

**Mindsets:
A View From Two Eras**

Carol S. Dweck
Stanford University

David S. Yeager
University of Texas at Austin

Author Note

Address correspondence to Carol S. Dweck (dweck@stanford.edu) or David S. Yeager (dyeager@utexas.edu).

Writing of this article was supported in part by the William T. Grant Foundation and the National Institute of Child Health and Human Development Grants R01-HD084772 (to D. S. Yeager) and P2C-HD042849 (to the Population Research Center at The University of Texas at Austin).

Abstract

A growth mindset is the belief that human capacities are not fixed but can be developed over time, and mindset research examines the power of such beliefs to influence human behavior. This article offers two personal perspectives on mindset research across two eras. Given recent changes in the field, the authors represent different generations of researchers, each focusing on different issues and challenges, and both committed to “era-bridging” research. The first author traces mindset research from its systematic examination of how mindsets affect challenge seeking and resilience, through the ways in which mindsets influence the formation of judgments and stereotypes. The second author then describes how mindset research entered the era of field experiments and replication science, and how researchers worked to create reliable interventions to address underachievement—including a national experiment in the U.S. The authors conclude that there is much more to learn, but that the studies to date illustrate how an era-bridging program of research can continue to be generative and relevant to new generations of scholars.

Mindsets:

A View from Two Eras

Introduction to the Authors

Carol Dweck: I was invited to write a personal retrospective on mindset research as part of a series in which mature scientists reflect on their careers and offer sage advice to younger scholars. But as I pondered this, I thought, “Maybe the young scholars are not all that eager to hear from us. We came of age in a different era, things have changed, and maybe our advice doesn’t seem so relevant.” With this in mind, I invited my younger colleague David Yeager to join forces with me. For the past 12 years, David has taken mindset research in new exciting directions and into the era of field research and replication science. With his expertise in research methods, statistics, and intervention science, as well as his reach across areas of psychology, he has helped make mindset research into an interdisciplinary, international, and generalizable effort. I will be your

primary guide for the first half of the paper, and he will be your primary guide for the second half.

David Yeager: I have played a modest role in the broader story of mindsets. Here, I will try to address a challenge that I faced, and that I suspect many young scholars entering the field today face as they figure out what to make of the foundational findings from the era that preceded them. With an increased and important focus on replication, and with advances in methodology, scholars entering the field want to know: What can I trust? And, when previous findings prove to be replicable, what can I contribute to a program of research that seems well-established? My goal here is to show how Carol, my colleagues, and I have tried to carry out research that takes the hard-fought insights from a past era, brings them into conversation with the methods of today, and generates a new program of research that belongs to the new era—what we call era-bridging research.

Introduction to the Research (Carol Dweck)

People can believe that a particular attribute, such as intelligence or personality, is simply fixed. Or they can believe that it can be shaped and developed. This article tells the story, thus far, of a research program on people's beliefs about the nature of human attributes and the consequences of the differing beliefs.

As with any research program, there have been highs and lows, triumphs and setbacks, but two things always saw me through any setbacks. First, I have always had a tremendous research group. My graduate students and post-docs have made my career a great joy. We always believed there was nothing we couldn't solve with enough thought and discussion—and, of course, research. Even in moments of discouragement or anxiety, we had great faith in each other and our ability to problem-solve together.

The second thing is my love for my area of research. I am fascinated by how motivation affects people's success, independent of their starting ability. And I am fascinated by the beliefs that underlie this motivation. It is my deep conviction that if you love your topic, have endless curiosity about it, and believe in its importance, it will inevitably be a powerfully rewarding journey. You will always leave something others can build on.

Beliefs About Human Malleability

The belief that human attributes can be developed has a long history, with a turning point in the Renaissance. The Renaissance was not just a period in which the arts and sciences flourished. It was, perhaps more importantly, a time when a new conception of what makes us human came into prominence. Giovanni Pico della Mirandola, a key thinker of the age, argued that we humans are the only species with the ability to transform ourselves (Pico Della Mirandola, 1486/2012). In fact, he argued that the very dignity of humans lies precisely in their potential to make themselves into what they aspire to be. This view stood in stark contrast to historical notions of fixed endowments and predetermined positions in the hierarchy of merit. Although our research does not speak directly to the accuracy of different views, it does speak to the impact of believing in human malleability (see, e.g., Sauce & Matzel, 2018 for a perspective on the actual malleability of human intelligence.)

Overview of the Article

What is the impact on students' motivation of holding a fixed mindset of intelligence—the belief that intelligence cannot be developed? What is the impact of holding a growth mindset of intelligence—the belief that intelligence *can* be developed, for

example, through personal effort, good learning strategies, and lots of mentoring and support from others? In this article, David Yeager and I trace mindsets from a fledgling idea to a theory of challenge-seeking and resilience, and then into this new scientific era: to the development of replicable growth-mindset interventions aimed at enhancing motivation and well-being on a larger scale. We describe the developments in some detail so that the reader can understand how the research program took root and then sprouted in different directions.

It is important to note, however, that as much as we've learned, our research to date is just a foundation for what is to come. This may sound strange to say after 45 years of research, but we still know far too little about how best to transmit a growth mindset to individuals, how contexts determine whether students take up and apply a new mindset, or how to help embed a growth mindset in the cultures of schools and organizations. Research into these issues is critical because we have learned that it is too easy for people to implement a growth mindset poorly. We are also beginning to understand how mindsets and kindred concepts fit into larger theories of motivation, personality, and development, and this too is an exciting new direction.

Mindset's Genealogy: Learned Helplessness and Attribution Theory (Carol Dweck)

Research on mindsets has an interesting lineage. I entered graduate school in the late 1960s as behaviorism was losing its supremacy in psychology and as the cognitive revolution was dawning. During the long behaviorist era, talk of cognitive processes was banned and even mocked. Indeed, when the great learning theorist Edward Tolman proposed that cognitions resulted from and guided the learning process, he was taunted for leaving his rats "buried in thought" (Guthrie, 1935, p. 172). Yet, people (and animals), as

they navigate and learn about their environments, must inevitably develop beliefs about how the world works. How can these beliefs *not* have important implications for what they do and how they do it?

As psychology entered the cognitive revolution, animal learning theory itself (the field I was in at the time) took on a more cognitive cast. For example, work on learned helplessness in animals (Seligman & Maier, 1967) suggested that organisms formed beliefs from their experiences and that these beliefs could then play a key role in their motivation. In this case, animals exposed to uncontrollable shocks, later made little effort to prevent or terminate shocks, even when the shocks became controllable.

I was intrigued by these findings and, just a few years later, I set out to integrate the work on learned helplessness in animals with the emerging work on attribution theory in humans (e.g., Weiner & Kukla, 1970). Attribution theory proposed that people try to find explanations for what happens to them and these explanations then shape their reactions. For example, students who explain their failure as due to a lack of ability may well react differently to a failure than students who blame their effort, something that is typically more under their control (Weiner & Kukla, 1970).

To achieve this integration, I, with Dick Reppucci (Dweck & Reppucci, 1973) and Carol Diener (Diener & Dweck, 1978), confirmed that children's attributions could in fact predict a "helpless" or "mastery-oriented" response to setbacks, even in children with equal ability on a task. Based on how they interpreted a failure, some children simply wilted, while others showed a remarkable tendency to relish the challenge. But I still struggled to understand: *Why* would students of roughly equal ability show such different attributions and reactions?

To address this question, Elaine Elliott and I (Elliott & Dweck, 1988; see also Nicholls, 1984) helped build the foundation of achievement goal theory by showing that student's achievement goals —performance goals (the goal of validating or proving your ability) vs. learning goals (the goal of developing your ability)--could set the stage for the different reactions to setbacks (see also Grant & Dweck, 2003). But a key question still remained: Among students with roughly equal ability, why might some care more about proving their ability and others more about improving it? Along came Mary Bandura to help answer this question, and, with this, mindset research was born.

The First Era of Mindset Research (Carol Dweck)

Mary Bandura and I were exploring topics for her PhD thesis (Bandura, 1983) when we suddenly realized that the “ability” that people wish to *prove* had a different feel to it than the “ability” that people wish to *improve*. A strong wish to prove the adequacy of one’s ability makes that ability seem like a deep-seated, fixed attribute of the self, whereas a strong desire to improve one’s ability makes it seem like a more dynamic quality that can be developed. Immediately, I shifted the focus of my research to these different views of ability, which we called “implicit theories of intelligence.” We called them “theories” because they were potentially falsifiable ideas about what intelligence is and how it might work. We called them “implicit” because we believed that people were often unaware of them. (Later I changed their names from “entity” and “incremental” theories to the more user-friendly terms of fixed and growth mindsets; Dweck, 2006).

