Beliefs, Affordances, and Adolescent Development: Lessons from a Decade of Growth Mindset Interventions

To appear in J. Lockman (Ed.), *Advances in Child Development and Behavior*

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Acknowledgements:
Research reported in this chapter was supported by the National Institutes of Health under award number R01HD084772, the National Science Foundation under grant number 1761179, the William T. Grant Foundation under grant 189706, the Bill and Melinda Gates Foundation under grant numbers OPP1197627 and INV-004519, the UBS Optimus Foundation under grant number 47515, and an Advanced Research Fellowship from the Jacobs Foundation to David S. Yeager. This research was also supported by grant, P2CHD042849, Population Research Center, awarded to the Population Research Center at The University of Texas at Austin by the Eunice Kennedy Shriver National Institute of Child Health and Human Development. Cameron A. Hecht is supported by the National Science Foundation Postdoctoral Research Fellowship under grant number 2004831. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health, the National Science Foundation, and other funders.

Abstract

Beliefs play a central role in human development. For instance, a *growth mindset*—a belief about the malleability of intelligence—can shape how adolescents interpret and respond to academic difficulties and how they subsequently navigate the educational system. But do usually-adaptive beliefs have the same effects for adolescents regardless of the contexts they are in? Answering this question can reveal new insights into classic developmental questions about continuity and change. Here we present the Mindset × Context framework and we apply this model to the instructive case of growth mindset interventions. We show that teaching students a growth mindset is most effective in educational contexts that provide *affordances* for a growth mindset; that is, contexts that permit and encourage students to view ability as developable and to act on that belief. This evidence contradicts the "beliefs alone" hypothesis, which holds that teaching adolescents a growth mindset is enough and that students can profit from these beliefs in almost any context, even unsupportive ones. The Mindset × Context framework leads to the realization that in order to produce more widespread and lasting change, we must complement the belief-changing interventions that have been aimed at students with new interventions that guide teachers toward classroom policies and practices that allow students' growth mindset beliefs to take root and yield benefits.

Keywords: Adolescence, beliefs, growth mindset, affordances, intervention, education

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1. Introduction

From infancy, our beliefs (i.e., schemas, lay theories, or mindsets) occupy an interesting space between our past and future selves. Beliefs are our packaged mental representations of the world as we experienced it (see Dweck, 2017), but they also shape how we engage with the world going forward—how we interpret what happened, what we expect to happen next, and which actions make sense in light of our interpretations. And yet our beliefs do not make us oblivious to reality, even as they narrow our vision, because we must decide when and how to act on them. Thus, beliefs are an effect of our socializing environments on the one side and a cause of our future development on the other (see Olson & Dweck, 2008), yet still dependent on our contexts. In the present chapter we explore the implications of these observations for understanding the different effects of beliefs in different contexts during adolescence.

We focus in particular on the possibility that adolescents depend on the *affordances* in their environments to invite them to act on their beliefs. The term affordances refers to what the environment "*offers*…, what it *provides* or *furnishes*, either for good or ill" (Gibson, 1977, p. 127). Originally, affordances were thought of as physical possibilities in a context, e.g., a sidewalk affords walking along a certain path. But affordances can also refer to the psychological possibilities in a context—the beliefs and behaviors that are permitted or invited by the local opportunity structure or ideology (e.g., Barends et al., 2019; Diekman et al., 2010; Reis, 2008; Steele & Sherman, 1999; Walton & Yeager, 2020; Zambrano et al., 2020; Zebrowitz & Collins, 1997). As we will see, a teacher's classroom culture can hold affordances that support a belief in a better future, or not. The aim of this chapter is to set the stage for a more thorough

understanding of how adolescents' beliefs and behaviors may be constrained or facilitated by contextual affordances.

1.1. Historical Background

The theme of continuity and change in beliefs and action has a long history in developmental science (see Gopnik, 2012; Wellman & Gelman, 1992), dating back at least to Jean Piaget, who described the belief systems that organized children's understanding of their environments (see Flavell, 1963). Piaget observed that children's beliefs were sometimes stubbornly resistant to environmental input, as they assimilated new information into an existing mental architecture but did not change it significantly. Other times, children's beliefs underwent rapid transformation as children accommodated, or changed, their schemas in the face new information, which in turn produced swift and enduring changes in judgment and behavior.

Over the years, developmental scientists in the social-cognitive tradition (see Olson & Dweck, 2008) have expanded on the theme of continuity and change in beliefs in key social domains, including research on mental models of the caregiver relationship (Bretherton & Munholland, 2008; Johnson et al., 2007), hostile attribution biases (Dodge & Coie, 1987), normative beliefs about aggression (Huesmann & Guerra, 1997), group-based stereotyping (Diesendruck, 2021; Diesendruck & haLevi, 2006; Goudeau & Cimpian, 2021; Levy & Dweck, 1999; Mulvey et al., 2010), and more. In each domain, researchers have identified environments, such as harsh or inconsistent parenting, persistently threatening peer groups, or subtle linguistic or behavioral cues, that have left their impression on emerging beliefs. Children's belief systems have then carried forward the effect of past lived experiences, going on to predict outcomes such as internalizing symptoms, reactive or proactive aggression, group-based discrimination, or loss of motivation. More interesting still, in each of these domains, belief systems have been

amenable to changes later on. In some cases, interventions that target beliefs (hereafter "belief-change interventions") have shifted long-term developmental trajectories (Bai et al., 2020; Dodge et al., 2017), confirming the causal status of beliefs.

