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Can We Change Their Minds? Investigating an Embedded Tutor's Influence on Students' Mindsets and Writing

Abstract

This article describes a semester-long study that used replicable, aggregable, data-supported (RAD) research methods to investigate embedded tutoring efficacy. The research occurred in three sections of an engineering course, one of which had a course-embedded writing tutor. Over the course of a semester, the researcher investigated changes in students' mindsets, namely their beliefs about the malleability of writing skills. Results suggested students who worked with the embedded tutor improved their mindsets significantly more than did nontutored students. Students in the course-embedded section became more growth-minded, seeing themselves as capable of improving. The researcher also blindly rated samples of students' writing and found tutored students improved their literature-review drafts more significantly than did nontutored students. Tutored students' revised literature reviews were significantly better in terms of organization, style, and mechanics. These findings suggest an embedded tutor can not only improve students' writing performance but also influence their mindsets, demonstrating the important role writing centers can play in promoting the growth mindset.



In over 14 years working in writing centers, I have heard many students say they are bad writers. In these moments, students often may not sound frustrated or depressed but simply resolved to accept their fate. According to Casey Jones (2001), many students believe writing is a “gift’ that one either has or does not have” (p. 11). This false notion has serious consequences if students’ beliefs about ability affect the students significantly, as Carol Dweck (2006) contends. According to Dweck’s research, students who believe their abilities and intelligence are “fixed” are more likely to avoid taking risks and expending effort in challenging situations. In contrast, students who believe their abilities are malleable tend to work harder and overcome failure (Blackwell, Trzesniewski, & Dweck, 2007), perform better academically (Good, Aronson, & Inzlicht, 2003), and even feel less “sick, tired, or in pain” (Yeager, Johnson, Spitzer, Trzesniewski, Powers, & Dweck, 2014, p. 871). Importantly, psychologists have discovered that relatively small interventions can prompt students to think differently about their potential (Blackwell, Trzesniewski, & Dweck, 2007). These findings raise important questions: Can tutoring interventions change students’ beliefs about their writing abilities? Can tutors change students’ *mindsets*?

Mindsets¹ are a psychological construct defined as “core assumptions about the malleability of personal qualities” (Yeager, Johnson, Spitzer, Trzesniewski, Powers, & Dweck, 2014, p. 303). According to mindset theory, mindsets fall along a spectrum from “fixed” to “growth,” with fixed-mindedness characterized by the belief that traits are unchangeable and growth-mindedness characterized by the belief that traits are malleable (Dweck, 2006). Students’ mindsets have been studied in a number of domains, and researchers have found students’ mindsets directly influence their beliefs, behaviors, learning strategies, and performance (Blackwell, Trzesniewski, & Dweck, 2007).

This research in psychology has led me to hypothesize that students’ mindsets influence their writing and that tutors can affect students’ mindsets and performance. I tested this hypothesis by investigating the effects of a course-embedded-tutoring intervention on students’ mindsets and writing. What I found was surprising. One might expect that mindset changes occur only after multiple, sustained interventions, but this study and others suggest relatively brief interactions can transform students’ mindsets and have significant effects (see also Blackwell, Trzesniewski, & Dweck, 2007; Yeager, Johnson, Spitzer, Trzesniewski, Powers, & Dweck, 2014). In this article, I describe the results of my study and aim to show assessing mindset changes can demonstrate one compelling area of embedded-tutoring efficacy, a goal

1 Psychologists also use the terms *incremental theory* and *entity theory* to refer to mindsets. This terminology is interchangeable in the literature.

that has eluded our field despite many attempts to “prove” our effectiveness (Lerner, 2014).

Studying mindsets is also one way to respond to calls from the field for more empirical evidence of writing center effectiveness (Bell, 2000; Lerner, 2001; Thompson, 2006). Even though we know anecdotally that tutors help writers, it is difficult to demonstrate that impact because drawing causal links between tutoring and writing improvement is complicated (Jones, 2001). To develop more evidence of writing center efficacy, researchers have called for more empirical methods that study deeper, internal factors instead of relying primarily on external factors like satisfaction surveys, grades, and retention rates to demonstrate tutorial success (Lerner, 2001; Schendel & Macauley, 2012; Thompson, 2006). My work responds to these calls for more meaningful measures of student learning by investigating an embedded tutor’s impact on both writers’ mindsets and their writing. As James Bell (2000) asserts, “Writing centers are aiming to alter behavior” (p. 15); one way to test the effectiveness of tutoring interventions is to examine an embedded tutor’s influence on students’ mindsets, the catalysts for behavior and performance (Blackwell, Trzesniewski, & Dweck, 2007).

Although I believe mindset theory has implications for the writing center at large, a course-embedded-tutoring (CET) program is an ideal place to study mindsets because the embedded context provides a relatively controlled research environment. Students in an embedded course can be randomly placed in control and experimental groups to isolate the effects of tutoring. Such experimental conditions are difficult to create in a typical writing center. CET programs can also facilitate frequent interactions between students and the embedded tutor.

