

Leveraging Psychosocial Interventions to Motivate Instructor Participation in Teaching Professional Development

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ABSTRACT

To promote undergraduate education reform, teaching professional development (TPD) efforts aim to encourage instructors to adopt evidence-based practices. However, many instructors do not attend TPD. There may be many reasons for this, including low intrinsic motivation to participate in TPD. Psychologists have dealt with motivational barriers in educational contexts using psychosocial interventions, brief activities that draw on a rich history of psychological research to subtly alter key, self-reinforcing psychological processes to yield long-term intrinsic motivation and behavioral changes. Psychosocial interventions, for example, have been used to alter students' noncognitive attitudes and beliefs, such as attributions and mindset, which positively influence students' motivation and academic performance. Here, we propose that insights from research on psychosocial interventions may be leveraged to design interventions that will increase instructors' motivation to participate in TPD, thus enhancing existing pedagogical reform efforts. We discuss psychological principles and "best practices" underlying effective psychosocial interventions that could guide the development of interventions to increase instructors' motivation to attend TPD. We encourage new interdisciplinary research collaborations to explore the potential of these interventions, which could be a new approach to mitigating at least one barrier to undergraduate education reform.

INTRODUCTION

As faculty developers can attest, providing effective TPD [teaching professional development] for faculty is second to the importance of motivating faculty to participate in the first place—you can build it, and build it well, but they will not necessarily come.

Bouwma-Gearhart (2012a, p. 559)

Over the last several years there has been a consistent national focus on moving educational practices away from traditional, teacher-centered instruction toward more effective, student-focused, active instruction (e.g., Freeman *et al.*, 2014; American Association for the Advancement of Science [AAAS], 2015, 2019). To achieve these changes, undergraduate instructors often need support in the form of teaching professional development (TPD; Connolly *et al.*, 2016; Derting *et al.*, 2016; Pelletreau *et al.*, 2018). However, not every instructor participates in TPD. For instance, a survey of science and mathematics faculty across undergraduate institutions in Louisiana concluded that most faculty had access to many supports for instructional innovation (e.g., grants to travel to educational workshops) but only a fraction of faculty used them (Walczyk *et al.*, 2007). Similarly, another study of faculty in three science departments at one university found that most faculty rarely

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accessed information sources to learn about new teaching practices (Lund and Stains, 2015).

Although there are many reasons why instructors may not take advantage of these TPD opportunities (including judgments of the quality of the TPD being offered), one reason may be that instructors differ in their levels of motivation to participate in TPD (Bouwma-Gearhart, 2012a; McCourt *et al.*, 2017). Motivation is strongly related to behavior, and interventions that can increase motivation to attend and engage in effective TPD may positively impact undergraduate reform efforts. Here, we propose a novel strategy for increasing instructor motivation to participate in TPD, drawing on research on “psychosocial interventions.” We propose that these interventions, based on psychological theories of motivation, may be leveraged to influence instructors’ personal values, thoughts, beliefs, and feelings about TPD and motivate those who have not attended TPD in the past to take those first steps toward participating (Caffarella and Zinn, 1999; Woodbury and Gess-Newsome, 2002). For the purposes of this essay, we use “participate in TPD” to refer to both attending and engaging in TPD with the aim to enact pedagogical reform.

In alignment with this cross-disciplinary special issue, we draw from the rich psychological literature—specifically, work related to motivation, cognition, and psychosocial interventions—and merge it with the literature in science, technology, engineering, and mathematics (STEM) education related to TPD, to synergistically inform a critical challenge to educational reform efforts. The research from each field highlighted in this essay often have different contexts, participants, and outcomes, but are focused on psychological principles related to motivation that are broadly applicable across human developmental periods and have long histories of research support (e.g., Rotter, 1966; Deci, 1971). Although motivation is not the only barrier to TPD attendance that instructors face (we outline a compendium of barriers later in the paper), we believe that the interventions we propose here to increase motivation to participate in TPD could be part of a multipronged strategy to advance instructional reform efforts through effective TPD.

Although this essay is probably most relevant to TPD facilitators at academic institutions, STEM education researchers are also needed to conduct research on these interventions. Ideally, TPD facilitators, STEM education researchers, and cognitive psychologists should be partners in these endeavors.

TPD IN HIGHER EDUCATION

TPD can broadly be thought of as models of training and support to develop teaching-related knowledge, skills, and abilities and encourage reflection about teaching practices and student learning. The goals of TPD can vary, but often focus on creating teaching excellence at an institution, responding to the teaching needs of individuals, or advancing new initiatives in teaching and learning (McKee *et al.*, 2013). Most research on TPD is focused on three types of instructor participants: K–12 teachers, faculty in higher education, and future faculty, such as graduate teaching assistants (GTAs) and postdoctoral researchers. The focus of the psychosocial interventions proposed in this essay will be faculty and future faculty at research-intensive institutions, where motivation to participate in TPD may be low relative to other work demands and responsibilities (Goodwin *et al.*, 2018; Lane *et al.*, 2019).

TPD exists in a multitude of forms: it can be local (e.g., programs run by institutional teaching and learning centers) or national (e.g., Summer Institutes on Scientific Teaching); and formal (e.g., presemester orientation, pedagogical class, or workshop) or informal (e.g., peer mentoring, participating in a learning community, or reading articles on pedagogy; Mulnix, 2016). Research on TPD suggests that each model can have different outcomes for the participants based on design, context, participant characteristics, or other factors (e.g., Gardner and Jones, 2011; Reeves *et al.*, 2016, 2018; Manduca, 2017). In sum, there is no “one best” TPD model; each institution must customize its efforts depending on the participants, pedagogical context, and desired instructional outcomes.

