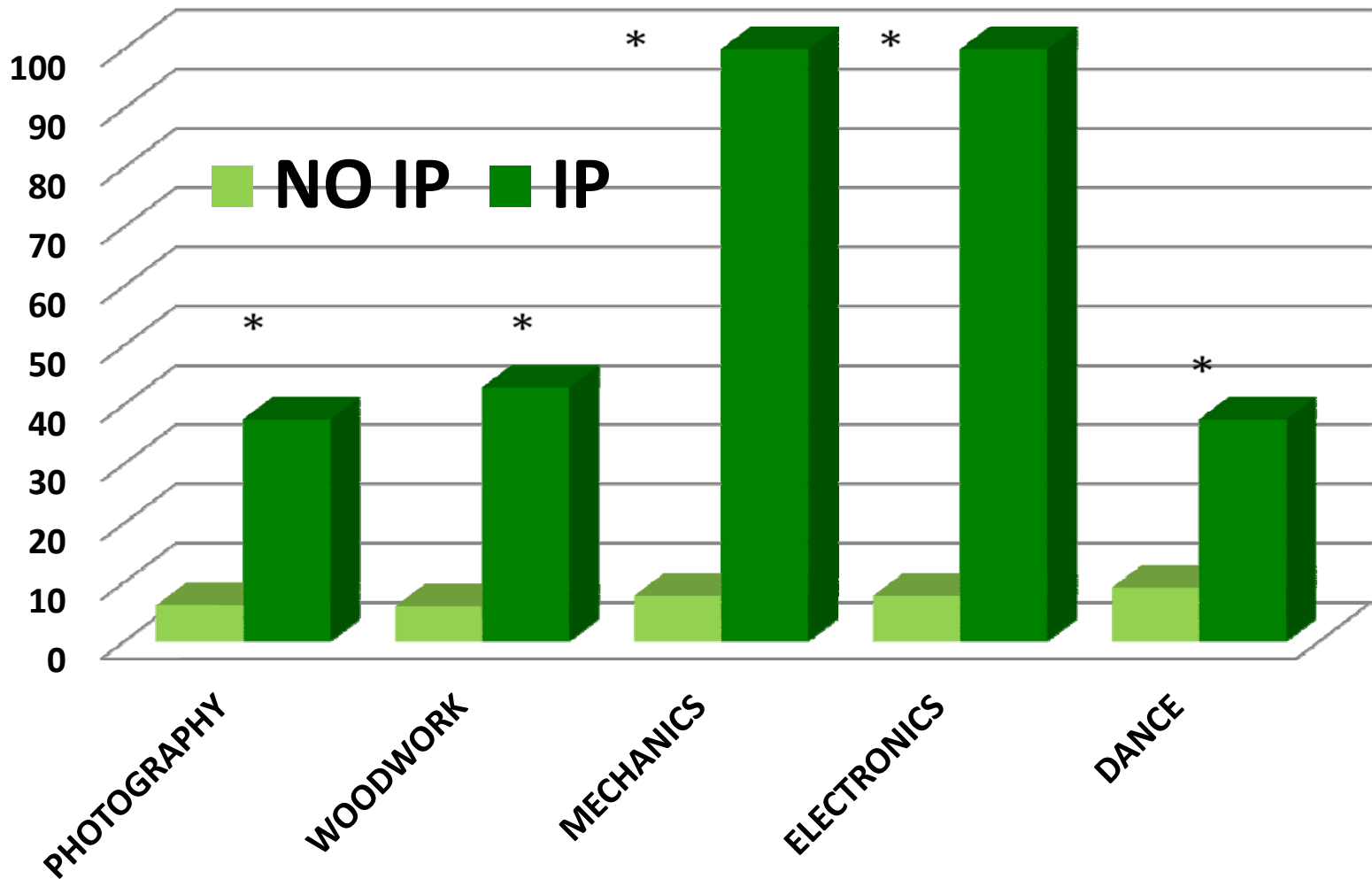
# Sustained Avocations Among Engineers Correlates With Entrepreneurship