Literature Review

Mindset Research

Mindset research is gaining momentum in many fields. Although new scholars are increasingly appearing in the literature, most of the foundational studies were conducted by Carol Dweck, a psychologist at Stanford University. Dweck (2006) initially coined the terms “growth mindset” and “fixed mindset” after studying students’ implicit theories of intelligence for decades. Growth-minded students are characterized by their orientation toward learning over performance, their appreciation for effort, their willingness to take productive risks, and their positive response to failure (Dweck, 2006). In contrast, fixed-minded students are characterized by their avoidance of effort, challenge, and failure, along with their preoccupation with performance (Robins & Pals, 2002). Studies have shown students’ mindsets influence their academic performance (Good, Aronson, & Inzlicht, 2003), resilience (Yeager

& Dweck, 2012), beliefs about other people (Yeager, Miu, Powers, & Dweck, 2013), and mental health (Schleider & Weisz, 2018). Although mindsets are powerful, psychologists are careful to clarify that mindsets operate along a continuum and that people can be more or less growth- or fixed-minded in different contexts (Mercer & Ryan, 2010).

The negative consequences of a fixed mindset have been demonstrated in the literature. Studies have shown fixed-minded students enjoy school less (Aronson, Fried, & Good, 2002), have lower self-esteem (Robins & Pals, 2002), and even experience more stress and illness (Yeager, Johnson, Spitzer, Trzesniewski, Powers, & Dweck, 2014). Even when researchers control for factors like grade-point average and IQ, they find fixed-minded students tend to underperform or feel worse than do growth-minded students (Dweck, 2006). For instance, Richard Robins & Jennifer Pals (2002) conducted pathway analyses to see how students' mindsets influenced their behaviors and affective responses. Studying over 500 students, they found fixed-minded students "felt more distressed about their academic performance and were less likely to feel determined and inspired, despite performing as well as [growth-minded students]" (p. 329). On average, fixed-minded students "give up more easily when challenged" and attribute instances of success to external factors (p. 331). Despite these harmful effects, fixed mindsets are surprisingly common among students (Dweck, 2006). For this reason, course-embedded writing tutors must be prepared to help students reconceptualize their notions of growth.

A variety of intervention studies show that mindsets are malleable and that becoming more growth-minded can lead to positive results (Aronson, Fried, & Good, 2002; Blackwell, Trzesniewski, & Dweck, 2007; Good, Aronson, & Inzlicht, 2003). For instance, Jessica Schleider & John Weisz (2018) found that adolescents who were encouraged to develop a growth-minded view of personality became significantly less depressed. Although students' mindsets can change, they are relatively stable without intervention (Robins & Pals, 2002). Additionally, the qualities of effective interventions have not been fully defined in the literature (Mercer & Ryan, 2010), leaving significant room for writing center scholars to contribute to these discussions. Since writing center professionals can observe student interactions and investigate learning in process, we are well positioned to observe mindset changes and the conditions that promote them. Writing center professionals who are essentially working in learning laboratories (Lerner, 2009) can witness the effects of peer influence.

Writing Center Research on Noncognitive Factors

Mindset research falls within a larger field of research on *noncognitive factors*, which include students' attributes, attitudes, and behaviors (Farrington, Roderick, Allensworth, Nagaoka, Keyes, Johnson, & Beechum, 2012). In

composition studies and writing center studies, noncognitive factors are typically described as *dispositions*, or “personal, internally held characteristics that students bring into learning situations” (Driscoll & Powell, 2016). Scholars argue dispositions are critical because they influence students’ ability to transfer their learning across contexts (Baird & Dilger, 2018). However, dispositions encapsulate a large spectrum of internal qualities, and they are difficult to measure (Driscoll & Powell, 2016). In contrast, mindset is a more foundational construct that describes one’s belief regarding the nature of ability. While dispositions refer to attributes and behaviors, mindsets are about beliefs. Research suggests that people’s behaviors and attitudes stem from their mindsets (Blackwell, Trzesniewski, & Dweck, 2007). That is, a person’s mindset influences their disposition. For instance, people are usually more persistent when they believe their efforts will pay off. Since mindsets affect other noncognitive factors, researchers who study dispositions and transfer should consider them, too.

Several key studies in writing center research have examined tutors’ influence on students’ noncognitive factors, such as students’ levels of engagement (Bell & Frost, 2012; McCourt & Carr, 2010), persistence (Huntly & Donovan, 2010), and metacognition (Regaignon & Bromley, 2011). A few studies have examined writing center users’ help-seeking behaviors (Williams & Takaku, 2011), procrastination behaviors (Young & Fritzsche, 2002), and attitudes (Davis, 1988; Huang, 2011), but none of these researchers explore students’ mindsets. Still, this growing research area suggests students’ noncognitive factors influence their writing performance and therefore affect writing center work.

More commonly studied is the connection between writing center use and self-efficacy, defined as a person’s “belief that he or she can perform well on a designated task” (Williams & Takaku, 2011, p. 2). Unlike mindset research that examines belief systems, self-efficacy research investigates students’ confidence levels. For instance, James Williams & Seiji Takaku (2011) conducted a longitudinal study in which they studied the relationships among self-efficacy, help seeking, writing center usage, and student performance. They found that writing center usage was highest among multilingual students with low self-efficacy. Moreover, they discovered frequent writing center visitors earned higher grades than nonusers. Pam Bromley, Kara Northway, & Eliana Schonberg (2016) also saw increased self-efficacy in writing center users, particularly “in the areas of specific writing skills and task completion” (“Breakthroughs,” para 10). Although increased self-efficacy is a positive tutoring outcome, Robins & Pals (2010) caution confidence may not be enough to “buffer” students against helplessness (p. 330). They write, “Even if a high level of confidence may at first help [fixed-minded students] respond adaptively in achievement situations, this confidence could be so fragile when confronting the constant

threat of failure that the helpless pattern eventually takes over” (p. 330). Since confidence is not enough to inspire success, writing center researchers need to understand more foundational influences on students’ writing performance. Through pathway analyses, psychologists have discovered students’ mindsets deeply influence their performance (Blackwell, Trzesniewski, & Dweck, 2007), suggesting mindsets may affect writing performance more than confidence does.