It took a lot of hard work to hone the idea and to develop ways to reliably assess and manipulate these theories or mindsets, but once we did we were off and running. We were moving further toward the goal of understanding the psychology behind challenge-seeking

and resilience—why some people run from difficulty, while others run to it—and perhaps toward the goal of understanding why some people fulfill their potential and others do not.

Mindsets As the Core of Meaning Systems

Earlier, I talked about how people form beliefs based on their experiences and how these beliefs can guide their motivation and behavior. Now, some beliefs are not isolated ideas, but rather can serve an organizing function, bringing together goals, beliefs, and behaviors into what might be called a “meaning system” (Hong, Chiu, Dweck, Lin, & Wan, 1999; Molden & Dweck, 2006). My students and I proposed that mindsets create meaning systems. Indeed, we proposed that mindsets might organize virtually all of the variables we had previously studied (including goals/challenge-seeking, attributions, and helplessness) into one meaning system. To these variables, we added the concept of “effort beliefs,” the belief that effort is a positive thing that helps grow your ability, as opposed to a negative thing whose necessity speaks to deficient ability (see Leggett, 1986; Miele & Molden, 2010; Miele, Son, & Metcalfe, 2013 for research on the relation between mindsets and effort beliefs).

That is, we proposed that when people are in a fixed vs. growth mindset, all these variables can take on different importance or meaning. Specifically, when people view ability as fixed, then validating their ability (by pursuing performance goals or by avoiding challenges) can take on more importance; high effort may more readily be seen as indicating low ability; and setbacks are more easily attributed to low ability. When this happens, persistence can be curtailed. In contrast, when people view ability as something that can be improved, then developing that ability (by taking on challenging learning goals) can become more important, effort may be seen as a tool in this process, and setbacks too

can more readily be seen as information about the learning process. When this happens, persistence can be sustained.

The research that followed carefully examined these meaning systems, especially the implications of the mindsets for students' desire for challenging learning tasks and for persistence in the face of setbacks. In our theoretical paper Ellen Leggett and I (Dweck & Leggett, 1988) spelled out the mindset theory—its predictions and its proposed mechanisms—and also provided an initial test of the challenge-seeking hypothesis.

Later, with Ying-Yi Hong and C.Y. Chiu (Hong et al., 1999), we took the challenge-seeking hypothesis into the real world, looking at the desire for challenging learning goals in students entering the University of Hong Kong. At this elite university, all courses were conducted in English and all materials and exams were in English, but not all students were proficient in English. For this reason, we asked the students how interested they would be in taking a high quality remedial English course if it were offered. Students who endorsed a fixed mindset were not very enthusiastic about taking such a course, even when they were low in English proficiency. However, students who endorsed a growth mindset and were low in English proficiency were substantially more enthusiastic about taking the course. They seemed willing to expose a deficiency for the sake of correcting it. These findings were conceptually replicated in an experimental study in which students' mindsets were temporarily induced, demonstrating the causal effects of the mindsets (Hong et al., 1999, Study 3).

Still later, with David Nussbaum, we conducted a series of experiments examining the causal role of mindsets in students' desire to undertake further learning after a clear failure, as opposed to taking defensive measures that would shore up their sense of their

ability but in no way would improve their actual ability (Nussbaum & Dweck, 2008).

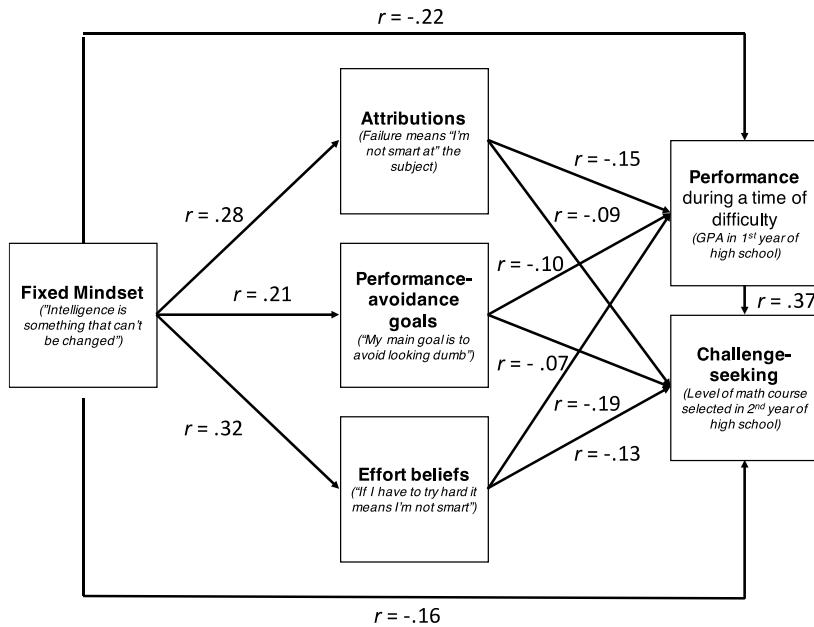
Looking inside the brain, Moser, Schroder, Heeter, Moran, and Lee (2011) then brought to light these processes at the neural level, demonstrating again the enhanced focus on learning after errors that accompanies a growth mindset of intelligence (see also Mangels, Butterfield, Lamb, Good, & Dweck, 2006).

Thus, research supported the idea that mindsets can play a role in the desire for challenging learning and in the persistence of that desire even in the face of obstacles or failures. Larger studies also tested the overall “meaning system” framework. Robins & Pals (2002), in a correlational study, followed 363 students at the University of California at Berkeley across three years of college, along the way assessing reports of their mindsets, goals, attributions for academic outcomes, and helpless responses to setbacks. They found direct paths from mindsets to all of these other variables, as well as indirect paths from mindset to helpless vs. mastery-oriented responses through these variables (and through affective responses).

In a later correlational study, Blackwell, Trzesniewski, & Dweck (2007, Study 1) followed 373 students across the difficult transition to junior high school (7th grade) for a period of two years (7th and 8th grade), measuring many of the same variable assessed by Robins and Pals (2002) and adding beliefs about effort. Our model showed clear paths from mindsets to goals, effort beliefs, and attributions and on to reports of helpless vs. mastery-oriented strategies in the face of setbacks. In this study, the strategies then went on to predict changes in math grades over the two-year period following this challenging transition.

Studies have gone on to replicate these basic “meaning system” associations and to find correlations between mindsets and students’ grades. Perhaps most compelling are data from a recent nationally-representative sample of over 14,000 9th grade students (Yeager et al. under review; see also data from over 100,000 students in the state of California in West, Buckley, Krachman, & Bookman, 2017). Using data from the nationally-representative sample, we replicated the “meaning system” predictions and found that the average correlation between fixed mindset and GPA for 9th grade students in the U.S. is $r = -.22$ (see Figure 1).

Figure 1. The Mindset-Related Meaning System Can Predict Challenge-Seeking and Performance in a Nationally Representative Sample of U.S. Public High School Students.



Note: Paths are zero-order correlations, not paths estimated simultaneously in a structural equation model. These are meant to illustrate the unadjusted strength of association and the conceptual framework, and do not represent estimates of causal effects. All correlations are significant at $p < .001$. Data come from the *National Study of Learning Mindsets*, which involved a representative sample of 9th grade students in U.S. public schools surveyed in

the fall of 2015 and followed until 2016. Max $N = 14,530$. Exact items and sample sizes reported in the online supplemental material.

The findings from correlational and experimental research that a growth mindset can predict and promote more challenge-seeking, resilience, and positive outcomes do not mean that a growth mindset is always positive. Perhaps some personal attributes cannot or should not be changed. Perhaps a growth mindset can be used for negative ends (getting better at an ability that is used to inflict harm), and perhaps it is sometimes appropriate or wise to give up (persistence without progress should always be questioned). Our findings simply suggest that a growth mindset can form the core of a larger meaning system that can, under favorable conditions, help people engage in thoughts and actions that lead them closer to their goals.

Where Do These Mindsets Come From?

I was deeply curious to know how these meaning systems might be formed. Where do they come from? As children try to make sense of the world of intelligence, what experiences might they learn from? My students and I decided to start our search for the antecedents of mindsets by examining what children learn from praise for their successes. Claudia Mueller and I (Mueller & Dweck, 1998) conducted six studies on the effects of praise for success in late grade-school children. Across the studies, we demonstrated that after a success, praise for intelligence (person praise) was more likely than praise for effort (process praise) or praise for outcome to induce a fixed mindset, along with its old friends: performance goals, low-ability attributions after failure, and impaired performance (helpless reactions) following failure.¹

¹ Readers interested in exploring or re-analyzing the original raw data from Studies 1 and 2 in Mueller and Dweck (1998) can find it here: osf.io/kgfhu/

Kamins and Dweck (1999), with younger children, examined the impact of person versus process praise and criticism, this time including strategy feedback as a form of process feedback. We again found that person (versus process) feedback led to a greater belief in stable traits and greater helplessness in the face of criticism or failure. (For more research on the effects of person praise, see Cimpian, Arce, Markman, & Dweck, 2007; Zhao, Heyman, Chen, & Lee, 2017). Later, Gunderson and colleagues (2013) and Pomerantz and Kempner (2013) took this phenomenon into the real world and showed a relationship between parents' process or person praise and children's subsequent mindsets. The work on praise was our first foray into potential antecedents of mindsets, and an initial window into how children derive meanings from their experiences.

