Research Studies on Language Learning Mindsets and Interventions

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Introduction

People hold various beliefs regarding their abilities and skills in different domains of aptitude. Over the past three decades, interdisciplinary studies in fields of psychology and education have shown that implicit theories of intelligence serve as a significant antecedent of an individual's goal orientations and associated beliefs (Dweck, 2006). Implicit theories of intelligence, more commonly known as "learner mindsets", has led to the development and formation of "mindset theory", which proposes that people hold different beliefs regarding their capability and capacity to change fundamental psychological attributes, such as their intelligence, personality characteristics, or attitudes. Moreover, learner mindsets play an important role in shaping motivation and behaviors, particularly in academic environments and long-term personal learning, growth, and development.

In educational settings, research has shown that mindsets are connected to a wide range of motivational and educational outcomes, and that interventions can have a large part in affecting learners' mindsets. "Mindset interventions do not change students' learning environment, but rather, change how students think about their learning and ability, thereby encouraging them to utilize opportunities to grow in their learning environment" (Lou & Noels, 2019, p. 8). The potential for inducing motivational and mastery-orientated behaviors in learners is an attractive suggestion for any educator or researcher interested in helping learners succeed in academics or achieve desirable outcomes in personal growth. Thus, psychologically orientated concepts such as learner mindsets and mindset interventions have gradually begun to appear on the radar of language researchers and educators who are interested in how these notions can impact learners' second language acquisition (SLA). In the past decade, SLA research has started to address and conceptualize language learning (L2) mindsets (Ryan & Mercer, 2012), followed by the design, creation, and testing of robust, psychometric tools for quantitatively measuring L2 mindsets (Lou & Noels, 2017) and their associated links to L2 learners' motivation. This initial research provided evidence for the importance, practicality, and effect of the mindset framework for understanding learners' L2 learning motivation (Lou & Noels, 2019). Subsequently, the adaptation and implementation of interventions on learners' L2 mindsets represents a new and emerging field in SLA; a lucrative opportunity to develop evidence-based practices to possibly induce and enhance

learners' L2 learning motivation, both inside and outside academic settings.

This critical review analyzes existing studies on L2 mindsets and the use of interventions to influence L2 learners' mindsets. An examination of the contributions of these studies enable the understanding of how L2 mindsets, interventions, and other variables coalesce to form learners' L2 beliefs and impact their motivation. First, an examination of the main theories which drive the conceptualization of L2 mindsets, their operationalization, and contributions to the field of SLA are discussed. This is followed by an investigation of the statistical methodologies employed in previous research literature to analyze L2 mindsets and the effect of intervention use. Lastly, an analysis of the significant findings and suggestions for future research are provided.

Conceptualization of L2 Mindsets and Interventions

In order to understand L2 mindsets and interventions, it is necessary to become familiar with mindset theory from which L2 mindsets are derived from. Stemming from psychology, the generalized nature and applicability of this theory and its principles has enabled it to become an interdisciplinary area of study, applicable in a number of research areas in both the sciences and humanities. A description of implicit theories of intelligence, mindset theory, L2 mindsets, L2 mindset construct measurement, and intervention use in classroom settings are discussed.

Implicit Theories of Intelligence

Dweck and Leggett's (1988) studies on individual learners' beliefs led to the conceptualization of "implicit theories of intelligence" or more commonly known as, "learner mindsets". Serving as a lay theory, implicit theories of intelligence are "implicit" because individuals are usually not aware of them and refer to one's underlying beliefs as to whether intelligence or abilities can change (Dweck & Leggett, 1988). In their research, Dweck and Leggett (1988) examined schoolchildren's learning mindsets in relation to their academic performance and identified that learners' mindsets were characterized by two types of mindsets: an entity theory of intelligence and an incremental theory of intelligence. In their study, some schoolchildren possessed an entity theory of intelligence, espousing an implicit belief in the unmalleability of competence; a fixed mindset that conditions individuals to pursue performance approach or performance avoidance goals and give up in the face of obstacles. The other schoolchildren displayed what resembled an incremental theory of intelligence, championing an implicit belief in the malleable nature of competence; a growth mindset that primes individuals to pursue mastery orientated goals with a focus on

the potential to change and adopt adaptive and learning orientated habits in the presence of obstacles. A description of entity (fixed mindset) and incremental (growth mindset) theories of intelligence and their associated behaviors in academic settings are displayed in Figure 1.