One of the most common forms of institutional TPD for many instructors is a mandatory teaching orientation, which varies in length and content depending on the institution (Austin and Sorcinelli, 2013; Schussler *et al.*, 2015). Beyond mandatory teaching orientations, instructors may voluntarily choose to pursue TPD, sometimes within a context of institutional and cultural pressures to focus on research (Bouwma-Gearhart, 2012a; Goodwin *et al.*, 2018; Lane *et al.*, 2019). This results in some instructors engaging in TPD and others choosing not to participate. For example, Goodwin and colleagues (2018) interviewed 32 biology graduate students and found that only 59% sought out opportunities to learn and practice evidence-based teaching practices. Bouwma-Gearhart (2012a) indicated that only a small proportion of STEM faculty at a research university regularly attend TPD and suggested that there are barriers that need to be overcome for broader systemic TPD participation.

TPD efforts can be powerful influencers to improve instructor delivery of evidence-based teaching practices (e.g., Owens *et al.*, 2018; Pelletreau *et al.*, 2018), but only if instructors participate. Therefore, this essay is not focused on the practices or principles of TPD, but rather on how to get instructors (faculty members, postdocs, graduate students) who are currently not motivated to attend TPD, to go to existing sessions and engage in reforming their teaching practices.

BARRIERS TO PARTICIPATING IN TEACHING PROFESSIONAL DEVELOPMENT

Many researchers have studied the barriers and supports to instructors participating in TPD and/or changing their teaching practices after participating in TPD. Barriers include a lack of institutional support or incentives, perceptions of student resistance, not identifying as a teacher, and lack of resources and time (specifically in the face of pressure to make progress in research), among others (Brownell and Tanner, 2012; Lowenthal *et al.*, 2013; Sabagh and Saroyan, 2014; McCourt *et al.*, 2017; Bathgate *et al.*, 2019). Caffarella and Zinn (1999) categorized the factors that enhance or impede TPD of faculty members into four main domains: 1) people and interpersonal relationships, 2) institutional structures, 3) personal considerations and commitments, and 4) intellectual and psychosocial relationships. They point out that the four domains work in concert, meaning that internal motivations can be subverted by influencers like department chairs who do not support TPD, reward structures that do not support TPD, or personal issues that erode time to commit to TPD. Although this makes it seem like a hopeless confluence of barriers, positive personal beliefs and desires of instructors can override other barriers because of

the strong role that beliefs play in instruction (Gess-Newsome *et al.*, 2003; Andrews and Lemons, 2015; Robert and Carlsen, 2017; Gibbons *et al.*, 2018). Indeed, Lund and Stains (2015) found that science faculty's adoption of evidence-based instructional practices was influenced by their beliefs about teaching. This suggests that Caffarella and Zinn's (1999) fourth domain of intellectual and psychosocial relationships may be an important lever for TPD and thus change in teaching; if instructors come to believe that participating in TPD is worth the time and effort, then they may choose to attend despite other barriers. In his influential text on educational reform, Fullan (2001) wrote that "educational change depends on what teachers do and think—it's as simple and as complex as that" (p. 117).

The idea that instructors' beliefs are crucial to educational reform inspired the teacher-centered systemic reform model (Woodbury and Gess-Newsome, 2002), a model in K–12 education that posits that changing teachers' thinking is essential to promote longer-term behavioral change. This model recognizes the complex interplay between 1) teachers' thinking, 2) the contexts of their work, and 3) their personal backgrounds and classroom practices as critical influences to reform. In sum, both Caffarella and Zinn (1999) and Woodbury and Gess-Newsome (2002) acknowledge that institutional and cultural factors can be significant barriers to instructional change but posit that personal values, thoughts, beliefs, and feelings can be powerful positive forces for change in teaching. This suggests that changing instructor thinking could be an effective target for increasing motivation to participate in TPD (Singer, 1996; Andrews and Lemons, 2015; McCourt *et al.*, 2017). For example, influencing the extent to which instructors believe it is possible to improve their teaching skills (i.e., growth mindset), how they frame the perceived causes of problems encountered during teaching (i.e., attributions of failure or success in the classroom), or addressing personal anxieties in relation to teaching (i.e., coping with teaching anxiety) could all increase instructors' motivation to participate in TPD.

In this essay, we propose interventions designed to shift instructors' thinking about their teaching and the potential value of participating in TPD in such a way that motivational barriers to participating in TPD are reduced or eliminated. While we argue that increasing instructor motivation to participate in TPD has the potential to improve instructor practices, it is important to note that a lack of motivation to attend TPD does not inherently make one a "poor" or "unskilled" instructor. This approach does not aim to stigmatize instructors by presuming that those who do not attend TPD are "bad" instructors, but instead, to help instructors consider how they can always grow and learn in their pedagogy.

Many current successful TPD programs overcome barriers to participation by using external incentives, such as department heads personally asking instructors to participate, acquiring funds to financially incentivize participation, or joining in a collaborative publication (Owens *et al.*, 2018; Pelletreau *et al.*, 2018). These strategies can be used to great effect when motivating instructors to attend a specific professional development program with specific objectives and outcomes. Our approach is focused more on global participation in TPD, however. How can we get instructors to voluntarily seek out and attend the multiple types of TPD that their institutions offer, even if no incentives are offered and they have typically not attended TPD in the

past? We propose that the answer to this question lies in influencing intrinsic motivation. Psychologists describe behaviors that are in themselves inherently rewarding as being intrinsically motivated (Deci and Ryan, 2000). Comparatively, extrinsically motivated behaviors are performed in anticipation of some outcome that will result from the behavior (e.g., financial compensation, satisfying the request of a supervisor, etc.), which may be easier to achieve when a specific professional development program is targeted for participation. Addressing intrinsic motivations to participate in TPD through psychosocial interventions may lead individuals to ascertain for themselves that TPD of any type is something they may want to consider engaging in.

