



Pre-post Changes in Implicit Theories of Second Language Acquisition After a Successful Learning Experience

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OPEN ACCESS

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Specialty section:

This article was submitted to
Educational Psychology,
a section of the journal
Frontiers in Education

Received: 05 March 2019

Accepted: 31 October 2019

Published: 19 November 2019

Citation:

Brown CM and Seibert Hanson AE
(2019) Pre-post Changes in Implicit
Theories of Second Language
Acquisition After a Successful
Learning Experience.
Front. Educ. 4:135.
doi: 10.3389/feduc.2019.00135

Students enrolled in language classes often report believing that natural talent is necessary to acquire a second language in adulthood, and this belief can reduce motivation and learning. The purpose of this research was to test if a positive experience promotes the belief that language learning is an ability that can be developed through persistence and effort (i.e., an incremental implicit theory, or growth mindset). We hypothesized that participants would endorse an incremental implicit theory more after using effective study strategies to successfully learn characters in another language. In this study, participants were taught how to read 20 Japanese characters, and their implicit theories of second language acquisition were measured at three time points: days before the learning experience, immediately after, and 2 weeks after the learning experience. Results showed that this brief episode of success in language learning increased an incremental implicit theory of second language acquisition, and this change persisted 2 weeks later.

Keywords: implicit theories, second language acquisition, growth mindset, motivation, language education

INTRODUCTION

Learners' motivation to acquire a second language (L2) is critical to eventual success in second language acquisition (SLA), but motivation is a complex mental process that extends from a multiplicity of both internal (e.g., enjoyment, interest) and external (e.g., social support, potential rewards) factors (Dörnyei, 2005). From this perspective, learners who have a positive attitude toward the target language and the learning situation will experience the greatest motivation and thereby learn the most (Gardner, 2010). Although some of the factors that determine positive attitudes can be idiosyncratic to the learner and outside of the teacher's control (e.g., inherent interest in and enjoyment of a particular language), experiences that occur within the learning situation can also foster positive attitudes (MacIntyre and Mercer, 2014).

In this research, we focused on learners' beliefs about the attainability of SLA through effort vs. natural talent, known as their *implicit theory* of SLA (Mercer and Ryan, 2010).

Implicit theories are beliefs about the malleability of various skills (Dweck et al., 1995). People with an entity theory believe certain skills—e.g., intelligence, mathematics, music—are determined by natural talent and are resistant to change, whereas those with an incremental theory believe effort and practice can improve these skills. These beliefs are also known as fixed vs. growth mindsets, respectively (Yeager and Dweck, 2012).

The purpose of this research was to test if a brief positive experience of successful learning can promote an incremental theory of language acquisition that is sustained over time. Decades of research on implicit theories, pioneered by Dweck et al. (1995), have shown that people who adopt an incremental theory of ability are more successful in that performance domain. In academics, students with an incremental theory of intelligence attribute their grades to their own efforts, so they are more likely to persist in the face of setbacks and to respond to challenges by changing their approach (e.g., Dweck and Leggett, 1988). For example, in a longitudinal study by Shively and Ryan (2013), students who came to endorse a stronger entity theory of math over time (i.e., believing people either do or do not have a capacity for math) also earned lower math grades, while students who maintained an incremental theory about math were more likely to seek tutoring or other forms of help and subsequently earned higher math grades.

IMPLICIT THEORIES AND SECOND LANGUAGE ACQUISITION

In the U.S., where the current research was conducted, attitudes toward language learning often start positive but become more negative as schooling continues over the years (Heining-Boynton and Haitema, 2007). There are numerous obstacles for SLA in the U.S., such as English's status as a global language reducing the perceived value of learning an L2 (Crystal, 2003), which is a problem in other English-speaking countries as well (Graham, 2004). However, implicit theories of SLA may be one contributing factor, and this psychological factor can influence motivation in learners around the world. We speculate that many learners have experienced failure to learn an L2 in the past simply because they used ineffective learning strategies. Operating under this assumption that beliefs originate in past experiences, in the current research we sought to facilitate positive beliefs about SLA (specifically, an incremental implicit theory) by providing learners with a positive experience of language learning.

