How Shaping Mindset Can Enhance Educational Outcomes, Employability, and Well-being

by

Richard K. Miller

Executive Summary. As described in a previous white paper[1], the mindset that university students acquire—not just their knowledge and skills—seems to play an important role in future achievement and well-being of alumni in multiple domains, including how well they do in school, their well-being later in life, and their employability. Recent Gallup surveys provide compelling evidence that indicates a strong correlation between personal emotional support together with significant experiential learning opportunities while in college and the long-term well-being of thousands of university graduates[2]. Furthermore, corporate leaders are consistently pointing out that an excess of technical expertise does not compensate for a deficiency in the attitudes, behaviors and motivations that are foundational to success in today's workplace[3,4,5]. This paper focuses on strategies for attempting to shape the mindset of undergraduate students with the goal of enhancing student outcomes—academically, in the workforce, and more broadly in enhancing life. It includes a concept for building a voluntary movement among like-minded universities to strengthen and build faculty motivation for, competence in, and commitment to mentoring the next generation with the mindsets needed to shape the future.

> *Hopeful faculty members spread hope among their students, and cynical faculty members spread cynicism. Have you ever met a cynical entrepreneur? You haven't, because that's an oxymoron!*

Why mindset matters: enhanced educational outcomes. Research in K-12 education has shown that the mindset that young students acquire can make a profound difference in their ability to learn and achieve in school. For example, Professor Carol Dweck, a psychologist at Stanford University, has shown that students who develop a "growth" mindset do better in school than those who have a "fixed" mindset. Her work over 25 years has shown that mindset can be defined, measured, cultivated and shaped, and that it has a lasting impact on outcomes for students[6]. Professor Dweck's work is widely respected in the social sciences. She was awarded the Atkinson Prize in Psychological and Cognitive Sciences from the National Academy of Sciences in 2016 for her work in this field.

At the heart of mindset, as Professor Dweck has discovered, is what students believe. In particular, beliefs about who they are, what they are capable of and what can be done to improve are central to their success in learning. In a recent interview, she explained it this way:

> *"In a fixed mindset students believe their basic abilities, their intelligence, their talents, are just fixed traits. They have a certain amount and that's that, and then their goal becomes to look smart all the time and never look dumb. In a growth mindset students understand that their talents and abilities can be developed through effort, good teaching and persistence. They don't necessarily think everyone's the same or anyone can be Einstein, but they believe everyone can get smarter if they work at it.[7]"*

In her recent book[6], she extends these findings about enhanced educational achievement to other areas of life, including business, sports, personal relationships, teaching and parenting. She has shown that the

---

1 Miller, Richard K., *The Importance of Mindset*, Olin College of Engineering, October, 2016.
2 Busteed, Brandon, *The REAL Data Revolution*, Trusteeship magazine, July/August 2016.
3 STEMconnector Innovation Task Force, *STEM2.0: An Imperative for Our Future Workforce*, STEMconnector, Washington, DC, June, 2014.
4 Beyond IT Inc., *IBM's Role in Creating the Workforce of the Future*, Beyond IT, Inc, Houston, TX, 2009.
5 Hansen, Morten T., *IDEO CEO Tim Brown: T-Shaped Stars: The Backbone of IDEO's Collaborative Culture*, Chief Executive.net.
6 Dweck, Carol S., Mindset: The New Psychology for Success, Ballantine Books, 2007.
7 Morehead, James, *Stanford University's Carol Dweck on the Growth Mindset and Education*, OneDublin.org, June 19, 2012.

attitudes and behaviors of parents, students and peers can create lasting change in mindset with significant consequences.