Then, a few years ago, my student Kyla Haimovitz began to study how parents might transmit mindsets to their children through their reactions to the children's failures. One day, after analyzing data from a number of her studies, she came to my office and announced that she was finding little if any correlation between parents' and children's mindsets. I was surprised. I might have even gulped. So I said to her, "Are you sure?" And when she said yes, I said "I'm all in. Let's figure this out." Her research found that it was parents' beliefs about failure and their reactions to children's failures that consistently predicted their children's mindsets (Haimovitz & Dweck, 2016) (see Haimovitz & Dweck, 2017, for a discussion of how overt cues like adults' praise or reactions to failure might be more visible to children than the adults' actual mindsets). The question of what other cues from the environment children may use to construct their mindsets is an important area for future research.

Social Judgments: Traits and Stereotypes

It is also critical for people to develop theories about their social world, and so we began to ask: Can people look at *others* through a fixed or a growth mindset lens? If so, how does that affect how they view and interact with them? For a long time, my students and I struggled with these questions, how to formulate them, and how to wrestle them into testable form. Working with Cynthia Erdley, C.Y. Chiu, Ying-Yi Hong, Sheri Levy, Steve Stroessner, Jason Plaks and Daniel Molden, we began to show that mindsets could play a distinct role in how people judge others, both individuals and groups (see Dweck, Chiu, & Hong, 1995; Levy et al., 2001 for reviews). Because person judgments and group stereotypes cut across human attributes, in this research we assessed a more domain-general mindset, rather than focusing on just intelligence. We used items such as, "Everyone is a certain kind of person, and there is not much that can be done to really change that" or "The kind of person someone is is something very basic about them and it can't be changed very much" vs. "Everyone, no matter who they are, can significantly change their basic characteristics."

If people believe in fixed traits, will they infer traits more quickly and invest them with more power? First, we learned that those with a fixed view of human attributes did in fact more readily infer traits from behavior and invest traits with more predictive power (Chiu, Hong, & Dweck, 1997; Erdley & Dweck, 1993). For example, those with a fixed mindset took traits or even one trait-relevant behavior and made stronger forecasts about what a person would do in the future than did those who favored more of a growth mindset (i.e., they showed the "fundamental attribution error" more strongly; Chiu et al, 1997, Studies 1 and 2). This tendency was found in two distinct cultures (the United States and Hong Kong; Chiu et al., 1997, Study 4); moreover, an experiment in which mindsets were

manipulated suggested a causal role for the mindsets in the process (Chiu et al., Study 5; see McConnell, 2001; Molden, Plaks, & Dweck, 2006; Plaks, 2017 for more about mindsets and the mechanisms underlying mindset differences in trait inferences).

If the differing kinds of judgments that arise from mindsets apply to groups too, it could suggest a role for mindsets in stereotyping. Five studies by Levy, Stroessner & Dweck (1998) showed the ability of mindsets to predict differences in stereotyping of groups. People endorsing more of a fixed mindset made stronger stereotypical judgments of ethnic and occupational groups and formed more extreme trait judgments of new groups. Further, mindsets predicted stereotype endorsement above and beyond other relevant individual difference variables, and manipulating mindsets suggested their causal role in the stereotyping process. (see Levy & Dweck, 1999, for related findings with children).

We learned that mindsets can play another role in the maintenance of stereotypes—in how people respond to information that conflicts with stereotypes. Four studies by Plaks, Stroessner, Dweck, and Sherman (2001) showed that mindsets predicted altered attention to information that supported or conflicted with stereotypes, with a fixed mindset (whether measured or manipulated) associated with heightened attention to information that was consistent with and supportive of existing stereotypes. Together, this research shows that stereotyping can be influenced by beliefs about human nature that on the surface may seem unrelated to stereotypes. Mindsets are beliefs about whether human attributes are fixed or malleable, but they can lead people to invest group labels with greater meaning and, thus, to grasp them more quickly and hold onto them more firmly.

Interestingly, prejudiced behavior can grow out of mindsets, even apart from stereotypes or prejudice—that is, even when it is not motivated by stereotyping. In eight

studies, Carr, Dweck, and Pauker (2012) examined the impact of believing that prejudice is a relatively fixed human trait, as opposed to something that can be improved. For example, participants were asked to agree or disagree with statements such as: "People have a certain amount of prejudice and they can't really change that" vs. "No matter who somebody is, they can always become a lot less prejudiced." Quite apart from participants' level of implicit or explicit prejudice, those who believed that prejudice was fixed appeared to be more worried about discovering prejudice in themselves or looking prejudiced to others. In line with this, they showed lowered interest in interracial interactions and diversity-related activities, and heightened symptoms of anxiety (including physiological symptoms) in an actual interracial interaction. In other words, even people who are low in implicit or explicit prejudice may avoid cross-group interactions if they worry about feeling or appearing prejudiced—that is, about detecting or displaying a negative and unchangeable quality of the self.

This research by Carr and colleagues (2012) suggests that programs meant to encourage diversity should not just call out prejudice. Instead, these programs also need to contain a message about the malleability of prejudice and suggest how intergroup interactions can help individuals learn more about other groups and become more comfortable interacting with members of different groups. This message may be increasingly important given that many people are inexperienced at cross-race interactions due to growing levels of neighborhood segregation in the U.S. (Owens, Reardon, & Jencks, 2016).

In summary, once we drilled down and carefully laid the foundation for understanding mindsets and their relation to personal motivation, we were able to extend

this understanding to a very different set of phenomena: people's judgments of others and their behavior toward them. Thus, mindset research began to illuminate not only the scope of people's own strivings, but the potential scope and nature of their social world.

The Current Era: Interventions and New Domains (David Yeager)

When I first encountered the research on growth mindset, in my first year as a graduate student (2006 to 2007), it was thrilling. As someone who had taught middle school English to adolescents from lower-income families, the idea that mindsets could help me understand why some students embraced challenges gave me hope for improving education.

Nonetheless, if mindsets were just another fixed trait, mindset research would not be terribly useful for improving people's lives. What captured my attention—and ultimately my own program of research—was the evidence, just beginning to emerge at the time, that mindsets could be changed, and that doing so could, under some conditions, alter motivation and behavior. Even so, the standards and approaches of my generation of scholars saw ways in which mindset research could be even stronger. This included larger-sample replications, more efficient and scalable means of intervention delivery, and greater attention to generalizability and social context. It also included connections to new and different problems like the causes, prevention, or alleviation of adolescent aggression, depression, and stress. The exciting prospect of effective interventions that grew out of a well-studied theoretical model—one culmination of the first era of mindset research—led us into a second era of mindset research—an era characterized by intervention studies addressing the question of mindset change using large samples and longitudinal designs, and extensions of mindset research into new domains.

Early Growth Mindset Interventions

In 2006, when I began conducting mindset research, there were only two published growth mindset interventions (Aronson et al., 2002; Good et al., 2003) and one in press (Blackwell et al. 2007). In the late 1990s, Joshua Aronson, then a post-doctoral scholar at Stanford University, wondered whether a fixed mindset might play a role in the Black-White achievement gap. Over the course of several sessions, Aronson, Fried, and Good (2002) taught college students a growth mindset—including the memorable metaphor that the brain is like a “muscle” that gets stronger with exercise. Aronson and colleagues also asked participants to use what they learned to write mentoring letters to struggling middle school students. Their letters (meant to help the college students internalize the growth mindset) encouraged the younger students to persevere, reminding them that their brains were growing as they confronted challenging work. Aronson and colleagues found that the African American college students who received the growth mindset intervention went on to earn higher grades than their counterparts in the control groups, and to show an increase in their enjoyment and valuing of academic work.

Not long after, Good, Aronson, and Inzlicht (2003), and then Blackwell et al., (2007, Study 2), designed and carried out growth mindset interventions for adolescents, a vulnerable age at which declines in achievement are common and can have important consequences for future life success. These multi-session, in-person interventions capitalized on the “brain is like a muscle” metaphor, presented the idea that the brain forms new or stronger connections with rigorous learning, and targeted students who were academically at risk: 7th grade students from racial and ethnic minority groups. In these studies, students in the growth-mindset group earned higher achievement test scores

(Good et al., 2003) or math grades (Blackwell et al., 2007) than students in the control group.²

The initial ventures into growth mindset interventions set the template for intervention studies to come. The standard approach became to teach scientific information about the brain and its malleability—that the brain is made up of networks of neurons and that these networks become “stronger” and more efficient when people learn new and challenging material. The interventions also find creative ways to invite students to reflect on and “own” this idea as they try to apply it to their own lives, such as writing letters to future struggling students who might benefit from having a growth mindset—a technique called “saying-is-believing” (E. Aronson, 1999; Wilson, 2011).