In the last decade or so, there has been a resurgence of interest in beliefs and their interactions with environmental contexts among scientists working at the intersection of developmental, social, and personality psychology (see Dweck, 2017). This new research has continued to delve into the ontogeny of beliefs (e.g., Goudeau & Cimpian, 2021), but it has also come to examine the developmental contexts that permit children to act on their already-formed beliefs. Underlying this resurgence of interest has been an evidence base of longitudinal studies testing the effects of shorter and more-targeted belief-change interventions. Examples include beliefs about the nature of intelligence and ability, the normative process of adjusting to college, or the value of learning (for reviews, see Harackiewicz & Priniski, 2018; Walton & Wilson, 2018; Yeager & Walton, 2011). When these interventions have been delivered at turning points in a young person's life, such as a moment of vulnerability or threat, or on the precipice of a major life decision, then beneficial effects on consequential developmental outcomes have often been surprisingly long-lasting (e.g., Binning et al., 2020; Hecht, Harackiewicz, et al., 2019; Murphy et al., 2020; Okonofua et al., 2016; Walton et al., 2015; Walton & Cohen, 2011; for a review, see Hecht, Priniski, et al., 2019).

Belief-change interventions in this recent tradition can be distinguished in part by their brevity and low cost. This has allowed them to be delivered in very large randomized trials conducted in many different contexts. As a result, there is now a growing body of evidence concerning the developmental contexts that interact with beliefs when predicting outcomes.

This newer research can bear on two hypotheses about the effects of beliefs, which are

discussed in this chapter. The first is the "*beliefs alone*" hypothesis, which posits that people can adopt new beliefs, and then implement them and benefit from them in almost any context. In this view, a belief is like an asset that can be used to compensate for prior risk factors regardless of the context. The second is the "*beliefs + supportive context*" hypothesis, which proposes that the effects of individuals' newly adopted beliefs depend on affordances—the cues or features of the context that permit or encourage individuals to internalize and act on their new beliefs. In this view, a belief is more like a readiness to make a situational appraisal, but a person must still be invited by the environment to call forth the belief and make it applicable to a given problem.

Interestingly, emerging evidence is beginning to support the *beliefs + supportive context* hypothesis. This has brought to the foreground new research questions, such as: When and how does the promotion of usually-adaptive beliefs translate into better trajectories? When do they fail to do so? And how can belief-change interventions be optimized in the future to achieve policy aims such as reducing inequality? These questions represent a new flavor of the debate about continuity and change in beliefs, one pertaining to contexts that permit or support action, rather than solely the development or updating of beliefs. In this chapter, we begin to answer these new questions by drawing on the emerging and exciting intervention literature.

1.2. Overview of this Chapter

In this chapter we first draw on the results of large multi-site randomized trials that address questions about how social contexts can support or undermine the beliefs promoted by an intervention (e.g., Rege et al., 2020; Walton et al., 2021; Yeager et al., 2019, 2021). Building on this literature, we develop the *Mindset × Context* framework, which can interpret emerging evidence and guide the next generation of research on belief-*supporting* interventions, to complement the established belief-*changing* interventions. We illustrate these points throughout

with the case study of growth mindset intervention effects interacting with teachers' own mindsets and the classroom cultures teachers create (also see Dweck & Yeager, 2019; Yeager et al. 2021).

1.3. A Focus on "Wise Interventions"

One of the best ways to understand the role of beliefs in development is to examine studies that changed beliefs using random-assignment experiments. In these studies, both "groups," the experimental and the control groups, started at exactly the same place, but one was exposed to a new belief-inducing stimulus—the intervention. This is often preferable to examining naturally-occurring beliefs, because if we had divided people into groups on the basis of their existing beliefs, we could not assume that the groups were equivalent in other ways.

Therefore, we focus here primarily on what are called "wise" interventions. These are interventions that are known to *change* people's beliefs (or "mindsets") in adaptive ways and to set in motion new trajectories of behavior and outcomes (see Harackiewicz & Priniski, 2018; Walton, 2014; Walton & Wilson, 2018).

How can wise interventions change long-standing beliefs—even those acquired through years of socialization—in a relatively short period of time? They are effective, in part, because they utilize established principles of attitude and behavior change derived from social-psychological theory to instill new beliefs (see Walton & Wilson, 2018; Yeager & Walton, 2011). These include support for autonomy (Deci & Ryan, 2000), internalization through self-persuasion (E. Aronson, 1968), the use of descriptive social norms (Cialdini & Goldstein, 2004; McDonald & Crandall, 2015; Sherif, 1936), and capitalizing on source credibility (Cialdini, 1984; Cialdini & Goldstein, 2004; Hovland & Weiss, 1951; Petty & Cacioppo, 1986). In short, many wise interventions, instead of preaching to adolescents about what they should think or do:

(1) ask participants to personally advocate for the desired change, thereby supporting autonomy while fostering belief and behavior change (E. Aronson, 1999; Higgins & Rholes, 1978), (2) provide information about norms that is consistent with the proffered belief or behavior, and (3) provide testimonials from credible sources, such as other adolescents who have benefitted from the relevant belief or behavior change.

