The University of Texas at Austin
Texas Education Review
College of Education

Journal Homepage: Texas Education Review
Published online: January 2022
Submit your article to this journal

This work is licensed under a Creative Commons Attribution 4.0 International License. Permissions beyond the scope of this license may be available at www.review.education.texas.edu

The Research-Practice Divide Is Not Only an Issue of Communication, but of Values: The Case of Growth Mindset

BRENDAN A. SCHUETZE
The University of Texas at Austin

To cite this article: Schuetze, B. A. (2022). The research-practice divide is not only an issue of communication, but of values: The case of growth mindset. *Texas Education Review*, *10*(1), 92-104. https://doi.org/10.15781/8gv2-1023

The Research-Practice Divide Is Not Only an Issue of Communication, but of Values: The Case of Growth Mindset

BRENDAN A. SCHUETZE
The University of Texas at Austin

Thousands of educational research papers are published each year and many of them do not have much impact outside of a small circle of academic readers (Hurd, 1986; Tucker, 2016). Yet, there are a few, select findings from social science that gain outsized influence among teachers, administrators, and policymakers alike (Hess, 2020). Different explanations have been proposed for how and why this academic research successfully crosses the research-practice divide. Many social scientists (at least implicitly) argue that the issue preventing research from crossing the divide is a lack of communication—that scientists need to simply communicate more clearly and more frequently to relevant educational stakeholders (Nisbet & Scheufele, 2009). However, this does not explain why some ideas capture the attention of educators more than others in cases when the science communication is comparable. Rather, as will be discussed in this paper, values-alignment is an important predictor of whether research crosses into mainstream practice. That is, when an idea aligns with the existing values of educators, the research will feel more intuitive, because it fits their existing classroom practices and beliefs about pedagogy (Luong et al., 2019). This values-alignment helps bring ideas from research into practice, but it is a double-edged sword: it also comes with the risk of (a) proliferating research ideas before they have been sufficiently demonstrated to be effective or fully understood, and (b) leading to the adoption of select parts of the research that happen to fit pre-existing beliefs.

Growth mindset research (and the accompanying misunderstandings concerning this theory often termed *false growth mindset*) is one example of a research idea that has been quickly adopted into educational language and can be used as a case study to provide insight into the unique issues associated with the translation of social scientific research into K-12 settings. This case study will explore how alignment of values between existing K-12 pedagogical practice and growth mindset theory partially explain why this theory so readily crossed the research-practice gap, though empirical evidence fails to find large effects of growth mindset interventions (Sisk et al., 2018) and academic researchers only endorse a relatively narrow conception of growth mindset (e.g., Dweck, 2017). The lesson for social scientists and educational researchers from this case study, then, is that how educational theories are framed might work for or against their popularization and broader impact (Bryan et al., 2019; Mansfield & Volet, 2010). To believe that education research is value-free (Kuhn, 2012/1962) or that theories succeed purely on the merit of their evidence base is to misunderstand how educational research becomes pedagogical practice (Fendler, 2012; Kahan, 2010; Schneider, 2014).

The Academic History of Growth Mindset as a Motivational Theory

Growing out of educational psychology in the 1980s and 1990s (Dweck 1986; Dweck & Leggett, 1988; Mueller & Dweck, 1998), the fundamental claim of growth mindset research (also known as mindset theory) is the following: students who endorse a stronger belief in the ability to change one's intelligence will be motivated to study more strategically and achieve higher grades (Dweck & Yeager, 2019). That is, if a student agrees with statements such as "No matter who you are, you can significantly change your intelligence level" they exhibit a growth mindset (Midkiff et al., 2017, p. 169) and will be more likely to be motivated to put effort into their schoolwork (Blackwell et al., 2007). Crucially, growth mindset is not the same as self-esteem theory, which posited that students' achievement was boosted when they felt confident about themselves (Humphrey, 2004).

Despite a large body of growth mindset research (Sisk et al., 2018), mindset theory continues to be described by most, if not all, researchers in this field as a theory of achievement motivation (Dweck & Yeager, 2019). That is, growth mindset attempts to narrowly explain why students are driven to engage with academic material; it does not prescribe broad recommendations about pedagogy or education. Additionally, most mindset researchers, themselves, do not see growth mindset as a totalizing theory of motivation, but rather one component of a larger approach to student motivation centered around implicit theories, meaning systems, and action-tendencies (Dweck, 2017).