When language learners have struggled in the past, there is an incentive to believe in the notion of "language giftedness": past failure or poor performance can be blamed on not having an aptitude for language, rather than on insufficient or ineffective practice (Horwitz, 1988; Dörnyei, 2003; Graham, 2004; Hsieh and Schallert, 2008; Mercer and Ryan, 2010). Beginning learners may be especially vulnerable to this process. For example, in a study of secondary students learning French in the U.K., beginning students said ability—the presence or lack thereof—was the number one reason for their success or failure, whereas advanced learners rated effort as most important (Graham, 2004). When learners decide they do not possess a talent for languages, their self-efficacy for SLA decreases as does their motivation to persist (Graham, 2004; Hsieh and Schallert, 2008).

Learners' implicit theories of language also predict how they think SLA occurs, with potentially destructive consequences. For example, learners with an entity (i.e., fixed) theory of language learning think they can acquire an L2 while studying abroad simply through exposure and absorption, and that explicit,

effortful learning is unnecessary (Mercer and Ryan, 2010). In reality, SLA in adulthood requires considerable time, sustained study, and active engagement with the material (e.g., Seliger, 1977; Ortega, 2009). These beliefs are particularly important when language learners experience failure or setbacks. Lou and Noels (2016) primed either an incremental or entity mindset of language in university students by having them read a bogus news article endorsing one of the two mindsets. They found that learners who were primed with an incremental language theory more strongly endorsed learning goals and exhibited mastery responses in failure situation, compared to learners who had been primed with an entity language theory. Lou and Noels (2017) additionally proposed and tested a Mindsets-Goals-Responses model of SLA, finding that participants' implicit theories determined their goal orientations, which in turn sheds light on their reactions to setbacks. Their research did not test actual learning outcomes, however. There are strong associations between using better study strategies, self-efficacy, and attained proficiency (Oxford and Nyikos, 1989), yet many learners report believing that people who "have" to study must not be gifted at languages (Mercer and Ryan, 2010). Although individual differences can affect SLA, SLA is achieved through various abilities, some of which can develop through the learners' efforts (Mercer, 2012).

Implicit Theory Interventions

Experimental interventions designed to change students' implicit theories provide support for a causal relationship between these beliefs and performance. Middle school students who were taught to have an incremental theory earned higher math grades than those who were only taught about study strategies (Blackwell et al., 2007). Similarly, university students who were taught that the brain grows new connections when they learn (i.e., an incremental theory) received higher grades over the course of a year than students in a control condition (Aronson et al., 2002). In both Noels and Lou (2015) and Lou and Noels (2016), university students enrolled in language courses who were primed with incremental language beliefs had less negative reactions to setbacks and greater intentions to continue with language study. Several implicit theory interventions have been found to produce sustained changes, with the positive effects still apparent 6 (Heslin et al., 2005) and 9 (Aronson et al., 2002) weeks later.

However, a recent meta-analysis revealed that the effect sizes of growth mindset interventions are small at best (Sisk et al., 2018). A growth mindset involves focusing on effort rather than ability, but emphasizing effort can backfire if students do not use effective learning strategies (Dweck, 2015). In fact, students who study or practice intensely with the wrong strategies and fail to improve may become even more certain that they lack ability. In a way, people can feel relieved when lack of progress can be blamed on lack of natural ability; it becomes a rational excuse to try less and reduces motivation for that task or learning domain (Rattan et al., 2012). Implicit theories are related to essentialism, which is the pervasive belief that people and things have unchanging natural essences (Bastian and Haslam, 2006). In the U.S. people show a preference for a person who has always

possessed a positive trait compared to someone who acquired that trait over time (Lockhart et al., 2013), and students are most attracted to peers who earn high grades with little effort (Juvonen and Murdock, 1995). Although success without effort is attractive, even when talent is never mentioned, people assume that a performer who supposedly achieved success through hard work must have natural talent as well (Brown et al., 2018). Many students report believing that learning will occur either quickly or not at all, and this belief predicts worse academic performance (Schommer, 1994). In fact, continued effort could indeed become wasted effort for the many students who use ineffective study strategies and have mistaken beliefs about how learning occurs (Kornell, 2009).