Table 1. *Examples of studies that assess contextual moderators of wise interventions.*

Intervention	Description	Evidence of Contextual Heterogeneity
Growth mindset intervention	The intervention teaches students the "growth mindset": the belief that intelligence and academic ability can be grown with well-invested effort. The intervention is theorized to promote adaptive approaches to learning and positive learning outcomes.	The intervention had effects on 9th grade students' math grades when their teacher reported more of a growth mindset (Yeager et al., 2021). The intervention had stronger effects on at-risk (i.e., low performing) 9th grade students' grade point averages (GPAs) when the school's peer norms supported challenge seeking (Yeager et al., 2019).
Social belonging intervention	The intervention teaches students who are transitioning to a new academic context the belief that concerns about fitting in are common, normal, and tend to dissipate with time. The intervention is theorized to reduce uncertainty about belonging (e.g., the thought that "people like me don't belong here") and promote better adjustment and academic outcomes.	The intervention had stronger effects on first-year college students' gains in full-time first-year completion rates in schools where students from the same demographic group (who did not receive the intervention) tended to experience greater belonging by the end of the first year (Walton et al., 2021).
Purpose intervention	The self-transcendent purpose for learning ("purpose") intervention promotes the belief in students that they can use their education to not only advance their personal goals, but also to impact something beyond themselves (e.g., family, community, society). The intervention is theorized to increase students' engagement with school and diligence in learning tasks by connecting learning with important personal and social goals.	The intervention had stronger effects on academically at-risk (i.e., non-native-English speaking) middle-school students' performance on a writing assignment when their teacher described the assignment as an opportunity to work toward purposeful future goals (Reeves et al., 2020).

Do wise interventions work the same for all people in all contexts? They do not, even though the predicted effects are replicable and theoretically-motivated (for reviews, see

Harackiewicz & Priniski, 2018; Walton & Wilson, 2018; Yeager & Walton, 2011). The heterogeneity in effects of these interventions is a primary source of the theorizing in this chapter. A preview of the evidence reviewed in this chapter appears in Table 1.

1.4. A Focus on Adolescents

Why focus on adolescents when beliefs are consequential at every stage of development (see Dweck, 2017; Gopnik & Wellman, 2012; Wellman & Gelman, 1992)? First, adolescence is a period during which beliefs may cohere into more overarching meaning systems that yield more persistent individual differences in behavior, rather than existing as loosely affiliated concepts (Gelman et al., 2007). This means that, during adolescence, changes in beliefs may be more likely to have behavioral effects that transfer across situations and over time.

Second, adolescence is, in the U.S., a period of transition (Benner, 2011). Adolescents often change between institutions (e.g., from middle school to high school) and must adjust to their new contexts, for instance to new levels of academic rigor, or to new peer groups. Beliefs can change motivation during these transitions because they change how adolescents interpret and respond to novel and difficult aspects of their institutional arrangements.

The third reason for focusing on adolescents is purely pragmatic. Relative to younger children, adolescents are usually better able to self-administer web-based interventions. They have better reading skills and they can more easily understand abstract analogies and metaphors that drive home the belief-change arguments. These facts mean that adolescent belief-change interventions can be efficient and scalable, and can thus be administered in a large enough sample of diverse contexts to permit studying cross-context heterogeneity of effects.

1.5. A Motivating Case: Growth Mindset Interventions

Many beliefs are consequential for adolescent development and have been changed with

wise interventions. Here we narrow our focus to consider the last decade or so of *growth mindset* intervention studies to develop theories about the possible interactions between belief changes and social contexts. As appropriate, we also draw on emerging findings from the other interventions summarized in Table 1 (i.e., belonging and purpose interventions).

What is a growth mindset intervention? The mindset intervention teaches the *growth mindset* belief that people's intellectual abilities are malleable and can be developed through hard work, good strategies, and help from others. It contradicts the *fixed mindset* belief that intelligence cannot be changed (Blackwell et al., 2007; Good et al., 2003; Paunesku et al., 2015). In doing so the intervention has impacted academically-relevant outcomes, such as grades (e.g., Blackwell et al., 2007; Yeager et al., 2016, 2019, 2021), achievement test scores (e.g., Good et al., 2003), full-time enrollment status in college (Yeager, Walton, et al., 2016), and advanced high school course taking (e.g., Rege et al., 2020; Yeager et al., 2019). For example, the U.S. National Study of Learning Mindsets (NSLM) used a pre-registered study design with a nationally-representative sample to show that a short online (< 1 hour) growth mindset intervention (which taught students the notion that intelligence is not fixed but can be developed) had an effect on the grades of lower-achieving students and, across achievement levels, on the taking of advanced math a year later (Yeager et al., 2019).

Why do we use the growth mindset as a case study for the present analysis? First, the basic intervention effects on academic performance for at-risk groups (e.g., Blackwell et al., 2007; Good et al., 2003; Yeager et al., 2016, 2019) have been replicated in pre-registered studies (Yeager et al., 2016, 2019) and verified in independent analyses (Zhu et al., 2019). This means that an analysis of how the effects varied across contexts cannot be dismissed by concerns that

one is chasing statistical noise around a truly null effect.[1]

Next, there is rigorous evidence of theoretically-informative moderation of effects across school and classroom contexts (Rege et al., 2020; Yeager et al., 2019, 2021). Notably, past multi-site trials ruled out more mundane reasons for variation in effects across contexts—such as poor study implementation or insufficient tailoring of the intervention content to the population.

Finally, there is a growing evidence base that teachers can create classroom cultures that are consistent (or inconsistent) with growth mindset beliefs, and that this can affect students' perceptions of or reactions to the context (see Canning et al., 2019; Heyder et al., 2020; Kroeper, Muenks, et al., 2021; LaCosse et al., 2020; Leslie et al., 2015; Meyer et al., 2015; Muenks et al., 2020). This perspective on how classroom characteristics communicate consistency with the growth mindset can guide hypotheses about how effects of the growth mindset intervention may depend on context. In summary, a focus on growth mindset can illustrate the value of a new framework about the interactions between individuals' beliefs and the contexts they inhabit.

2. Review of Growth Mindset Interventions

2.1. Growth Mindset Beliefs and Meaning Systems

Are students' growth (and fixed) mindsets isolated beliefs? No, these mindsets form *meaning systems* that include goals, attributions, and other beliefs, such as beliefs about effort (see Crum, 2020; Dweck & Yeager, 2019; Molden & Dweck, 2006, for reviews). That is, mindsets inform how a person makes meaning of themselves and their environments: what should I try for? Why did that failure occur? Is effort a good thing or a bad thing?