Rigorous large-scale studies have either shown statistically significant, yet small, effects of growth mindset (e.g., Yeager et al., 2019) or null results (e.g., Ganimian, 2020; Li & Bates, 2019), indicating the effects of growth mindset are limited and variable across contexts. Meta-analytic evidence supports this notion of the limited scope of the growth mindset construct, with Sisk et al.'s (2018) synthesis of 273 studies across a wide array of K-12 and post-secondary contexts (Total N = 365,915 students) estimating that the correlation between growth mindset and achievement was small ($r = 0.10$, $p < .001$). Put otherwise, even when not controlling for potential confounders, growth mindset only explains approximately one percent of the variance in educational outcomes ($R^2 = 0.01$). Altogether, mindset theory occupies a position in educational psychology as a relatively constrained theory of student motivation. Furthermore, the empirical evidence does not support the use of growth mindset as an overarching theory of education or pedagogy (Burgoyne et al., 2020; Moreau et al., 2019).

Views of Growth Mindset in Educational Settings

Although growth mindset began as an academic theory, its public influence far exceeds many other similar research agendas in motivation science and educational research writ large. Its originator, Carol Dweck, frequently ranks as one of the most eminent education researchers of the twenty-first century (Hess, 2020). Dweck's (2006) popular press book *Mindset: The New Psychology of Success* boasts more than two million copies in print; one of her keynote speeches has been translated into 43 languages and viewed over 13 million times (Dweck, 2014). With widespread popular interest in growth mindset, however, comes a cost, that being the increasingly high chance of losing control of the message and being misinterpreted by the popular audiences reached by these efforts. Witness the litany of results that show up in a Google search of "false growth mindset" (currently numbering over 12,000 as of November 2021).

Acknowledging the proliferation of misunderstandings related to growth mindset, Dweck and other mindset researchers have attempted to reconcile the mixed narratives of growth mindset through a series of blog posts aimed at popular audiences (e.g., Briceño, 2015; Dweck, 2016) and journal articles aimed at motivational researchers (e.g., Dweck & Yeager, 2019). In Dweck's (2015) own words, "[my fear is] that the mindset concepts, which grew up to *counter* the failed self-esteem movement, will be used to *perpetuate* that movement. In other words, if you want to make students feel good, even if they're not learning, just praise their effort!" (n.p., emphasis in original).

Expansive and overly positive notions of growth mindset were also reflected in a recent qualitative survey, administered to K-12 teachers in a school district in the southwestern United States, with one teacher defining growth mindset simply as: "To think as positively as possible." Others saying: "Growth mindset is a state of mind [where] one feels positive about learning new material and feels encouraged to do so;" "having an open mind and willingness to go out of our comfort zone;" and "we can accomplish ANYTHING, we just have to believe that we can" (Schuetze & Yan, 2021).

Similarly, Patrick and Joshi's (2019) interviews of teachers in a large urban school district in Pennsylvania found that growth mindset is frequently associated with "relentless positivity" (p. 161). Journalists, too, have misinterpreted growth mindset, with a headline in *The Guardian,* stating: "New test for 'growth mindset', the theory that anyone who tries can succeed" (Rustin, 2016).

The prevalence of misunderstandings associated with growth mindset has been further supported by Rissanen et al.'s (2018, 2019) qualitative research on teacher interpretations of mindset theory in Finnish elementary schools, which shows that growth mindset is often construed as a totalizing theory of pedagogy, rather than a relatively constrained theory prescribing one of many ways to increase student motivation. Totalizing understandings of growth mindset can also be seen in teacher development materials, such as Brock and Hundley's (2016) *The Growth Mindset Coach: A Teacher's Month-by-Month Handbook for Empowering Students to Achieve*. This book instructs teachers on a variety of topics, not traditionally associated with the motivational theory of growth mindset, ranging from goal setting to relationship-building. Perhaps not the fault of the authors, themselves, a larger indictment of the overbroad interpretations of growth mindset stems from their book's back cover, which claims that a growth mindset will allow teachers to "motivate students to believe in themselves and achieve anything."

This qualitative evidence showing the divergence between teacher and researcher conceptions of growth mindset has been corroborated by recent quantitative evidence from surveys of teacher understandings of growth mindset. Buttrick (2020) found that 38 percent of teachers surveyed in a nationally representative sample of American schools endorsed a "false" growth mindset, whereas 39 percent endorsed a "true" growth mindset, and 22 percent endorsed a fixed mindset (p. 2). Interpreted differently, this data reveals that, of the teachers who endorse a growth mindset, nearly fifty percent of these teachers endorse an unduly optimistic understanding of the phenomenon.

Despite Dweck's (2015, 2016) efforts to raise alarms about false mindsets half a decade ago, this evidence further confirms Dweck and Yeager's (2019) reflection on the contemporary state of growth mindset showing that the popular and academic conceptions of growth mindset have yet to be unified: "we have learned that it is too easy for people to implement a growth mindset poorly" (p. 482; see also Yeager, 2019). Taken together, it is clear that growth mindset is often seen as an all-encompassing fuzzy "open-minded or positive outlook" (Hattie, 2017, n.p.), largely unconnected to the narrow claims of the original academic work of Dweck and colleagues.

Why are misunderstandings about growth mindset so pervasive?