It should be acknowledged that some faculty already hold personal values and beliefs that result in high motivation to participate in TPD despite any institutional or cultural barriers. Bouwma-Gearhart (2012b) mentions how a faculty research participant quipped to her that "the number one predictor of TPD involvement is TPD involvement," indicating that faculty engagement with TPD seems to further beget more engagement. These faculty attend so regularly that they are called "the choir" (Bouwma-Gearhart, 2012a; McCourt *et al.*, 2017). However, there are some instructors who lack intrinsic motivation for TPD and take little or no advantage of existing TPD opportunities. Here, we propose how research on psychosocial interventions may be leveraged to increase motivation to participate in TPD among this group of faculty (those not already in "the choir"). Many theories of motivation contend that internal values, beliefs, and feelings are a strong driving force behind behavior (e.g., Deci and Ryan, 2000; Wigfield and Eccles, 2000); thus, these may be critical levers to get instructors who typically do not participate in TPD to show up. In this essay, we target some potential motivational barriers that may prevent instructors from participating in TPD and propose how we may shift their internal values, beliefs, and feelings in a way that increases motivation to participate in TPD through psychosocial interventions.

PSYCHOSOCIAL INTERVENTIONS IN ACADEMIC SETTINGS

Psychologists have approached issues related to student motivation in educational contexts using psychosocial interventions. Psychosocial interventions are "brief exercises that do not teach academic content but instead target students' thoughts, feelings, and beliefs in and about school" (Yeager and Walton, 2011, p. 268). Interventions are typically brief activities (e.g., watching a video, reading an article, reflective writing) that can be implemented once or on multiple occasions. They can target a variety of "psychosocial processes": patterns of thoughts, feelings, and beliefs at the intersection of the self and the social environment (Woodward, 2015). In academic settings, the ultimate goal of these interventions is typically to shift the psychosocial processes that impede success and thereby improve students' content knowledge and academic outcomes, such as grades and retention (Yeager and Walton, 2011).

Researchers have demonstrated that psychosocial interventions can result in a variety of positive academic outcomes. For example, a recent, large-scale, double-blind, randomly assigned experiment with a nationally representative sample of high school students showed that an intervention promoting the belief that intelligence is not fixed, but rather can be developed

(termed a “growth mindset”) improved grades and persistence in STEM, especially among lower-achieving students (Yeager et al., 2019). Other psychosocial interventions have resulted in a number of desirable outcomes, including increased student engagement (Aronson et al., 2002; Blackwell et al., 2007), improved academic performance (Aronson et al., 2002; Blackwell et al., 2007; Brady et al., 2016; Fink et al., 2018; Yeager et al., 2019), persistence in STEM (Yeager et al., 2019), improved health outcomes (Yeager and Walton, 2011), reduced racial and gender achievement gaps (Good et al., 2003; Cohen et al., 2006; Walton and Cohen, 2011; Brady et al., 2016; Jordt et al., 2017; Fink et al., 2018), increased feelings of social belonging (Walton and Cohen, 2011), attributing failures to controllable causes (Haynes et al., 2009), and reducing anxiety (Cohen et al., 2006; Brady et al., 2016). In addition to being celebrated for this wide range of positive outcomes, psychosocial interventions are valued for their potential to produce these positive outcomes from short and inexpensive interventions (Yeager and Walton, 2011; Henry et al., 2019).

While much of the research on psychosocial interventions has been conducted in K–12 environments (Good et al., 2003; Blackwell et al., 2007; Yeager et al., 2014), studies have shown that similar interventions can be successfully applied in other contexts, including postsecondary environments. For example, growth mindset interventions have been most extensively studied in K–12 students (e.g., Dweck, 1999; Good et al., 2003; Blackwell et al., 2007), but have been successfully implemented for undergraduates as well (e.g., Aronson et al., 2002; Yeager et al., 2016; Fink et al., 2018). This transferability is possible, because precise details vary across developmental periods but the psychological principles underlying psychosocial interventions are broad and can operate in many situations (Rotter, 1966; Lent et al., 1994; Heckhausen and Dweck, 1998; Dweck, 1999).

INTERVENTIONS TO MOTIVATE PARTICIPATION IN TEACHING PROFESSIONAL DEVELOPMENT

We propose that the underlying psychological principles driving the success of psychosocial interventions may be leveraged to increase instructors' intrinsic motivation to participate in TPD and thereby enhance undergraduate educational reform efforts. The decision to participate in TPD requires instructor buy-in and motivation to change instructional practices in some way (Bouwma-Gearhart, 2012a; AAAS, 2019). Just as psychologists have used psychosocial interventions to increase student motivation and encourage more productive behavior (Yeager and Walton, 2011), we suggest that related interventions could be used to increase instructor intrinsic motivation and encourage instructors to participate in TPD and engage in pedagogical reform. We propose that insights from psychological research on psychosocial interventions may be leveraged to address one of the barriers to TPD participation and, potentially, pedagogical change and educational reform.

Here, we propose drawing on research on psychosocial interventions to design *TPD motivation interventions*, which we define as brief exercises that aim to change instructors' thoughts, feelings, and beliefs with the goal of increasing their motivation to participate in TPD. TPD scholars have long recognized the importance of instructors' thoughts, feelings, and beliefs as levers for teaching change (Singer, 1996; Caffarella and Zinn,

1999; Woodbury and Gess-Newsome, 2002). Singer (1996) noted the relationship between teaching beliefs and behaviors, saying, “If one accepts that thought and action are intuitively associated, then the reconfiguration of teachers' thoughts becomes a potentially powerful lever for initiating behavioral change” (p. 660). It is important to note that the interventions we are proposing are not a form of TPD themselves, but rather would motivate instructors to make use of existing TPD resources and supports, which should lead to increased adoption of evidence-based teaching practices, depending on the nature and quality of the available TPD programs (Stupnisky et al., 2018; Fong et al., 2019).

In the remainder of this essay, we outline two design principles that underlie the effectiveness of psychosocial interventions and explain how they might apply to instructors in a post-secondary education context: 1) they are *persuasive but not controlling*, and 2) they tap into *self-reinforcing processes* (Yeager and Walton, 2011). Then, we identify three different instructor thoughts, feelings, and beliefs that likely hinder instructors' motivation to participate in TPD and thus may be effective intervention targets. We propose potential intervention designs for these three targets based on research on psychosocial interventions. Finally, we discuss the limitations of this approach and how these might be addressed, along with future research directions.