Taking the Growth Mindset Intervention Online—and to Scale

Growth mindset interventions showed promise for changing students’ academic performance when delivered face-to-face. But, to me and others trained in the education field, it was apparent that the time and expense of training facilitators for these face-to-face workshops sharply limited the potential for scaling and replication. For this reason, around 8 years ago, Dave Paunesku, Carissa Romero, and I set out to discover whether a growth mindset intervention could be delivered online. This was a turning point because it increased the ease with which we could replicate the intervention in more, and more diverse, contexts. This work would not have been possible even a few years earlier, since many schools did not have devices with Internet access for entire cohorts of students.

² Note that a condition in the Good et al. (2003) study that manipulated attributions (a documented mediator of mindset effects) was also successful in raising test scores.

Initially, we did not know whether it would be possible to shift students' mindsets through a short online experience, let alone improve their grades months later. We thought this might be particularly unlikely for adolescents, who are notoriously resistant to adults' efforts to change them (see Yeager, Dahl, & Dweck, 2018). Of course, we did not expect effects for online interventions to be nearly as large as the ones found for in-person workshops, but we thought it would be amazing if we could change mindsets with a short, direct-to-student online program, and if this resulted in *any* change in grades across the very different schools, teachers, curricula, and peer groups.

Over the past 8 years, we have conducted randomized trials with tens of thousands of students (Paunesku et al., 2015; Yeager, Walton, et al., 2016), including two pre-registered replications (Yeager, Hanselman, et al., 2018; Yeager, Romero, et al., 2016). The data show that online interventions can change mindsets and academic outcomes under certain conditions. Effects on academic outcomes are of course modest, and typically appear for students with higher levels of risk for academic underperformance: in high school, students who had lower grades before the intervention, especially if they are attending medium-to-low-achieving schools (Bettinger, Ludvigsen, Rege, Solli, & Yeager, 2018; Paunesku et al., 2015; Yeager, Hanselman, et al., 2018; Yeager, Romero, et al., 2016) and in college, students who belonged to under-represented or stereotyped groups (students of color or first-generation college students; Broda et al., 2018; Yeager, Walton, et al., 2016). Therefore, growth mindset interventions may be useful in addressing a portion of inequalities in education at scale and at an extremely modest cost.

But what about higher achieving students? Are growth mindset interventions of any value for them? We learned that students who already have high grades also change their

mindsets in response to our intervention, but they show benefits in terms of other outcomes, such as a willingness to take on challenges (Yeager, Romero, et al., 2016) or take advanced math up to a year later (Yeager, Hanselman, et al., 2018). Such challenge-seeking behaviors might push them to develop higher-level skills, which could benefit them in terms of lifelong health and work outcomes (Carroll, Muller, Grodsky, & Warren, 2017).

Lessons from the Era of Interventions and Replications

So far, there have been at least three lessons from our efforts to bring mindset research into the current era of psychological science. First, it has become clear that effect sizes should be evaluated differently as mindset research has moved from laboratory studies into an era involving replications in heterogeneous samples, and tests of real-world, longitudinal outcomes. In the previous era of mostly laboratory experiments, it might have been useful to compare effect sizes to theoretical benchmarks such Jacob Cohen's (1988) cut-points for small, medium, or large effects. But as mindset experiments have come to look more like randomized trials, it has become important to employ the more appropriate benchmarks for effect sizes in educational evaluation studies (e.g. Hill, Bloom, Black, & Lipsey, 2008).

Most interventions in education—including those that test new curricula, teacher-training models, or school redesigns—have found no effects on student outcomes, often despite considerable cost (see Boulay et al., 2018). In fact, according to government databases of rigorously evaluated programs, such as the *What Works Clearinghouse* or the *Investing in Innovation Fund* (Boulay et al., 2018), some of the best-in-class (i.e., successful) studies with adolescents have effects on lower-achieving students' GPA of around .06 grade points (Somers et al., 2010), and increase the proportion of students on track to graduate by 3 to 8 percentage

points (Weiss et al., 2017). The *largest* effects in the literature for large-sample, randomized controlled experiments with adolescents are roughly .20 SD (see, e.g., Cheung & Slavin, 2016; Nye, Hedges, & Konstantopoulos, 2000; see also Dynarski, 2017). These benchmarks are equal to or smaller than Cohen's cut-point for "small" effects, but they are realistic and meaningful.

It is striking then, that brief, online, direct-to-student growth mindset interventions have produced effect sizes that are comparable to many extensive and costly programs for adolescents that are considered successful. A typical online growth mindset program has effects on lower-achieving students' GPA of around .10 grade points (with double that in certain school contexts), and/or improvements of 4 to 8 percentage points in lower-achieving students' rates of being on track for high school or college graduation (Paunesku et al., 2015; Yeager, Hanselman, et al., 2018; Yeager, Romero, et al., 2016; Yeager, Walton, et al., 2016). Again, although seemingly small relative to laboratory study benchmarks, or relative to the total amount of variance in the outcome, these are longitudinal effects on longer-term educational outcomes in the real world. If these effects could be seen across the nation then many thousands more students per year could be helped to finish 9th grade on track for graduation.

A second lesson from the new era of replications and field experiments is that interventions that are easy to *deliver* (i.e. by taking students to the computer lab to do a survey) are not necessarily easy to *develop*. As growth mindset materials have moved from being employed in laboratory experiments with well-understood populations (i.e., undergraduates at one's home university) and into the vastly heterogeneous schools across the nation, it has been important to recognize that growth mindset interventions are highly

dependent on subtle features of the materials and procedures, and on how they are matched to the target population.

For the *National Study of Learning Mindsets*, we carried out extensive research and development (R&D) to craft materials so they were ready for the target population: a nationally representative sample of entering high school students (Yeager, Romero, et al., 2016). This R&D process involved several years and thousands of pilot participants (Yeager, Romero, et al., 2016; see Table 1). Below, we lay out the broad approach, because our R&D methods may provide a useful guide for other researchers interested in interventions.

In the *National Study of Learning Mindsets*, we sought to develop the most effective growth mindset message that we could for beginning 9th graders and one that could be administered in two 25-minute sessions. We made sure not just to present interesting information about the brain, but also to help students use this information to understand how challenges and setbacks could foster greater learning. We did not simply teach students the idea of the growth mindset, but also included exercises that gave students ownership of the concept and a sense of why it is an important concept.

Phase 1 of the R&D evaluated the “base” intervention materials that had been used in previous randomized trials with over 9,000 students from 2010 to 2012, including evaluations with high school students (Paunesku et al., 2015), community college students (unpublished data reported in Yeager & Dweck, 2012), and four-year college students (Yeager, Walton, et al., 2016). But that did not mean that they were the best we could do for 9th grade students making the transition to high school.

Therefore, in Phase 2, we immersed ourselves in the psychological world of 9th grade students: When did they worry about whether their intelligence measured up? And what could help them adopt and maintain a growth mindset during those times? We adapted procedures from user-centered design: *A/B tests* (in which small variants on a message are tested against each other in multi-factor randomized studies), and *rapid prototyping* (in which early-stage materials are shared with user groups who point out areas that could be improved). We learned, for example, that presenting students with both the fixed mindset and growth mindset in the short period of time we had was not as effective as just teaching a growth mindset. In Phase 3 we tested the product of this R&D process—the “new” growth mindset intervention—against the “base” growth mindset treatment, and found that the revised intervention was in fact better at increasing challenge-seeking (a marker of growth-mindset behavior) at immediate post-test (Yeager, Romero, et al., 2016).

We then carried out a pre-registered evaluation of the new intervention in a sample of 10 public high schools, and found that it raised GPAs among lower-achieving students in core classes (Yeager, Romero, et al., 2016). After more editing and re-writing, the “even newer” growth mindset intervention was finally ready for evaluation in a nationally-representative sample of public high schools. The revised intervention showed positive effects at a national scale both in terms of grades for lower-achieving students and challenge-seeking across both higher and lower achievers (Yeager, Hanselman, et al., 2018). We have now shared the intervention with economists who, after carrying out their own R&D processes, replicated and extended the effects to students’ achievement in Norway. (Bettinger et al., 2018).

Table 1. Research and Development Timeline for the High School Growth Mindset Intervention.