Given that there are clear and widespread misconceptions concerning growth mindset (Dweck & Yeager, 2019), the intuitive follow-up questions are "why do these misconceptions exist?" and "why are they so widespread?" Previous answers to these questions have mostly surrounded the need for increased communication between researchers and teachers. Nevertheless, the present paper draws on research concerning other instances of science communication failures to assess potential other reasons for the gap between research and practice.

Social scientists see growth mindset misunderstandings as an information deficit

Social scientists researching growth mindset tend to interpret these incorrect or "false" understanding of mindset theory primarily as a result of a lack of information on the part of teachers (e.g., Briceño, 2015; Denworth, 2019; Dweck & Yeager, 2019). For example, Yeager (2019), writes "If

scientists want to break the hype cycle and help students in a lasting way, we need to change our practices. The most important thing we can do is to conduct studies showing where our ideas don't work, as well as where they do. And then we need to spread the word responsibly about how to make our ideas work reliably" (n.p.). Here, social scientists' message is that with enough research and responsible communication to the public, the misunderstandings related to growth mindset can be resolved.

However, such a view misses out on the larger social environment within which the communication of scientific findings occurs. Work in the academic field of science communication—which focuses on the best ways to communicate scientific findings to non-scientists—has identified issues associated with so-called *deficit theories* of science communication (deficit theories of science communication should not be confused with broader deficit theories in education), which are commonly held by social scientists. Under deficit theories, discordance between the scientific evidence base and (educational) practice are explained by a lack of knowledge (Nisbet & Scheufele, 2009; Reincke et al., 2020). That is, to improve science communication, scientists simply need to communicate their findings more frequently and more clearly to the public. Then, scientific theories can be translated into practice based on the strength of their scientific evidence.

Such deficit theories of science communication have been found to be insufficient to explain the gap between scientific findings and popular understandings of science (Nisbet & Scheufele, 2009; Washburn & Skitka, 2018). Though factors, such as access to information, undoubtedly influence the adoption of educational research in schools and other applied settings, a deficit-based conception of science communication leaves out equally important factors: values and social context (Bucchi, 2008; Feinstein & Waddington, 2020; Lewis & Wai, 2021; Zengilowski et al., 2021). Recent work has shown that values and social context often determine which information is integrated into an individual's or community's belief system (Brossard et al., 2009; Luong et al., 2019). That is, information that is incongruent with a community's belief systems will be filtered out before it can lead to meaningful change in behavior (Mansfield & Volet, 2010; Nisbet & Scheufele, 2009).

One classic example of this phenomenon relates to the difficulties in convincing people of the importance of climate change due to the perceived effects mitigation measures will have on the economy (Thagard & Findlay, 2010). Similar trends have been seen with vaccine hesitancy (Amin et al., 2017) and evolution (Dunk et al., 2019). In the case of evolution, Weisberg et al. (2018) showed that religious beliefs and values accounted for 38 percent of the variance in the endorsement of the scientific understanding of evolution, while scientific knowledge only predicted an additional five percent.

In cases, such as climate change mitigation, vaccination, and evolution, the scientific evidence has been clearly and repeatedly conveyed, but resistance to the scientific evidence remains staunch (in at least some groups of people). When science communication fails, lack of information may be part of why people resist the scientific consensus, however, values and politics are clearly modulating the uptake of scientific information (Brossard et al., 2009). Indeed, it seems most high-profile conflicts between scientific consensus and popular opinion rest at least partially on some other foundational conflict between communities that hold different values (Washburn & Skitka, 2018). For this reason, scientists cannot rely on a mere increase in communication frequency to improve the uptake of scientific knowledge, rather they must understand the underlying values that are causing divides between scientific and popular understandings.

Perceived alignment with existing educational values hastened the adoption of growth mindset

Misunderstandings related to growth mindset may appear relatively benign compared to those associated with political issues such as climate change. Nevertheless, educational researchers can still learn lessons from the failure of information deficit models in these high-profile instances of science communication failure. Indeed, these science communication failures have made it clear that researchers in the social sciences must avoid an information deficit-based approach to the communication of their science. Rather, social scientists must understand the values and views of the educational professionals they are trying to reach when they share their results of their studies.

Therefore, to understand the issues associated with false interpretations of growth mindset outside of the domain of motivation research, one must begin with the complex, murky, and contradictory sets of values underlying teaching and learning. Indeed, there is a chronic under-conceptualization and lack of agreement concerning the purpose of schooling and education (Bass, 1997). What is it, then, that teachers believe the purpose of pedagogy and education? Given that, as Kincheloe (2004) acknowledges, teachers and teacher education programs are far from a monolith in and of themselves, it is almost easier to answer the converse question: "What do teachers and teacher education programs disavow?"