Several writing center scholars who have studied tutees’ attitudes and behaviors have used questionnaires and surveys as their primary research methods, establishing precedence in the literature for using self-reported data. For example, Roberta Henson & Sharon Stephenson (2009) administered the Daly-Miller Writing Apprehension Test to determine whether the writing center “helped alleviate clients’ writing anxiety” (p. 3). Kevin Davis (1988) used the Writing Attitude Scale, which poses statements on a Likert scale to determine students’ writing preferences, confidence levels, fears, and beliefs about writing. Davis found that writing center users improved their attitudes by significantly greater degrees than nontutored students did. Beth Rapp Young & Barbara Fritzsche (2002) also assessed students’ anxiety levels using the State-Trait Anxiety Inventory and a procrastination scale that asked students to rate their procrastination tendencies and resulting psychological stress. Young & Fritzsche found that students who visited the writing center procrastinated less and “were more satisfied with their writing process” (p. 53). All three of these studies’ attention to students’ beliefs, feelings, and behaviors suggests tutors influence students’ noncognitive factors, lending support to the hypothesis that embedded tutors can help students adopt a new mindset toward writing.

Course-Embedded Writing Tutoring Efficacy

Although CET programs are increasingly common (Hughes & Hall, 2008), few studies rigorously investigate their effectiveness (Soven, 2001). Several scholars have used interviews (Gladstein, 2008; Ronesi, 2017) and satisfaction surveys (Dvorak, Bruce, & Lutkewitte, 2012) to gauge tutoring efficacy. For instance, Lynne Ronesi (2017) found, through observations and interviews, that an embedded tutor effectively guided chemical engineering students and “facilitated learning by asking relevant and appropriate prompting questions” (p. 141). Survey results showed 60% of students were satisfied with their embedded tutor, saying she was “helpful in organizing the paper and in turning their focus to the applications, advantages and disadvantages, and to the challenging section on improvements” (p. 134). Jill Gladstein (2008) also used interview methods to investigate embedded-tutoring efficacy in the sciences. Gladstein found embedded tutors’ “insider knowledge” enabled them to help students follow genre conventions and increased their confidence and enthusiasm for the subject matter, suggesting an embedded tutor can influence

students' behaviors and feelings ("The Gray Spaces Between the Binaries," para. 9).

Other scholars have evaluated CET efficacy by assessing students' writing samples (Dinitz & Harrington, 2014) and comparing students' grades (Titus, Scudder, Boyle, & Sudol, 2014). Sue Dinitz & Susanmarie Harrington (2014) analyzed session transcripts and student papers and found specialist tutors in their study were more effective than generalist tutors because specialist tutors prioritized global issues, challenged students to improve, and offered students transferable writing advice. As a result of these findings, Dinitz & Harrington recommend embedded tutors be matched with courses that reflect their disciplinary background. Kevin Dvorak, Shanti Bruce, & Claire Lutkewitte (2012) also assessed student writing samples and calculated satisfaction rates. They found that, on average, students who consulted frequently with their embedded tutor "scored 9.4 points higher on the 25-point [writing-assessment] scale" than those who met with the tutor infrequently (p. 117). Survey results showed students were satisfied with the CET program, with 83% reporting they hoped to have an embedded tutor in the future.

One empirical study that correlates embedded tutoring with noncognitive factors is found in Dara Rossman Regaignon & Pamela Bromley's (2011) research. Regaignon & Bromley evaluated writing produced by students in an English class supported by an embedded tutor to assess students' metacognitive awareness. External reviewers used holistic and trait scoring to evaluate three essays in students' portfolios. By comparing portfolio scores, the researchers found that students who worked with embedded tutors had statistically significant improvement on their work, whereas students in the control group did not. The researchers also discovered that students who worked with embedded tutors displayed "an increased awareness of their own writing processes and a greater sense of their ability to evaluate and improve their own writing" (p. 49). These results may suggest students experienced mindset changes although the researchers did not investigate this line of inquiry. Megan Titus, Jenny Scudder, Josephine Boyle, & Alison Sudol (2014) also argue that embedded tutors are experts at "heightening the students' metacognitive awareness" (p. 16). The fact that embedded tutors are depicted in the literature as mentors with strong influential power suggests they have the rapport and authority to influence their peers' mindsets, as well as their writing performance.

Methods

The context for this semester-long, mixed-methods study was a large mid-Atlantic comprehensive public university with an enrollment of over 20,000 students. The CET program is run out of the University Writing Center and staffed by writing center tutors who have at least one semester of experi-

ence tutoring. Embedded tutors are placed in courses with a strong writing emphasis, where they have a number of responsibilities, including delivering mini-lessons and workshops, holding writing consultations, and collaborating with course instructors on assignment design. The CET program originated in 2010 as a grassroots response to growing needs for pedagogical support and as a promotion system for tutors. Each year, the program supports up to 11 classes.