With this in mind, the goal of the current research was to use a firsthand experience of language learning success to change students' implicit theories of SLA. A key distinction between this study and past research is that we did not prime implicit theories using readings, lectures, or instructions that make statements in support of one of the two mindsets. Instead, we sought to change participants' beliefs using a firsthand experience of success in an early stage of language learning. This change is valuable for several reasons: Manipulations that involve exposing learners to statements in favor of a growth mindset may be overly transparent, which could elicit reactance in some learners (Brehm and Jack, 1981). Second, experiencing a personal success may be more powerful and longer-lasting than being told, in the abstract, that a particular ability can be changed.

Overview of the Current Research

In this study, English-speaking students at a university in the U.S. reported their implicit theories of SLA prior to an experimental training that was administered in a laboratory. During the laboratory visit, they successfully learned how to read 20 Japanese characters. Their implicit theories were measured at the end of the session as well as 2 weeks later to assess immediate and sustained change in beliefs.

We hypothesized that a firsthand experience of successful learning would cause participants to adopt a more incremental theory of SLA. We randomly assigned participants to one of three learning tasks that were supposed to vary in effectiveness. Past research shows that recalling previously-read material causes better retention than simply re-reading that material, a phenomenon known as the testing effect (Roediger and Karpicke, 2006). Two of our conditions involved learning through quizzing, and we predicted that both performance and incremental beliefs would be highest in these conditions. Unexpectedly, however, participants in the control condition also performed very well on the learning task, so all participants ultimately experienced success in an early phase of language learning. Therefore, the effect of this positive experience was assessed by comparing changes in implicit theories over time across all participants. We also measured participants' implicit theory of intelligence and their beliefs about the nature of learning to assess if change in beliefs about language would transfer to other domains.

METHODS

Participants

The population of learners we were interested in was university students. Our research objective was to test the effectiveness of a learning experience with learners who are *not* already intrinsically motivated to study an L2 and whose past experiences may have led to maladaptive beliefs about SLA. Most college students have already had years of L2 education (i.e., high school and middle school classes), making this an ideal group to receive our planned positive learning experience to change beliefs. College may also be the last opportunity to use external incentives (e.g., required classes) to stimulate interest in learning an L2. However, recruiting from and administering surveys in language classes would create demand characteristics, so we carried out the experience in a context not obviously connected to language education. Most of the student population had previously studied Spanish or French, so we chose Japanese as the target language to ensure that participants would be complete beginners. As described below, four participants with some knowledge of Japanese were excluded.

At the beginning of the academic semester, a short online survey (Time 1 session) was made available to students enrolled in psychology courses with a research participation requirement. Completing this survey made them eligible to sign up for the laboratory session (Time 2). Of the 72 participants who completed the Time 1 survey, 55 (45 women, 10 men; age $M = 19.95$, $SD = 3.03$) chose to sign up for the laboratory session. Seventy-one percent of these participants (32 women, 7 men; age $M = 20.05$, $SD = 3.52$) also completed the Time 3 follow-up survey. The decision about when to terminate data collection was not based on predetermined sample size. Instead, because we knew that attrition across sessions would naturally limit sample size, we decided *a priori* to run the experiment for the entire duration of the semester in order to recruit as many participants as possible.

Errors during the Time 2 laboratory procedure (e.g., frozen computer) necessitated the exclusion of data from two participants. An additional four participants were excluded because they reported having studied Japanese in the past. The final sample for the laboratory session was 49 participants (40 women, 9 men; $M = 20.02$, $SD = 3.20$). The sample of participants who completed all three sessions was 36 (30 women; 6 men; $M = 20.14$, $SD = 3.64$), and the comparison between Time 2 and Time 3 responses is limited to these participants. However, the analyses of performance on the laboratory learning tasks and change in beliefs from Time 1 to Time 2 include all 49 participants present at Time 2, but the results remain the same when participants who did not complete Time 3 are excluded.

Time 2 implicit theories of SLA did not differ between participants who did and did not complete the final Time 3 follow-up survey [$F_{(1,47)} = 0.04$, $p = 0.846$, $d = 0.07$]. Attrition for Time 3 also did not vary by Time 2 condition, as each of the three conditions lost either 4 or 5 participants. Retention was excellent during the first month of the experiment (97% retention). Immediately after spring break, retention dropped to 33%. By this point most students had already completed their

required research credits so they lacked incentive to complete the final survey.