Figure 1

Entity and Incremental Theories (Mindsets) and Related Behaviors in Academic Settings

Academic Mindsets, for Those With More of an Entity Versus Incremental Implicit Theory of Intelligence		
	Entity Theory	*Incremental Theory*
Goals	Look smart	Learn
Value of effort, help, and strategies?	Lower	Higher
Response to challenge	Tendency to give up	Work harder and smarter
Changes in grades during times of adversity	Decrease or remain low	Increase

Note. Adapted from "Mindsets that promote resilience: When students believe that personal characteristics can be developed," by D. S. Yeager and C. S. Dweck, 2012, *Educational Psychologist, 47*(4), p. 303. https://doi.org/10.1080/00461520.2012.722805

Mindset Theory

The implicit theories of intelligence framework connects aspects of learner behavior and motivation to the decisions people make regarding self-regulation, learner beliefs, and goal-orientations (Dweck, 1999). From this, mindset theory has since become an independent theory of motivation that accounts for the resilient or destitute patterns of responses to challenges and setbacks (Dweck, 2006). Researchers began investigating the effect of promoting growth mindsets in classroom settings to students to find out what the effects were. In a seminal, longitudinal study conducted by Blackwell et al. (2007), the researchers instructed learners with incremental-theory-training in the form of a psychological intervention to manipulate eighth-grade students' mindsets for mathematical achievement. The intervention group learnt about growth mindsets and effective learning strategies during eight in-class workshops, while the control group received no intervention. The results showed that at the end of the semester, the intervention group had increased levels of motivation and heightened belief in the malleability nature of ability in comparison to the control group. The students in the experimental condition also exhibited a significant improvement in mathematics achievement after the intervention, while those in the control condition demonstrated a significant decline during the same period. The experimental-

group students were also perceived by their teachers to have demonstrated positive changes in their classroom motivation and performance after the intervention. Through the use of an intervention based on in-class learning sessions about growth mindsets, this had a significant effect on increasing learner motivation, supporting the idea that students' theories of intelligence are a major key in their achievement motivation (Blackwell et al., 2007).

Yeager et al. (2016) emphasized the importance of effectively designing a simple, yet impactful intervention on learners through the use of "design thinking". Through an iterative, user-centered process based on positive and negative feedback they received from their study's participants (ninth-grade students in the U.S.) in a pilot study, Yeager et al. presented their participants with a two-session mindset program consisting of a scientific article effusing the message that "your intelligence can grow" and a "saying is believing" exercise in which participants were asked to author a letter or message to a future student who is struggling in school (Yeager et al., 2016). The researchers placed a strong emphasis on adapting the principles of conducting research methodology at a low-cost, short-term, large-sample, random-assignment manner, making their invention more generalizable to a larger population (Yeager et al., 2016). With their redesigned interventions, the researchers conducted their experiment with a sample of ninth-grade students ($N = 3004$) in the U.S at various high schools as these were learners who were going through a transition period of newly entering high school, and thus, the possible effect of the intervention on their long-term academic performance in high school was more significant (due to their longer length of time in high school). By measuring the students' academic performance, the researchers found that their revised intervention was more effective in changing proxy outcomes such as beliefs and short-term behaviors than in previously designed intervention studies (Yeager et al., 2016). In a second study, they also identified that the invention increased the core course grades for previously low-achieving students.

Yeager et al. (2019) developed a cost-effective, scalable intervention that could be used to improve the academic outcomes of teenage students ($N = 12490$) in the U.S. on a mass scale, targeting the entire generalizable population of ninth-grade students in U.S. high schools. By employing a simple online growth mindset intervention that teaches that intellectually abilities can be developed (presented by older students or admired adults) and an interactive session in which students reflected on their own learning and how a growth mindset could help a struggling ninth-grade student in school (Yeager et al., 2019), their findings suggested that 5.3% of the students in the intervention groups would be prevented from being "off track" for graduation as a result of the low-cost growth mindset intervention (Yeager et al., 2019). They also discovered that lower-achieving students had increased enrollment into advanced

mathematics courses in their following year (tenth-grade) by 3% and although this may seem like a trivial increase, when taking into account the generalized population (estimated to be over 1.5 million ninth-grade U.S. students), 3% represents a large number of students.