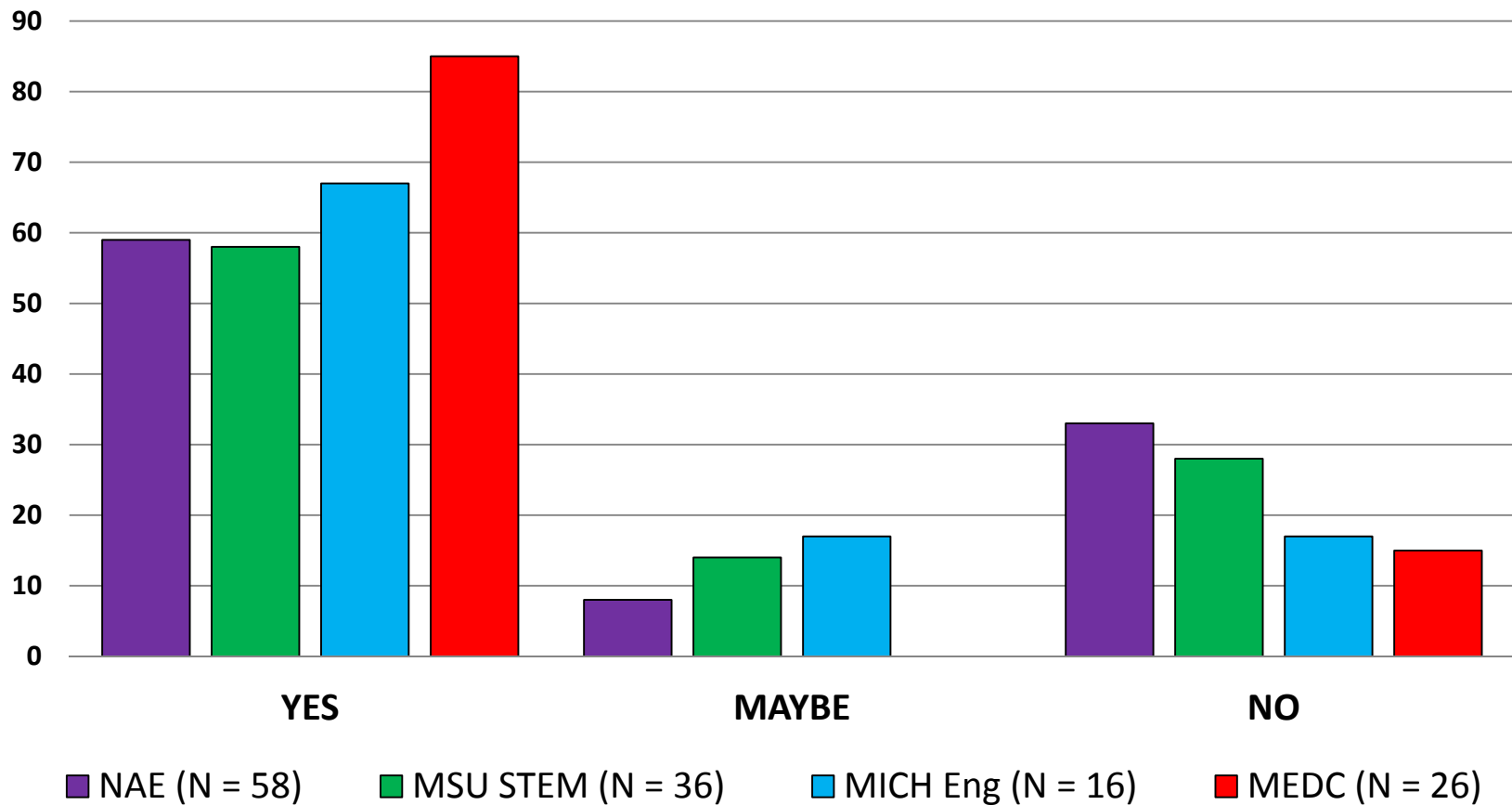


# Intellectual Property Production Correlates with Sustained Arts & Crafts

## MSU HONORS COLLEGE STEM GRADS



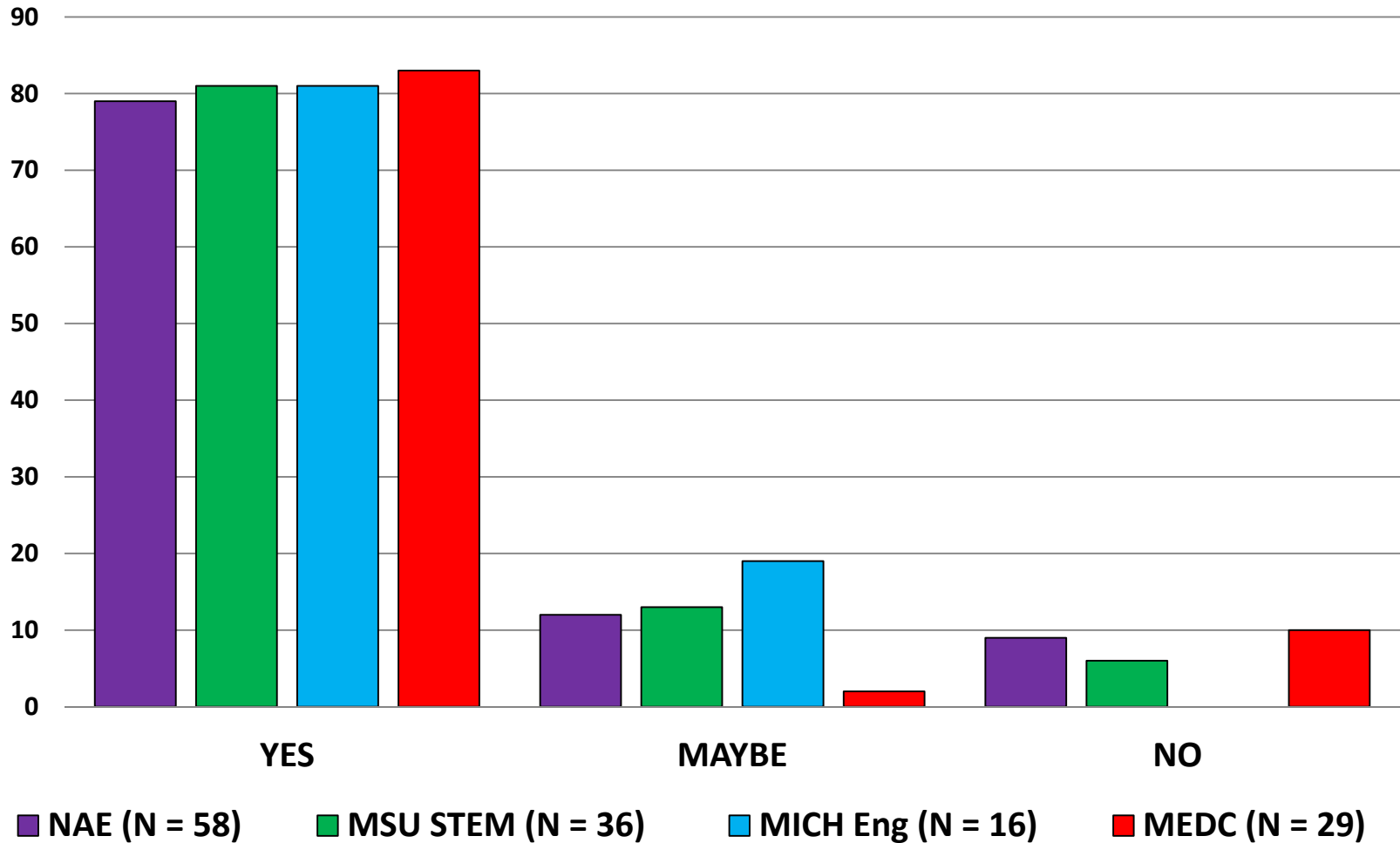
# Does Your Avocation or the Skills, Knowledge, Etc. Derived From It, Play Any Role in Your Vocation?



# Some Typical Responses

- “Paper-folding, wood blocks gave me early insight into 3-D geometry” (NAE)
- *“I use some of my skills from drawing for creating stimuli for experiments. Experience with visual composition helps to create good diagrams and presentations.”* (MSU STEM)
- *“Quilting is a great way to use creativity and analytical thinking to solve problems and create something that is aesthetically appealing. It ... improves my creativity in my current vocation.”* (MSU STEM)
- “I work in lasers and photonics, which has an indirect, coincidental link to photography hobby” (NAE)
- “Mechanical and material properties I learn in my hobbies can often relate to mechanical and material issues in microelectronics, especially in my specific discipline.” (NAE)