DESIGN PRINCIPLES

Design Principle 1: Interventions Should Be Persuasive but Not Controlling

Psychosocial interventions for adolescents and young adults are most successful when they do not appear controlling or prescriptive (Sherman et al., 2009; Yeager and Walton, 2011). In the context of TPD motivation interventions, this implies that participants should not be aware that the explicit purpose of the intervention is to get them to attend TPD, or they may feel they are being manipulated. However, the message of the intervention needs to impact their thinking. Thus, we contend that an effective intervention needs to subtly walk a fine line between being persuasive but not controlling.

A subtle approach is important, because it reduces feelings of stigma and loss of autonomy. A heavy-handed intervention wherein participants are told that the purpose of the activity is to help them may make participants feel targeted, stigmatized, and defensive, and they may consequently become resistant to the message of the intervention (Yeager and Walton, 2011). For example, Sherman and colleagues (2009) found that subtlety was a key component in their self-affirmation intervention designed to bolster undergraduate students against threatening events (e.g., low exam score). They discovered that the intervention was less effective for students who were aware that the intervention was designed to boost their global self-worth.

This implies that TPD motivation interventions should be framed in a way that does not make instructors feel that they are being targeted because they are lacking in some aspect of teaching. Instructors do not want to be told that they need to attend TPD because they are bad at their job or risk offering themselves up as a case study for criticism. In an interview study about participation in university TPD, the participants reported that they would prefer to participate in TPD with peers and a TPD leader they trust because of their concerns about

being criticized (Bouwma-Gearhart, 2012a). They explained that TPD providing a safe and supportive venue to discuss teaching was enjoyable and allayed these concerns. McCourt and colleagues (2017) also documented biology faculty comments about the value of positive peer and leader support being important to their TPD experiences. Additionally, Andrews and colleagues (2016) found that certain biology faculty members with disciplinary teaching specialties were used as sources of teaching information more than others. This indicates that faculty are selective about whom they are willing to interact with about teaching improvements, favoring a supportive and knowledgeable environment. Thus, faculty may be hesitant to attend TPD because of the perceived threat to their professional identities, but once in TPD, they often find this concern is unwarranted. Bouwma-Gearhart (2012a) recommended that one way to motivate more faculty instructors to attend TPD would be to normalize the notion that higher education instructors receive insufficient pedagogical training during graduate school and to destigmatize TPD. We suggest that interventions should emphasize TPD as a positive opportunity to learn new ideas as a way to increase participants' comfort and willingness to attend TPD.

Participants may also be resistant to the message of the intervention if they feel like they are being told what they should think or believe (Yeager and Walton, 2011). This is because interventions that feel controlling reduce participants' sense of autonomy, which is one of the three pillars of motivation according to self-determination theory, a universal theory of human motivation (Deci and Ryan, 2000). Autonomy may be particularly relevant when instructors are the intervention participants, because autonomy in teaching is a major component of both job satisfaction (Turner and Boice, 1986; McCrickerd, 2012) and teaching quality (Stupnisky *et al.*, 2018). In considering a STEM teaching change initiative at one university, loss of autonomy was raised as one of the top three barriers to adopting new teaching practices (Shadle *et al.*, 2017). Thus, TPD motivation interventions are potentially important levers, because they may persuade instructors to modify their thinking in such a way that they autonomously choose to attend TPD rather than feeling forced to go.

Design Principle 2: Interventions Tap into Self-Reinforcing Processes

Psychosocial interventions are particularly powerful tools for change, because they have the potential to yield long-term effects from a single, brief activity. Interventions achieve these surprisingly large, long-term outcomes by activating self-reinforcing processes (i.e., positive feedback loops) that compound effects over time (Yeager and Walton, 2011). For example, a student who believes that his or her intelligence can be improved will be more likely to invest effort into studying and use more effective study strategies (Blackwell *et al.*, 2007). These efforts will result in learning, which serves as further evidence that intelligence can be improved, and the student will be further motivated to invest effort into learning (Limeri *et al.*, 2020; Gonida *et al.*, 2006). Thus, if a brief intervention can encourage students to believe that they can improve their intelligence, it could result in a long-term change in behavior via self-reinforcing processes. The goal of the intervention is to activate these self-reinforcing processes.

Studies that follow students for multiple years after an intervention have uncovered evidence that successful interventions work by setting self-reinforcing processes into motion. One study found that undergraduate students' grades increased steadily over 3 years following a social belonging intervention (Walton and Cohen, 2011). The year-to-year improvement is evidence that the mechanisms driving improvement are playing out and increasing over time, indicating a positive feedback loop mechanism. Furthermore, they found that at the end of the 3 years, few students even recalled the intervention. This suggests that the intervention itself was not particularly memorable, but rather it activated a self-reinforcing process that resulted in long-term gains that increased each year (Walton and Cohen, 2011). Another study by Brady and colleagues (2016) documented how a values affirmation intervention created an enduring shift in the way undergraduates interpreted and responded to future adversity. Two years after a self-affirmation intervention, students spontaneously generated more self-affirming and less self-threatening thoughts and feelings in response to academic stressors than students in a control group (Brady *et al.*, 2016).

Self-reinforcing psychological processes occur in a wide variety of contexts related to interest and motivation. For example, social cognitive career theory (SCCT) describes how career interest (an intrinsic motivation) and career choices are influenced by past learning experiences, self-efficacy, and expectations of outcomes (Lent *et al.*, 1994). All three of these factors are in turn affected by the career choices that individuals make and subsequently circle back to inform their future choices and behaviors. In sum, SCCT posits that self-reinforcing processes operate broadly in the development of career interests. Self-reinforcing processes exist for interest in teaching in a higher education context as well. For example, Lane and colleagues (2019) built a mechanistic model of how graduate students develop a teaching identity. Their model includes multiple positive feedback loops, in which interest in teaching motivates graduate students to pursue teaching experiences, and teaching experiences (particularly ones that are autonomous) in turn increase their interest in teaching.