Language Learning (L2) Mindsets

There has been relatively few SLA research studies in the domain of language learning (L2) mindsets. "Despite the widespread perception of a natural, innate aptitude for language learning, very little attention has been paid to the role of implicit theories within the field of applied linguistics" (Ryan & Mercer, 2012, p. 78). Lou and Noels (2016, p. 23) also stated that "it is surprising that there is a lack of systematic research on mindsets about language learning" and in the past five years, their publication output has dominated this sphere of L2 investigation. L2 mindsets incorporate implicit theories of intelligence into the field of L2 acquisition and are domain-specific beliefs about whether the ability to learn languages is malleable or not (Lou & Noels, 2019). Based on Dweck's (1999) framework of growth mindsets, Mercer and Ryan (2010) initiated the exploration of L2 mindsets of EFL learners in Austria and Japan through qualitative methods. They interviewed nine first year EFL learners from Austrian and Japanese universities and interviewed them regarding their L2 mindset beliefs. The learners expressed L2 learning beliefs that could not be clearly identified as being either fixed or growth mindset orientated as the learners possessed attributes of both mindsets to varying degrees. Moreover, the learners possessed different L2 mindsets for various linguistic domains (e.g., speaking, listening, grammar, etc.). Therefore, Mercer and Ryan (2010) concluded that it would be better to conceptualize individuals' L2 mindsets on a continuum rather than divide them into dichotomous categories. Nationalistic differences were also noted, as Japanese learners placed greater emphasis on the meaning of hard work in an overall sense but did not focus on the L2 mindset differences for specific L2 domains, unlike the Austrian participants. In summary, Mercer and Ryan suggested that L2 mindsets are complex, situated, and socially constructed belief systems (Mercer & Ryan, 2010) and their findings suggested that L2 mindsets are distinct from mindsets in other spheres.

In further studies, Ryan and Mercer (2012) conceptualized implicit theories in L2 learning by proposing the conceptualization of L2 mindsets, displayed in Figure 2.

Figure 2

L2 Mindsets and Associated Behaviors

	Core beliefs about language learning	Language learning behaviour
Fixed language learning mindset	a successful language learner has an innate talent successful language learning occurs naturally, without conscious effort the learner is a passive vessel	avoid challenges give up easily regard effort as pointless ignore or avoid negative feedback easily discouraged by mistakes
Growth language learning mindset	anybody can learn a language if they work hard at it language learning requires long-term purposeful/strategic effort learners are active agents in their learning	seek challenges persist in the face of difficulties regard effort as intrinsically rewarding welcome and learn from feedback admit mistakes and work to overcome them

Note. Adapted from "Language learning mindsets across cultural settings: English learners in Austria and Japan," by S. Ryan and S. Mercer, 2012, OnCUE Journal, 6(1), p. 10.

Ryan and Mercer (2012) stated that a learner with a fixed L2 mindset views successful L2 learning as being derived from an innate disposition or talent, whereas a learner with a growth L2 mindset believes that L2 learning is a malleable process, changeable through conscious effort and strategic adaptation. In a small-scale mixed-methods study, Ryan and Mercer (2012) found that learners' L2 mindsets were "an extremely complex construct", in which their participants simultaneously endorsed conflicting fixed and growth beliefs. Dweck and Leggett's (1988) conceptualization of learner mindsets derived from American primary and secondary school settings and Ryan and Mercer were interested in how L2 mindsets manifest in culturally different L2 learning environments. Their sample consisted of all first-year foreign language majors, 40 Austrian students, and 41 Japanese students. The students answered questionnaire items regarding their L2 learning beliefs as well as their learning beliefs in domains such as athletics, geography, and general intelligence (Ryan & Mercer, 2012). The study's results revealed that the Austrian learners tended to display more domain-specific beliefs, but the Japanese learners' responses were conflicting, reflecting a "blind faith" in effort and persistence (Ryan & Mercer, 2012). The Japanese students' responses illustrated an unwillingness to give up, resembling an avoidance of failure and damage to one's self concept (Ryan & Mercer, 2012). Again, the authors concluded that their conceptualization of L2 mindsets may have been oversimplified, as a growth mindset not only represents a belief in the value of effort and perseverance, but also requires a strategic component for learners to

successful adapt to failure experiences (Ryan & Mercer, 2012). Their findings also suggested that the complex nature of L2 mindsets differentiates between different sub-domains of L2 learning and heeded the call for future studies to investigate this area. A final suggestion from the researchers was for the development and creation of an innovative research instrument to measure L2 mindset constructs in a valid and reliable way, as learners may not be immediately aware of them or able to articulate them through qualitative processes (Ryan & Mercer, 2012).