IRB-approved research occurred in three sections of a junior-level engineering course. One course section had an embedded tutor, but students were not aware of this feature when registering for the class. Consenting participants fell into one of three research groups: 1. the experimental group, which included students in the course section with an embedded tutor; 2. the control group, which included students in the section without an embedded tutor; and 3. the comparison group, which included students in a third section who were taught by a different instructor who used the same course structure to cover identical material. All three sections used the same textbook, assignment sequence, and online learning modules. The embedded tutor, Sara,² was an experienced and paid University Writing Center tutor who delivered a single in-class lesson on mindset theory and consulted once with students individually on their literature-review drafts. During the writing consultation, the embedded tutor reinforced the idea that writing ability is malleable. The study's methodological approach and design were guided by the following research questions³:

1. To what degree do students' mindsets change over the course of the semester?
2. To what degree does students' writing improve after consulting an embedded tutor?
3. To what degree do students' mindset scores differ across treatment groups?

Embedded-Tutoring Intervention

Students in the experimental section received an embedded-tutoring intervention that featured two main components: an in-class presentation on mindset theory and individual writing consultations. The tutor, Sara, also met with the course instructor several times to discuss her assignment expectations and her goals for improving students' writing. Before the intervention, I trained Sara in mindset theory, and she read Dweck's (2006) book *Mindset*. As part

2 Pseudonym

3 This study is part of a larger research project with additional research questions and data (IRB protocol number 17-0094).

of the training, Sara and I met regularly throughout one semester to discuss psychological studies that model methods of using an intervention to teach a growth mindset (Aronson, Fried, & Good, 2002; Blackwell, Trzesniewski, & Dweck, 2007; Yeager, Johnson, Spitzer, Trzesniewski, Powers, & Dweck, 2014). We also watched online videos on mindset theory (Briceño, 2012; Dweck, 2014) and neural plasticity (Khan Academy, 2014). Throughout the semester, we discussed Sara's beliefs about the nature of writing ability and her experiences developing as a writer, which helped me assess her mindset and reinforce her growth-minded approach to writing.

The training materials informed Sara's in-class lesson, which she delivered to students in the experimental section at the beginning of the semester. This 30-minute presentation resembled other intervention studies described in the psychological literature: Sara informed students about the expandable nature of intelligence, she showed short video clips about neural plasticity, and she discussed students' past experiences of growth in writing and other areas (Aronson, Fried, & Good, 2002; Yeager, Johnson, Spitzer, Trzesniewski, Powers, & Dweck, 2014). Several studies show a relatively short intervention like this one can have measurable results. For instance, David Yeager, Rebecca Johnson, Brian James Spitzer, Kali Trzesniewski, Joseph Powers, & Carol Dweck (2014) delivered a single 25-minute intervention that was considered a "one-time activity" that was "not mentioned again to students by researchers or teachers" (p. 8). They correlated both short-term and long-term benefits to this intervention. The experimental group in Lisa Blackwell, Kali Trzesniewski, & Carol Dweck's (2007) study received four 25-minute lessons, although the researchers attributed the results to even less time, concluding that "a brief, targeted intervention, focusing on a key belief, can have a significant effect on motivation and achievement" (p. 258), lending support to the design of this embedded-tutoring intervention.

The second component of the embedded tutoring was individual writing consultations. Sara held these consultations during the last weeks of the semester, when students were writing their literature reviews, the main writing assignment for the course. Unlike tutors in some embedded-tutoring models, Sara did not meet with students frequently throughout the course. Instead, Sara consulted with each student once, making the intervention relatively targeted, which is consistent with other mindset interventions in the psychological literature. During writing consultations, Sara prioritized higher-order concerns, but she also invited writers to direct session content. I instructed Sara to promote a malleable theory of writing improvement and to encourage students to see themselves as capable of improving. With several weeks separating the two parts of the intervention, Sara was able to reinforce mindset theory. Although the time gap between the in-class presentation and the consultation was wide, the results did not indicate this design proved problematic.

Surveys

At the beginning and end of the semester, I administered a survey as a pre/post measure. The survey was adapted from three validated instruments: Michael Palmquist & Richard Young's (1992) Writing Questionnaire, Carol Dweck's (2000) Mindset Scale, and Teresa Limpo & Rui Alves's (2014) Implicit Theories of Writing Scale. It contained the following eight items, which students responded to using a Likert scale of *strongly disagree* to *strongly agree*:

1. Good writers are born, not made.
2. Hard work, desire, dedication, and enough time are all I need to become a good writer.
3. You have a certain amount of writing ability, and you can't really do much to change it.
4. I believe I was born with the ability to write well.
5. My essays will always have the same quality, no matter how much I try to change them.
6. Good teachers can help me become a better writer.
7. No matter how hard I try, I will never be a great writer.
8. No matter who you are, you can significantly change your writing ability.