Phase 1	Phase 2	Phase 3	Phase 4		
2010-12	2013-14	2014-15	2015-16		
Paunesku et al. (2015); Yeager et al. (2016a) al. (2016b)	Yeager et al. (2016a)	Yeager et al. (2016a)	Yeager et al. (2018)		
1.1. Test the "base" versions, adapted from lab manipulations	2.1. Attempts to re-write (N~3,000) 2.2. A/B tests testing (N~300)	2.4. Extensive re-writing to finalize "new" version	3.1. Head-to-head test of "base" vs. registered "new", proxy outcome (N~7,500) 3.2. Pre-control, GPA, convenience sample (N~3,600)	4.1. Extensive pre-writing to finalize registered "newer" version evaluation control, GPA, convenience sample (N~3,600)	4.2. Pre-writing to finalize registered "newer" version evaluation control, GPA, convenience sample

Note: The growth mindset intervention is available for schools in the U.S. to implement at no cost to them at www.perts.net

Although we now have a treatment that, in principle, could be scaled at very low cost to 9th graders across the U.S., one take-home from the R&D process is how much interventions need to be tailored to particular populations. Therefore, it is not clear that even this revised treatment could be easily transported to other contexts, such as colleges or the workplace. Successful replication in these other settings may well require new rounds of R&D (Yeager & Walton, 2011). And, as we noted above, we plan to continue our R&D to further improve the current intervention in the future.

A third and final lesson from our experience bridging the two eras of mindset research is that direct-to-student treatments are only the beginning. That is, our initial interventions were useful for demonstrating causality and policy relevance. The student interventions were also a reasonable place to start because they grew out of careful prior work (both laboratory research and in-person interventions) that had been delivered directly to students. Moreover, individual treatments are often preferable in educational

evaluation research because one can randomize at the person level and dramatically improve statistical power for main effects or for moderators.

However, future work on how to promote and maintain growth mindset effects, we expect, will focus on the “mindset environment,” and will foster collaborations with researchers from other disciplines that have historically studied the effects of social contexts, such as organizational science and sociology. That is, it is time to turn more seriously to an examination of the mindsets conveyed by or embodied in the environments that students (or adults) are in. What are the teacher (employer) practices in terms of types of work given, feedback for successes and struggles, opportunities for improvement, evaluation policies, and so on? We consider this next.

Building Growth Mindset Cultures: Promise and Obstacles (Carol Dweck)

We have proposed that a more effective and lasting approach might be to imbue an environment with instructional tasks and practices that foster a growth mindset. And that it is only when this happens that we will know the full potential of growth mindsets to affect motivation and learning. Contexts, or even whole organizations, can embody a mindset and this is a potentially powerful force in shaping the beliefs, values, and behaviors of the people in those environments (Murphy & Dweck, 2010).

The proposal to focus on the mindset environment may have a ring of truth, but it is much easier said than done. At first, we naïvely thought it was straightforward to create a growth mindset climate. Educators simply had to understand what a growth mindset was and think through how to communicate it to their students in words and actions. Our naiveté was fed by many communications from sophisticated educators who were

implementing mindsets in original and compelling ways with noteworthy effects for their students.

However, over time we learned that many educators who professed to have a growth mindset did not fully grasp what it was and were implementing practices that failed to communicate a growth mindset to their students. In some cases, we believe they were succeeding in doing just the opposite. We called this “false growth mindset,” a term coined by our Australian colleague Susan Mackie.

What forms did false growth mindset take? Many educators, it appeared, simply equated a growth mindset with effort—for example, praising effort, even when it wasn’t effective. This could have the effect of leaving students feeling incompetent, as the educator simply accepts their lack of progress and tries to make them feel good about it. Focusing on effort alone (without bringing in the key role of good strategies and the essential role of mentorship, connections, and access to resources in success) could lead people to “blame the victim” if a person is not successful (see Levy, West, Ramirez, & Karafantis, 2006). In a related vein, some educators told their students that they could do anything, but did not provide them with strategies, guidance, or information about resources for the accomplishment of this promise. This could lead students to feel increasingly frustrated and inept if they fail to make progress toward their goals.

Yet other educators simply put up posters in the front of the room or gave a lecture on growth mindset and then expected the students to do the rest. They might even reprimand those students who didn’t adopt the recommended mindset with its attendant practices, despite the fact that nothing else in the classroom changed to support a change in mindset. Some educators thought a growth mindset meant that all children were the same

and that differences in current achievement levels could be ignored, often leaving advanced students unchallenged and bereft of meaningful learning. We learned a great deal from these practices and realized that educators needed far more guidance than we had provided. How, in fact, are growth mindset cultures created in the classroom?

As a first step, new research by Mary Murphy and her colleagues has looked into college classrooms to understand which instructor practices promote different mindset climates or cultures. In a large and intensive study of college STEM professors, they are finding that these professors' mindsets do in fact predict their classroom practices and the achievement of students in their classes, particularly the students from underserved or stigmatized groups, such as women and African American, Latinx, or first-generation students (Canning, Muenks, Green, & Murphy, 2018). In fact, they find significantly larger racial achievement gaps in STEM classes taught by teachers who endorse more of a fixed (vs. growth) mindset.

With regard to teaching practices, Murphy and colleague are finding that STEM professors who are perceived by their students to endorse more of a growth mindset are more likely to (a) engage in process-focused teaching (e.g., monitoring student progress, adapting instruction as needed); (b) communicate positive views of effort (e.g., telling students it is important to give their full effort even if they don't always get things right); and (c) deliver process praise (e.g., praising students' problem-solving strategies; pointing out and complimenting students' progress and development) (Muenks, Canning, Green, & Murphy, 2018). Consistent findings are beginning to emerge from the *National Study of Learning Mindsets*, which included data from math teachers and their students in a national sample of 9th grade math classes in the U.S.

The research on the mindset environment is providing the basis for a rigorous and validated curriculum that can help teachers gain an accurate understanding of a growth mindset and develop teaching practices that embody it and communicate it to their students. Such a curriculum is now being developed and tested by Stephanie Fryberg and Mary Murphy in collaboration with educators from the Seattle Public Schools. When it is completed and fully evaluated, it will be made available at no cost to schools.

To summarize this section, current direct-to-student programs do not tell us about the full potential of growth-mindset concepts and practices to enhance motivation and learning. We will understand this more clearly when educators (and leaders of all kinds) create environments in which challenges are greeted with relish rather than dread, mistakes are learned from rather than punished, people collaborate to formulate effective learning strategies, and everyone's talents are deeply respected and vigorously developed.

Broadening to the Social Domain (David Yeager)

Can mindsets about one's social attributes play a role in mental health, social coping, and well-being? About the same time that we were learning how to take intelligence mindset interventions online, we were learning how to adapt the template to craft new interventions in the social domain. These studies have brought mindset theory to bear on other social problems.

My research built on the basic research on "personality" mindsets (Chiu et al., 1997; Erdley & Dweck, 1993; Molden et al., 2006; Plaks, 2017) and took these mindsets into the world of high school victimization and aggression (Yeager, Trzesniewski, Tirri, Nokelainen, & Dweck, 2011; see also Yeager & Dweck, 2012). We found that some high school students had more of a fixed mindset about social qualities—the belief that being a good or bad

person, a winner or a loser, a bully or a victim was a fixed trait. In line with this, they were more likely to view a peer's bullying behavior as a sign that the peer was fundamentally "bad" and, at the same time, a sign that themselves were "not likable" or a "loser." These fixed trait attributions led to greater reports of shame and a greater desire for revenge. A short experiment (Yeager et al. 2011, Study 3) found that a growth mindset manipulation reduced these tendencies among adolescents responding to a hypothetical bullying scenario.

Building on the example set by the Aronson, Fried, & Good (2002) and Blackwell et al. (2007) growth mindset of intelligence workshops, Yeager, Trzesniewski, and Dweck (2013) asked whether an in-person workshop to change personality mindsets in an urban high school might lead to reductions in aggressive behavior (Yeager, Trzesniewski, & Dweck, 2013). In six ~45-minute, face-to-face sessions with trained workshop leaders, students learned that people's socially-relevant traits have the potential to change. The growth mindset message was this: *people's behaviors often come from thoughts and feelings, which live in the brain, and can be changed*. They learned that change was not easy or certain, but that people had the potential for change, especially in adolescence. The intervention taught this message via scientific content about the brain and evidence of how changing people's thoughts and feelings can influence their aggression (e.g. Dodge et al., 2015).

One month after the program, we measured students' aggression with a behavioral paradigm. Students first had a brief experience of exclusion by peers in an online game, Cyberball (Williams, Yeager, Cheung, & Choi, 2012), which was followed by an opportunity to retaliate. Specifically, they had to decide how much spicy hot sauce (an amount greater

than zero) to allocate to a peer who excluded them (Lieberman, Solomon, Greenberg, & McGregor, 1999), knowing full well that the peer disliked spicy foods. (Of course, students were thoroughly debriefed. They understood that no one was excluded and no one was required to eat hot sauce, and they enjoyed discussing the experience afterwards.) Relative to two control conditions—a no-treatment control and a control group that was taught best-in-class coping skills—the growth mindset of personality intervention substantially reduced the amount of hot sauce allocated to the peer, signaling less retaliatory aggression. The growth mindset intervention also increased the number of prosocial notes students wrote to accompany the hot sauce, signaling a greater degree of empathy. These findings were confirmed by an analysis of teacher ratings of student conduct at the end of the school year (Yeager et al., 2013).