There is also evidence of self-reinforcing processes related to faculty members' interest in participating in TPD. In an interview study, STEM faculty members at a research institution indicated that they were not initially interested in TPD, but as they participated in TPD programs, they became more interested in continuing to participate in TPD, because they realized positive outcomes and experienced TPD as a safe space to improve without feeling judged (Bouwma-Gearhart, 2012a). This suggests that a positive experience with TPD enhances motivation to attend TPD in the future, constituting a self-reinforcing process. Thus, TPD interventions may be able to tap into a self-reinforcing process to foster increased interest in TPD. The goal of the intervention, then, would be to spark interest in participating in TPD for the first time. Positive experiences with TPD would then reinforce interest in TPD and lead to continued participation. In the following section, we propose that interventions may foster initial interest in attending TPD through mechanisms such as encouraging instructors to view teaching as improvable or reducing anxiety.

It is important to note here the mechanistic differences between developing interest to attend TPD and actually

TABLE 1. Barriers and predicted outcomes for each proposed TPD motivation intervention with an illustrative hypothetical instructor quote for each barrier and outcome

Barrier to TPD participation	Intervention	Predicted intervention outcome
Fixed mindset “I’m just not a natural teacher.”	Growth mindset	Growth mindset “I can improve my teaching skills if I work at it and get help through TPD.”
Uncontrollable attributions “Active learning will fail because the students won’t like it and won’t want to participate.”	Attribution retraining	Controllable attributions “I can get active learning to work if I learn how to implement and frame it the right way to reduce student resistance.”
High teaching anxiety “If I try to do something new in the classroom, it will fail and I’ll be exposed as a fraud.”	Values affirmation	Moderate teaching anxiety “Trying new teaching strategies is a challenge that I can meet.”

developing improved teaching knowledge and skills. Developing interest is a self-reinforcing process, and thus a feasible target for interventions like the ones we propose. Conversely, research on TPD has established that one-shot pedagogical workshops are not effective in changing pedagogical practices, because reforming teaching practices is not a self-reinforcing process, but rather a developmental process that requires ongoing, sustained engagement and support (Gardner and Jones, 2011; Austin and Sorcinelli, 2013). Thus, it is *interest* in attending TPD that we propose to target with these brief interventions, with the hope that increased interest will spur sustained participation in TPD, which will drive changes in teaching practices (Connolly *et al.*, 2016; Derting *et al.*, 2016).

POTENTIAL TPD INTERVENTION TARGETS AND DESIGN

Here, we identify and discuss three potential targets for TPD motivation interventions: instructors’ beliefs about the malleability of their teaching skills (i.e., teaching mindset); how instructors explain the causes of their teaching problems (attributions); and instructors’ teaching anxiety (Table 1). Drawing from psychosocial intervention literature, we propose intervention design principles that could guide the development of TPD motivation interventions. At the end of this section, we further suggest where and when these interventions may be implemented. The interventions we propose here are meant to be examples that we think are supported by theory; they are not meant to be prescriptive or an exhaustive list of possibilities.

Target 1: Teaching Mindset

The extent to which people view traits or abilities as malleable (i.e., their *mindset*) influences their motivations and behaviors. Psychologists target students’ beliefs about the malleability of intelligence as a lever for improving student success (mindset interventions; Yeager and Walton, 2011; Yeager *et al.*, 2019). Believing that intelligence is unchangeable (i.e., a *fixed mindset*) is a barrier to student persistence and success, because students with a fixed mindset do not believe that investing more effort or trying a different study strategy will improve their intelligence, and therefore are more likely to drop out of their class, major, or program (Dweck, 1999; Smiley *et al.*, 2016). By encouraging students to think about intelligence as a trait they can improve, mindset interventions help students respond positively to challenge, earn higher grades, and persist in STEM (Dweck, 1999; Yeager *et al.*, 2019). For example, a growth mindset intervention for seventh-grade students halted the downward performance trajectory that is typically associated with the transition

into middle school for students in the intervention, but not the control group (Blackwell *et al.*, 2007).

Similarly, some have posited that a fixed mindset about teaching ability is a barrier to engaging in TPD (Turner and Boice, 1986; McCrickerd, 2012; Thadani *et al.*, 2015). A survey of 86 faculty from a variety of disciplines found that those who believed that their teaching skills were fixed were less interested in and less likely to pursue TPD, even when controlling for differences in teaching self-efficacy (Thadani *et al.*, 2015). Thus, encouraging instructors to adopt a growth mindset about their teaching skills may increase their motivation to participate in TPD (Table 1, row 1). Additionally, a growth mindset may facilitate persistence when instructors try new pedagogies. In one study with physics faculty, 23% of those who implemented a research-based instructional strategy after a TPD program discontinued its use thereafter, presumably because it did not work smoothly on the first implementation (Henderson *et al.*, 2012). A growth mindset may increase instructors’ persistence with implementing new pedagogies, because the notion that challenges are normal and can be overcome is implicit with a growth mindset. For example, students across educational levels who hold a growth mindset about their intelligence view struggle and setbacks as part of the learning process and are more likely to persist through academic challenges (Dweck, 1999; Smiley *et al.*, 2016). Thus, mindset beliefs about teaching skills may be a powerful target for interventions to not only increase instructors’ motivation to participate in TPD, but to persist in implementing and troubleshooting new pedagogical practices.

Many mindset interventions have worked by leveraging the social contagion effect—the passive spreading of thoughts, behaviors, and beliefs from one person to another (Levy and Nail, 1993). Social contagion effects are not the result of intentional, explicit attempts to influence an individual’s beliefs, but rather occur indirectly, and thus help interventions feel persuasive but not controlling. In one study, undergraduates read magazine articles purportedly featuring a successful athlete or businessperson espousing either a fixed mindset (e.g., the person has always been talented in this field) or a growth mindset (e.g., the person has not always been successful and has improved his or her skills with effort and practice). Results supported the social contagion effect; students’ mindsets shifted to align with the view espoused by the article they read (Burkley *et al.*, 2017). A growth mindset TPD motivation intervention could use a similar structure by having instructors read an article about or watch an interview with a respected scientist or

TABLE 2. Examples of different failure attributions using hypothetical instructor voices

Ability	Effort
Internal, stable, uncontrollable	Internal, unstable, controllable
"I'm just no good at keeping a student discussion going. I'll never be one of those active-learning people!"	"I didn't try as hard to prepare in-class activities as I probably should have. I'll have to spend more time on them next time."
Task difficulty	Luck
External, stable, uncontrollable	External, unstable, uncontrollable
"Getting students to do reading before coming to class is impossible! No wonder the whole flipped classroom thing flopped!"	"I just got unlucky this term and had a group of students that really didn't want to participate. Fingers crossed that things work better next term!"

educator in their fields espousing a growth mindset about developing their teaching skills and overcoming setbacks when implementing new teaching strategies. Additionally, based on interviews with STEM faculty at research universities, Bouwma-Gearhart (2012a) recommended reducing stigma associated with TPD by normalizing the need for faculty to participate in TPD, because they often did not receive sufficient training earlier in their career.