Individuals in more of a growth mindset, relative to those in more of a fixed mindset, tend to pursue goals of learning (rather than avoiding looking incompetent), attribute their

[1] For a summary of critiques about growth mindset and our responses to them, see Yeager & Dweck (2020).

failures to controllable factors such as effort and strategies (rather than to fixed low ability), and believe that they will improve if they invest effort into learning (Dweck & Yeager, 2019; Yeager & Dweck, 2020). In turn, these adaptive goals, attributions, and beliefs predict students' academic behavior and their achievement in school (Dweck & Yeager, 2019; Molden & Dweck, 2006; Robins & Pals, 2002; Figure 1).

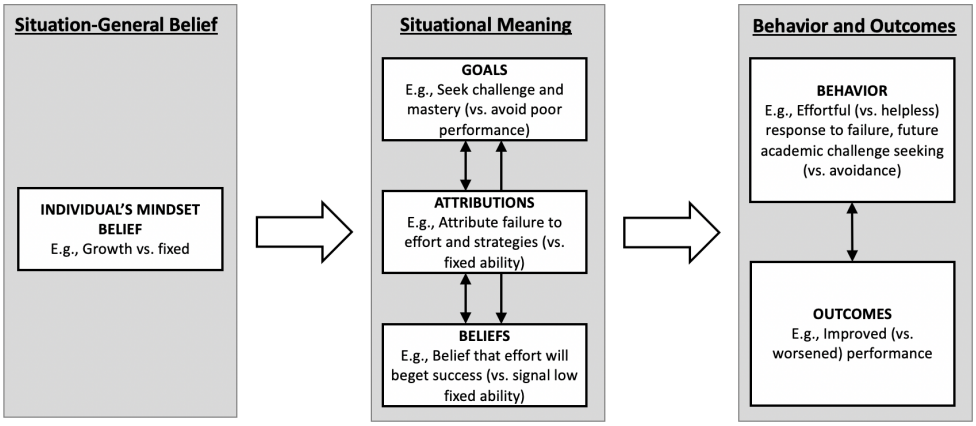

Figure 1. Schematic representing how students' mindset beliefs affect meaning systems within a context, and thus affect their behavior and outcomes.

2.2. Background on Direct-to-Student Growth Mindset Interventions

As we have noted, growth mindset interventions seek to shift adolescents away from fixed mindset beliefs and toward growth mindset beliefs. What does the intervention teach, and how does it do it?

Although there have been several versions of the intervention over the years, one of its most consistent features is its use of a memorable metaphor that the "brain is like a muscle" that gets stronger and makes new connections when you persevere on hard tasks and overcome challenges. In addition, the intervention gives recipients an active role by asking them to reflect on how the message applies to their own lives or the lives of peers (*saying-is believing*; see E. Aronson, 1999; Higgins & Rholes, 1978; Walton, 2014; Wilson, 2011). We call this a "direct-to-student" intervention because, simply stated, it seeks to instill a growth mindset directly in

students. This is in contrast to context-level interventions, such as teacher professional development programs, which seek to affect students indirectly by changing the school and teacher/classroom context. Later we return to the question of how teacher-focused interventions may interact with direct-to-student ones.

In early studies, the direct-to-student growth mindset intervention was delivered to students in person by trained personnel across multiple sessions. The intervention showed the potential to improve African American college students' grades (J. Aronson et al., 2002), as well as middle school students' achievement test scores (Good et al., 2003) and math grades (Blackwell et al., 2007). Paunesku and colleagues (2015) adapted that intervention so that it could be delivered in a short, online format. This version of the intervention was tested among U.S. high school students and showed a significant effect on lower-achieving students' end-of-term grades. Not surprisingly, this briefer intervention had a smaller effect than the iterations tested in earlier studies, but the online format opened the possibility for testing at scale. Yeager, Romero, and colleagues (2016) then used qualitative methods and iterative experiments to revise and improve the online intervention. The researchers tested this revised intervention among high-school students and found stronger effects than the earlier iteration of the online intervention.

Then, Yeager and colleagues (2019) tested the final version of the online growth mindset intervention in the NSLM, a nationally-representative sample of 12,490 9th grade students in the United States. The intervention was quite successful in instilling the growth mindset belief, regardless of student and context characteristics, and had a significant overall effect on lower-achieving students' course grades (GPA) (Yeager et al., 2019). Exploratory analyses also revealed positive effects, across achievement levels, on students' advanced math course taking.

In summary, there is now a standardized intervention for directly instilling a growth

mindset in students and improving achievement in population-scale studies. But, of course, no intervention has the same effects for all people in all contexts. Differences between students, classrooms, and schools predicted the degree to which students put the intervention's lessons into practice. We developed the Mindset × Context framework to understand this heterogeneity.

3. The Mindset × Context Framework for Understanding Intervention Effect Heterogeneity

The Mindset × Context framework guides specific predictions about where and for whom belief-change interventions should be effective, and where they might not improve outcomes. The framework integrates theories of motivation and behavior change that underlie wise interventions (Cohen & Sherman, 2014; Walton & Wilson, 2018; Yeager & Walton, 2011), sociological theories of education and lifespan development (Carroll & Muller, 2018; Crosnoe & Muller, 2014), and dominant models of policy evaluation studies (Weiss et al., 2014).