Materials

Implicit Theory of SLA

We adapted a preexisting domain-specific measure of implicit theories, Biddle et al.'s (2003) short version of the Conceptions of the Nature of Athletic Ability scale (Sarrazin et al., 1996), to apply to second language acquisition. The instructions read, "The following statements are about learning a new language. Please indicate how much you agree with each statement." Participants responded to 11 questions on a scale of 1 (*strongly disagree*) to 6 (*strongly agree*). Sample statements include, "How good you are at using another language will always improve if you work at it," and "To be good at a new language, you need to be naturally gifted" (Time 1, 2, and 3 α s = 0.84, 0.90, 0.93).

After these statements, participants were asked to complete the following equation such that it totaled 100%: "Learning a new language = ___% effort + ___% ability." Below this were two boxes, "% ability" and "% effort." The survey program alerted participants if the sum of their answers was not 100.

Implicit Theory of Intelligence

We used the three-item measure of implicit theory of intelligence from Dweck et al. (1995). Participants indicated their agreement to statements such as, "You can learn new things, but you can't really change your basic intelligence," on a 6-point agreement scale (Time 1, 2, and 3 α s = 0.92, 0.93, 0.91). Participants also completed the effort vs. ability equation for intelligence, assigning a percentage of 0–100 for each.

Quick-Learning Beliefs

Using the same 6-point scale, participants rated their agreement with three statements from Mori (1997); adapted from Schommer (1990): "If I cannot understand something quickly, it usually means I will never understand it," "If I am ever going to be able to understand something, it will make sense to me the first time I hear it," and "Successful students understand things quickly" (Time 1, 2, and 3 α s = 0.61, 0.76, 0.74).

Procedure

The study took place over three sessions. Participants provided informed consent during each session and received research credit compensation immediately after each session. The first session was an online survey, containing the measures as well as questions about demographic variables, languages they knew or had studied, and their general study habits.

When participants arrived for the laboratory session, they were told,

"This study is about how people learn. We're testing different strategies for learning how to read characters in another language to see which strategy is most effective. A computer will teach you how to pronounce 20 foreign characters. The first 10 characters will be taught in a slightly different way than the next 10, and you'll take a test after each round of learning."

All participants began with a round of learning by re-reading, administered via computer. They saw 10 Japanese characters, each followed by its English pronunciation (e.g., **け** is *ke*) and an audio clip of its pronunciation. Participants encountered each character a total of five times. We chose to teach participants 10 characters because pilot data suggested learning 20 characters was too difficult. Immediately after the first learning phase, participants took a multiple-choice test of the 10 characters. The characters were tested in the same order in which they had been learned, and the computer displayed the participant's score and the correct answers at the end of the test.

Next, participants were randomly assigned to one of three conditions for learning a new set of 10 Japanese characters:

- (1) Control: Participants completed a second round of "learning by reading" for the new characters, but with seven exposures per character instead of five.
- (2) Quizzing Condition A: Participants were exposed to each character seven times, but after the first exposure they were asked to *recall* the character's pronunciation before the computer showed the correct pronunciation again. Reading and quizzing were interspersed to help participants recall the characters better. For example, the sequence looked something like this:
See **か**; recall **か**; see **か**; see **さ**; recall **さ**; see **さ**; recall **か**; see **か**; see **た**; recall **た**; see **た**; recall **か**; see **か**; recall **さ**; see **さ**; recall **た**; see **た**; etc.
- (3) Quizzing Condition B: Participants read the list of characters once, and then they practiced recalling them using a flashcard program called Anki (<http://ankisrs.net>), which has been found to improve learning outcomes in SLA (Seibert Hanson and Brown, 2019). For each flashcard, participants evaluated their own performance by selecting one of three options: Incorrect, Hard, or Good. Anki keeps track of participants' performance on each flashcard and repeats cards in a mixed order until the participant indicates "Good" for that card.