Measuring L2 Mindsets Constructs

Drawing from Dweck's (1999, 2006) mindsets framework and Mercer and Ryan (2010) and Ryan and Mercer's (2012) studies, Noels and Lou (2015) and Lou and Noels (2016) began work on designing a robust and empirical questionnaire to delineate the distinct aspects that measure a learner's L2 mindset. The researchers isolated three primary components central to L2 mindsets: general language intelligence beliefs, second language aptitude beliefs, and age sensitivity beliefs about L2 learning (Lou & Noels, 2016). General language intelligence beliefs refer to the notion of whether an individual's learning beliefs (in all domains of learning) possess fixed or growth-orientated characteristics. Second language aptitude beliefs refer to perceptions about whether L2 learning abilities are fixed or malleable. Age sensitivity beliefs about L2 learning refer to whether L2 ability is malleable up to a particular age and then become fixed, or whether L2 abilities remain malleable throughout life. By using these three hypothesized aspects of L2 mindsets and the two sets of language beliefs (entity and incremental), Lou and Noels (2017) aimed to encapsulate the complexity of L2 mindsets. Additionally, their objective was to extend research of L2 mindsets to new questions with larger samples that provided quantitative measurements beyond the scope of previous L2 mindset studies. This culminated in the creation of their Language Mindsets Inventory (LMI) to ensure L2 mindsets were able to be assessed and associate expected variables with research hypotheses (Lou & Noels, 2017).

In order to confirm the validity and reliability of the LMI, Lou and Noels (2017) conducted two studies to demonstrate its validity in psychometric assessment of learners' L2 mindsets. In their first study, 117 participants registered in language courses responded to 18 questionnaire items on the LMI concerning the general dimensions of intelligence beliefs (six items), L2 dimensions of intelligence beliefs (six items), and age sensitivity beliefs in L2 learning (six items). Each dimension included three incremental and three entity-orientated items for a total of nine growth-orientated L2 mindset items (e.g., People can always substantially change their L2 intelligence) and nine fixed L2 mindset items (e.g., It is difficult

to change how good you are at learning FL). Participants responded on a 6-point Likert scale from "strongly disagree" to "strongly agree" and the questionnaire items were reverse scored to maintain a consistency of answers. A pretest-posttest was conducted, and the participants' responses were analyzed with a hierarchical confirmatory factor analysis (HCFA) which revealed a six-factor structure with two second-order factors. As this was the desired result containing the constructs that the researchers wanted to measure, this was evidence that the LMI possessed sound internal consistency through confirming the questionnaire items' interrelationships, the stability of mean scores across time, and test-retest reliability (Lou & Noels, 2017).

In a second study of the same publication, Lou and Noels (2017) further examined evidence of validity with the LMI by sampling 180 students and analyzed the correlation values between the participants scores on the LMI and their written reflections on their L2 beliefs. Correlational results revealed the expected pattern of associations between the LMI and variables theoretically linked with mindsets and provided evidence of the reliability and validity of the LMI as items on the LMI appeared to measure the same construct consistently and with stability over time (Lou & Noels, 2017). Learners with LMI scores that correlated to a range of fixed to growth mindset attributes on a continuum, respectively had written responses that matched the same construct areas of their LMI scores. Thus, the LMI reliably predicted the learners' expressed L2 beliefs, providing researchers with a valid and robust quantitative measurement tool to predict observations in the field of L2 mindsets research.

Further investigation of L2 mindsets using the LMI, conducted by Lou and Noels (2020b), examined whether L2 mindsets were linked with perceived language proficiency, moderated by the length of residence of migrant university students in Canada. The study's participants, whose native language was not English, completed the LMI and their responses were collected and analyzed. Lou & Noels (2020b) found that the migrant participants' perceived English proficiency was significantly predicted by a growth mindset orientation more so than a fixed mindset. Additional findings suggested that participants possessing a growth mindset became a weaker predictor of perceived English proficiency as length of residence in Canada increased (Lou & Noels, 2020b). Participants with a fixed L2 mindset did not predict perceived language proficiency, regardless of the length of residence in Canada time.