Prior to seeing the data from multi-site trials, we considered two competing ways in which belief-change interventions might interact with the context. On the one hand, and as we indeed found, we thought it was plausible that these interventions would have stronger effects in contexts with more *affordances* for the relevant belief and its associated behavior (which would be consistent with the beliefs + supportive context hypothesis). This possibility is grounded in the cues hypothesis (Murphy et al., 2007), which proposes that people actively look to situational cues when deciding whether their beliefs or behaviors are legitimate or adaptive in a given setting. Evidence for the importance of affordances would be a *positive* interaction between a direct-to-student growth mindset intervention and the growth mindset culture in classrooms or schools.

On the other hand, we thought that the opposite pattern of results might be found: perhaps a supportive context would lead to smaller estimated effects of a growth mindset intervention.

Perhaps students in supportive contexts, because of favorable teacher practices, already had more of a growth mindset and already were taking on challenging learning tasks and dealing well with setbacks. Perhaps students in unsupportive contexts were the ones most in need of the growth mindset perspective that was absent from their classrooms and would benefit most from receiving a direct-to-student intervention that encouraged a growth mindset. That is, the student mindset intervention could compensate for an unsupportive classroom climate. The empirical support for this hypothesis would be a *negative* interaction between a direct-to-student growth mindset intervention and classrooms' or schools' growth mindset cultures. Such a result would suggest a model of a student who can implement their mindset in any context, even an unsupportive one.

As we have foreshadowed, the evidence has been consistent with the former possibility. Studies have found positive interactions between student interventions and contextual supports; that is, these interventions have had stronger effects in more supportive contexts. The full Mindset × Context framework, depicted in Figure 2, incorporates this positive interaction into a broader model of how the effects of a direct-to-student intervention can be modified by individual and contextual factors.

The key takeaway from the framework is that belief-change interventions should have stronger effects when students (1) take up the intervention message, (2) are at risk for poor outcomes (for example, due to a history of lower performance), (3) are in a context that provides opportunities to act on the resulting change in beliefs, and (4) especially, are in a context that actively supports them in adopting and acting on their new beliefs.

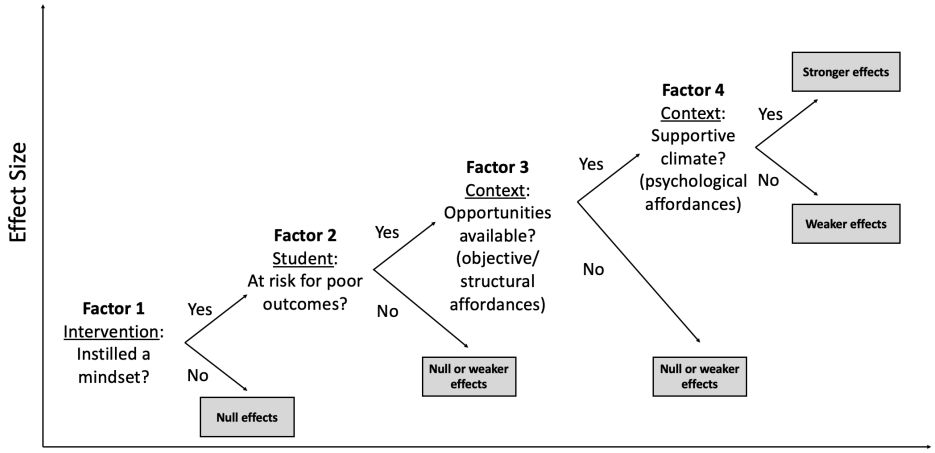

Figure 2. The Mindset × Context framework of direct-to-student intervention effect heterogeneity, depicted as a decision tree predicting the magnitude of intervention effects depending on individual and contextual factors. Adapted from Yeager and Dweck (2020).

3.1. Individual and Contextual Moderators of Intervention Effects

Factor 1: Instilling the targeted mindset. A direct-to-student mindset intervention must first successfully instill the targeted mindset (see Weiss et al., 2014). An intervention may only instill the mindset to the degree that it is well-designed and psychologically attuned to its intended population (Harackiewicz & Priniski, 2018; Yeager & Walton, 2011), if it is implemented with fidelity (Hulleman & Cordray, 2009), and if the mindset has not already been instilled in the population within the context. Ideally, an intervention would instill a mindset homogeneously, as was the case with the NSLM (see Yeager et al., 2019). However, in some cases, features of the context could prevent an intervention from instilling its message, such as when schools do not have working computers or internet to access a web-based intervention, or if poor implementations of the intervention message have already been communicated to students in ways that may undermine the intervention arguments. In other cases, uptake of the intervention may depend on students' psychological characteristics or local cultural contexts that make them more or less sensitive to the message (see Yeager & Walton, 2011).

Factor 2: Student risk for poor outcomes. Once the intervention has instilled the

mindset, effects are expected to be the strongest among students who are at risk of showing poor outcomes for a given measure. Indeed, most wise interventions have shown stronger effects for students who are more at-risk of poor performance on the relevant outcome (e.g., Harackiewicz et al., 2016; Murphy et al., 2020; Okonofua et al., 2016, 2020; Reeves et al., 2020; Stephens et al., 2014; Walton et al., 2015; Walton & Cohen, 2007, 2011; Williams et al., 2020; Yeager et al., 2016, 2019). One reason for this is that students who are already doing well do not have as much room to improve. Further, in line with resource-substitution theory from sociology (Ross & Mirowsky, 2006), among students who were not previously provided the psychological "resource" of a growth mindset by their socializing environments, the intervention may serve as an alternative source of this factor and can help students improve their learning (also see Olson & Dweck, 2008).

Factor 3: Objective/structural affordances in the context. Next, an intervention's effects depend on whether the context provides objective (structural) affordances. Objective/structural affordances are defined as opportunities for students to alter their choices and behaviors as a result of changes in their psychology (see Bryan et al., in press). For example, an intervention to motivate voter turnout cannot work if people's names have been removed from voter registration rolls.