Why mindset matters: employability and the shifting economy. Like many companies, IBM has undergone a major transition from selling expensive products to providing expert services in the last few decades[8]. "*I.B.M.'s services business was born of necessity—a way to unbundle its pricing of big mainframe computers. In the early 1990s, I.B.M.'s business was threatened as it became increasingly possible to move some corporate workloads off expensive mainframes and onto computers powered by lower-cost microprocessor technology. So the company began charging separately for services and support that previously had been rolled into the price of a big mainframe.*

"The services strategy at I.B.M. evolved steadily. A big step came in 2002, when I.B.M. bought the consulting arm of PricewaterhouseCoopers for $3.5 billion. That moved I.B.M. services up from the care and updating of customers' data centers and specialized software to advising senior corporate executives on how to use technology to cut costs and generate new business.

"'That was a gigantic push into business solutions,' said Irving Wladawsky-Berger, a former senior technology strategist for I.B.M. 'As the components of technology—especially hardware—become inexpensive and commoditized, you want to focus less on the components and more on how customers want to use technology.'[9]" Services and software now account for more than 80 percent of IBM's business.

As this transition took place, the culture within IBM needed to change. The importance of human dynamics and teamwork across disciplines grew in importance. As a result, IBM pioneered the concept of the T-shaped employee, in which the vertical bar of the T represents technical competence within an academic discipline (or a system within a company), and the horizontal bar represents the ability to cross disciplines and work effectively with colleagues in neighboring disciplines (or systems), adeptly navigating the human dynamics needed to form productive and effective teams to solve complex problems[4]. The skills of the T-shaped employee include both technical competence and also a set of attitudes, behaviors, and motivations—or mindset—that enable the workforce to address problems in which human behavior plays a major role in the desired outcomes. Mr. Nick Donofrio, then Executive Vice President of Innovation and Technology, brought the concept of the T-shaped individual to prominence within IBM, and later across many other industries. Few people played a bigger role in this transition than Mr. Donofrio. I will return to him, and his approach to leading this culture change at IBM, later.

IBM is not an isolated case in the US economy. In the last 50+ years, the vast majority of the growth in employment in the U.S. has occurred in the services sector, not the manufacturing sector. As shown in Figure 1 on the following page, the services sector began to pull away from manufacturing about 1950. Since then, nearly all growth in the economy has taken place in the services industry. The trend toward increasing demand for better abilities to work in teams across disciplines and systems, and directly with clients, has grown across many industries. In a previous paper[10], I outlined the general character of these abilities (as deduced from many independent reports from industry groups) as a set of "mindsets" including: collaborative mindset, interdisciplinary mindset, entrepreneurial mindset, empathetic/ethical mindset, and global mindset.

[8] Snyder, Bill, *IBM says bye-bye to hardware and hello to the cloud,* InfoWorld, February 25, 2014.
[9] Lohr, Steve, *Huge Payoff for IBM After Shift*, New York Times, January 19, 2010.
[10] Miller, Richard K., *Why the Hard Science of Engineering is No Longer Enough to Meet 21st Century Challenges*, Olin College of Engineering, May 2015.