Instantiating a growth mindset in instructors may have additional benefits beyond encouraging them to participate in TPD and persist with implementing new pedagogies. Instructors often serve as role models to students in their classes, and they may pass on their growth mindset to their students via the social contagion effect. Additionally, there is evidence that faculty with a growth mindset elicit better and more equitable student outcomes. A recent study found that college STEM instructors with a growth mindset had lower racial achievement gaps in their classes and inspired more motivation from their students (Canning *et al.*, 2019).

Target 2: Attribution Retraining

Attribution is the process through which people seek causal explanations for particular outcomes or events (Weiner, 1985). Attributions matter, because they motivate future behavior. For example, students who attribute poor academic performance to uncontrollable factors, such as a low, fixed level of intelligence, are likely to react with helplessness when they struggle. Their subsequent failure is interpreted as confirmation that their performance is out of their control, fueling more uncontrollable attributions and further helpless responses to challenges. Attribution retraining interventions interrupt this negative cycle by encouraging students to attribute their academic performance to controllable factors, such as the level of effort they invest (Haynes *et al.*, 2009).

When considering attributions, three dimensions are important: locus, stability, and controllability (Rotter, 1966). *Locus* refers to whether one judges the cause to be internal or external; *stability* refers to whether the causal factor will be stable over time and across contexts; and *controllability* refers to the sense of perceived control that one has over the causal factor (Rotter, 1966; Henry *et al.*, 2019). Motivational and affective outcomes vary based on these dimensions. Specifically, when people attribute negative outcomes to internal, unstable, controllable factors, they are motivated to take action to address the problem. However, attributing negative outcomes to external, unstable, uncontrollable outcomes deflates motivation to act, because action is seen as pointless. Weiner (1979) identified and described the four most common causal factors for any achieve-

ment situation: ability, effort, task difficulty, and luck. We propose hypothetical examples of how instructors may attribute the success or failure of their teaching practices to these four factors (Table 2).

For STEM faculty, a common barrier to trying new teaching practices is the belief that students will react negatively or resist (Henderson and Dancy, 2007; Herreid, 2010; Brownell and Tanner, 2012; Seidel and Tanner, 2013; Shadle *et al.*, 2017; Bathgate *et al.*, 2019). Anticipating that new teaching practices would fail due to student resistance is an example of an external, uncontrollable attribution that leaves instructors unmotivated to reform their teaching practices (Brownell and Tanner, 2012; Seidel and Tanner, 2013). For example, one study of educational reform across 12 STEM departments at one university found that some faculty held an underlying belief that new teaching practices may not work simply because students are resistant to change, and therefore instructors should continue with their current teaching practices (Shadle *et al.*, 2017). Thus, if an attributional retraining intervention can shift instructors' attributions for problems with teaching toward controllable causal factors, instructors may become more motivated to participate in TPD and reform their teaching practices (Table 1, row 2).

Most attributional retraining interventions have been modeled much like mindset interventions. For example, Perry and Penner (1990) showed undergraduates a video of a professor encouraging them to view challenges as due to effort rather than intelligence and to view effort as controllable. TPD motivation interventions could be modeled similarly—instructors could watch a video or read an article by a professor discussing attributions. For example, the professor could talk about how they worried about student resistance to a new teaching practice, but were able to mitigate this problem by framing the reasoning for the pedagogy or implementing it using evidence-based techniques. Attributional messaging could be combined with growth mindset messaging to explore whether there is an additive effect or interaction.

Target 3: Teaching Anxiety

According to social psychologist Albert Bandura (1988), anxiety is the state of anticipatory apprehension over possible negative events. Anxiety has a curvilinear effect on motivation; too much anxiety is debilitating, while too little anxiety results in a lack of motivation to act (Yerkes and Dodson, 1908). Studies investigating the effects of anxiety have found that high levels of anxiety reduced undergraduates' executive functioning (e.g., tasks that require working memory, inhibition, and cognitive flexibility; Shields *et al.*, 2016). Thus, instructors who are highly anxious about teaching (e.g., perhaps new instructors or instructors who

have been criticized in the past for their teaching skills) may worry so much about their performance that their executive functioning is compromised, decreasing their abilities to focus and control their thoughts. Ironically, then, worrying too much that one will teach poorly is likely related to actually teaching poorly. Additionally, having so many cognitive resources taxed with anxiety can leave an instructor unable to consider or benefit from solutions for that anxiety, such as TPD. On the other hand, if there is total indifference toward teaching (and therefore no attendant anxiety), instructors may not feel they need to invest in improving their pedagogy by attending TPD.

Studies have documented the negative effects of excessive anxiety related to teaching, its responsibilities, and classroom environment (i.e., “teaching anxiety”; Buitink and Kemme, 1986; Williams, 1991; Pelton, 2014). For example, graduate students can experience teaching anxiety, particularly when it comes to balancing teaching responsibilities with their research (M.M.C.M. and E.E.S., unpublished data; Williams, 1991; Roach, 2003). In environments that are not supportive of teaching identities, science graduate students may be discouraged from attending TPD from both external pressures (e.g., from advisors) and internal pressures (e.g., perception that teaching takes away from research), contributing to teaching anxiety (Brownell and Tanner, 2012). Some K–12 teachers may also be reluctant to change practices that they feel have been working for them and adopt practices that seem less safe (Gess-Newsome, 2001). For example, some instructors may perceive criticism from a colleague about one aspect of their teaching as threatening to their perception of themselves as teachers.