To calculate students' mindset scores, the survey was scored using a 6-point scale (1=*strongly agree* and 6=*strongly disagree*). Growth-minded statements were reverse scored. Low scores indicated a fixed mindset, whereas high scores indicated a growth mindset. I calculated basic inferential statistics to compare mindset scores of students in the experimental group ($N = 7$) with the mindset scores of students in the control and comparison groups ($N = 22$).⁴ Since the control sample size was small, I combined the control and comparison groups to increase the power of the statistical tests. This decision was warranted because the three class sections were nearly identical in class structure and pedagogy. Both instructors used the same syllabus, schedule, lesson plans, video modules, assignments, and grading rubrics. Furthermore, the professors delivered most of the writing instruction in common lecture sessions. In my initial data analyses, I found insignificant differences in terms of control and comparison group students' mindset scores and grades at the end of the semester, indicating no evidence of an instructor effect. To compare

4 I consulted a statistician to develop plans for analyzing the data. The statistician helped me select the most appropriate statistical tests for my data sets and research questions. We also worked together to conduct statistical analyses using SPSS software.

students' mindset changes across treatment groups, I conducted an independent samples *t*-test, and I conducted a paired samples *t*-test to measure the significance of students' mindset changes. I conducted *t*-tests rather than an ANOVA because the sample size was not balanced, making it difficult to check the normality assumptions necessary for an ANOVA.

Writing Assessment

To assess students' writing performance, I collected 102 literature-review drafts from consenting students, and I blindly rated them using the 4-point trait-scoring rubric engineering faculty members use for grading. The rubric contained five traits: purpose, complexity, organization, style, and mechanics, with ratings of *beginning* (1), *developing* (2), *competent* (3), and *advanced* (4). Although I did not have the institutional resources to employ a team of normed raters, I followed careful procedures to ensure a blind rating. Before rating students' literature reviews, I removed all identifying information, and my colleague coded essays for later reidentification and then rearranged the essays into random order. This system ensured I did not know, when rating, which authors were in which research groups and which essays were first and final drafts. After completing all ratings, I consulted the identification key and created a spreadsheet that included students' pseudonyms and corresponding essay scores for first and final drafts. After rating students' essays, I conducted a paired samples *t*-test to compare students' first and final drafts. I repeated the *t*-test for each treatment group to see whether one group had greater improvement across drafts.

Interview

At the end of the semester, I interviewed the embedded tutor about the length and content of tutoring sessions, her observations of students' writing strategies, and her perceptions of students' mindsets. Collecting this data gave me access to Sara's interactions with students and her observations of students' writing performance. I coded the interview transcript using an inductive approach to identify emerging themes that demonstrated patterns in students' beliefs, behaviors, learning strategies, and performance. The data gathered from these qualitative methods create triangulation with the survey and writing-assessment data, providing a more robust understanding of the connections between students' mindsets and students' writing.

Findings

Surveys

Since participation was entirely voluntary, not all students elected to complete both surveys. Of 66 total students in the three engineering sections,

57 completed the presemester survey, 36 completed the postsemester survey, and 29 completed both surveys. At the end of the semester, students in the control group had mindset scores ($M = 4.4$, $SE = 0.384$) similar to students in the comparison group ($M = 4.5$, $SE = 0.151$). This difference, 0.10, 95% CI [-0.6118, 0.8265], was not significant, $t(20) = 0.311$, $p = 0.76$. Since an independent samples t -test did not show evidence of an instructor effect, I combined the two groups to offset the effects of a small control-group sample size.

Data from the subgroup of participants who completed both the presemester and postsemester surveys ($N = 29$) provide points of comparison for each treatment group. Table 1 shows the pre- and postsemester mean mindset scores for students in these two groups.

Table 1
Pre- and PostSemester Mindset Scores for Students Who Completed Both Surveys

	Experimental group's ($N=7$) mindset mean	Control and comparison groups' ($N=22$) mindset mean
Pre	4.36 (0.68)	4.56 (0.50)
Post	4.71 (0.63)	4.48 (0.66)

Note: Standard deviation in parentheses

As Table 1 displays, students in the experimental group experienced dramatic mindset changes. An independent samples t -test revealed that, on average, students who received the embedded-tutoring intervention had greater gains in their mindset scores ($M = 0.36$, $SE = 0.18$) than those who did not receive the embedded tutor's intervention ($M = -0.07$, $SE = .09$). This difference, 0.43, 95% CI [0.04, 0.82], was significant, $t(27) = 2.26$, $p = 0.032$, and represented a large effect size, $d = 0.96$.

The results show that, on average, students in the experimental group who received the embedded-tutoring intervention became more growth-minded over the course of the semester. These students had higher scores after the intervention ($M = 4.71$, $SE = 0.24$) than before it ($M = 4.36$, $SE = 0.26$). A paired samples t -test showed that this presemester/postsemester difference, 0.36, 95% CI [0.07, 0.79], was approaching significance, $t(6) = 2.03$, $p = 0.088$, and represented a nearly large effect size, $d = 0.77$.

Writing Assessment

To assess students' writing performance, I blindly rated 102 first and final literature-review drafts using a trait-scoring rubric. The results showed that, on average, experimental-group students' ($N = 17$) final drafts earned higher scores than their respective first drafts on four of five rubric traits: purpose, organization, style, and mechanics (see Table 2).

Table 2

Experimental Group Students' First and Final Draft Trait Scores

		Mean	N	Std. deviation
Pair 1	Purpose – final draft	2.9412	17	.70450
	Purpose – first draft	2.853	17	.6316
Pair 2	Development – final draft	2.4118	17	.56556
	Development – first draft	2.471	17	.5987
Pair 3	Organization – final draft	2.7941*	17	.73013
	Organization – first draft	2.324	17	.6600
Pair 4	Style – final draft	2.5000*	17	.39528
	Style – first draft	2.206	17	.3976
Pair 5	Mechanics – final draft	2.6176*	17	.45171
	Mechanics – first draft	2.353	17	.5524

NOTE: *Represents a significant increase at .05 level.