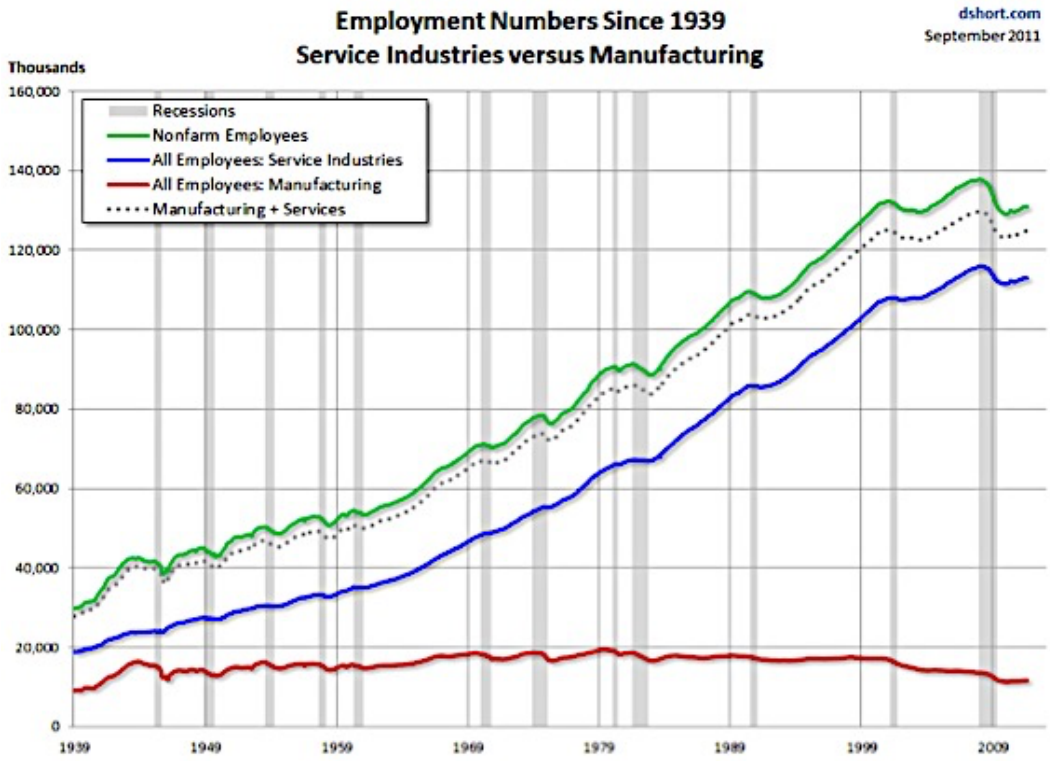

Figure 1
(from Doug Short, Advisor Perspectives, *Charting the Incredible Shift from Manufacturing to Services in America,* Business Insider, September 5, 2011.)

While these specific mindset skills are described in different terms from those in Dweck's work, it appears that there are linkages between the underlying beliefs in the growth mindset and those that form the foundation of these mindset skills in the workplace, as implied in Dweck's book[6].

It is important to note that the last major sea change in the curriculum for the study of engineering nationally occurred shortly after the Sputnik launch in 1957[10]. At that time, there was great national urgency to increase the scientific rigor of the engineering curriculum, which resulted in the standard that persists to this day in which—where applied science represents the core of the program, and people skills play a minor role. The priorities then seem to have favored natural science above all else. Increased rigor in technical competence was a "must have" while the professional or people skills were a "nice to have."

As a result, the values and rewards of academic institutions continue to focus on ever increasing emphasis on specialization and technical advances. The make-up of the faculty is almost exclusively that of PhD researchers in applied science and engineering who are recognized for their break-through contributions to new science as put forward in peer reviewed publications. Few have experience either in managing complex, multidisciplinary engineering systems in industry, or in teaching undergraduate students. Not surprisingly, the core of the curriculum reflects the competencies and skills of the faculty in applied science, not in developing mindset.

The continued unmitigated growth in the importance of services in the national economy has created, however, a new set of priorities in which professional or people skills must also be considered as a "must have" outcome from an engineering education (and essentially any undergraduate education today)[11]. It

[11] This raises the question: is it possible to focus too narrowly in education on the value specialized technical competence to the exclusion of its applications in a service-driven economy?

appears that the market demand for new college graduates with both technical and mindset competence is significantly higher than that for technical competence alone.