There were two key differences between Quizzing Conditions A and B. First, Quizzing Condition A quizzed participants on each character a fixed number of times, whereas Quizzing Condition B continued quizzing participants on a character until the participant self-rated their performance as good. Second, participants in Quizzing Condition A had to type their answer whereas participants in Intervention B answered in their heads. However, as explained below, all three conditions produced similarly high performance.

Participants then took a multiple-choice test of their memory for the new set of 10 characters. The computer displayed their score immediately afterward. Next, they completed the implicit theories and quick-learning measures, answered questions about their study habits, and reported if they had already known any of the Japanese characters. Before leaving the laboratory, participants in the two quizzing conditions also read a brief description of the testing effect, which we intended to further motivate them to change their study strategies when they left the lab.

Two weeks after the laboratory session, participants received an email inviting them to complete another web survey (Time 3) for research credit. The Time 3 survey contained all of the implicit theories and quick-learning beliefs measures, as well as questions about study habits. If participants did not complete the survey within a few days of the first email, a second email was sent. Participants received no more than three email invitations total.

RESULTS

Test Performance and Task Difficulty

Re-reading generally produces low memory retention (Roediger and Karpicke, 2006), so we expected participants to perform somewhat poorly on Test 1. However, the mean score on Test 1 was near ceiling: 9.47 out of 10 ($SD = 0.68$) correct.

The three conditions were meant to produce different firsthand experiences in the effectiveness of certain study strategies, with the two quizzing conditions intended to improve retention over the re-reading control condition. Instead, the near-ceiling performance on Test 1 meant all participants experienced the initial strategy—which was supposed to be ineffective—as effective, and it also allowed no room for improvement with a different study strategy. The mean score on Test 2 was similarly high, at 9.57 ($SD = 0.87$) out of 10 correct. Participants' performance from Test 1 to Test 2 did not vary by condition, as shown by a non-significant Test (1, 2) \times Condition (Control, Quizzing Condition A, Quizzing Condition B) interaction, $F_{(2,46)} = 1.80$, $p = 0.177$, $\eta_p^2 = 0.07$.

Because the laboratory session became an experience of successful language learning for all participants, we collapsed across conditions when analyzing change in participants' beliefs over time. We applied a Bonferroni correction when comparing the same measure at each of the three time points, resulting in a new significance threshold of $p < 0.017$ for comparisons between Time 1, 2, and 3 responses (0.05 divided by 3 comparisons).

Implicit Theory of SLA

Scores on the implicit theory of SLA scale were coded such that higher scores represent believing language learning requires natural talent (i.e., an entity theory, or fixed mindset). Scores decreased from Time 1 ($M = 2.29$, $SD = 0.67$) to Time 2 ($M = 2.12$, $SD = 0.71$), $t_{(48)} = 3.21$, $p = 0.002$, $d_z = 0.46$, representing greater endorsement of a growth mindset after the experience in the lab. This change persisted across time, as Time 3 responses ($M = 2.06$, $SD = 0.75$) were still significantly lower than Time 1, $t_{(35)} = 3.23$, $p = 0.003$, $d_z = 0.54$. Time 2 and 3 did not differ, $t_{(35)} = 1.39$, $p = 0.172$, $d_z = 0.23$.

Participants also said that a higher percentage of language learning ability comes from effort immediately after the Time 2 laboratory tasks ($M = 74.86$, $SD = 12.55$) compared to Time 1 ($M = 70.51$, $SD = 16.50$), $t_{(48)} = -2.34$, $p = 0.024$, $d_z = -0.33$. However, this difference did not persist over time, as participants' Time 3 percentage ($M = 72.36$, $SD = 16.23$) fell non-significantly in between their answers at Time 1, $t_{(35)} = -0.97$, $p = 0.339$, $d_z = -0.16$, and Time 2, $t_{(35)} = 0.66$, $p = 0.512$, $d_z = 0.11$.

TABLE 1 | Correlations between the belief measures at each time point.