If a generalization can be made, Hansen (2008) argues teacher education programs tend to endorse transformative constructivist pedagogy (as opposed to more traditionalist pedagogy), where social justice and the socio-emotional needs of students are increasingly seen as legitimate educational concerns (see Bursztyn, 2004; Krahenbuhl, 2016). In a similar vein, Hey and Leathwood (2009) note the existence of a general movement to a student-centered social justice orientation and the associated "affective turn" towards creating supportive learning environments starting in the latter half of the twentieth century (see Noddings, 1992).

In line with this affective turn, teachers are encouraged to be concerned not only with intellectual development, but also with molding, inspiring, and caring for their students (Clegg & Rowland, 2010) — or what might summarize in one word as the "growth" of students (cf. Sockett, 2008). Given this increasing emphasis on creating a positive classroom environment where students feel valued, the present paper argues growth mindset transferred so readily across the research-practice gap, not because it challenged or innovated upon prevalent teacher philosophies or practices, but because it meshed with and reinforced existing understandings of the purpose of education.

Empirical data supports this notion, with Mansfield and Volet (2010) finding generally that teachers adopt pedagogical strategies that reinforce existing views of education. More specifically to growth mindset, Nestor's (2017) study of elementary school teachers in Pittsburgh found that 75 percent of teachers reporting strong integration of growth mindset into their classroom practice. Interestingly, both Yettick et al. (2016) and Nestor (2017) found that teachers did not see a strong link between growth mindset and students' grades, suggesting they were incorporating these practices into their pedagogy for largely non-achievement-related (i.e., socio-emotional) reasons. A similar focus on the perceived socio-emotional and inclusion benefits of growth mindset-infused pedagogy, even when admitting only small effects on course grades, can be seen in Burgasser's (2019) meditation on the use of growth mindset pedagogy in undergraduate astronomy courses.

It may also be helpful to think about the success of growth mindset in terms of a counterfactual: Imagine in an alternate world, Dweck had discovered that inducing fixed mindsets, that is coldly reminding students of their innate ability, was the best way to encourage students to persist, particularly high achieving students. Imagine that meta-analytically derived average effect sizes were twice as large ($d = 0.20$, $p < .001$). Would such an idea have caught on in the same manner as growth mindset? Under the present framework, it would not have. The alternative theory of fixed mindset does not mesh well with the teaching profession's social justice and affect-oriented ethos. This counterfactual suggests that it is not the strength of scientific evidence behind the growth mindset that makes it broadly popular. Rather, it is the high degree to which growth mindset matches and reinforces the existing pedagogical practice that makes this theory broadly popular with educational practitioners. In short, growth mindset has become synonymous with "good teaching" as defined by the teacher-endorsed pedagogical theories discussed above.

Growth mindset has become a new label for pre-existing practices

One might argue that the pedagogical theory of growth mindset even preexisted the motivation theory of growth mindset. In fact, Patrick and Joshi's (2019) interviews of schoolteachers in a large southwestern urban school district found that "[m]ultiple teachers explained that learning about growth and fixed mindsets merely gave them a new language to talk about something they already believed or supported" (p. 162). Broader survey evidence also backs this notion of growth mindset-supportive practices existing prior to the adoption of "growth mindset" as a pedagogical label. Yettick et al. (2016) surveyed 600 teachers across the United States, finding that a strong majority of teachers wanted to learn more about the academic theory of growth mindset (85%, p. 20).

Yet simultaneously, these same teachers reported already using five queried growth mindset supportive practices (e.g., "Encouraging students who are already doing well to keep trying to improve") much more frequently than the four queried non-growth mindset supported practices (e.g., "Praising students for their intelligence"). The average growth mindset supportive practice was employed "every day" by 56 percent of teachers, while average non-growth mindset supportive practice was only reported to be used every day by 27 percent of teachers. Similar results were found by Nestor's (2017) survey of elementary school teachers in Pittsburgh. Though more research needs to be done on representative samples of teachers concerning their pedagogical beliefs, this initial evidence suggests that the adoption of growth mindset did not greatly change pre-existing practice.

In terms of students' beliefs, evidence from McPartlan et al.'s (2020) study of first-generation and low-income students at UC Irvine reveals that even the most disadvantaged first-year undergraduate students reported relatively high growth mindsets. Sun et al.'s (2021) analysis of 2018 PISA data found that most (68%) United States students report a growth mindset, and that this rate was significantly and substantially higher than that of comparison students in China ($d = 1.07$).

Thus, it seems there is evidence to believe that the United States school system, in terms of both students (McPartlan et al., 2020; Sun et al., 2021) and teachers (Patrick & Joshi, 2019; Yettick et al., 2016), may already be defined by high levels of growth mindset, even if teachers, themselves, may not always recognize this to be the case. This is to say, when an educator adopts "growth mindset" into their pedagogy, this terminology functions as a pithy phrase referring to a pre-existing affect-oriented and student-centered pedagogy; this pedagogy shares some overlap with the academic theory of growth mindset, but is simultaneously much more expansive and optimistic than is warranted

by the social scientific evidence underlying mindset theory (i.e., growth mindset does not mean that anyone can achieve anything just because they believe their intelligence is malleable).