Why mindset matters: well-being later in life. Through its recent surveys of thousands of university alumni across the U.S., the Gallup organization has provided important new insights into what really matters in the long run in a college education[12]. Among the many salient observations they identified in this correlational study, they found that alumni who reported that, as an undergraduate, they had (1) a faculty member who cared about them as a person, inspired their learning, and nurtured their dreams, and (2) enhanced experiential learning, such as an opportunity to apply what they learned in a real world environment, belonged to a group with about twice the well-being later in life as the average university graduate. The concept of well-being has been developed by Gallup-Sharecare for the past 80 years in their annual well-being index[13]. The five elements of this index are:

- **Purpose**: liking what you do each day and being motivated to achieve your goals
- **Social**: having supportive relationships and love in your life
- **Financial**: managing your economic life to reduce stress and increase security
- **Community**: liking where you live, feeling safe and having pride in your community
- **Physical**: having good health and enough energy to get things done daily

While this correlational study does not explore cause and effect, and many factors are likely to be involved, the magnitude of the positive impact on alumni appears to be substantial. The central point here is that by insuring that each undergraduate receives both a degree of personal emotional support through mentoring and also enhanced engagement in experiential learning, it is empirically possible to substantially improve the well-being of thousands of university graduates.

If we assume that these mentoring and experiential learning experiences provide enhanced opportunities for students to develop the mindset and people skills mentioned above, then the Gallup results may provide important guidance on the changes in the learning environment needed to enhance the educational and employment outcomes for university graduates on a large scale.

In fact, several universities have already come to this conclusion and committed to make strategic changes in their programs to align with these findings. In particular, Purdue University, Furman University and the online Western Governors University, and others, have incorporated the objectives of enhanced personal mentoring and increased experiential learning as central to their strategic initiatives[14].

All this evidence points to a strong case that the role of the university in the 21st century should change. In addition to creating new knowledge and transferring it to the next generation, it now needs to assume a degree of responsibility for shaping the mindset of the next generation. The benefits of doing so appear to be important both to the university graduate and also to society in general.

A culture shift within the educational system is required in order to achieve this, however. Several concerns about such an expansion of the role of higher education are inevitable. First, isn't it the responsibility of parents or others in society to prepare students with the appropriate mindset? Furthermore, how do we know that mindset can be changed? And since faculty can only teach what they know, how do we build the faculty needed to lead this effort?

This culture shift within higher education may be parallel in important ways to the shift that occurred at IBM under the leadership of Mr. Donofrio. All of these concerns were present at IBM when they undertook to make similar changes. In spite of the challenges, they succeeded in making the transformation and today IBM has emerged as an organization with a new mindset. Perhaps there are lessons learned at IBM that may be instructive for higher education.

[12] http://www.gallup.com/topic/gallup_purdue_index.aspx
[13] http://www.well-beingindex.com/about
[14] Brandon Busteed, presentation at October 2016 President's Council at Olin College of Engineering.

Where does mindset come from? According to Professor Dweck, the heart of changing a mindset is changing personal beliefs. In her research, she has developed methods that involve thoughtful and careful strategies intended to shape the beliefs of students. She has found that the attitudes and beliefs of parents and teachers can have a major impact on what students believe about themselves, and hence their growth mindset. Since students not only listen to what you say, but also to the way you say it, the consistency with which you say it, and the consistency between your words and your actions as well, it is clear that parents and teachers need to have a growth mindset to effectively cultivate it among students. In short—you can only teach what you know. If you don't really believe in the growth mindset, you are unlikely to succeed in transmitting it to others[15].

It is important here to provide a framework for understanding the different role that a university professor must play to effectively influence beliefs and mindset. Let me propose a taxonomy for this, consisting of three layers (see Figure 2). At the lowest level is transmitting knowledge. This is traditionally what we think of as the role of teaching. Teaching can be done in many ways, including lectures, reading books, watching videos, answering questions, solving example problems, etc. Training and teaching are similar in this taxonomy. The goal is simply to increase what the student knows, as measured on a test. It is largely about intellectual content and explaining things. It need not involve a personal relationship—in fact, it may not be necessary to ever meet the teacher in person (e.g., Khan Academy, MOOCs, etc.).