L2 Mindset Interventions Studies

A significant body of research on implicit theories of intelligence and interventions exist in psychology and education research. In regard to L2 mindsets and interventions however, there have been few studies in this domain on investigating the effect of inventions on L2

mindsets. The body of research that currently exists stems from 2015 onwards; it exists as an unknown and under researched sphere of SLA. From the available studies, the premise and rationale behind the work of L2 mindset intervention researchers has centered on designing and delivering an intervention to learners in attempt to alter or manipulate their L2 mindsets. This has been primarily conducted with pretest-posttest measures with varying sample sizes, intervention designs, learning contexts, and study timeframes. Each of the following studies on L2 mindset interventions have contributed to the growing body of knowledge in this growing field.

Lou and Noels (2016) investigated whether an intervention could shift learners' L2 mindsets and change their goal orientations and failure responses. The researchers wanted to see if it was possible to convince learners to think in a more fixed- or growth-orientated manner (Noels & Lou, 2015). Their study participants consisted of 150 university students enrolled in L2 courses at a university in Canada. Their L2 mindset intervention was a mock article that contained scientific findings purporting either a fixed or growth mindset, adapted from Hong et al., (1999). They hypothesized that an incremental prime would lead learners to set more learning goals and in turn, lead learners to respond more positively in failure situations and demonstrate a stronger willingness to continue studying L2 (Lou & Noels, 2016). After reading the mock article, the participants completed indices of their self-perceived language competence, goal orientations, fear of failure, responses to failure situations, and the LMI (Lou & Noels, 2016). The results showed that participants who underwent the treatment condition (read the growth mindset-orientated mock article) had stronger L2 growth beliefs than those who read a fixed mindset content mock article. Lou and Noels concluded that psychological interventions had the capacity to shift learners' L2 mindsets on a short-term basis (Lou & Noels, 2016). This was a significant milestone in this research field as this was the first experimental study that tested the causal claim that mindsets can influence different kinds of responses in the L2 learning context, extending and expanding upon prior qualitative and correlational research (Lou & Noels, 2016).

Molway and Mutton (2019) were interested in the long-term influences of L2 mindset interventions and conducted a longitudinal study on whether a growth mindset-orientated intervention would have an effect on learners' L2 mindsets long term. Their study participants were 127 year 9 (ages 13-14) students learning German in England. The participants were divided into five groups, two of the groups received growth mindset-orientated instruction and reading strategies interventions for a total of five hours, two of the other groups received only a reading strategies intervention for a total of two hours, and the control group received no intervention. By using questionnaires, analysis of students' academic performance, and

measuring students' intention to continue L2 studies beyond compulsory L2 courses, Molway and Mutton found that the interventions had a significant and lasting effect on the students' L2 mindsets over a 7-month period. The interventions had the largest effect on students who initially reported low levels of L2 attainment, whom by posttest results, displayed strong motivation to continue with L2 study. The researchers also noted that the intervention groups had a decrease in maladaptive, non-strategic classroom behavior, and a significant correlation was found between the strength of students' incremental theories and the level of progress they made over the year (Molway & Mutton, 2019).

Brown and Hanson (2019) tested to see if a brief positive experience of successful L2 learning could promote an incremental theory of L2 acquisition that was sustainable over a short period of time. Rather than using an explicitly designed intervention to prime an implicit theory or intelligence through the use of readings, lectures, or instructions, the researchers wanted to see if the experience of a successful episode in L2 learning could serve as an intervention in itself. Moreover, the researchers were interested in finding out whether a firsthand experience of successful L2 learning at an early stage would spur learners to continue L2 learning later on in university. The study took place in three sessions with 72 participants. In each session, the participants were separated into three different quizzing conditions and were asked to learn and recall 10 Japanese characters (none of the participants had prior Japanese L2 learning experiences). The participants then completed a questionnaire regarding implicit theories and quick-learning beliefs. The researchers found that all participants who experienced a single episode of success at learning the Japanese characters developed a growth mindset that remained after two weeks (Brown & Hanson, 2019). As this was a significant departure from previous work that employed explicit instruction about implicit theories in order to produce change (Lou & Noels, 2016), the researchers proposed that interventions should equip learners with tools for effective learning and provide an experience of improvement accompanied with those tools (Brown & Hanson, 2019).

Lou and Noels (2020a) examined the role of an experiment-induced L2 mindset intervention on low to high English competence ESL students' anxiety and performance. Using a growth-mindset priming mock article with an experiment and control condition, 72 migrant university students at a Canadian university were then asked to complete an interaction task with a native-English speaker. In the interaction task, the participant and native-speaking partner conducted a conversation and then participants completed a final questionnaire to measure perceived rejection, performance-avoidance anxiety, intergroup anxiety, and future contact avoidance (Lou & Noels, 2020a). Their results found that the participants who underwent the growth-mindsets intervention had reduced levels of perceived

rejection and future contact avoidance among the learners with lower English competence, but not the learners with higher English competence. However, they also found that inducing growth L2 mindsets did not affect intergroup anxiety, performance-avoidance, and peer-perceptions of avoidance (Lou & Noels, 2020a).