Conclusion

As has been argued throughout this paper, the issues associated with translating growth mindset (and educational research broadly) into schools stem not just from a lack of information on the part of educators and contextualized science on the part of the researchers (cf. Yeager, 2019). Rather, the potency of growth mindset language stems from a superficial overlap and values alignment between commonly held views of teaching and public understandings of growth mindset. This has led to a situation where certain psychological theories are almost *too amenable* to pre-existing views of pedagogy commonly found in schools. These research-practice-philosophical gaps and overlaps between educational stakeholders help explain why some psychological theories and constructs are readily (yet superficially) integrated into the professional vocabulary of K-12 education (Brossard et al., 2009; Mansfield & Volet, 2010). For example, theories, such as self-esteem theory (Humphrey, 2004), the theory of multiple intelligences (Gardner & Hatch, 1989; Schneider, 2014; Warne & Burton, 2020), and growth mindset have all been integrated into educational practice; while other (potentially more robust) strands of educational research fail to find the same level of popularity in applied settings, such as effective study strategies (Agarwal et al., 2012; Dempster, 1988; Morehead et al., 2016) and cognitive load theory (Zhang et al., 2021).

This case study of the complexities associated with translating psychological research into the classroom should amplify existing calls for educational researchers not only to clarify their constructs, theories, and philosophies, but also to attend to the complexities of teacher experience (Chase, 1998), schooling contexts (Hattie et al., 2020; Murphy & Alexander, 2000), and the "webs of meaning" (Berliner, 1992, p. 143) pedagogical practices inhabit (Fendler, 2012). Acknowledging that scientific knowledge and interventions are not value-free (Kuhn, 2012/1962; Prinzing, 2020), deficit theories of scientific communication must be avoided; rather science communication must be conceptualized as an ongoing and reciprocal dialogue where both values and access to information matter.

If researchers assume that teachers' professional commitments, meaning systems, and school contexts do not predispose them towards or against certain pedagogical stances, educational researchers are destined to continue making similar mistakes. Though the current paper may appear critical on the surface, the intention is to enable educational researchers to think with, learn from, and communicate more clearly with educators about the use of research in educational settings. Particularly, researchers and educators must be attentive to when and why they might be talking past one another due to differences in values and educational perspectives.

Brendan A. Schuetze is a Ph.D. student at the University of Texas at Austin in the Educational Psychology department, specializing in Human Development, Culture, and Learning Sciences. As a member of the Science of Learning and Metacognition Lab, he uses both the tools of cognitive science and motivational research to understand why and how students learn. Recent research has focused on category learning, human memory, and belief revision (i.e., how people change their minds, particularly in socio-politically complex situations).

References

Agarwal, P. K., Bain, P. M., & Chamberlain, R. W. (2012). The value of applied research: Retrieval practice improves classroom learning and recommendations from a teacher, a principal, and a scientist. *Educational Psychology Review*, *24*(3), 437-448. https://doi.org/10.1016/j.cedpsych.2020.101864

Amin, A. B., Bednarczyk, R. A., Ray, C. E., Melchiori, K. J., Graham, J., Huntsinger, J. R., & Omer, S. B. (2017). Association of moral values with vaccine hesitancy. *Nature Human Behaviour*, *1*(12), 873-880. https://doi.org/10.1038/s41562-017-0256-5

Bass, R. V. (1997). The purpose of education. *The Educational Forum*, *61*(2), 128–132. https://doi.org/10.1080/00131729709335242

Berliner, D. C. (1992). Telling the stories of educational psychology. *Educational Psychologist*, *27*(2), 143-161. https://doi.org/10.1207/s15326985ep2702_2

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.

Briceño, E. (2015, November 16). Growth mindset: Clearing up some common confusions. *KQED: Mindshift.* https://www.kqed.org/mindshift/42769/growth-mindset-clearing-up-some-common-confusions

Brock, A., & Hundley, H. (2016). *The growth mindset coach: a teacher's month-by-month handbook for empowering students to achieve*. Simon & Schuster.

Brossard, D., Scheufele, D. A., Kim, E., & Lewenstein, B. V. (2009). Religiosity as a perceptual filter: Examining processes of opinion formation about nanotechnology. *Public Understanding of Science*, *18*(5), 546-558. https://doi.org/10.1177/0963662507087304

Bryan, C. J., Yeager, D. S., & Hinojosa, C. P. (2019). A values-alignment intervention protects adolescents from the effects of food marketing. *Nature Human Behaviour, 3*(6), 596-603. https://doi.org/10.1038/s41562-019-0586-6

Bucchi, M. (2008). Of deficits, deviations and dialogues: Theories of public communication of science. *Handbook of Public Communication of Science and Technology*, 71-90).