A paired samples t -test showed that the difference in organization, 0.47, 95% CI [0.09, 0.85], was significant, $t(16) = 2.63$, $p = 0.018$, and represented a medium effect size, $d = 0.64$. The difference in style, 0.29, 95% CI [0.09, 0.50], was also significant, $t(16) = 3.05$, $p = 0.008$, and represented a nearly large effect size, $d = 0.74$. Finally, the difference in mechanics, 0.26, 95% CI [0.04, 0.49], was significant, $t(16) = 2.50$, $p = 0.024$, and represented a medium effect size, $d = 0.62$. (see Table 3).

Table 3

Paired Samples T-Test Comparing Experimental-Group Students' First and Final Drafts

		Mean	Std. Deviation	Std. error Mean	95% Confidence interval of the difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Purpose (final) – Purpose (first)	.08824	.47550	.11533	-.15625	.33272	.765	16	.455
Pair 2	Dev (final) – Dev (first)	-.05882	.49631	.12037	-.31400	.19636	-.489	16	.632
Pair 3	Org (final) – Org (first)	.47059	.73889	.17921	.09069	.85049	2.626	16	.018
Pair 4	Style (final) – Style (first)	.29412	.39760	.09643	.08969	.49855	3.050	16	.008
Pair 5	Mech (final) – Mech (first)	.26471	.43724	.10605	.03990	.48951	2.496	16	.024

In comparison to the students in the experimental group, students in the control and comparison groups ($N = 34$) improved their drafts on all rubric traits, but students' final drafts were not significantly better on most traits (see Table 4). A paired samples t -test showed that only the difference in organization, 0.24, 95% CI [0.07, 0.40], was significant, $t(33) = 2.96$, $p = 0.006$, and represented a medium effect size, $d = 0.50$.

Table 4

Control/Comparison-Group Students' First and Final Draft Trait Scores

		Mean	N	Std. deviation
Pair 1	Purpose (final draft)	2.8235	34	.68404
	Purpose (first draft)	2.706	34	.6976
Pair 2	Development (final draft)	2.3676	34	.58139
	Development (first draft)	2.338	34	.5867
Pair 3	Organization (final draft)	2.5588*	34	.53321
	Organization (first draft)	2.324	34	.5349
Pair 4	Style (final draft)	2.3235	34	.34559
	Style (first draft)	2.250	34	.3941
Pair 5	Mechanics (final draft)	2.5441	34	.60762
	Mechanics (first draft)	2.368	34	.6069

NOTE: *Represents a significant increase at .05 level

Interview

Interviewing the embedded tutor provided a window into the tutoring sessions and insight into the engineering students' motivations and perceptions. In the interview, Sara reported students mostly needed help with in-text citations, transitions, signposting, and paragraph length. During sessions, Sara also spent considerable time explaining the conventions and purposes of a literature review because many students were unfamiliar with the genre. According to Sara, most students were quite receptive to her feedback, which surprised her because she had expected students to be unengaged during mandatory tutoring sessions. However, she did encounter a couple of resistant students. For instance, she talked at length about one student who "seemed uninterested in help and was only interested in pointing out how stupid his paper was." The student's impatience, distraction, and resistance to her guidance made it one of the most frustrating sessions she had faced as a tutor. She explained:

Every time I would start answering [his question], there was a constant shutdown and it was about—it wasn't even always about things that were just suggestions where I was saying, "Well, maybe you should do this." There were times when I would say, "This is what a lit. review is. This is how you have to write a lit. review." And he would say, "No, no, that doesn't apply to me." And so I mean, I guess, I'm not really supposed to make conjectures but I feel like, you know, he was very closed minded about it, very much like, "It's a terrible paper. There's nothing you can do. This is all a waste of time."

Sara suspected the student "probably" thought he was "an okay writer but that writing in general or this assignment was very dumb." Importantly, the student Sara referenced scored quite low on the mindset survey (3.5), suggesting he had a fixed mindset. His postsemester survey results showed he saw no change in his writing process or performance, and he indicated in the survey that talent is more important than effort when it comes to writing success.

The interview transcript showed that modeling a growth mindset and teaching for transfer were important goals for Sara. Although she did not explicitly use the phrase *growth mindset*, she reported she was "really conscious about saying, "This is a skill, like you can apply this elsewhere. You can do this in other assignments. You could do this in your like business emails." Sara tried to help students see how their writing skills extended beyond one particular assignment or class by "bringing it even broader than just their engineering project or just their school life." According to Sara, this focus on transfer was the way she emphasized a growth mindset because she believed concentrating on developing writing skills in general, rather than on performing well on a single assignment, emphasized improvement and growth. In fact, she thought students might have been uncharacteristically open to growth because they had attended her mindset lecture in class. She said "the overarching theme" of the

tutoring sessions “was that they did want to improve and change it. It almost felt like more so than in a regular writing center session, they were interested in learning in terms of writing and not just in terms of the assignment.” Here, she connected students’ desire to improve with transferable writing skills, believing both may have been inspired by her in-class presentation on mindset theory.