Research Methodology

The following section examines the research methodologies used in the previously review L2 mindset and intervention studies. The studies used inferential statistics and quantitative measures in their research procedures, analyses, and findings to answer their research questions.

Descriptive Statistics

Descriptive statistics provide a useful initial account of participants and data collected, even if a study's principal method of statistical inquiry is inferential. Descriptive statistics were used to identify participants' demographic background, including variables such as age, gender, nationality, languages spoken, and student classification. This was necessary for all the studies (Brown & Hanson, 2019; Lou & Noels 2016, 2017, 2020a, 2020b; Molway & Mutton, 2019, Noels & Lou, 2015) because participants needed to meet certain sampling requirements in order to maintain research and measurement validity in each study.

Confirmatory Factor Analysis

The use of a questionnaire to measure learners' L2 mindsets necessitated the use of confirmatory factor analysis (CFA) to validate measurement instruments. Noels and Lou (2015) used CFA to support a six-factor model, fixed general learning beliefs, fixed L2 learning beliefs, fixed age sensitivity L2 learning beliefs, growth general learning beliefs, growth L2 learning beliefs, and growth age sensitivity L2 learning beliefs. The researchers also performed a second-order CFA to reduce the previously mentioned six factors into two general factors of fixed and growth mindsets (Noel & Lou, 2015). The correlations between the fixed and growth mindset constructs were strong and led to the development of the LMI, answering the researchers' question of designing a reliable and valid tool for measuring L2 mindsets. Lou and Noels (2017) used hierarchal confirmatory factor analysis to further validate the robustness of the LMI. Their analyses suggested that the HCFA supported six distinct factors that could be validly represented in two broad sets of correlated beliefs: incremental (growth) and entity (fixed) mindsets (Lou & Noels, 2017). Their results suggested that researchers looking to investigate learners' L2 mindsets can justifiably use either the six

factors of learning beliefs, two subscales (fixed and growth), or as a single index, for research purposes adaptable for various research designs (Lou & Noels, 2017).

ANOVA

Lou and Noels (2016) used two, one-way between-subject ANOVAs to check the effectiveness of their L2 mindset intervention between pretest and posttest among their participants. For the pretest, the participants' responses on the LMI for entity and incremental conditions did not significantly differ on the pretest. This meant that the learners in both the entity and incremental groups had the same beliefs during the pretest. In a follow-up analysis for the posttest, the ANOVA results revealed that participants in the entity condition had higher scores on entity belief items than those in the incremental condition. Lou and Noels (2016) also used two repeated-measures ANOVAs to examine changes over time for the entity and incremental conditions. The findings revealed that participants in the entity condition endorsed stronger entity beliefs in the posttest when compared to their pretest, and participants in the incremental condition endorsed weaker entity beliefs in the posttest when compared to their pretest. The researchers also found that participants in the incremental condition endorsed stronger incremental beliefs than those in the entity condition.

Noels and Lou (2015) used one-way ANOVAs to examine mean differences between participants' LMI scores and written reflections regarding their learner beliefs. The results revealed that the learners' written responses matched their LMI scores. If a learner scored on the "fixed mindset" spectrum area of the LMI, their written responses also reflected a similar fixed mindset. Noels and Lou (2015) found that similar patterns were found with other fixed to growth aspects as well and concluded that the LMI was able to measure the learners' expressed fixed to growth L2 mindset beliefs.

Brown and Hanson (2019) used RMANOVA to analyze changes in their study participants' L2 mindsets. Upon undergoing an initial successful experience in the first session of learning ten Japanese characters, participants completed a questionnaire that measured their implicit theories of SLA. These scores were recorded and taken again during the second and third sessions, which also included the successful recall of the ten learned Japanese characters. The mean values from the questionnaires of three sessions showed greater endorsement of L2 growth mindsets after repeated measures, from the first to the third session. Using RMANOVA, Brown and Hanson (2019) also identified that participants believed that a higher percentage of L2 learning ability stems from effort after completing session two and compared to session one (a great endorsement of effort beliefs occurred) but was not significant after completing session three and comparing to session two.