Burgasser, A. J. (2019). Why I teach growth mindset. *Nature Astronomy*, *3*(12), 1038-1040. https://doi.org/10.1038/s41550-019-0940-7

Burgoyne, A. P., Hambrick, D. Z., & Macnamara, B. N. (2020). How firm are the foundations of mind-set theory? The claims appear stronger than the evidence. *Psychological Science*, *31*(3), 258–267. https://doi.org/10.1177/0956797619897588

Bursztyn, A. (2004). Working on the future: Concluding thoughts. In *Teaching teachers: Building a quality school of urban education* (Vol. 1–3).

Buttrick, N. (2020, August 8). False growth mindsets negatively impact student beliefs and performance. https://doi.org/10.31219/osf.io/vbrsc

Chase, C. I. (1998). A chat room—Educational psychologists but no curriculum methodologists?. *Educational Psychology Review*, *10*(2), 239-248.

Clegg, S., & Rowland, S. (2010). Kindness in pedagogical practice and academic life. *British Journal of Sociology of Education*, *31*(6), 719–735. https://doi.org/10.1080/01425692.2010.515102

Dempster, F. N. (1988). The spacing effect: A case study in the failure to apply the results of psychological research. *American Psychologist*, *43*(8), 627. https://doi.org/10.1037/0003-066x.43.8.627

Denworth, J. (2019). Debate arises over teaching "growth mindsets" to students. *Scientific American*. https://www.scientificamerican.com/article/debate-arises-overteaching-growth-mindsets-to-motivate-students

Dunk, R. D., Barnes, M. E., Reiss, M. J., Alters, B., Asghar, A., Carter, B. E., ... & Wiles, J. R. (2019). Evolution education is a complex landscape. *Nature Ecology & Evolution*, *3*(3), 327-329. https://doi.org/10.1038/s41559-019-0802-9

Dweck, C. S. (1986). Motivational processes affecting learning. *American Psychologist*, *41*(10), 1040. https://doi.org/10.1037/0003-066x.41.10.1040

Dweck, C. S. (2006). *Mindset: The new psychology of success*. Random House Digital, Inc.

Dweck, C. S. (2014). *The power of believing that you can improve*. TED. https://www.ted.com/talks/carol_dweck_the_power_of_believing_that_you_can_improve/discussion

Dweck, C. S. (2015). Carol Dweck revisits the growth mindset. *Education Week*, *35*(5), 20–24. https://www.edweek.org/leadership/opinion-carol-dweck-revisits-the-growth-mindset/2015/09

Dweck, C. S. (2016, January 13). What having a "growth mindset" actually means. *Harvard Business Review*. https://hbr.org/2016/01/what-having-a-growth-mindset-actually-means

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. https://doi.org/10.1037/rev0000082

Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological Review*, *95*(2), 256. https://doi.org/10.1037/0033-295x.95.2.256

Dweck, C. S., & Yeager, D. S. (2019). Mindsets: A view from two eras. *Perspectives on Psychological Science*, *14*(3), 481–496. https://doi.org/10.1177/1745691618804166

Feinstein, N. W., & Waddington, D. I. (2020). Individual truth judgments or purposeful, collective sensemaking? Rethinking science education's response to the post-truth era. *Educational Psychologist*, *55*(3), 155-166. https://doi.org/10.1080/00461520.2020.1780130

Fendler, L. (2012). The magic of psychology in teacher education. *Journal of Philosophy of Education*, *46*(3), 332-351. https://doi.org/10.1111/j.1467-9752.2012.00865.x

Ganimian, A. J. (2020). Growth-mindset interventions at scale: Experimental evidence from Argentina. *Educational Evaluation and Policy Analysis*, *42*(3), 417-438. https://doi.org/10.3102/0162373720938041

Gardner, H., & Hatch, T. (1989). Educational implications of the theory of multiple intelligences. *Educational Researcher*, *18*(8), 4-10. https://doi.org/10.3102/0013189x018008004

Hansen, D. T. (2008). Values and purpose in teacher education. In Cochran-Smith, M., Feiman-Nemser, S., McIntyre, D. J., & Demers, K. E. (Eds.). (2008). *Handbook of research on teacher education: Enduring questions in changing contexts*., 10-26.