Discussion

Several explanations might account for the significant improvement tutored students experienced. First, the embedded tutor had several years of tutoring experience, and she was quite accomplished in her own academic career. From all accounts, Sara was a focused, clear, and insightful tutor. Also, as a double major in writing and design, she knew the value of hard work, and she was dedicated to her studies and to her embedded-tutoring position. These qualities likely helped her model a growth mindset and endorse the value of effort. Since Sara was both experienced and growth-minded, it is unclear which of these qualities made the most difference for tutees. However, the training Sara received in mindset theory and the nature of her intervention support a correlation between embedded tutoring and mindset improvement. Sara’s training and her in-class presentation both contained fundamental features of previous studies’ interventions: instruction in mindset theory, discussion about neural plasticity, and reflection on students’ experiences (Aronson, Fried, & Good, 2002; Blackwell, Trzesniewski, & Dweck, 2007; Good, Aronson, & Inzlicht, 2003). Since previous studies have drawn correlations between comparable interventions and mindset change, similar outcomes likely occurred in this study. Other research also suggests tutors can influence writers’ behaviors and attitudes (Davis, 1988; Huntly & Donovan, 2010; Regaignon & Bromley, 2011). For instance, Young & Fritzsche (2002) found that writing center use correlated with decreased procrastination behavior, even when tutors did not intentionally discourage students from procrastinating. Young & Fritzsche conclude that helping procrastinators falls within the “normal course of operations” for writing centers (p. 55). Similarly, it is reasonable to expect that growth-minded tutors model growth mindsets without even being told to do so.

This study cannot pinpoint exactly why students in the experimental group revised their drafts more significantly than those in the control and comparison groups did. It is probable that tutored students improved their drafts because they received helpful suggestions from the embedded tutor. Another explanation is that they became more growth-minded and therefore expended more effort on revision. It is also possible both of these variables, or another one, influenced students’ final drafts. I did not conduct linear regression modeling, so I cannot say with certainty what relationship existed among the tutoring, mindset changes, and writing improvement. However,

my statistical analyses showed significant relationships between the tutoring intervention and mindset changes and between the tutoring intervention and draft improvements. The fact that previous research has found that students who work with embedded tutors earn higher grades (Dvorak, Bruce, & Lutkewitte, 2012; Titus, Scudder, Boyle, & Sudol, 2014) and improve their drafts (Regaignon & Bromley, 2011; Pagnac, Bradfield, Boertje, McMahon, & Teets, 2014) lends support to this study's findings.

Interestingly, the results suggest one-on-one consultations were the most crucial component of the CET intervention. I discovered this finding after I ran the statistical tests for the subgroup of experimental-group students who participated fully in the embedded-tutoring intervention. Although all students in the experimental group had access to the in-class lecture and individual consultations, not all of them took advantage of these resources. Several students did not attend any writing consultations. When I removed these students from the mindset data set, I found it was the students who attended writing consultations that exhibited substantial gains in their mindset scores. This finding underscores the value of one-on-one tutoring, the bread and butter of most writing centers. It also suggests the study's results may be replicable in a typical writing center context. That is, if one-on-one consultations make the most difference for writers, students would likely experience similar results with general writing tutors.

It is worth noting, too, that students may not need multiple consultations in order to benefit from a tutor's assistance. In this study, the embedded tutor met with students only once. I was surprised such a small intervention had significant results because I had assumed students would need several interactions with the tutor in order to internalize and apply her feedback. The fact that students significantly improved their drafts on three of five rubric traits after one tutoring session is striking. Bromley, Northway, and Schonberg (2016) also found that "students who visited [the writing center] one time" reported acquiring "knowledge about writing tasks" they could apply to future assignments ("Breakthroughs," para. 6 & 1). Combined, these studies suggest single sessions can help writers significantly. This is good news if other institutions resemble ours, where the majority of writing center clients attend only one session. Of course, we strive to attract repeat clients, but this study suggests even one-time users benefit from their experience.

Although this study highlights students' capacity for improvement, fixed-minded writers' potential barriers are illustrated in the interview data. During her interview, Sara described two students that represent both ends of the mindset spectrum. First, Sara described a writer who was "super-interested because he did want to improve as a writer." According to Sara, this motivation led him to ask "questions that were broader and reflected an interest in learning as a writer, not just for this assignment." Their session was highly productive.

Importantly, data from this student displayed a high-growth mindset score (5), and he reported seeing moderate improvement in his writing process and performance. On the other hand, Sara described strong resistance from a writer who believed his paper was “terrible” but was unwilling to receive assistance. Reviewing data from this student reveals compelling correlations: His survey data displayed a fixed mindset score (3.5), and his responses indicated he saw no improvement in his writing over the course of the semester; he also said writing success is tied mostly to talent. These two example cases show how mindsets, writing processes (including response to feedback), and performance can be interrelated, quite similar to the direct pathways psychologists found from students’ mindsets to their beliefs, behaviors, learning strategies, and performance (Blackwell, Trzesniewski, & Dweck, 2007).

Although fixed-minded writers might initially resist tutoring, they may be the population most in need of assistance. As Yeager & Dweck (2012) assert, “Sometimes the forces in a system are adequate to support learning, but students have mindsets that prevent them from fully taking advantage of those forces” (p. 310). In the case of writing centers, fixed-minded students might avoid seeking help on their own. To incentivize writing center use, Young & Fritzsche (2002) contend that required tutoring sessions can be a useful pedagogical practice. Their study showed that students with high procrastination tendencies procrastinated less if they went to the writing center. One implication of this finding is that mandatory writing center visits might benefit students who would otherwise avoid the writing center. However, mandatory visits can cause logistical challenges if students from one class exhaust resources, and the practice can undermine our philosophy and mission (e.g., promoting student autonomy). However, the CET context can incorporate tutoring into the course curriculum more organically, lessening the philosophical tension required writing center visits may create. Fixed-minded writers might benefit from tutoring requirements in the CET context, especially if they do not seek assistance from a tutor on their own.