	Implicit theory of SLA	Implicit theory of intelligence	Quick-learning beliefs
Time 1			
Implicit theory of SLA	–	0.68**	0.49**
Implicit theory of intelligence	–	–	0.58**
Quick-learning beliefs	–	–	–
Time 2			
Implicit theory of SLA	–	0.65**	0.48**
Implicit theory of intelligence	–	–	0.53**
Quick-learning beliefs	–	–	–
Time 3			
Implicit theory of SLA	–	0.63**	0.55**
Implicit theory of intelligence	–	–	0.61**
Quick-learning beliefs	–	–	–

** $p < 0.001$.

Implicit Theory of Intelligence

Responses on the implicit theory of intelligence measure correlated with the other belief measures at each time point (see **Table 1**). Responses were coded such that higher scores represent believing intelligence is a fixed trait. Time 1 scores ($M = 2.53$, $SD = 1.15$) were not significantly different from scores at Time 2 ($M = 2.70$, $SD = 1.27$), $t_{(48)} = -1.30$, $p = 0.199$, $d_z = -0.19$, or Time 3 ($M = 2.68$, $SD = 1.23$), $t_{(35)} = -0.57$, $p = 0.571$, $d_z = -0.10$. There was a non-significant increase in the percentage of intelligence attributed to effort from Time 1 ($M = 57.35$, $SD = 22.46$) to Time 2 ($M = 61.75$, $SD = 21.01$), $t_{(48)} = -1.68$, $p = 0.100$, $d_z = -0.24$, and from Time 1 to Time 3 ($M = 62.36$, $SD = 22.85$), $t_{(35)} = -1.88$, $p = 0.068$, $d_z = -0.31$. Collectively, however, these results show that the decrease in participants' belief that language learning ability is fixed did not transfer to beliefs about intelligence more generally.

Quick-Learning Beliefs

Responses on the quick-learning beliefs measure correlated with the other belief measures at each time point (see **Table 1**). Responses were coded such that higher scores represent believing learning occurs either quickly or not at all. Time 1 scores ($M = 2.08$, $SD = 0.77$) were marginally lower than Time 2 ($M = 2.29$, $SD = 0.86$), $t_{(48)} = -2.39$, $p = 0.021$, $d_z = -0.34$, suggesting that participants tended to have *stronger* quick-learning beliefs at the end of the laboratory session. The brief experience of effectively learning 20 Japanese characters seems to have heightened participants' confidence that successful learning occurs quickly. However, this did not last, as Time 3 scores ($M = 2.33$, $SD = 0.87$) were not significantly different from Time 1, $t_{(35)} = -1.52$, $p = 0.136$, $d_z = -0.25$.

The Role of Prior Language Learning Experience

During the Time 1 baseline survey, participants were asked how many languages (including English) they were fluent in, as well as what languages they studied in the past. Of the 49 participants who completed the laboratory session, 36 (74%) reported being fluent in only one language, eight reported fluency in two, and five reported fluency in three. Most participants reported having studied one ($n = 16$), two ($n = 19$), or three ($n = 13$) languages, with one participant reporting five or more.

Because participants with fluency in two or more languages may have learned those languages as children, we focused on participants' experience *studying* second languages. A repeated measures ANOVA of Time (1 vs. 2) on implicit theory of SLA with number of languages studied as a covariate revealed a significant interaction between time and languages studied, $F_{(1,47)} = 4.96, p = 0.031, \eta_p^2 = 0.10$. The difference between Time 2 and Time 1 scores was positively correlated with number of languages studied, $r_{(49)} = 0.31, p = 0.03$, meaning participants were *more* likely to benefit from the experience (i.e., to show an increase in their belief that language learning is not based on talent) when they had studied fewer languages in the past.

DISCUSSION

Participants who experienced a single episode of success at learning characters in another language developed more incremental theories of second language acquisition, and this change was still present 2 weeks later. We originally predicted that this pattern would only be observed among participants who used the effective learning strategy of repeated recall testing (i.e., self-quizzing), but the design of our task led all participants to learn the Japanese characters quite well.