Hattie, J. (2017, June 28). Misinterpreting the growth mindset: Why we're doing students a disservice. *Education Week: Finding Common Ground*. https://blogs.edweek.org/edweek/finding_common_ground/2017/06/misinterpreting_the_growth_mindset_why_were_doing_students_a_disservice.html

Hattie, J., Hodis, F. A., & Kang, S. H. K. (2020). Theories of motivation: Integration and ways forward. *Contemporary Educational Psychology*, 101865. https://doi.org/10.1016/j.cedpsych.2020.101865

Hess, R. (2020). The 2020 RHSU edu-scholar public influence rankings. *Education Week*. https://blogs.edweek.org/edweek/rick_hess_straight_up/2020/01/the_2020_rhsu_edu-scholar_public_influence_rankings.html

Hey, V., & Leathwood, C. (2009). Passionate attachments: Higher education, policy, knowledge, emotion and social justice. *Higher Education Policy*, *22*(1), 101–118. https://doi.org/10.1057/hep.2008.34

Humphrey, N. (2004). The death of the feel-good factor? Self-esteem in the educational context. *School Psychology International*, *25*(3), 347-360. https://doi.org/10.1177/0143034304046906

Hurd, P. D. (1986). Issues in linking research to science teaching. *ERIC Clearinghouse for Science, Mathematics and Environmental Science Information Bulletin*, *l*, 2-6.

Kahan, D. (2010). Fixing the communications failure. *Nature*, *463*(7279), 296-297. https://doi.org/10.1038/463296a

Kincheloe, J. L. (2004). The bizarre, complex, and misunderstood world of teacher education. In *Teaching teachers: Building a quality school of urban education* (Vol. 3, pp. 1–49). Peter Lang New York.

Krahenbuhl, K. S. (2016). Student-centered education and constructivism: Challenges, concerns, and clarity for teachers. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, *89*(3), 97–105. https://doi.org/10.1080/00098655.2016.1191311

Kuhn, T. S. (2012). *The structure of scientific revolutions*. University of Chicago Press. (Original Work Published 1962).

Lewis, N. A., & Wai, J. (2021). Communicating what we know, and what isn't so: Science communication in psychology. *Perspectives on Psychological Science, 16*(6), 1242-1254 https://doi.org/10.1177/1745691620964062

Li, Y., & Bates, T. C. (2019). You can't change your basic ability, but you work at things, and that's how we get hard things done: Testing the role of growth mindset on response to setbacks, educational attainment, and cognitive ability. *Journal of Experimental Psychology: General*, *148*(9), 1640-1655. http://dx.doi.org/10.1037/xge0000669

Luong, K. T., Garrett, R. K., & Slater, M. D. (2019). Promoting persuasion with ideologically tailored science messages: A novel approach to research on emphasis framing. *Science Communication*, *41*(4), 488-515. https://doi.org/10.1177%2F1075547019862559

Mansfield, C. F., & Volet, S. E. (2010). Developing beliefs about classroom motivation: Journeys of preservice teachers. *Teaching and Teacher Education*, *26*(7), 1404-1415. https://doi.org/10.1016/j.tate.2010.04.005

McPartlan, P., Solanki, S., Xu, D., & Sato, B. (2020). Testing basic assumptions reveals when (not) to expect mindset and belonging interventions to succeed. *AERA Open*. https://doi.org/10.1177/2332858420966994

Midkiff, B., Langer, M., Demetriou, C., & Panter, A. T. (2017, July). An IRT analysis of the growth mindset scale. In *The Annual Meeting of the Psychometric Society* (pp. 163-174). Springer, Cham.

Moreau, D., Macnamara, B. N., & Hambrick, D. Z. (2019). Overstating the role of environmental factors in success: A cautionary note. *Current Directions in Psychological Science*, *28*(1), 28–33. https://doi.org/10.1177/0963721418797300

Morehead, K., Rhodes, M. G., & DeLozier, S. (2016). Instructor and student knowledge of study strategies. *Memory*, *24*(2), 257-271. https://doi.org/10.1080/09658211.2014.1001992

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. https://doi.org/10.1037/0022-3514.75.1.33

Murphy, P. K., & Alexander, P. A. (2000). A motivated exploration of motivation terminology. *Contemporary Educational Psychology*, *25*(1), 3–53. https://doi.org/10.1006/ceps.1999.1019

Nestor, A. L. (2017). *Investigating mindset theories: The implications for classroom instruction and professional development*. Doctoral dissertation, University of Pittsburgh.

Nisbet, M. C., & Scheufele, D. A. (2009). What's next for science communication? Promising directions and lingering distractions. *American Journal of Botany*, *96*(10), 1767-1778. https://doi.org/10.3732/ajb.0900041

Noddings, N. (1992). *The challenge to care in schools: An alternative approach to education* (2nd ed). Teachers College Press.