Newer research is taking the personality mindset intervention into the domains of stress and depression, both of which can increase dramatically in adolescence (Miu & Yeager, 2015; Schleider & Weisz, 2016; Yeager, Lee, & Jamieson, 2016). This research is showing that these interventions can improve coping and well-being over time and, in doing so, suggest that it can be a relief for adolescents to hear a compelling message that people have the potential for change, that the stressful social experiences they are having are not a reflection of who they are and who they have the potential to be, and therefore that these negative experiences are not inevitable in the future (see Yeager et al., 2014).

It is not just *adolescents'* problematic relationships that can be influenced by mindsets. In a program of research conducted in the Middle East, Halperin, Russell, Trzesniewski, Gross, and Dweck (2011), and Goldenberg et al. (2017) have examined the effects of teaching Israelis and Palestinians a growth mindset about groups, the belief that

groups do not have a fixed, inherent nature (e.g., as evil or violent), but rather always have the potential for growth and change. In this research, the other group involved in the conflict in question was not mentioned so as not to imply that the researchers had an agenda and so as not to evoke reactance. In both short-term experiments (Halperin et al., 2011) and a longer-term study (involving a 5-hour “leadership” workshop and a 6-month follow-up, Goldenberg et al., 2018), those in the growth-mindset groups, compared to the control group, showed more positive attitudes toward the other party, as well as greater willingness to entertain important concessions for the sake of peace. In addition, in the latter study the group differences were maintained over the 6-month period. Although this is just a beginning, these initial findings are promising and may provide insights for future conflict resolution efforts.

Looking Toward the Future (Carol Dweck and David Yeager)

Together, we have presented a history of mindset research from its inception up to the present. Although in some ways the work is mature, in many ways it is still in its youth because there is so much more to learn.

As we have noted, we have much to learn about where mindset interventions do and do not work well. Toward that end, we are working closely with sociologists, economists and statisticians to understand context effects more fully. And our colleagues are working to develop programs that will help create contexts in which growth mindsets, with their attendant challenge-seeking and resilience, can more readily take root.

Can growth mindsets be woven into specific material to catalyze learning? We are extremely interested in how mindsets can be integrated into rigorous learning curricula to help students thrive in the face of challenges. Several expertly done integrations have

worked well so far (Andersen & Nielsen, 2016; Bryk, Gomez, Grunow, & LeMahieu, 2015), and we expect more will emerge in the future.

We are continuing to spell out the broader theoretical and practical implications of the mindset approach. On a theoretical level, one of us (Dweck) has recently proposed a unified theory of motivation, personality, and development that is organized around the development of beliefs and belief systems (Dweck, 2017). It shows how these beliefs can shape motivation and play a role in the formation of personality. Both of us have explored the question of why so many extensive, costly interventions that seem to work with children, often seem to fail when given to adolescents—and have suggested how an analysis of mindset interventions and other brief psychological interventions can provide guidelines to help them succeed (Yeager, Dahl, et al., 2018).

Conclusion: Looking Back (Carol Dweck & David Yeager)

What have we learned? Above all, we have learned that this research is hard to do: It takes many years of hard work on the part of many dedicated people to build a research program and especially to take it out into the real world. We have also learned that era-bridging research—that is, research that successfully makes a transition from one era's methods and models to another's—is important for cumulative science. Finally, we have learned that there are few things in life as gratifying as studying human potential and growth and believing that perhaps you are doing your small part to promote it.

References

- Andersen, S. C., & Nielsen, H. S. (2016). Reading intervention with a growth mindset approach improves children's skills. *Proceedings of the National Academy of Sciences*, 113(43), 12111–12113. doi:10.1073/pnas.1607946113
- Aronson, E. (1999). The power of self-persuasion. *American Psychologist*, 54(11), 875–884. doi:10.1037/h0088188
- Aronson, J. M., Fried, C. B., & Good, C. (2002). Reducing the effects of stereotype threat on African American college students by shaping theories of intelligence. *Journal of Experimental Social Psychology*, 38(2), 113–125. doi:10.1006/jesp.2001.1491
- Bandura, M. M. (1983). *Children's conceptions of intelligence in relation to achievement goals and patterns of achievement-related cognitions, affect, and behavior*. (Doctoral Dissertation). The Pennsylvania State University, University Park, PA.
- Bettinger, E. P., Ludvigsen, S., Rege, M., Solli, I. F., & Yeager, D. S. (2018). Increasing perseverance in math: Evidence from a field experiment in Norway. *Journal of Economic Behavior & Organization*, 146, 1–15. doi:10.1016/j.jebo.2017.11.032
- Blackwell, L. S., Trzesniewski, K. H., & Dweck, C. S. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child Development*, 78(1), 246–263. doi:10.1111/j.1467-8624.2007.00995.x
- Boulay, B., Goodson, B., Olsen, R., McCormick, R., Darrow, C., Frye, M., ... Sarna, M. (2018). *The Investing in Innovation Fund: Summary of 67 Evaluations* (No. NCEE 2018-4013) (p. 166). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education.

- Broda, M., Yun, J., Schneider, B., Yeager, D. S., Walton, G. M., & Diemer, M. (2018). Reducing inequality in academic success for incoming college students: A randomized trial of growth mindset and belonging interventions. *Journal of Research on Educational Effectiveness, 0*(ja), 00–00. doi:10.1080/19345747.2018.1429037
- Bryk, A. S., Gomez, L. M., Grunow, A., & LeMahieu, P. G. (2015). *Learning to improve: How America's schools can get better at getting better*. Cambridge, MA: Harvard Education Press. Retrieved from <http://hepg.org/hep-home/books/learning-to-improve>
- Canning, E., Muenks, K., & Murphy, M. C. (2018). Faculty mindset beliefs predict racial achievement gaps in STEM classes.
- Carr, P. B., Dweck, C. S., & Pauker, K. (2012). “Prejudiced” behavior without prejudice? Beliefs about the malleability of prejudice affect interracial interactions. *Journal of Personality and Social Psychology, 103*(3), 452–471. doi:10.1037/a0028849
- Carroll, J. M., Muller, C., Grodsky, E., & Warren, J. R. (2017). Tracking health inequalities from high school to midlife. *Social Forces, 96*(2), 591–628. doi:10.1093/sf/sow065
- Cheung, A. C. K., & Slavin, R. E. (2016). How methodological features affect effect sizes in education. *Educational Researcher, 45*(5), 283–292.
doi:10.3102/0013189X16656615
- Chiu, C., Hong, Y., & Dweck, C. S. (1997). Lay dispositionism and implicit theories of personality. *Journal of Personality and Social Psychology, 73*(1), 19–30.
doi:10.1037/0022-3514.73.1.19
- Cimpian, A., Arce, H.-M. C., Markman, E. M., & Dweck, C. S. (2007). Subtle linguistic cues affect children’s motivation. *Psychological Science, 18*(4), 314–316. doi:10.1111/j.1467-9280.2007.01896.x

- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale (2nd ed.).
Hillsdale, NJ: Lawrence Erlbaum Associates.
- Diener, C. I., & Dweck, C. S. (1978). An analysis of learned helplessness: Continuous changes
in performance, strategy, and achievement cognitions following failure. *Journal of
Personality and Social Psychology*, 36(5), 451. doi:10.1037/0022-3514.36.5.451
- Dodge, K. A., Bierman, K. L., Coie, J. D., Greenberg, M. T., Lochman, J. E., McMahon, R. J.,
... Conduct Problems Prevention Research Group. (2015). Impact of early intervention
on psychopathology, crime, and well-being at age 25. *American Journal of Psychiatry*,
172(1), 59–70. doi:10.1176/appi.ajp.2014.13060786
- Dweck, C. S. (2006). *Mindset: The new psychology of success*. New York, NY: Random House.
- Dweck, C. S. (2017). From needs to goals and representations: Foundations for a unified theory
of motivation, personality, and development. *Psychological Review*, 124(6), 689–719.
doi:10.1037/rev0000082
- Dweck, C. S., Chiu, C., & Hong, Y. (1995). Implicit theories and their role in judgments and
reactions: A world from two perspectives. *Psychological Inquiry*, 6(4), 267–285.
doi:10.1207/s15327965pli0604_1
- Dweck, C. S., & Reppucci, N. D. (1973). Learned helplessness and reinforcement responsibility
in children. *Journal of Personality and Social Psychology*, 25(1), 109–116.
doi:10.1037/h0034248
- Dynarski, S. M. (2017). *For better learning in college lectures, lay down the laptop and pick up
a pen* (Evidence Speaks). The Brookings Institution. Retrieved from
[https://www.brookings.edu/research/for-better-learning-in-college-lectures-lay-down-the-
laptop-and-pick-up-a-pen/](https://www.brookings.edu/research/for-better-learning-in-college-lectures-lay-down-the-laptop-and-pick-up-a-pen/)