Psychologists have combated the debilitating effects of excessive anxiety using self-affirmation interventions (Sherman and Cohen, 2006; Yeager and Walton, 2011). Self-affirmation theory is rooted in individuals’ perception of themselves as “good, moral, and efficacious” (Steele, 1988; Sherman and Cohen, 2006). Threats to these individual self-perceptions, by external or internal pressures, can induce excessive anxiety. Self-affirmation theory posits that reminding people of their diverse, positive characteristics can help individuals cope with negative stressors. The values affirmation intervention bolsters people’s sense of self by asking them to write about values that are personally important to them, thus reminding them of multiple, positive aspects of themselves unrelated to the challenging task at hand. Laboratory experiments and field interventions have shown that self-affirmation interventions with students can have dramatic benefits, including improved performance on academic tasks, increased overall grade point average, reduced racial achievement gaps, and increased sense of self-adequacy (Martens *et al.*, 2006; Cohen *et al.*, 2009; Sherman *et al.*, 2009; Miyake *et al.*, 2010; Brady *et al.*, 2016; Jordt *et al.*, 2017). For example, Jordt and colleagues (2017) found that a self-affirmation intervention reduced the racial achievement gap between white and underrepresented minority (URM) students by raising the performance of URM students in introductory biology courses. Similarly, Brady and colleagues (2016) found that affirmed undergraduate students spontaneously generated more self-affirming and less self-threatening thoughts and feelings when they were stressed. For instructors who experience debilitating levels of teaching anxiety, a self-affirmation intervention may help reduce anxiety to a manageable level and increase their interest in engaging with TPD (Table 1, row 3).

In the self-affirmation intervention, participants are given a list of values (such as relationships with friends or family or being good at art) and asked to indicate their two or three most important values. Participants then write a brief paragraph about why their selected values are important to them. To reinforce the message, participants then indicate their levels of agreement with statements concerning their chosen values (such as “I care about these values”; Cohen *et al.*, 2006). This brief activity is flexible and can be implemented in a number of ways. For example, it could be framed as an activity to connect scientists to the public by showing that scientists are multidimensional people who have values that non-scientists share. It could also be incorporated into a mental health workshop for graduate students, such as the ones developed and run for chemistry graduate students at the University of Minnesota (Mousavi *et al.*, 2018).

Intervention Design: When and Where Should Interventions Take Place?

Broadly speaking, TPD motivation interventions could be done in any context where implementers have the attention of the intended audience and incentive for them to engage. Because the goal of TPD motivation interventions is to foster motivation among instructors who have low levels of motivation to participate in TPD, the largest and most obvious challenge in implementing them will be finding a way to reach these instructors to implement the intervention. Thus, an ideal strategy would be to incorporate a TPD motivation intervention into a required academic training activity. This could occur during orientation and training sessions at career transitions (i.e., new faculty hires or beginning graduate students). Biology graduate students often are required to participate in some form of TPD before they act as GTAs for the first time (Schussler *et al.*, 2015). Implementing a TPD motivation intervention at the beginning of a mandatory TPD session may help increase instructors’ motivation to engage in that session and may also increase their motivation to seek additional TPD beyond the minimum requirement. Similarly, if an institution has any mandatory professional development for faculty (e.g., research ethics training, conflicts of interest training), an intervention could be incorporated into this session. These types of mandatory training events are particularly appealing, because there is strong incentive for individuals to engage in the activity and individuals will not feel targeted, as the activity is a part of everyone’s required training. Other options include events where all department members are expected to attend and participate, such as department retreats, seminars, or faculty meetings, or for graduate students, as part of a course or weekly lab preparation meeting. Interventions during events like these are likely to garner widespread attention, but it may be more difficult to incentivize individuals to engage with the activity.

LIMITATIONS AND FUTURE DIRECTIONS

We have outlined, we believe, a strong theoretical basis supporting the idea of interventions to motivate instructors to attend and engage in TPD. However, there are limitations that are important to consider, as well as a number of practical challenges associated with the design, implementation, and evaluation of these interventions that will need to be addressed.

While we believe that interventions to motivate instructors to attend TPD may be a potentially powerful tool for improving

the quality of undergraduate education, there is no “magic bullet,” with this approach. First, it is important to keep in mind that TPD interventions would target only one barrier to widespread pedagogical reform, namely, instructors’ motivation to attend TPD. Other barriers exist that may override any possible effects of increasing instructors’ motivation to attend TPD, such as TPD programs being unavailable or low quality or other types of institutional or cultural barriers. The goal of these interventions is to influence instructors’ motivation to attend TPD, not to directly influence their pedagogy. Thus, these interventions are intended to supplement, not replace, existing TPD and pedagogical reform efforts. These interventions would not be sufficient on their own to facilitate undergraduate education reform. Rather, the effectiveness of TPD motivation interventions is predicated on high-quality TPD being readily available for the target population and other barriers being surmountable.

Second, human behavior and motivation are complex and influenced by many factors, so it may be difficult for interventions to achieve large effect sizes (Yeager and Walton, 2011; Yeager *et al.*, 2019; Sisk *et al.*, 2018). However, interventions have low costs, because they are inexpensive and brief, so we argue that they are valuable even if they provide only small or moderate effects. Further, there is evidence that interventions have disproportionate effects on particular subgroups of participants (e.g., Aronson *et al.*, 2002; Yeager *et al.*, 2019). Thus, even if the overall effect sizes are low, effect sizes for some groups may be large.