Patrick, S. K., & Joshi, E. (2019). "Set in Stone" or "Willing to Grow"? Teacher sensemaking during a growth mindset initiative. *Teaching and Teacher Education*, *83*, 156-167. https://doi.org/10.1016/j.tate.2019.04.009

Prinzing, M. M. (2020). Positive psychology is value-laden—It's time to embrace it. *The Journal of Positive Psychology*, 1-9. https://doi.org/10.1080/17439760.2020.1716049

Reincke, C. M., Bredenoord, A. L., & van Mil, M. H. (2020). From deficit to dialogue in science communication: The dialogue communication model requires additional roles from scientists. *EMBO reports*, *21*(9), e51278. https://doi.org/10.15252/embr.202051278

Rissanen, I., Kuusisto, E., Hanhimäki, E., & Tirri, K. (2018). Teachers' implicit meaning systems and their implications for pedagogical thinking and practice: A case study from Finland. *Scandinavian Journal of Educational Research*, *62*(4), 487–500. https://doi.org/10.1080/00313831.2016.1258667

Rissanen, I., Kuusisto, E., Tuominen, M., & Tirri, K. (2019). In search of a growth mindset pedagogy: A case study of one teacher's classroom practices in a Finnish elementary school. *Teaching and Teacher Education*, *77*, 204–213. https://doi.org/10.1016/j.tate.2018.10.002

Rustin, S. (2016, May 10). New test for 'growth mindset', the theory that anyone who tries can succeed. *The Guardian*. theguardian.com/education/2016/may/10/growth-mindset-research-uk-schools-sats

Schneider, J. (2014). *From the ivory tower to the schoolhouse: How scholarship becomes common knowledge in education*. Harvard Educational Publishing Group.

Schuetze, B. A., & Yan, V. X. (2021). Views of growth mindset in a southwestern school district. *Figshare*. https://doi.org/10.6084/m9.figshare.16913302

Sockett, H. (2008). The moral and epistemic purposes of teacher education. In Cochran-Smith, M., Feiman-Nemser, S., McIntyre, D. J., & Demers, K. E. (Eds.). (2008). *Handbook of research on teacher education: Enduring questions in changing contexts*., 45-65.

Sisk, V. F., Burgoyne, A. P., Sun, J., Butler, J. L., & Macnamara, B. N. (2018). To what extent and under which circumstances are growth mind-sets important to academic achievement? Two meta-analyses. *Psychological Science*, *29*(4), 549–571. https://doi.org/10.1177/0956797617739704

Sun, X., Nancekivell, S., Gelman, S. A., & Shah, P. (2021). Growth mindset and academic outcomes: a comparison of US and Chinese students. *npj Science of Learning*, *6*(1), 1-9. https://doi.org/10.17605/OSF.IO/37TUD

Thagard, P., & Findlay, S. (2010). Changing minds about climate change: Belief revision, coherence, and emotion. In *Belief revision meets philosophy of science* (pp. 329-345). Springer, Dordrecht. https://doi.org/10.1007/978-90-481-9609-8_14

Tucker, M. (2016, March 9). Why education research has so little impact on practice: The system effect. *Education Week*. https://www.edweek.org/education/opinion-why-education-research-has-so-little-impact-on-practice-the-system-effect/2016/03

Warne, R. T., & Burton, J. Z. (2020). Beliefs about human intelligence in a sample of teachers and nonteachers. *Journal for the Education of the Gifted*, *43*(2), 143-166. https://doi.org/10.1177/0162353220912010

Washburn, A. N., & Skitka, L. J. (2018). Science denial across the political divide: Liberals and conservatives are similarly motivated to deny attitude-inconsistent science. *Social Psychological and Personality Science*, *9*(8), 972–980. https://doi.org/10.1177/1948550617731500

Weisberg, D. S., Landrum, A. R., Metz, S. E., & Weisberg, M. (2018). No missing link: Knowledge predicts acceptance of evolution in the United States. *BioScience*, *68*(3), 212-222. https://doi.org/10.1093/biosci/bix161

Yeager, D. S. (2019, November 15). How to overcome the education hype cycle. *BOLD: Blog on Learning and Development*. https://bold.expert/how-to-overcome-the-education-hype-cycle/

Yeager, D. S., Hanselman, P., Walton, G. M., Murray, J. S., Crosnoe, R., Muller, C., Tipton, E., Schneider, B., Hulleman, C. S., Hinojosa, C. P., Paunesku, D., Romero, C., Flint, K., Roberts, A., Trott, J., Iachan, R., Buontempo, J., Yang, S. M., Carvalho, C. M., … Dweck, C. S. (2019). A national experiment reveals where a growth mindset improves achievement. *Nature*, *573*(7774), 364–369. https://doi.org/10.1038/s41586-019-1466-y

Yettick, H., Lloyd, S., Harwin, A., Riemer, A., & Swanson, C. B. (2016). Mindset in the classroom: A national study of K-12 teachers. *Editorial Projects in Education*.

Zengilowski, A., Schuetze, B. A., Nash, B. L., & Schallert, D. L. (2021). A critical review of the refutation text literature: Methodological confounds, theoretical problems, and possible solutions. *Educational Psychologist*, *56*(3), 175-195. https://doi.org/10.1080/00461520.2020.1861948

Zhang, L., Kirschner, P. A., Cobern, W. W., & Sweller, J. (2021). There is an evidence crisis in science educational policy. *Educational Psychology Review*. https://doi.org/10.1007/s10648-021-09646-1