- Elliott, E. S., & Dweck, C. S. (1988). Goals: An approach to motivation and achievement. *Journal of Personality and Social Psychology, 54*(1), 5–12. doi:10.1037/0022-3514.54.1.5
- Erdley, C. A., & Dweck, C. S. (1993). Children's implicit personality theories as predictors of their social judgments. *Child Development, 64*(3), 863–878. doi:10.2307/1131223
- Goldenberg, A., Cohen-Chen, S., Goyer, J. P., Dweck, C. S., Gross, J. J., & Halperin, E. (2018). Testing the impact and durability of a group malleability intervention in the context of the Israeli–Palestinian conflict. *Proceedings of the National Academy of Sciences, 115*(4), 696–701. doi:10.1073/pnas.1706800115
- Goldenberg, A., Endevelt, K., Ran, S., Dweck, C. S., Gross, J. J., & Halperin, E. (2017). Making intergroup contact more fruitful: Enhancing cooperation between Palestinian and Jewish-Israeli adolescents by fostering beliefs about group malleability. *Social Psychological and Personality Science, 8*(1), 3–10. doi:10.1177/1948550616672851
- Good, C., Aronson, J., & Inzlicht, M. (2003). Improving adolescents' standardized test performance: An intervention to reduce the effects of stereotype threat. *Journal of Applied Developmental Psychology, 24*(6), 645–662. doi:10.1016/j.appdev.2003.09.002
- Grant, H., & Dweck, C. S. (2003). Clarifying achievement goals and their impact. *Journal of Personality and Social Psychology, 85*(3), 541–553. doi:10.1037/0022-3514.85.3.541
- Gunderson, E. A., Gripshover, S. J., Romero, C., Dweck, C. S., Goldin-Meadow, S., & Levine, S. C. (2013). Parent praise to 1- to 3-year-olds predicts children's motivational frameworks 5 years later. *Child Development, 84*(5), 1526–1541. doi:10.1111/cdev.12064
- Guthrie, E. R. (1935). *The psychology of learning*. New York, NY: Harper and Brothers.

Haimovitz, K., & Dweck, C. S. (2016). Parents' views of failure predict children's fixed and growth intelligence mind-sets. *Psychological Science*, 27(6), 859–869.
doi:10.1177/0956797616639727

Haimovitz, K., & Dweck, C. S. (2017). The origins of children's growth and fixed mindsets: New research and a new proposal. *Child Development*, 88(6), 1849–1859.
doi:10.1111/cdev.12955

Halperin, E., Russell, A. G., Trzesniewski, K. H., Gross, J. J., & Dweck, C. S. (2011). Promoting the Middle East peace process by changing beliefs about group malleability. *Science*, 333(6050), 1767–1769. doi:10.1126/science.1202925

Hill, C. J., Bloom, H. S., Black, A. R., & Lipsey, M. W. (2008). Empirical benchmarks for interpreting effect sizes in research. *Child Development Perspectives*, 2(3), 172–177.
doi:10.1111/j.1750-8606.2008.00061.x

Hong, Y., Chiu, C., Dweck, C. S., Lin, D. M.-S., & Wan, W. (1999). Implicit theories, attributions, and coping: A meaning system approach. *Journal of Personality and Social Psychology*, 77(3), 588–599. doi:10.1037/0022-3514.77.3.588

Kamins, M. L., & Dweck, C. S. (1999). Person versus process praise and criticism: Implications for contingent self-worth and coping. *Developmental Psychology*, 35(3), 835.
doi:10.1037/0012-1649.35.3.835

Leggett, E. L. (1986). Individual differences in effort/ability inference rules and goals: Implications for causal judgments. *Dissertation Abstracts International*, 47(6-B), 2662.

Levy, S. R., & Dweck, C. S. (1999). The impact of children's static versus dynamic conceptions of people on stereotype formation. *Child Development*, 70(5), 1163–1180.
doi:10.1111/1467-8624.00085

- Levy, S. R., Plaks, J. E., Hong, Y., Chiu, C., & Dweck, C. S. (2001). Static versus dynamic theories and the perception of groups: Different routes to different destinations. *Personality and Social Psychology Review, 5*(2), 156–168.
doi:10.1207/S15327957PSPR0502_6
- Levy, S. R., West, T. L., Ramirez, L., & Karafantis, D. M. (2006). The protestant work ethic: A lay theory with dual intergroup implications. *Group Processes & Intergroup Relations, 9*(1), 95–115. doi:10.1177/1368430206059874
- Lieberman, J. D., Solomon, S., Greenberg, J., & McGregor, H. A. (1999). A hot new way to measure aggression: Hot sauce allocation. *Aggressive Behavior, 25*(5), 331–348.
doi:10.1002/(SICI)1098-2337(1999)25:5<331::AID-AB2>3.0.CO;2-1
- Mangels, J. A., Butterfield, B., Lamb, J., Good, C., & Dweck, C. S. (2006). Why do beliefs about intelligence influence learning success? A social cognitive neuroscience model. *Social Cognitive and Affective Neuroscience, 1*(2), 75–86. doi:10.1093/scan/nsl013
- McConnell, A. R. (2001). Implicit theories: Consequences for social judgments of individuals. *Journal of Experimental Social Psychology, 37*(3), 215–227. doi:10.1006/jesp.2000.1445
- Miele, D. B., & Molden, D. C. (2010). Naive theories of intelligence and the role of processing fluency in perceived comprehension. *Journal of Experimental Psychology: General, 139*(3), 535–557. doi:10.1037/a0019745
- Miele, D. B., Son, L. K., & Metcalfe, J. (2013). Children's naive theories of intelligence influence their metacognitive judgments. *Child Development, 84*(6), 1879–1886.
doi:10.1111/cdev.12101
- Miu, A. S., & Yeager, D. S. (2015). Preventing symptoms of depression by teaching adolescents that people can change: Effects of a brief incremental theory of personality intervention

- at 9-month follow-up. *Clinical Psychological Science*, 3(5), 726–743.
doi:10.1177/2167702614548317
- Molden, D. C., & Dweck, C. S. (2006). Finding “meaning” in psychology: A lay theories approach to self-regulation, social perception, and social development. *American Psychologist*, 61(3), 192–203. doi:10.1037/0003-066X.61.3.192
- Molden, D. C., Plaks, J. E., & Dweck, C. S. (2006). “Meaningful” social inferences: Effects of implicit theories on inferential processes. *Journal of Experimental Social Psychology*, 42(6), 738–752. doi:10.1016/j.jesp.2005.11.005
- Moser, J. S., Schroder, H. S., Heeter, C., Moran, T. P., & Lee, Y.-H. (2011). Mind your errors: Evidence for a neural mechanism linking growth mind-set to adaptive posterror adjustments. *Psychological Science*, 22(12), 1484–1489. doi:10.1177/0956797611419520
- Mueller, C. M., & Dweck, C. S. (1998). Praise for intelligence can undermine children’s motivation and performance. *Journal of Personality and Social Psychology*, 75(1), 33–52. doi:10.1037/0022-3514.75.1.33
- Muenks, K., Canning, E. A., Green, D., & Murphy, M. C. (2018). Perceived faculty mindsets shape college students’ psychological and academic outcomes.
- Murphy, M. C., & Dweck, C. S. (2010). A culture of genius: How an organization’s lay theory shapes people’s cognition, affect, and behavior. *Personality and Social Psychology Bulletin*, 36(3), 283–296. doi:10.1177/0146167209347380
- Nicholls, J. G. (1984). Achievement motivation: Conceptions of ability, subjective experience, task choice, and performance. *Psychological Review*, 91(3), 328–346. doi:10.1037/0033-295X.91.3.328

- Nussbaum, A. D., & Dweck, C. S. (2008). Defensiveness versus remediation: Self-theories and modes of self-esteem maintenance. *Personality and Social Psychology Bulletin, 34*(5), 599–612. doi:10.1177/0146167207312960
- Nye, B., Hedges, L. V., & Konstantopoulos, S. (2000). The Effects of Small Classes on Academic Achievement: The Results of the Tennessee Class Size Experiment. *American Educational Research Journal, 37*(1), 123–151. doi:10.3102/00028312037001123
- Owens, A., Reardon, S. F., & Jencks, C. (2016). Income segregation between schools and school districts. *American Educational Research Journal, 53*(4), 1159–1197. doi:10.3102/0002831216652722
- Paunesku, D., Walton, G. M., Romero, C., Smith, E. N., Yeager, D. S., & Dweck, C. S. (2015). Mind-set interventions are a scalable treatment for academic underachievement. *Psychological Science, 26*(6), 784–793. doi:10.1177/0956797615571017
- Pico della Mirandola, G. (2012). *On the dignity of man: A new translation and commentary*. (F. Borghesi, M. Papio, & M. Riva, Eds.). New York, NY: Cambridge University Press.
- Retrieved from <https://doi.org/10.1017/CBO9781139059565>
- Plaks, J. E., Stroessner, S. J., Dweck, C. S., & Sherman, J. W. (2001). Person theories and attention allocation: Preferences for stereotypic versus counterstereotypic information. *Journal of Personality and Social Psychology, 80*(6), 876–893. doi:10.1037//0022-3514.80.6.876
- Pomerantz, E. M., & Kempner, S. G. (2013). Mothers' daily person and process praise: Implications for children's theory of intelligence and motivation. *Developmental Psychology, 49*(11), 2040–2046. doi:10.1037/a0031840