Building upon the foundation of intellectual understanding, the next level up involves behavior and not just knowledge. It is important to see that "learning" at this level requires more than knowing facts and explanations. It also involves the ability to change one's behavior, which involves commitment, discipline, consistency, practice, and personal motivation. A typical model for this is what a coach does. A coach provides individual observation and advice on how a student should change her/his behavior to achieve a goal. An important aspect of coaching also involves accountability and extrinsic motivation.

A good example of the difference between teaching and coaching might be learning what it means to lose weight. A teacher may regard her/his job done when the student successfully passes a test that shows the student understands what calories are, the role of metabolism, and exercise physiology in maintaining a healthy body weight. But this alone rarely results in losing weight(!). Learning to lose weight involves much more, including a commitment to change your personal behavior. This is much easier to do with the accountability and personal influence provided by a coach—who plays a role well beyond a teacher. With a coach, a higher percentage of students are likely to learn what it really means to lose weight[16].

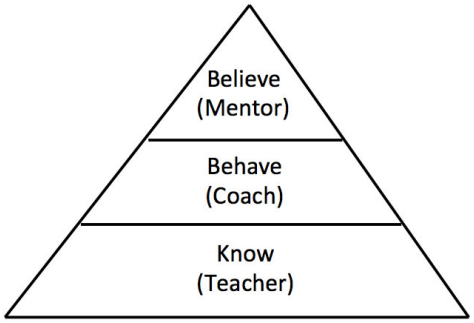

Figure 2
A Taxonomy of "Learning"

[15] Mary Murphy, a psychology professor at Indiana University and a protégé of Professor Dweck, is conducting research on how the beliefs and behaviors of faculty members at the university level shape the mindset of university students. She reports similar observations in the case of higher education that Dweck has found at the K-12 level.

[16] Incidentally, it is unlikely that a robot—no matter how accurate, patient, and persistent—will be able to exert the same degree of accountability and influence in changing personal behavior. There is something essential about the relationship between people involved in this level of influence.

But what happens when the relationship with a coach ends? The extrinsic motivation and accountability ends—and very often the behavior needed to maintain the desired weight also ends. Hence, the repeated cycle of weight gain and dieting resumes.

However, if a student has a very influential mentor (this could be a parent, sibling, physician, coach, etc.) whom the student implicitly trusts and respects, the relationship can have much deeper effects. For example, assume that the student has a physician that s/he respects, and this physician explains that the student has diabetes and therefore must forever take personal responsibility for careful control of everything that s/he eats in order to live a normal life. This changes the student's belief system in fundamentally different ways. The student's identity is forever changed, and a commitment must be made at a deep intellectual and emotional level to take permanent responsibility for her/his weight. This amounts to a permanent change in identity, intrinsic motivation, and personal beliefs. A coach is no longer needed to sustain the essential behavior.

The process of changing mindset as Professor Dweck has explained, involves changing personal beliefs, identity, and intrinsic motivation. In this taxonomy, a mentor relationship is required. So, to do this across a university, a significant number of faculty (or staff) members must play the role of a mentor to students. This is what the Gallup data seems to indicate when respondents report that they encountered at least one faculty member who cared about them as a person, inspired their learning, and nurtured their dreams. The level of personal engagement is substantial.

Of course, this taxonomy is only an idealization and there can be exceptions. For example, a student may be inspired to change her/his beliefs by a brief conversation with someone they deeply admire or respect—or even by watching a video presentation or reading a book by someone they greatly admire[17]. Since there is no personal accountability in this case, the effectiveness of such an encounter is less likely to be as high as when a personal mentor is involved. But it is possible for such an influence to result in a change in beliefs.

Returning now to Mr. Nick Donofrio and his challenge of leading the culture change at IBM, I recently interviewed him to get his perspective on how the mindset of an organization as complex as IBM might be shifted. He explained that when IBM realized the need to shift to a services organization, they had three separate internal communities: hardware systems, software systems, and services. Each had developed different views of the world, and struggled to work with each other. Nick and the IBM leadership decided the best way forward was a single integrated workforce. So he made a plea for the shift to a set of attitudes, behaviors, and competencies that embraced cross-disciplinary teams and inclusive collaborations. His presentation to a broad cross-section of the company describing the benefits of the new integrated workforce launched the T-shaped movement. The broader people were in terms of expertise and experience, the more valuable they became. They could be easily relocated between hardware, software, and services.