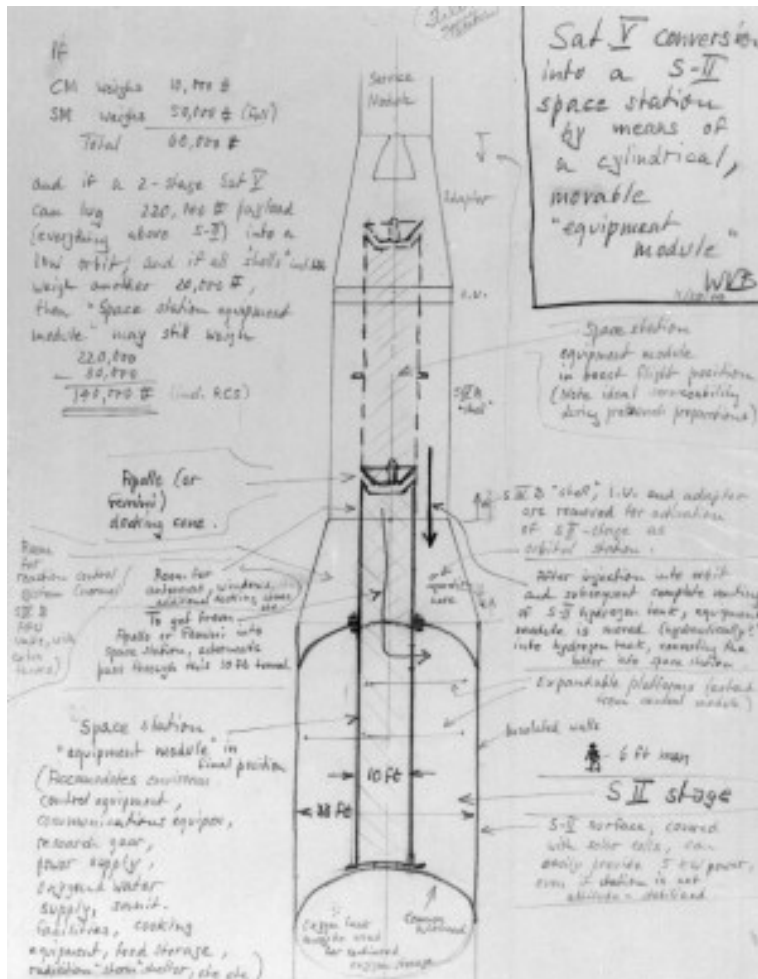
# Do You Recommend Arts and Crafts Education As a Useful or Even Essential Background for a Scientific or Engineering Innovator?



# Some Typical Responses

- “Yes, because it is relaxing and frees the mind. I think moving around -- dancing, playing on the playground, helps one get a visceral feeling for physics.” (NAE)
- “Hands on experience with tools, materials, etc., whether for arts and crafts or more practical pursuits (carpentry, home repair, auto mechanics, etc.), represents a very important experience for practical problem solving.” (NAE)
- “*Yes, allows you to explore materials in a different way, figure out how to put things together, try to do things differently.*” (MSU STEM)
- “Mechanical skills are important for constructing experimental apparatus. Pattern visualization is very important, and is developed by arts and crafts” (NAE)
- “Yes. Ability to make simple prototypes and models with own hands vital for creativity in product design” (NAE)
- “Yes- helps creativity” (NAE)