- Robins, R. W., & Pals, J. L. (2002). Implicit self-theories in the academic domain: Implications for goal orientation, attributions, affect, and self-esteem change. *Self & Identity, 1*(4), 313–336. doi:10.1080/15298860290106805
- Sauce, B., & Matzel, L. D. (2018). The paradox of intelligence: Heritability and malleability coexist in hidden gene-environment interplay. *Psychological Bulletin, 144*(1), 26–47. doi:10.1037/bul0000131
- Schleider, J. L., & Weisz, J. R. (2016). Reducing risk for anxiety and depression in adolescents: Effects of a single-session intervention teaching that personality can change. *Behaviour Research and Therapy, 87*, 170–181. doi:10.1016/j.brat.2016.09.011
- Seligman, M. E., & Maier, S. F. (1967). Failure to escape traumatic shock. *Journal of Experimental Psychology, 74*(1), 1–9. doi:10.1037/h0024514
- Somers, M.-A., Corrin, W., Sepanik, S., Salinger, T., Levin, J., & Zmack, C. (2010). *The enhanced reading opportunities study final report: The impact of supplemental literacy courses for struggling ninth-grade readers* (No. NCEE 2010–4022). Washington, DC: Institute of Education Sciences. Retrieved from <https://ies.ed.gov/ncee/pubs/20104021/pdf/20104022.pdf>
- Walton, G. M. (2014). The new science of wise psychological interventions. *Current Directions in Psychological Science, 23*(1), 73–82. doi:10.1177/0963721413512856
- Weiner, B., & Kukla, A. (1970). An attributional analysis of achievement motivation. *Journal of Personality and Social Psychology, 15*(1), 1–20. doi:10.1037/h0029211
- Weiss, M. J., Bloom, H. S., Verbitsky-Savitz, N., Gupta, H., Vigil, A. E., & Cullinan, D. N. (2017). How much do the effects of education and training programs vary across sites?

- Evidence from past multisite randomized trials. *Journal of Research on Educational Effectiveness*, 10(4), 843–876. doi:10.1080/19345747.2017.1300719
- West, M. R., Buckley, K., Krachman, S. B., & Bookman, N. (2018). Development and implementation of student social-emotional surveys in the CORE Districts. *Journal of Applied Developmental Psychology*, 55, 119–129. doi:10.1016/j.appdev.2017.06.001
- Williams, K. D., Yeager, D. S., Cheung, C., & Choi, W. (2012). Cyberball (Version 4.0).
- Wilson, T. D. (2011). *Redirect: The surprising new science of psychological change*. London, UK: Penguin UK. Retrieved from <https://www.penguin.co.uk/books/133281/redirect/>
- Yeager, D. S., Dahl, R. E., & Dweck, C. S. (2018). Why interventions to influence adolescent behavior often fail but could succeed. *Perspectives on Psychological Science*, 13(1), 101–122. doi:10.1177/1745691617722620
- Yeager, D. S., & Dweck, C. S. (2012). Mindsets that promote resilience: When students believe that personal characteristics can be developed. *Educational Psychologist*, 47(4), 302–314. doi:10.1080/00461520.2012.722805
- Yeager, D. S., Hanselman, P., Walton, G. M., Crosnoe, R., Muller, C. L., Tipton, E., ... Dweck, C. S. (2018). Where does a scalable growth-mindset intervention improve adolescents' educational trajectories? *Unpublished Manuscript, University of Texas at Austin*.
- Yeager, D. S., Johnson, R., Spitzer, B. J., Trzesniewski, K. H., Powers, J., & Dweck, C. S. (2014). The far-reaching effects of believing people can change: Implicit theories of personality shape stress, health, and achievement during adolescence. *Journal of Personality and Social Psychology*, 106(6), 867–884. doi:10.1037/a0036335

- Yeager, D. S., Lee, H. Y., & Jamieson, J. P. (2016). How to improve adolescent stress responses: Insights from integrating implicit theories of personality and biopsychosocial models. *Psychological Science, 27*(8), 1078–1091. doi:10.1177/0956797616649604
- Yeager, D. S., Romero, C., Paunesku, D., Hulleman, C. S., Schneider, B., Hinojosa, C., ... Dweck, C. S. (2016). Using design thinking to improve psychological interventions: The case of the growth mindset during the transition to high school. *Journal of Educational Psychology, 108*(3), 374–391. doi:10.1037/edu0000098
- Yeager, D. S., Trzesniewski, K. H., & Dweck, C. S. (2013). An implicit theories of personality intervention reduces adolescent aggression in response to victimization and exclusion. *Child Development, 84*(3), 970–988. doi:10.1111/cdev.12003
- Yeager, D. S., Trzesniewski, K. H., Tirri, K., Nokelainen, P., & Dweck, C. S. (2011). Adolescents' implicit theories predict desire for vengeance after peer conflicts: Correlational and experimental evidence. *Developmental Psychology, 47*(4), 1090–1107. doi:10.1037/a0023769
- Yeager, D. S., & Walton, G. M. (2011). Social-psychological interventions in education: They're not magic. *Review of Educational Research, 81*(2), 267–301. doi:10.3102/0034654311405999
- Yeager, D. S., Walton, G. M., Brady, S. T., Akcinar, E. N., Paunesku, D., Keane, L., ... Dweck, C. S. (2016). Teaching a lay theory before college narrows achievement gaps at scale. *Proceedings of the National Academy of Sciences, 113*(24), E3341–E3348. doi:10.1073/pnas.1524360113

Zhao, L., Heyman, G. D., Chen, L., & Lee, K. (2017). Praising young children for being smart promotes cheating. *Psychological Science*, 28(12), 1868–1870.
doi:10.1177/0956797617721529

Growth Mindset “Meaning System” Questions From the *National Study of Learning Mindsets*

Fixed mindset

Stem

1. You have a certain amount of intelligence, and you really can't do much to change it.
2. Your intelligence is something about you that you can't change very much.
3. Being a “math person” or not is something that you really can't change. Some people are good at math and other people aren't.

Response options

- Strongly disagree (1)
- Disagree (2)
- Mostly disagree (3)
- Mostly agree (4)
- Agree (5)
- Strongly agree (6)

Performance-avoidance goals

Stem

What are your goals in school from now until the end of the year?
Below, say how much you agree or disagree with this statement.

One of my main goals for the rest of the school year is to **avoid looking dumb in my classes**.

Response options

- Strongly disagree (1)
- Disagree (2)
- Mostly disagree (3)
- Mostly agree (4)
- Agree (5)
- Strongly agree (6)

Fixed ability attributions

Stem

Pretend that, later today or tomorrow, you got a **bad** grade on a very important math assignment.

Honestly, if that happened, how likely would you be to think these thoughts?

"This means I'm probably not very smart at math."

Response options

- Not at all likely to think this (1)
- Slightly likely to think this (2)
- Somewhat likely to think this (3)
- Very likely to think this (4)
- Extremely likely to think this (5)

Effort beliefs

Stem

When you have to try really hard in a subject in school, it means you can't be good at that subject.

Response options

- Strongly disagree (1)
- Disagree (2)
- Mostly disagree (3)
- Mostly agree (4)
- Agree (5)
- Strongly agree (6)

Raw Stata Output

```
Mindset | 1.0000
| 14618
|
GPA | -0.2175 1.0000
| 0.0000
| 11414 12641
|
Perform goals| 0.2145 -0.0989 1.0000
| 0.0000 0.0000
| 14522 11338 14528
|
Trait attrib | 0.2798 -0.1498 0.2213 1.0000
| 0.0000 0.0000 0.0000
| 14530 11348 14478 14536
10th math lvl | -0.1546 0.3689 -0.0660 -0.0932 1.0000
| 0.0000 0.0000 0.0000 0.0000
| 6673 7279 6623 6630 7415
|
Effrt blfs | 0.3209 -0.1919 0.1000 0.1733 -0.1265 1.0000
| 0.0000 0.0000 0.0000 0.0000 0.0000
| 14467 12522 14376 14387 7343 16139
```