Molway and Mutton (2019) also employed RMANOVA to gauge whether their participants had demonstrated any changes to their L2 mindsets at four data points. At data point one, 50% of the learners were classified as having a L2 growth mindset after completing questions adapted from Dweck's (1999) Theories of Intelligence questions. Between data points one and two, which took place one month apart without any L2 intervention treatment, there was no significant change found in the distribution of students demonstrating a fixed, growth, or undecided L2 mindset (Molway & Mutton, 2019). At data point three, one month after data point two and following the first L2 intervention treatment, the distribution of students that demonstrated a growth L2 mindset rose to 69%. At data point four which took place four months after data point three and seven months from data point one, 80% of the students demonstrated a growth mindset. The results indicated that targeted L2 interventions can influence learners' L2 growth mindsets in the short and long term.

Multiple Regression Analyses

Lou and Noels (2020a) conducted multiple regression analyses to test whether L2 mindsets moderated the link between perceived competence and performance outcome variables. "The mean-centered scores for language mindsets, self-perceptions of English competence, and their interaction were regressed on different outcome variables" (Lou & Noels, 2020a). Some of their findings suggested that outcome variables such as mastery orientation, language-based rejection sensitivity, and positive affect were linked to L2 mindsets regardless of self-perceived English competence. The researchers also identified significant interaction effects of L2 mindsets and self-perceived English competence on negative experience outcome variables such as avoidance orientation, future contact avoidance, negative affect, and peer-perceptions of avoidance. For instance, a combination of low English competence and fixed L2 mindsets fuels the aforementioned negative experiences.

Lou and Noels (2016) used path analysis to evaluate causal models by examining the relationships and effect transmissions between a dependent variable and independent variables. In their final model, the results revealed that an incremental condition predicted stronger learning goals, which in turn predicted a greater mastery response, a weaker helpless response, and a stronger intention to continue learning the L2 (Lou & Noels, 2016). The interactions and mediations of all the test variables can be seen in Figure 3.

Figure 3

Final Path Model of Language Mindsets and Mediation Effects
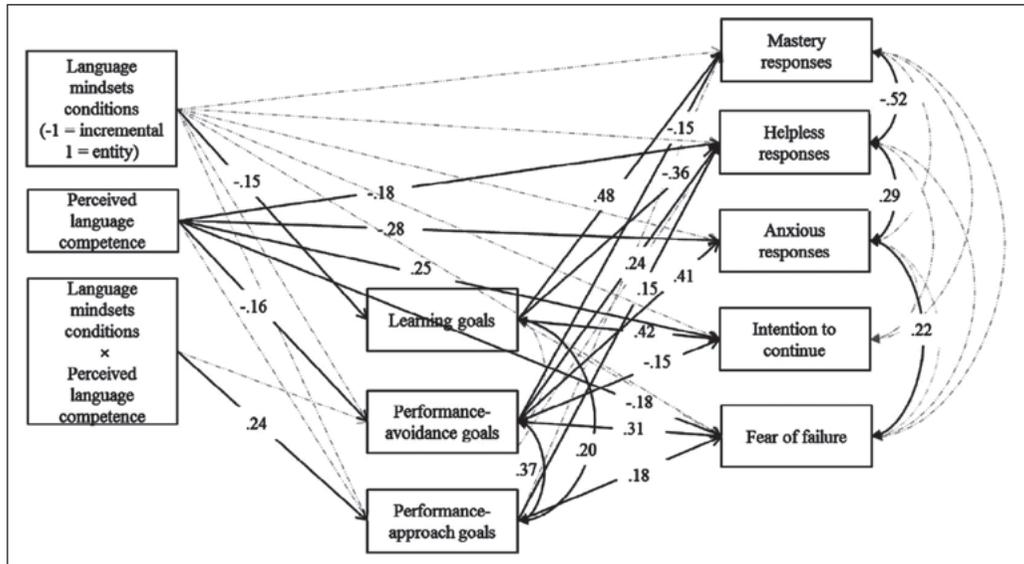
Note. Adapted from "Changing language mindsets: Implications for goal orientations and responses to failure in and outside the second language classroom," by N. M. Lou and K. A. Noels, 2016, Contemporary Educational Psychology, 46, p. 24.