Of course, this required persuading people to accept others with very different skills as respected colleagues. It required a new way of making decisions and resulted in periodic relocation of people within divisions to become immersed in the other ways of thinking. It required growth mindset. IBM eventually announced very openly their interest in seeking a workforce with these new mindset characteristics, and also launched a new educational program (Services Science, Management and Engineering) designed to create new academic programs intended to produce more people of this type, beginning with the University of California at Berkeley and North Carolina State University, and now spreading to many others[18].

Mr. Donofrio's passion and absolute dedication to the principles of this new culture are apparent in any conversation with him. His personal role in inspiring others to embrace this approach is well known by

[17] This is also substantiated in the recent longitudinal study of students at a residential liberal arts college: Chambliss, Daniel F., and Takacs, Christopher, How College Works, Harvard University Press, 2014.

[18] Services Science, Management and Engineering, https://en.wikipedia.org/wiki/Service_science,_management_and_engineering

many individuals who experienced the changes at IBM (including several members of the Olin College Board of Trustees and President's Council). He is often described as a "mentor" by leaders within IBM and elsewhere. I asked Nick why he has become involved in mentoring others, and his answers provided clear examples of why he was so inspirational and successful in influencing others. Nick explained that he came from immigrant parents who had little money. He was inspired by a meeting his father (who dropped out of high school in the 10th grade to support his family) arranged with a friend who was an engineer who worked for the New York Central Railroad. Although Nick did not spend much time with him, this engineer (Mr. Schnitzer) inspired Nick and changed his beliefs about what was possible for him. Just a few interactions made a profound difference. He decided very early to go to college and become an engineer. In college (at RPI) he found another mentor, Professor Pepe Borrego. Nick says of Borrego: *"One of the brightest men I ever met. A fantastic teacher…He took an interest in me as a person and nurtured my hopes and dreams. I was not a great student, but he chose me. I give him a tremendous amount of credit for shaping how I think…"* Nick explained that at one point in his career he was the worst manager in the entire division. He tried to do every job himself instead of enabling others to do the job themselves. He realized the only way to achieve success at the scale they needed was to build teams of diverse people empowered to solve problems themselves. As his career progressed, he has seen enormous demand for mentorship from others. He says being a mentor involves a degree of good personal chemistry, always being willing to listen and enable others, offer honest feedback on ideas, and never undertake to solve problems for others but rather open doors for them to solve problems themselves. Nick says he can't imagine not offering to help others. He feels it's a privilege and an obligation given his humble origins. To say that Nick Donofrio is well endowed with an authentic growth mindset would be an understatement!

Extracting from this example some of the characteristics of an exceptional mentor, we find authenticity, humility, a powerful growth mindset, a sense of gratitude, compassion for others, a clear vision, and above all, passion for the success of others. Listening, providing honest feedback on ideas, and opening doors are key ingredients. Avoiding involvement in actually solving problems for others is equally important.

Potential lessons for higher education. IBM's transformation to a service business started with a comprehensive vision and compelling big-picture explanation that was well reasoned (T-shaped movement). It was championed from the top of the organization. The movement was led by an extraordinarily passionate advocate (Nick Donofrio) who is the embodiment of growth mindset and a tireless evangelist. IBM established a mentoring program that worked on a local level to connect people across divisions throughout the company, and individuals were periodically relocated to other divisions to provide total immersion experiences in the different cultures. Ultimately, they launched the new academic field of Services Science, Management, and Engineering to encourage higher education to embrace this new mindset and produce more graduates who are well prepared to work at IBM.