If mindsets can create barriers to improvement and tutoring efficacy, tutors and teachers may need more tools to assist fixed-minded writers. To prepare tutors to address mindset interference, Dweck’s (2006) book *Mindset* is an accessible and useful resource for tutors. I also recommend writing center administrators ask tutors about their own mindsets, encourage tutors to pay attention to students’ mindsets, and discuss ways mindsets might influence tutoring sessions and outcomes. Such discussions are important because even seemingly helpful praise can trigger a fixed mindset (Yeager & Dweck, 2012) if tutors tell students they *are* good writers. Instead, tutors can promote growth-minded views of writing by asking students about their writing beliefs and inviting them to reflect on moments of growth in their lives. Talking ex-

licitly about these underlying belief systems and reflecting on their origins can transform students' thinking about their potential (Dweck, 2006).

Limitations

Relatively small sample sizes limit the generalizability of these findings. Also limiting is the data's small diversion from normality (in the statistical sense). Although this diversion is not severe enough to prevent normal statistical analyses, it suggests this group of students could be unusually oriented toward growth and development. The embedded tutor reported students were already skilled writers who sought "to improve and change," perhaps even "more so than in a regular writing center session." Such an unusually high attention to learning and growth may have affected the results, meaning I may have seen even greater gains in tutored students' mindset scores if their baseline mindset scores had been lower.

Another limitation to consider is the survey. Although Dweck's (2000) instrument has been previously validated, modifying it could have affected validity and reliability. For instance, the statement "I believe I was born with the ability to write well" could be interpreted in different ways. If students agreed with the statement, they could be expressing a fixed mindset about writing ability. However, they could also be expressing confidence in their potential as writers. Conversely, students who disagreed with the statement may be endorsing a growth mindset, or they might simply have little confidence in themselves as writers. Although such varied interpretations could have influenced a couple of students' scores, most students' responses to this statement were consistent with their responses to other items.

Conclusions

This study points to a correlation between embedded tutoring and mindset change; however, it cannot fully extricate the many factors that influence tutoring efficacy. In order to more definitively link mindset changes to embedded tutoring, future research would need to further disentangle the variables. For instance, researchers could divide participants into three experimental treatment groups: a group who receives a presentation on mindset theory, a group who participates in embedded-tutoring consultations, and a group who receives both the presentation and individual consultations. This research design could isolate the impact of mindset-focused tutoring with a greater degree of certainty. Replicating and extending the research in such ways would provide greater insight into the results of promoting a growth mindset when working with writers.

Researchers could also adapt this study's methodology to investigate tutors' influence on students' mindsets in the writing center. To study mindsets in a writing center context, researchers could administer the writing-mindset survey before and after tutoring sessions and then collect students' drafts to assess improvement, using multiple raters. Although such research could showcase the value of tutoring, it remains to be seen whether tutoring interventions have lasting effects on students' mindsets and writing. Future longitudinal studies could assess students' mindsets before and after a tutoring intervention and then reassess their mindsets again several years later. The literature suggests mindset changes positively influence students years later, as previous longitudinal studies have shown that students who are exposed to mindset interventions have higher standardized test scores (Good, Aronson, & Inzlicht, 2003) and higher grades in the future (Blackwell, Trzesniewski, & Dweck, 2007), compared to control groups.

Additionally, surveying a more normally distributed sample would provide greater insight into fixed-minded responses to survey items since this study had abnormally high percentages of students on the growth end of the mindset spectrum. For instance, studying mindset changes in the context of an embedded-tutoring program in a first-year writing program could suggest how students on both ends of the mindset spectrum respond to tutoring. First-year writing is especially relevant because students are most vulnerable to mindset interference during times of transition (Dweck, 2006). In fact, first-year college students are "particularly susceptible to damaging attributions about the permanence of their problems" because they often begin college with fears of failing (Wilson & Linville, 1982, p. 368). First-year writing students who are new to college may benefit most from a CET program, especially if they see their writing abilities as fixed.

Finally, scholars might investigate the degree to which a professor's mindset changes after collaborating with an embedded tutor. Aneeta Rattan, Catherine Good, & Carol Dweck (2012) found teachers' mindsets affect their assumptions about students' abilities and, consequently, influence students' perceptions of themselves. Since professors' mindsets can help or harm students, it may be especially important for embedded tutors to help faculty see students' potential for growth. Francesca Gentile (2014) argues that course-embedded-tutoring programs have a "contagious" quality that enables them to influence teaching practices and the disciplinary curriculum (p. 37). Since embedded tutors can be "change agents" (Zawacki, 2008) who are well positioned to influence instructors, researching the impact of an embedded tutor on participating faculty members' mindsets could further demonstrate the efficacy of an embedded-tutoring model.

This study suggests writing tutors can improve students' writing skills and influence their mindsets, which indicates embedded-tutoring programs are

worthwhile investments. This research has broken ground in linking mindset changes to writing center work. I hope writing center researchers will continue to explore ways to advance interdisciplinary understandings of the power of mindsets, particularly as they relate to writing improvement.

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