The strongest evidence of objective/structural moderators of the growth mindset intervention comes from the U-say study, a randomized controlled trial conducted with all but one of the 50 high schools in the two largest counties of Norway (Rege et al., 2020). In this study, the growth mindset intervention positively affected high-school students' mathematics course taking decisions. However, the effect was much stronger in school districts with flexible academic tracks that made it easier for students to choose their math course after the intervention

than in districts that made it difficult to switch math courses.[2]

We note that belief-change interventions may be most effective when they point students toward the existing objective/structural affordances in the environment. For example, Murphy and colleagues (2020) took objective affordances into account when customizing a prior social-belonging intervention (initially designed for an elite university context) for a broad-access institution. The intervention was adapted to highlight existing resources to cope with barriers to belonging within the context and increased enrollment for the at-risk group over two years.

Factor 4: "Psychological" affordances in the context. Finally, and perhaps most interestingly, an intervention's effects may depend on the psychological affordances of the context (see Walton & Yeager, 2020). As noted, psychological affordances are the characteristics of the environment that lead an individual to see a particular belief as a valid and useful guide to behavior in the context.

Psychological affordances therefore have at least two characteristics that may explain their effects. First, the context may be perceived to support (or refute) the validity or legitimacy of the belief within the context. For example, if a teacher consistently implies that students' abilities are fixed—some are smart and others are not—students will be unlikely to see this classroom as one in which the growth mindset applies. Second, the context can affect whether the behaviors that follow from a belief are useful or beneficial to the individual in that context, thereby affecting whether individuals are motivated to act on their belief. For example, students may be more likely to exert effort in a class where they get points for improvement, and less likely to do so in a peer culture in which working hard can negatively affect one's social status.

[2] Additional evidence of moderation by objective/structural affordances comes from research by Jia et al. (2021) which found that the effects of growth mindset beliefs on student achievement depended on the educational mobility in countries (Study 1) and learning situations (Study 2), though mindset was measured rather than manipulated.

Evidence of psychological affordances in the case of growth mindset interventions comes chiefly from the nationally-representative NSLM experiment. At the classroom level, the growth mindset intervention had a positive effect on students' grades in math when their teachers reported more of a growth mindset, but it had no effect when their teachers reported more of a fixed mindset (Yeager et al., 2021). This suggests that the growth mindset message may have felt more applicable to students' math classes when their teachers reinforced the idea that students could improve at math and provided opportunities for them to demonstrate their progress (for a case study, see Schmidt et al., 2015). At the school level, the growth mindset intervention had a positive effect on course grades for lower-performing students, but primarily when peer norms in the school were consistent with the type of challenge-seeking behavior promoted by the intervention message (Yeager et al., 2019). Students in the low-norm contexts may have been reluctant to act on growth mindset beliefs when their peers did not support growth mindset behaviors.

Recent studies also show evidence of psychological affordances as moderating the effects of other, related wise interventions: social-belonging and purpose (see Table 1). Researchers from the College Transition Collaborative (Walton et al. 2021) tested a social-belonging intervention among incoming students at 21 diverse colleges (N = 26,406). In a pre-registered analysis, they found larger improvements in full-time first-year completion among students whose demographic groups experienced greater levels of belonging throughout their first year of college without receiving the treatment (i.e., contexts that provided more support for these students' belonging). In psychologically supportive contexts, the belonging intervention's message presumably felt "truer" to them.

In a double-blind randomized experiment with 321 middle-school students, Reeves and

colleagues (2020) found that a purpose intervention (see Table 1) had stronger effects on students' performance on a writing assignment when it was accompanied by an affordance: a note from their teacher describing the assignment as an opportunity to develop their skills, which could help them achieve purposeful goals in the future. The treatment changed behavior when the teacher afforded students' belief that they could pursue their purposes in a given classroom on a given assignment. In other words, encouraging a self-transcendent purpose for learning was more effective when teachers provided psychological affordances for the intervention message.

Zeroing in on the classroom. The evidence reviewed above suggests that the classroom culture plays an important role in affording (or undermining) students' growth mindset beliefs. Yet there are many open questions about how teachers actually create supportive classroom cultures, setting the stage for students' mindsets to flourish. For the rest of this chapter, we focus on the role of teachers in creating classroom cultures and we frame the issues in a way that we hope can guide future research.

4. How do Teachers Provide Psychological Affordances for the Growth Mindset?

How can teachers use their influence in the classroom to create a culture of psychological affordances for students' growth mindset beliefs? In this section, we use affordances as a lens to review recent research on the practices, policies, and language teachers use that may lead students to apply their growth mindset beliefs in the classroom. Then we propose an agenda to launch a program of intervention research motivating and empowering teachers to create more growth-mindset-supportive classroom cultures.

4.1. Teacher Practices, Policies, and Language that May Afford the Growth Mindset

Compared to physical affordances—which are tangible characteristics of the environment (Gibson, 1977)—psychological affordances may be more difficult for the individual to perceive

or interpret (i.e., imbue with meaning). Therefore, to understand how teachers' actions can create affordances for the growth mindset, we must consider what makes these actions (a) visible to students and (b) minimally ambiguous in their meaning.

Not surprisingly, interventions that increase the *visibility* of affordances have been found to increase perceptions of these affordances. For example, describing the prosocial uses of STEM material in textbook excerpts was found to increase perceptions of the communal affordances of STEM careers (Brown et al., 2015; Zambrano et al., 2020). Regarding *ambiguity*, in one study, college students found it more difficult to categorize instructors' statements and teaching practices as consistent with a growth mindset (vs. fixed mindset) when instructors' motives for those practices were ambiguous and not explicitly stated (Kroeper, Fried, et al., 2021).