# Visual Thinking Training Improves Science and Engineering Ability



T. R. Lord, *J. Res. Sci. Teach.* 22, 395 (1985).

J. A. Deno, *Eng. Design Graphics J.*, 5 (autumn, 1995).

S. A. Sorby, B. G. Baartmans, *Eng. Design Graphics J.* 60, 13 (1996).

M. Alias, T. R. Black, D. E. Grey, *Inter. Ed. J.* 3, 1 (2002).

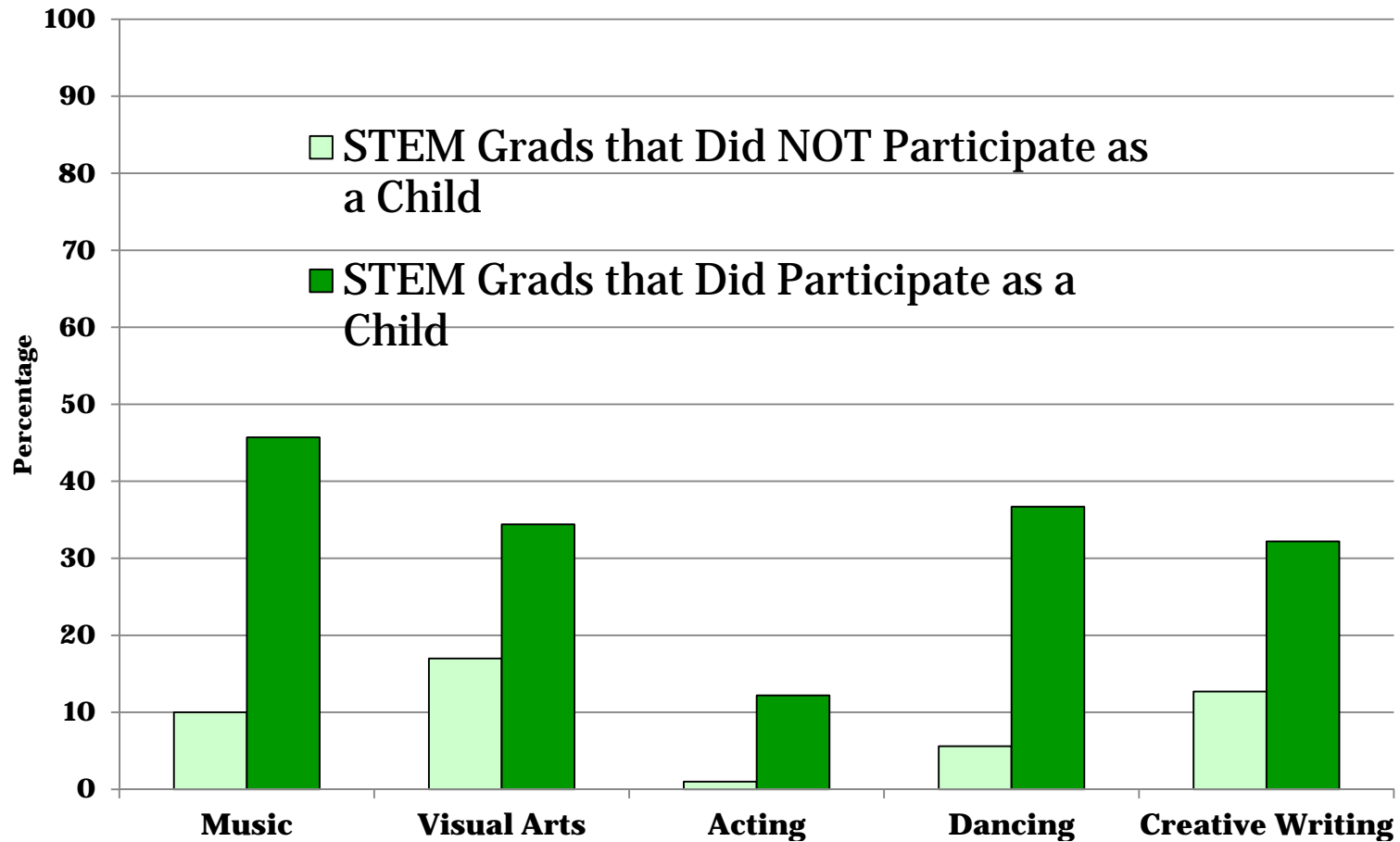
S. Sorby, *Cogn. Proc.* 10 (suppl. 2), S312,

10.1007/s10339-009-0310-y (2009).

# What Was the Most Important Exposure to Arts and Crafts?

- **Active arts and crafts** correlated with entrepreneurial outcomes better than passive ones (i.e., composing music rather than playing an instrument; painting or metalwork rather than photography or knitting)
- **Informal education, mentoring and self-education** were as important as **formal courses** and **private lessons**
- Participation over a **lifetime** (particularly as **adult!**) more important than any particular experience or time period

# Arts and Crafts participation in Mature Adults Is a Function of Childhood Involvement





# In Sum, Investing In Arts and Crafts Builds Innovative and Entrepreneurial Capacity Over a Lifetime

- We are NOT just talking about taking an art class or music lessons at some critical point in one's life
- We are NOT talking about building a theater or an art museum in one's community
- We are talking about as **SYSTEM** that makes available over a lifetime:
  - Formal education in arts and crafts
  - Informal education in arts and crafts
  - Personal and community access to arts and crafts materials and equipment (community centers, crafts and hobby shops, art stores, etc.)
  - Full range of community arts and crafts institutions (commercial, cultural, professional and amateur)

# Arts and Entrepreneurship SYSTEM:

## Lifetime access to:

- Formal education in arts and crafts
- Informal education in arts and crafts
- Personal and community crafts materials and equipment (community centers, crafts and hobby shops, art stores, etc.)
- Full range of community arts and crafts institutions (commercial, cultural, professional and amateur)