Perhaps an effort in higher education might follow some similar ideas in starting a movement to embrace the shaping of mindset among students. This might require a comprehensive vision for the type of change (mindset) that is needed, and a compelling explanation that is well reasoned. This might be prepared by a small group of like-minded university leaders.

In addition, a passionate leader is needed on each campus—one that exudes a growth mindset and inspires others to join. While changing the mindset of large numbers of undergraduate students may at first seem overwhelming, it is important to return to the Gallup survey and recall the key question: did you encounter at least one faculty member who cared about you as a person, inspired your learning, and nurtured your dreams? The key point here is that not every faculty member needs to be effective at mentoring. In fact, if an average student completes about 35 courses for a bachelors degree, then on average, only about 3% of the faculty encountered by each student needs to be an effective mentor. To be safe, we might aim at attempting to build a core faculty team on each campus eventually consisting of about 10% of the total faculty. If we undertake to identify and train these faculty pioneers over a ten year period, that means we need only aim to identify or prepare 1% of the faculty each year. This seems like a feasible goal. If a critical mass of universities were to join this effort, a tipping point could be achieved after a few years, resulting in a national movement.

To provide the kind of support from the top that might create the legitimacy and empowerment needed for these pioneering faculty, the president and provost of each university might need to speak several times each year about the importance of expanding the mission of higher education to include shaping the mindset of students. This could be one of a few top messages delivered at the fall convocation or at commencement.

Finally, a program for identifying and preparing the pioneering faculty members to become effective mentors must be developed. As noted earlier, this is not the same thing as becoming a good, or even an inspiring teacher. It requires—above all—a growth mindset and authentic caring for students as individuals. These faculty members are good listeners, they encourage students' goals and dreams, they provide honest feedback on ideas, and they connect students to resources and individuals that students will need to exceed their own expectations. They do not solve problems for students. Ultimately, they will need to earn the trust of the students they work with and help shape their beliefs about their identity and ability to succeed through persistence and hard work.

To build the faculty community needed for this assignment will take a comprehensive approach. The criteria for recruitment and promotion and reward for faculty needs to embrace the mission of shaping the mindset of undergraduate students now. This may eventually require a rethinking of the "faculty promotions manual" and the establishment of meaningful orientation and "teaching/mentoring" academies for new faculty members. To help faculty members understand the perspective of undergraduate students, it may be useful for them to expose themselves to the courses they assign students to take, and to teach in teams with colleagues from other disciplines in the first year. (This is similar to the IBM strategy of rotating staff into divisions outside their specialty periodically.)

Important research on the specific attitudes and behaviors of faculty members that result in a growth or fixed mindset of their students is currently underway[19]. One researcher is Professor Mary Murphy at Indiana University who is studying many hundreds of faculty members. Her preliminary research indicates that students exposed to faculty members with a fixed mindset are remarkably sensitive in picking this up, and are often influenced by it, sometimes resulting in a decline in persistence. In addition to the personal relationship with a mentor, research is underway on short intervention projects and exercises that show promising results in improving the persistence and self-efficacy of undergraduate students[20,21]. Many more experiments are needed to advance our learning in this field quickly, but we know enough now to begin.

[19] Indeed, a recent study by the National Academies calls for a significant increase in research on mindset and other competencies that correlate with success in school and other areas of life: Herman, Joan, and Hilton, Margaret. Supporting Students' College Success: Assessment of Intrapersonal and Interpersonal Competencies. National Academy of Sciences. 2017.

[20] Yeager, D. S. & Dweck, C. S. (2012). *Mindsets that promote resilience: When students believe that personal characteristics can be developed*. Educational Psychologist*, 47*, 302-314.

[21] Murphy, M. C. & Dweck, C. S. (2010). *A culture of genius: How environments' lay theories shape people's cognition, affect, and behavior*. Personality and Social Psychology Bulletin*, 36*, 283-296.