Given these two characteristics of psychological affordances, a recent body of research on the teacher practices, policies, and language that lead students to perceive their instructors' mindset beliefs can be instructive (Canning et al., 2019; Kroeper, Fried, et al., 2021; Kroeper, Muenks, et al., 2021; LaCosse et al., 2020; Muenks et al., 2020). These teacher practices can make a teacher's mindset visible and clear, and therefore allow a student's growth mindset to seem legitimate, rewarded, and actionable.

Research on teachers' mindset beliefs and related practices to date has mostly been conducted in college settings. In one study, college STEM instructors' mindset beliefs were found to be associated with the size of the racial/ethnic achievement gaps in their courses (Canning et al., 2019). In another study, students' perceptions of their instructors' growth mindsets were associated with reduced psychological vulnerability in class (i.e., reduced evaluative concerns and increased belonging), which in turn predicted greater engagement,

interest, and course performance (Muenks et al., 2020). These findings point, broadly, to the leverage teachers have in shaping the growth mindset culture of their classrooms. This research has been extended in recent studies that identify categories of teacher practices that can support students' growth mindsets (Kroeper, Fried, et al., 2021; Kroeper, Muenks, et al., 2021). These practices are consistent with the principles of psychological affordances described above in that they visibly and unambiguously emphasize and reward student growth. As described below, these findings suggest how, specifically, teachers create affordances for the growth mindset.

How can growth-mindset-supportive practices be categorized? To develop a useful taxonomy, Kroeper, Muenks, and colleagues (2021) conducted focus groups in which they taught college students about the growth and fixed mindsets and then asked them whether they had encountered instructors who seemed to hold one of these two mindsets. The researchers then asked the students to generate examples of the teachers' behaviors and practices that indicated their mindset beliefs. These qualitative data yielded four distinct categories of practices that signal teachers' growth or fixed mindsets: (1) value placed on student learning and development, (2) explicit messages about progress and success, (3) responses to struggle, confusion, or poor performance, and (4) provision of opportunities for practice and feedback (see Table 2 for a summary).

Other research has confirmed that practices in these four categories are perceived as growth-mindset-supportive. Kroeper, Fried, and colleagues (2021) taught college students about the growth and fixed mindsets and asked them to categorize 119 specific teaching practices as growth or fixed. The authors found that whether practices aligned with the four categories surfaced by Kroeper, Muenks et al. (2021) significantly predicted the practices' categorization in the expected direction.

Thus, teachers' expressed value for student development, explicit messages about success, responses to struggle and failure, and provision of opportunities for practice and feedback capture important and distinct ways in which teachers can afford (or undermine) students' growth mindsets. Potential statements from teachers which would convey each of the four categories of practices appear in Table 2.

Table 2. *Categories of growth-mindset-affording practices and example teacher statements.*

Category	Hypothetical Teacher Statements
Value placed on student learning and development	Undermining: "I will make sure this class is especially useful for the star students who demonstrate a natural talent in math." Affording: "This class is set up the way it is because I believe that all students can learn and most of you can do well in the class, no matter where you started out."
Explicit messaging about progress and success	Undermining: "It's a good sign if you've done well on this first test. Students who do the best at the beginning of the year are typically the same ones who do well at the end." Affording: "Students who don't do well at the beginning of the year can almost always improve their grades by the end if they work hard, use good learning strategies, and ask for help when they need it."
Response to student challenge, struggle, and poor performance	Undermining: "Don't worry if you're struggling. Remember, not everybody can be a 'math person.'" Affording: "If this doesn't make sense yet, let's work together to figure it out. Mistakes give us a chance to improve our understanding."
Opportunities for practice and feedback	Undermining: "When you turn in assignments, whatever grade you get will be final. So, pay attention to the assignments you turn in and don't make mistakes." Affording: "After I grade your assignments, you will be able to revise your work and turn it in again. Making mistakes, recognizing them, and correcting them will help you remember the concepts for a long time, even after you leave my class."

Note. These categories of mindset-relevant practices are reproduced from Kroeper, Muenks et al. (2021).

4.2. A Proposed Agenda of Intervention Research on Growth Mindset Affordances

The Mindset × Context approach we have reviewed opens the window to new lines of research that can both establish the causal role of teachers' mindsets and generate promising teacher-directed interventions.

Understanding the mechanisms of psychological affordances. First, it is important to continue to understand how affordances work together with student mindsets to shape adolescent development. Earlier, we mentioned two different characteristics of psychological affordances may could explain their moderating effects, but research has not directly tested these yet.

First, the context may be perceived to support (or refute) the legitimacy of the belief within the context. For example, if a teacher consistently implies that some students are smart and learn quickly, and favors them, then students will be unlikely to see this classroom as one in which the growth mindset applies. Thus, one function of an affordance is to confirm or disconfirm the accuracy of the belief when predicting and interpreting events in a setting. In this way, a situational affordance can determine whether people update their beliefs across many encounters, in a Bayesian sense.

The second characteristic has to do more with action than belief. The context can determine whether the behaviors that follow from a belief are beneficial (or detrimental) to the individual in that context, thereby affecting whether individuals are motivated to act on their belief. For example, students may be more likely to engage in growth-mindset-consistent learning behavior such as correcting mistakes on assignments when they receive credit for doing so. They may be less likely to engage in such growth-mindset-consistent behavior such as challenge seeking when the context creates negative repercussions (such as a peer culture in

which working hard negatively affects one's social status).