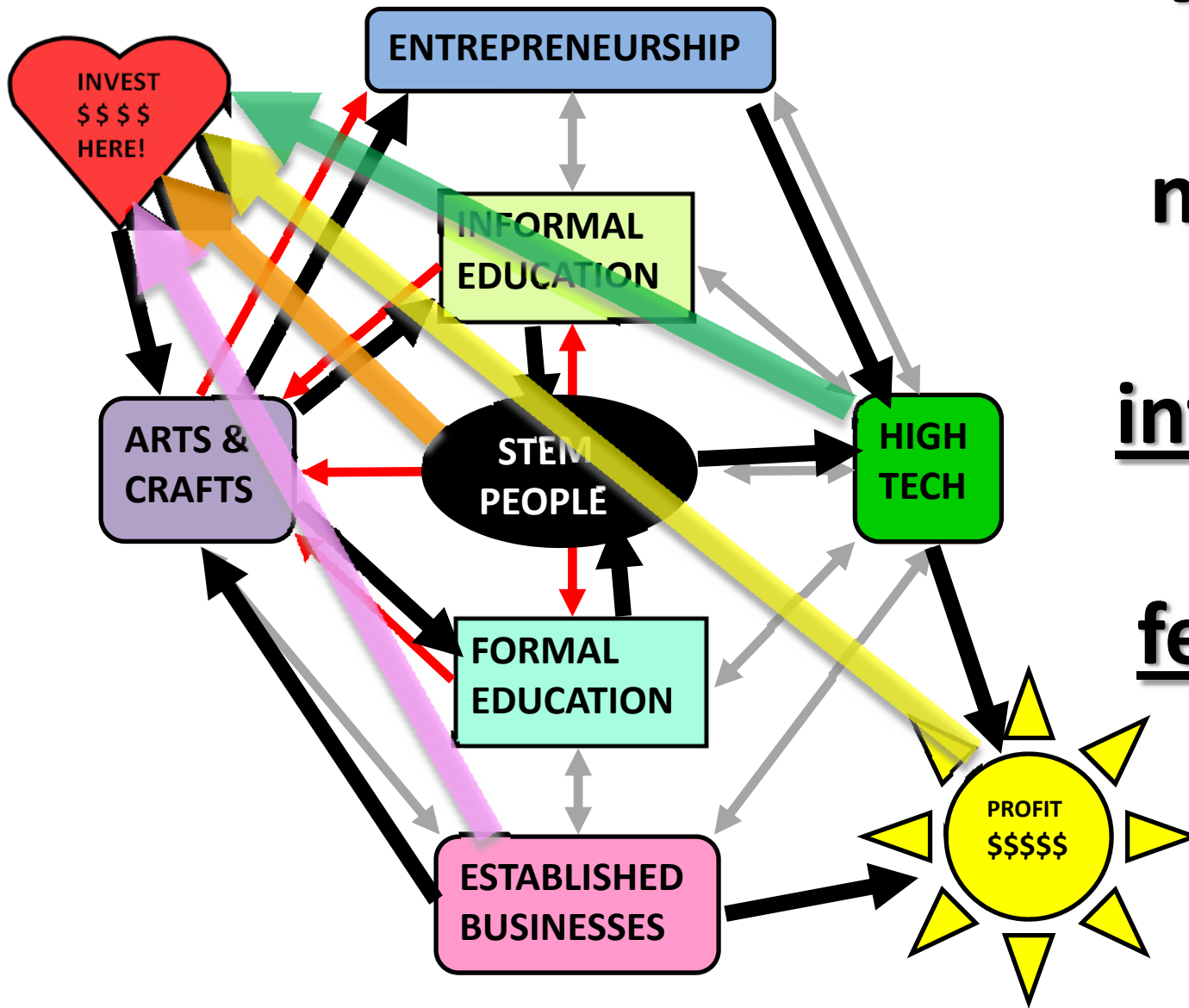
# Take home messages

**Strong formal and informal educational and cultural opportunities in arts and crafts build a creative STEM work force!**

**Science and technology flourish only where arts and crafts infrastructure is deep, wide, consistent and strong!**

**Conversely, strong STEM individuals and industries must promote arts, crafts and cultural development**

**Investment in arts and crafts may pay off only decades later as innovation in other professions!**



**We can't  
ignore  
necessity  
for  
integration  
and  
feedback!**