The persistence in more incremental beliefs at the final Time 3 survey was observed on the implicit theories of SLA measure, whereas the specific percentage of SLA that students attributed to effort vs. ability at Time 3 fell in between their responses at Time 1 and Time 2. Beliefs about whether language learning is a fixed or stable trait also did not transfer to beliefs about intelligence more generally. However, immediately after learning the 20 characters, participants reported somewhat greater endorsement of the idea of quick, all-or-none learning. This is an interesting outcome because this belief is usually negatively correlated with an incremental implicit theory and predicts worse academic outcomes (Schommer, 1994). Our participants did learn many new characters in a short period of time, so it is easy to see how this would boost confidence in their own ability to learn fast. Learning fast does not necessarily contradict incremental beliefs; a student can believe their own learning efforts will pay off quickly. As mentioned previously, however, such beliefs may backfire and reduce motivation if students' efforts are made with ineffective strategies.

In the domain of language acquisition, it is true that individual differences in cognitive skills, motivation, affect, and aptitude do affect proficiency outcomes (Ortega, 2009). However, language talent *per se* is not solely responsible for successful SLA, and there

are multiple routes for effective SLA (Mercer, 2012). Motivation appears to be the most critical factor (Dörnyei, 2005; Gardner, 2007), and frequent use of strategies that target various language modalities (e.g., Oxford and Nyikos, 1989; Uhl Chamot, 2005) is related to both motivation and proficiency. However, students enrolled in language classes often use strategies that are sufficient to get good grades but insufficient to develop true proficiency, an experience that is demotivating and creates doubts about their own language ability (Graham, 2004). Believing that language acquisition in adulthood is attainable through strategic efforts should be more productive and beneficial to motivation (Mercer and Ryan, 2010).

LIMITATIONS

We used a novel measure of implicit theory of SLA (adapted from Biddle et al.'s, 2003, implicit theory of athletic ability measure), without first assessing its construct validity. However, the measure exhibited adequate internal reliability at all three time points, and it significantly correlated with the other two belief measures in the conceptually appropriate direction (i.e., concurrent validity). Scores on the measure changed from Time 1 to Time 2 in response to the experience of success in the laboratory, but this across-individual change was also accompanied by within-participant stability: Time 1 and Time 2 scores were strongly correlated, $r = 0.86 (p < 0.001)$, which is similar to the two-week test-retest reliability of 0.80 reported by Dweck et al. (1995) for their implicit theory of intelligence measure.

We measured participants' beliefs prior to the laboratory experience instead of using a no-experience control condition for comparison, but it is possible that participants' scores may have changed over time due to practice effects or natural development of a growth mindset as life experience continues¹. However, these explanations can be refuted by comparing the pattern of changes in our three different dependent measures: implicit theory of SLA, implicit theory of intelligence, and quick-learning beliefs.

Specifically, implicit theory of SLA—our primary variable of interest—was the only measure on which scores became more positive (i.e., increased incremental theory) at Time 2, with this change remaining stable at Time 3. Scores did not continue to increase as time passed, which is what we would expect if repetition (practice effect) or the passage of time alone changed participants' scores.

Even more important, if there was a practice effect or a natural increase in growth beliefs with time, then we would expect similar patterns with implicit theory of intelligence and quick-learning beliefs. Instead, scores on the implicit theory of intelligence scale did not change at all across all three measures, and the quick-learning measure exhibited a marginally significant increase in a *fixed* mindset from Time 1 to Time 2.

In other words, if practice or the passage of time alone was responsible for participants adopting a more incremental theory of SLA, then we should see a similar pattern of change in the other two measures, which were conceptually—and

¹We thank an anonymous reviewer for this suggestion.

statistically—related (i.e., they all measured some form of a growth mindset). Yet the only belief that changed was the one that our experimental procedure directly targeted: Beliefs about acquiring a second language.

Of course, it would be ideal to compare the positive change in incremental theories against a control group that lacked a recent episode of successful learning. However, our conclusion is strengthened by each participant serving as their own control and by the unique pattern of change in implicit theory of SLA (compared to the other two beliefs).

Two additional limitations are the somewhat small sample size and the relatively positive implicit theories the students held prior to the laboratory experience. Initial scores on the implicit theory of SLA measure were below the midpoint, indicating that students tended to endorse an incremental theory at baseline. It remains to be seen if these results would hold in other samples characterized by a more negative and fixed implicit theory of SLA.