A step-by-step agenda. With a deeper understanding of growth mindset affordances, the next large challenge will be helping teachers to provide more psychological affordances for students. This will be difficult, but we do not need to aim for large differences in many teachers' beliefs and practices from the start. Instead, we can conduct this research in stages, beginning with teacher practices that may be easier to change and gradually developing interventions that are more layered. That is, we hope to proceed from helping teachers to learn a few new practices to helping them create a growth-mindset culture (see Figure 3).

A first step might be to assess the effects of reducing the most powerful fixed mindset practices that can undermine students' implementation of a growth mindset, such as teachers telling students they are not a "math person" if they struggle (Rattan et al., 2012). A second step could be to reduce or reframe "false growth mindset" messages—that is, statements that may seem to the teacher to be consistent with a growth mindset, but actually miss the point and can be counter-productive (see Dweck & Yeager, 2019). A third step for research might be to help teachers develop a few growth-mindset supporting practices that feel useful and authentic to them, such as how they provide critical feedback (Yeager et al., 2014). A final step might be more ambitious; it could focus on how teachers architect comprehensive growth-mindset-supportive classrooms, including integrating the practices in Table 2 into a coherent classroom philosophy, as exceptional teachers have done (see, e.g., Treisman, 1992).

In summary, a program of iterative research with teachers might be able to lead to substantial improvements in the benefits of growth mindset interventions. We note that to intervene on teacher's affordances successfully, researchers will need to overcome meaningful challenges to behavior change. For example, many teachers may already feel overwhelmed and

adding practices that seem to add to their workload may be rejected out of hand. Successful intervention efforts must find ways to motivate teachers and to help them readily incorporate new affordances into the curriculum. Therefore, we foresee a strong need for a parallel focus on the science of adult/teacher behavior change, to go along with the more specific focus on growth mindset affordances.

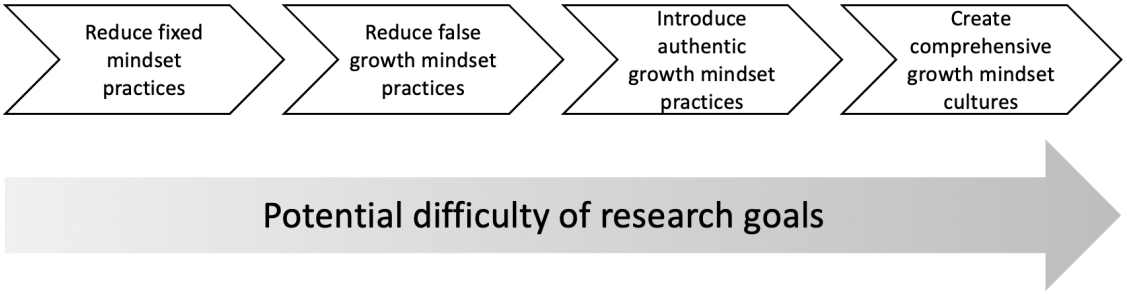

Figure 3. A possible sequence of research goals, ordered in terms of potentially increasing difficulty to achieve.

Moderating factors in teacher-directed interventions. As research along the lines depicted in Figure 3 proceeds, there will eventually be larger-scale evaluations of teacher-focused mindset interventions. We suggest that the Mindset × Context framework can be used to guide predictions about when teacher-directed interventions will be effective, similarly to how it can guide predictions about the effects of direct-to-student interventions. For example, we suspect that although the student-directed mindset intervention might be more effective with growth-mindset teachers (because the teacher mindset acts as an affordance), a teacher-directed intervention might be more effective with fixed-mindset teachers (because the teacher mindset acts as a prior vulnerability). In addition, teachers may face structural affordances or obstacles (e.g., a school district that makes it hard to deviate from its own prescribed policies and practices) or psychological affordances or obstacles (e.g., a more fixed-mindset-oriented teacher culture within the school). Thus, we envision rich and nuanced extensions of the Mindset ×

Context framework in future multi-level studies. Eventually, studies may be able to combine large, teacher-focused training studies with direct-to-student interventions. Only when we have evidence about the combined effects of changing student beliefs *and* improving the affordances in the context will we be able to see the full potential of belief-change interventions.

5. The Role of Affordances in Belief Socialization

In this chapter, we have mostly focused on how psychological affordances—particularly those provided by teachers—might amplify the effects of belief-change interventions. But what role might these affordances play in the gradual *socialization* of students' beliefs?

Of course, as children develop, the beliefs and actions of socializers (e.g., parents, teachers, peers) influence children's beliefs and attitudes (see Pomerantz et al., 2007 for a review). Theories of socialization in school settings suggest that affordances may, in fact, be a *mechanism* of such socialization (Wentzel & Looney, 2007). Thus, by utilizing the practices, policies, and language reviewed above, teachers can frame learning and development as the ideal standard to achieve (consistent with growth mindset beliefs) and simultaneously create supportive relationships that may, over time, facilitate students' internalization of these values.

6. Conclusions and Future Directions

To conclude, researchers are now beginning to test psychological interventions at scale, across representative samples, in a variety of contexts, and over longer periods of time. These studies are showing meaningful and robust evidence of moderation across contexts, and this consistent pattern of results has informed the development of the Mindset × Context framework. This new framework can anticipate moderation results and motivate new, mechanism-focused research on how individuals' beliefs interact with contexts.

In this chapter, we hope we have shown that the study of beliefs and belief-change is

alive and well in developmental science. This new body of evidence is rooted in the social-cognitive traditions of developmental psychology, but it has fruitfully branched out to social, personality, and educational psychology. Thus, the movement toward large-scale trials with both students and the contexts they live in makes it an exciting time for developmental (and developmental-adjacent) scientists to renew their interest in belief change research. We hope that the next decade of research in this field leads to even more growth in our understanding of children and adolescents' development than the last.

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