Third, in this proposal, we draw extensively on literature on TPD and psychosocial interventions. We attempt to apply the underlying ideas to the context of instructors’ motivations to attend TPD. However, much of the TPD literature that we are aware of is based on K–12 educators, and much of the psychosocial interventions work has been done with high school and college students. Nevertheless, many of the connections we explore are based on theories relevant for all ages. For example, self-determination theory, which delineates between externally driven and internally driven motivations, is a universal theory of human motivation (Deci and Ryan, 2000) and has been used by TPD scholars in the past to explain STEM faculty’s motivation to attend TPD (Bouwma-Gearhart, 2012a). While developmental trajectories in motivational behavior are important to consider, the influences of individual differences and context are equally if not more valuable (Heckhausen and Dweck, 1998). For example, implicit theories (i.e., mindsets) have been applied to a wide variety of contexts, including implicit theories of personalities and relationships (Dweck, 1999). Nonetheless, future research should pay careful attention to the extent to which the theories we draw on here are applicable to the context of instructor TPD.

Designing, implementing, and evaluating TPD motivation interventions will require expertise in psychology, professional development, and the local context and culture. This may be best achieved through collaboration with an interdisciplinary team, including TPD professionals, STEM scholars, and psychologists. Research on psychosocial interventions indicates that they are highly context dependent and need to be carefully crafted and customized to the context, psychological target, and participants (Yeager and Walton, 2011; Yeager *et al.*, 2019). For example, one challenge associated with TPD motivation interventions is that they require attendance and engagement from those who are least motivated to engage in precisely these kinds of activities.

We proposed that one strategy for addressing this problem could be to implement TPD motivation interventions in a context in which implementers have the attention of the target population of instructors, such as at mandatory training or department events. It is difficult and even undesirable to prescribe more specific recommendations, because contexts will vary by department and institutional cultures, norms, and policies. Other solutions may involve larger-scale institution change, but this kind of transformation is outside the scope of this proposal. Ultimately, we suggest that development and evaluation of TPD motivation interventions should be treated as an iterative optimization process involving a team with diverse cross-disciplinary expertise.

In developing TPD motivation interventions, it will be necessary to consider design elements, such as the timing and dosage of the intervention. Psychosocial interventions are often placed during key transitions, such as the transition from middle school into high school (Blackwell *et al.*, 2007; Yeager and Walton, 2011; Yeager *et al.*, 2019). It may make sense to target TPD motivation interventions at academic career-stage transitions, such as the transition into graduate school or into a new faculty position (Ebert-May *et al.*, 2015; Chen and Goller, 2019). This is logistically convenient, because career transitions are often accompanied by mandatory training, which may be a good context for interventions. Another important design question is the dosage, or frequency, of interventions. Some psychosocial interventions elicit positive outcomes from just a single intervention activity (e.g., Brady *et al.*, 2016; Burkley *et al.*, 2017), whereas others involve repeated interventions (e.g., Blackwell *et al.*, 2007; Yeager *et al.*, 2019). Thus, researchers should investigate dosage effects with instructor interventions to determine the optimal strategy for a given context and population.

Once a TPD motivation intervention is designed, it will be critical to evaluate its effectiveness. Research teams should consider using an experimental design that includes both a treatment group and a control group that can be used as a comparison. Psychosocial interventions typically have control groups conduct a similar type of activity as the treatment group but with the key message changed. For example, in values affirmation interventions, treatment groups select and write about values that are personally important to them, while control groups select and write about values that are not important to them but may be important to other people (Cohen *et al.*, 2006). If the sample size allows, multiple treatment groups could be used to test alternative designs, such as different timing or dosage levels.

Researchers could measure the effectiveness of the interventions using both proximal and distal outcomes. Proximal outcomes might include measuring the thoughts, feelings, or beliefs that were the target of the intervention both before and after the intervention. For example, a teaching mindset intervention might measure instructors’ beliefs about the malleability of teaching skills both before and after the intervention to evaluate whether the intervention shifted participants toward a growth mindset. Many measures of thoughts, feelings, and beliefs are available, and investigators should carefully select and validate measures that fit their contexts and research questions. Distal outcomes might include instructors’ subsequent participation in additional TPD and changes in their teaching practice. For example, researchers could measure how many optional TPD events participants in treatment and control conditions attend over 2 years following the intervention (perhaps by coordinating

with a local center for teaching excellence). Another option would be to measure whether participants in the treatment conditions adopt more evidence-based teaching practices than control participants. This could be accomplished either through using a classroom observation protocol to observe participants' teaching before and a year after the intervention or having instructors self-report their knowledge of and usage of evidence-based teaching practices (e.g., Lund and Stains, 2015).

Once a successful TPD motivation intervention is designed and evaluated, creators may wish to scale up implementation. However, there are important limitations and challenges associated with scaling interventions. Psychosocial interventions are difficult to scale, because they are highly context dependent (Yeager and Walton, 2011; Sisk et al., 2018). For example, a recent, large-scale experimental evaluation of growth mindset interventions revealed that intervention effects are moderated by the local culture, such that the intervention is most effective where the local culture is supportive of a growth mindset (Yeager et al., 2019). Attempts to replicate interventions without consideration of differences in context often fail to reproduce the original results (Sisk et al., 2018). Thus, an intervention that is designed and assessed at one institution may not be easily adopted at other institutions or even other departments within the same institution. Lund and Stains (2015) documented contextual differences among disciplinary departments of physics, biology, and chemistry that impacted faculty adoption of evidence-based teaching practices, providing a cautionary note of different contexts even among STEM fields. Interventions to motivate attendance in TPD may not be effective in departmental cultures that are particularly hostile to teaching. Or, perhaps departments that are hostile to teaching may pose the greatest potential for these interventions to influence participants. The effectiveness of an intervention also depends on the population being targeted. New instructors may be more amenable to changing their pedagogical decisions and behaviors relative to their senior colleagues (Ridgway et al., 2017). In sum, scaling TPD motivation interventions will require careful consideration of the contextual factors and will likely require further evaluation and iteration.

CONCLUSION

We propose that efforts to improve undergraduate education could benefit from a cross-disciplinary approach, integrating psychological principles and research. Specifically, by adopting strategies that psychologists have been using to improve student motivation and performance in academic settings, professional development scholars may be able to increase instructors' motivation to participate in TPD and continually improve their teaching strategies.

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