Contributions and Suggestions for Future Research

Dweck and Leggett's (1988) conceptualization of implicit theories of intelligence led to the development of mindset theory (Dweck, 2006) in which broad categorizations of fixed and growth mindsets defined the learning beliefs and behaviors of individuals (Dweck, 1999). Stemming from mindset theory, Blackwell et al. (2007), Yeager and Walton (2011), Yeager and Dweck (2012), and Yeager et al. (2016) demonstrated that students' mindsets led to differences in their motivation, academic performance, and adjustment to new classroom settings (i.e., when transitioning to high school from junior high school). These studies found that learners who possessed growth mindsets displayed attributes that positively correlated with learning goals, positive effort beliefs, low helpless attributions, and the use of learning strategies. Moreover, the use of interventions in Blackwell et al. (2007), Aronson et al. (2002), and Yeager and Walton (2011) showed that interventions in the form of instructing learners about brain malleability, embedding growth mindset-orientated messages in study materials, or conducting in-school workshops that intelligence could be improved through effort, were successful in bolstering students' academic performance because they were able to effectively alter students' perceptions of academic difficulty (Bostwick & Becker-Blease, 2018).

Recently, learner mindsets have been examined in the domain of L2 learning, in which

L2 learners' beliefs are labeled as language (L2) mindsets. Studies from Mercer and Ryan (2010) and Ryan and Mercer (2012) identified that students' L2 mindsets were significantly related to their L2 learning motivation and academic achievement. Ryan and Mercer (2012) adapted and conceptualized L2 mindsets to lay down the foundation of research in this area. Noels and Lou (2015) and Lou and Noels (2016, 2017, 2020a), further went on to theoretically conceptualize L2 mindsets in relation to learning constructs in their development of the LMI, a psychometric measurement questionnaire for assessing learners' L2 mindsets.

The majority of research on changing learners' L2 mindsets has been contributed by Lou and Noels (2016, 2017, 2019, 2020a, 2020b). Their use of interventions to induce growth orientated L2 mindsets resulted in their study participants to endorse stronger L2 growth mindsets than those who did not undergo any L2 mindset intervention (Lou & Noels, 2016, 2017). Additional work by Lou and Noels (2020a) showed that inducing growth mindsets through an intervention reduced ESL students' perception of rejection and encouraged them more to use L2, especially among learners with low levels of L2 competence. Molway and Mutton (2019) demonstrated through the use of theory of intelligence intervention training and the teaching of learning strategies led to increased academic outcomes among their participants as well as reporting adaptative attributions for failure. Brown and Hanson (2019) found that L2 beliefs could be changed after a brief, successful experience of learning how to read characters in an unfamiliar language, with this effect remaining present two weeks after the successful L2 learning experience.

Future research in L2 mindsets and interventions could benefit from analyzing learners with longitudinal studies as most of the existing research contains cross-sectional or short term (the longest study was seven months) analyses. Others have argued that mindsets only weakly predict students' performance. Sisk et al. (2018) suggested that the link between mindsets and academic success is complex and raised questions about the effectiveness of large-scale interventions and policy development based on such research. Burnette et al. (2013) suggested that priming mindsets predicts people's behaviours and emotions in threatening situations and does not necessarily elicit authentic responses from the participants. Lou and Noels (2019) suggested that L2 interventions may play a significant role in altering learner beliefs, but the development of learning strategies that help learners adapt growth orientated beliefs into actions is required.

To further establish an effective and theoretically robust L2 mindset intervention, future research needs to consider the contextual complexities for learners from specific groups, issues, and settings (Yeager et al., 2016). The majority of L2 mindset research has taken place in the North American university setting with a lack of research inquiry pertaining

this issue in other parts of the world. Future research should continue to examine the effect of language mindsets by adapting existing mindset intervention strategies to the needs of different language contexts and learner groups. It is unlikely that mindsets work the same way for all students and in all contexts. Considering the domain-specific nature of mindsets, it is also important to examine whether the mechanisms through which different mindsets, predict students' responses to challenges differently. Finally, it is important for future research to go beyond single small dose interventions and understand the effect of multiple and/or intensive interventions (e.g., workshops) into the language classrooms, which can be delivered online or through the teachers/researchers (Yeager et al., 2016). This approach may help us to effectively change people's mindsets and have a long-term effect on performance and success in the classroom. When designing interventions for language classrooms, scholars and teachers should take a student- centered approach to understand how to customize mindset interventions that are effective for different language learners. Moreover, we should also evaluate the effectiveness of an intervention not solely based on performance but also on different aspects of growth, including self-regulation, confidence, intercultural competence, and well-being.

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