CONSIDERATIONS FOR FUTURE RESEARCH

We observed a provocative interaction between language education and time: Participants who had more past experience (i.e., had studied more languages) were less likely to change their beliefs. It may be that individuals with fewer language learning experiences are better able to internalize the episode of success in the lab. In contrast, those who studied more languages may also have more experiences of *failing* to become proficient in a language, hence making it more difficult for one positive experience to change their beliefs.

An alternate, more positive explanation is that participants who reported having studied more than one language showed little change in their implicit beliefs based on the successful laboratory learning experience precisely because they have more experience with languages, which in itself has been shown to be a positive contributing factor to subsequent language (specifically script) acquisition (e.g., Abu-Rabia and Sanitsky, 2010).

It is also possible that students' lack of experience with and assumptions about their ability to learn Japanese played a key part in the success of the learning experience. Most of our participants had studied European languages previously, and their success at a novel language like Japanese may have led them to make external attributions for previous struggles (e.g., if they can learn Japanese so easily, then perhaps those previous difficulties were the result of that particular language, how it was taught, etc.). It would be enlightening to compare beliefs about the targeted language (Japanese) vs. a language participants had previously studied, but it remains important to note that the change we observed was for implicit theories of SLA overall. Therefore, it is not simply the case that participants developed an incremental theory for learning Japanese specifically.

We did not measure self-efficacy in this study, but we speculate that the episode of successful learning increased participants' self-efficacy for language learning, which is also an important variable in both SLA motivation and proficiency (e.g., Hsieh and Schallert, 2008). A critical part of the current experiment was that students *successfully* learned

Japanese characters. The recent finding that growth mindset interventions have small effect sizes (Sisk et al., 2018) could be because telling learners to focus on effort will not help unless learners are also expending effort with the right tools (i.e., effective study strategies; Dweck, 2015). Likewise, simply boosting self-efficacy may backfire if that confidence is unfounded.

A final anecdotal but important cautionary note is that even some expert language learners exhibit beliefs that resemble a fixed mindset (Mercer, 2011), although experts' historical behavior is characterized by concentrated and sustained effort in that domain (Mercer, 2012). If mindset does influence SLA success, the association may not be direct and it might be moderated by other factors, such as learner characteristics and contexts. These remaining questions highlight the need for additional research on the potentially complex role of mindset and SLA outcomes.

CONCLUSIONS

To foster positive attitudes toward language learning and the learning situation, it is valuable to consider the learners' beliefs about the relative importance of giftedness vs. effort. These beliefs may originate in past experiences, which unfortunately are often negative. In the case of the U.S., students are required to take years of language classes, yet few learners develop proficiency in a second language as a result of this formal schooling (Devlin, 2015; Commission on Language Learning, 2017). The use of ineffective study strategies and subsequent repeated failures to develop L2 proficiency may contribute to the maladaptive belief that natural talent is necessary to learn a language in adulthood (Graham, 2004; Mercer and Ryan, 2010). If this is the case, then we can similarly take advantage of actual learning experiences to transform this belief into one that is more positive and motivating.

The current research shows that beliefs about SLA can be changed after a brief, successful experience of learning how to read characters in an unfamiliar language, and this change remains present 2 weeks later. This has important implications for education in other subjects and domains, especially in light of the small effect sizes observed for growth mindset interventions (Sisk et al., 2018). Additionally, this is a significant departure from previous work that employed explicit instruction about implicit theories in order to produce change (e.g., Noels and Lou, 2015; Lou and Noels, 2016). We propose that psychological interventions should also equip learners with tools for effective learning and provide an experience of improvement achieved through those tools.

DATA AVAILABILITY STATEMENT

Data are available at: <http://dx.doi.org/10.17632/t8z7z8zt9r.1>.

ETHICS STATEMENT

This study was carried out in accordance with the recommendations of the American Psychological Association's

Ethical Guidelines. All subjects gave written informed consent in accordance with the Declaration of Helsinki. The protocol was approved by Arcadia University's Institutional Review Board.

AUTHOR CONTRIBUTIONS

CB conducted the study and analyzed the data. CB and AS co-wrote the paper.

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FUNDING

Funding for the publication of this paper was generously provided by Arcadia University's Landman Library.

ACKNOWLEDGMENTS

The authors thank Katie Jobson, Nicole Troy, and Jennifer Link for their assistance in data collection.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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